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Cover designed by Kevin Williams, M6CYB.
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RadCom THE RADIO SOCIETY OF GREAT BRITAIN'S MEMBERS' MAGAZINE

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Abbreviations and acronyms we use are listed at http://tinyurl.com/RC-acronyms

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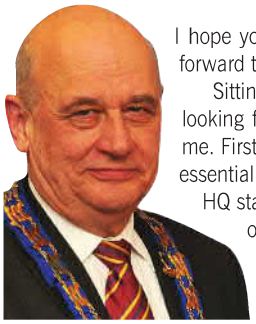
President's review of 2018



I hope you had a great Christmas and let us all look forward to a happy, healthy and prosperous 2019.

Sitting here contemplating the last 12 months and looking forward to the next year, a few things struck me. Firstly, what a great year 2018 has been – thanks essentially to our volunteers. With only 16 members of HQ staff, our 800-plus volunteers are the backbone of the Society. I have to admire the stoic make-up of our fantastic team of both volunteers and HQ staff – even after being lambasted by those who sit on the sidelines and criticise, often without offering any solutions or even contemplating offering their time to put right what they see as being wrong.

The work our volunteers put in is immeasurable and using this platform I would like to thank every single one of them for what they've done and, hopefully, will continue to do. We certainly wouldn't be where we are today, as one of the most respected National Societies not just in our IARU region but in the world, save for the efforts of our many and valued volunteers.

So, to my highlights of 2018…

At April's AGM, my predecessor Nick, G3RWF painted a really thought-provoking picture of where amateur radio is today. If you haven't picked up on the underlying message, it is this: the hobby is what you want to make of it. Surely isn't that what we all find fascinating and exciting? The tools are there for us, it's up to us how many of them we want to use and how we use them.

The RSGB National Radio Centre at Bletchley Park continues to thrive and attract increasing numbers of visitors under the stewardship of Martyn Baker, G0GMB. 2018 saw over 55,000 visitors discovering the wealth of information and passion housed at the Centre. For the vast majority of visitors, this was their first experience of amateur radio. Also, by recruiting additional volunteers it has been possible to open the NRC seven days a week.

The RSGB's involvement with September's National Hamfest helped make that another great event. Being able to showcase the work of our many committees and volunteers over the two days is as important an aspect of the event as meeting those involved. Another exciting part of the Hamfest is announcing of the National winners of the Club of the Year and the presentation of the various prizes and trophies, congratulations to all the clubs, who made it through to the National finals. Our thanks to the sponsors of this competition, Waters & Stanton.

October's RSGB Convention was once again an outstanding success, testament to the lectures and presenters, as well as to the organising team. The number of delegates continues to rise and the feedback reports seem to prove that for the majority of the time the programme is hitting the spot. Thanks go to the principal sponsor, Martin Lynch & Sons for yet another year supporting this event.

As we all know the average age in our hobby is increasing, and anything we can do to bring it lower has to be a good thing. We should not lose sight of the fact that the pressures young people come under these days make it likely that, while we encourage youngsters to join the hobby, they tend to 'disappear' for a few years while they establish themselves in society. Having said that, various successful events took place in 2018, probably the most high-profile being August's YOTA 2018 in South Africa. December brought YOTA Month 2018, which is just drawing to a close as I write these words, with many clubs and special interest stations engaging young people in amateur radio activities.

Space, in the form of satellites and communication with astronauts on the ISS, is another great way of encouraging young people to think about a STEM-related career (science, technology, engineering and mathematics). Scheduled contacts with the ISS from UK schools continue, the most recent being in December at Kenilworth School. I wish to publicly thank the UK's ARISS team for all their hard work in making these events happen.

A review of the year would not be complete without a mention of the RSGB's Strategy 2022. As momentum builds, many projects and initiatives aimed at meeting our strategic priorities are either under serious consideration, or are in the planning or developmental stages with further details to be announced soon.

So that is a snapshot of 2018 – what about 2019? We will continue to drive forwards with meeting our goal for 2022, to 'have an active and thriving amateur radio community, supported by a strong, representative and influential RSGB'. Through our army of volunteers we will take the hobby forward in a positive way. If you feel you would like to play your part in shaping the future of our hobby, we would be very happy for you to join us.

Finally, as I travel up and down the country, I look forward to meeting many of you during 2019.

73

Dave Wilson, G0OBW
RSGB President

2019 Band Plans

In this edition of *RadCom* are the 2019 Band Plans. This year's update is fairly unusual in having the fewest changes in some time. This is a consequence of 2018 having no IARU Region 1 meetings. Changes that may get discussed at IARU-Vienna in April 2019 (or arising from WRC-19) will not occur until January 2020. In summary, the 2019 edition has formal changes only in 144MHz.

HF: Whilst there are no formal changes at HF, we remain concerned with ongoing reports of out-of-band operation in 5MHz, particularly by UK FT8 usage. The 5MHz band plan explicitly refers to more detailed advice online, where HF Manager Ian Greenshields, G4FSU has guidance on operating and staying legal.

VHF: As mentioned above there are several relatively small changes to the 144MHz band – removal of the old UK microwave talkback frequency, more neutral 'Digital Usage' descriptions for ETCC-managed assignments and a correction to the simplex channels numbers.

The latest band plan information including 5MHz guidance and the master Excel files can be found on the Operating section of the RSGB website at rsgb.org/bandplans – and, if you are unsure, by all means contact either hf.manager@rsgb.org.uk, vhf.manager@rsgb.org.uk or microwave.manager@rsgb.org.uk

Murray Niman, G6JYB, RSGB Spectrum Chair

Youth Team report

In November we announced the appointment of Sara McGarvey, 2I0SSW, as 'Youth Champion'. Given the fundamental role the RSGB youth plays in delivering many of the objectives set against Strategy 2022's Growth priority, we saw Sara's appointment as opportunity to review the activity being undertaken in that area.

As a result, we have decided to reinvigorate the group by removing the constraints of a formal committee structure. The original Youth Committee, which was formed in 2014, will now be superseded by a newly-formed 'Youth Team', headed up by Sara. With Sara as an Honorary Officer at the helm, we remove the need for a chairperson, vice-chairperson and secretary. Sara is free to structure the members of the RSGB's Youth Team as required for separate projects and tasks, removing the hierarchy and allowing members to take on different responsibilities dependent on their strengths and the task in hand.

Mark Jones, G0MGX will remain the Board Liaison Manager for youth, responsible for the overall strategy compliance and budgetary matters. Mark says, "by creating a Youth Team we will allow its members to get on with all the activity planned, in a proactive and creative way, without being tied to the formal structure of a committee. It will allow the members to focus on what they are good at – promoting the hobby and encouraging others to join in the fun. We will still have team meetings, output from which will be published on the RSGB website, and we will provide an annual report on the Youth Team's activities".

The RSGB's youth is fundamental to delivering a number of objectives set against the strategic priority for Growth. To this end, Sara and the Youth Team will be responsible for:

- Developing an enthusiastic and invigorated team of young amateurs who are motivated to work hard to bring amateur radio to schools, Scouts, Universities and the general public
- Running the Buildathon at the 2019 Hamfest
- Establishing links to and supporting the Scout events at Gilwell Park
- Building on existing links with other RSGB committees (TEC, RF)
- Ensuring participation in the YOTA 2019 summer event
- Running YOTA Month 2019
- Planning engagement activities for British Science Week 2019
- Establishing links with Universities via Youth Team members
- Developing new and updated promotional material
- Updating the youth-related web content
- Ensuring Youth Team members are integrated into the Regional teams and are active in their own areas, attending rallies etc.

Sara says, "it is an exciting time for the RSGB and for me as the newly-appointed Youth Champion. It is my hope that the future of amateur radio can be secured through the new and invigorated Youth Team. We aim to spark interests, develop links and motivate young people to get involved. Our hobby is so diverse that there is something for everyone. It is the task of the Youth Team to be the guiding light in attracting young people to amateur radio, to challenge perceptions and create an environment in which to foster new skills and lifelong participation."

Volunteers appointed and wanted

The RSGB is pleased to announce that Bobby Wadey, MI0RYL has been appointed to the position of RSGB Awards Manager, taking over from Chris Burbanks, G3SJJ. We would like to thank Chris for his work as the RSGB Awards Manager.

Due to two Region 9 District Representatives standing down after many years of service to the RSGB and their areas, Region 9 Regional Representative Tom O'Reilly, G0NSY is looking for volunteers to take over the positions. Stephen Richardson, M0SLP covered Bedfordshire and Larry Smith, G4OXY covered Buckinghamshire. The RSGB would like to thank them for their service to their fellow amateurs. The prime duties in this annual and renewable post will be to liaise with the clubs and individuals in that area. There are opportunities to assist others and develop your own ideas to promote interest in amateur radio with the help of a team within Region 9 (London north of the River Thames and the Home Counties). Anyone wishing to step into these roles should contact the Regional Representative Tom, G0NSY, via rr9@rsgb.org.uk

With over 55,000 visitors to the RSGB National Radio Centre at Bletchley Park in 2018, we are looking to recruit further volunteers to engage with the public and give radio demonstrations. If you're interested in becoming an NRC volunteer you should be passionate about meeting people, feel confident explaining the hobby, as well as operating the NRC's radio station, GB3RS. You should be a licensed amateur, an RSGB Member and be prepared to work a minimum of one (preferably two) days per month.

You will be joining a team of enthusiastic, friendly and dedicated volunteers and full training will be given. Travel expenses are paid to volunteers living within reasonable travelling distance and NRC volunteers enjoy numerous benefits associated with volunteering at Bletchley Park.

Please email nrc.support@rsgb.org.uk for further information.

QSL matters

From January to June a series of special event stations in Germany will be celebrating the 100th anniversary of the maiden flight of the Junkers F-13 aircraft. Look out for DF13DEJU, DF13BLN, DF13BUD, DF13MUC, DF13PAR and DF13STO. The press release information confirms that all contacts will be sent a bureau card, sometime after 15 July. It looks likely that they will QSL 100%. We expect a very large influx of bureau cards later in the year. Interestingly, the information also says: "If you do not need a QSL card, let them know. This saves their time and money." The RSGB began recommending Members to advise contacts during their QSOs if they don't send or collect cards some years ago. Data and CW stations can send 'nil QSL'. It's good to see others now doing something similar. Reducing unwanted/uncollected cards not only has environmental benefits but also helps the throughput of wanted cards.

Z prefix locator: A recent caller to the bureau has advised us that the GZ locator in use by resident-only stations on the islands of the far North (Shetland etc) has now been withdrawn by Ofcom, with stations reverting to GM, 2M, MM etc.

Recycling: Although we have a 90-day recycling policy for uncollected QSL cards, many of our dedicated band of volunteer sub managers have been holding them for longer, hoping to receive collection envelopes from Members. At this time of year, we ask everyone that hasn't sent a collection envelope to their manager for 12 months to find time to do just that and without delay. Following concerns from some managers, we are advising them to recycle cards more regularly as it's unfair to ask them to store large volumes for longer. Details of your sub-manager can be found in the QSL section of the RSGB website. All a return envelope needs is your address a 2nd class stamp – and you might get a nice surprise!

Record number of visitors to RSGB National Radio Centre

The final number of visitors to the RSGB National Radio Centre in 2018 has been announced. Congratulations to Martyn Baker, G0GMB and the great volunteer team at the NRC for welcoming 55,232 people through the doors and introducing the vast majority of them to amateur radio for the first time.

Two of the recent visitors were Pam Hardenburg and her cousin Jenny (nee Robertson-Walker) Marris. Pam's Mother, Anita (nee Nugent-James) Hardenburg trained as an intelligence decoder at Bletchley Park and subsequently went on to work in Cairo and Paris as an MI6 agent. Her mother married Lt C Pullinger while serving in Cairo but was sadly widowed three weeks after their wedding. Later she worked in Paris where she met and married Lt H T Hardenburg USN – operating as an intelligence officer.

Pam and Jenny kindly donated her mother's silk escape map (issued to intelligence staff should they need to escape) that has been preserved as a family heirloom. The map, printed on both sides, covers much of Northern France, Belgium and Holland, with mountain passes and landmarks clearly illustrated. Silk was used for maps so they could be folded small and hidden discretely, and didn't crinkle or make a noise if the escaping agent was stopped and patted-down at checkpoints.

Amateur workshops

Two 'Introduction to Amateur Radio' workshops, intended to attract new interest in the hobby, were hosted at Bletchley Park and delivered by some of the RSGB's National Radio Centre (NRC) volunteers in December. The three-hour workshop consisted an introduction of the hobby and included a number of short presentations, practical sessions and some RSGB videos available on YouTube. It was pleasing to see that three of the attendees were YLs. On this occasion, the workshops were deliberately hosted on the same weekend as the YOTA event (GB18YOTA) held at the NRC so that the participants could go on to see amateur radio in action during the afternoon. It is hoped to run similar workshops in the first quarter of this year.

RSGB Convention videos

Two more 2018 Convention videos are available on the RSGB website. Popular Convention presenter Jim Bacon, G3YLA looks at Sporadic-E and discusses whether we understand any more about this phenomenon. Roger Balister, G3KMA catches us up on all the latest news for the Island On The Air programme and announcing the new IOTA groups. To view, go to the RSGB website at www.rsgb.org/videos

New ICQ Podcast video

The ICQ Podcast is a free fortnightly amateur radio podcast covering news and technical features from around the world. A new video has been released on their YouTube channel, filmed at the NRC (and featuring Simone Wilson, Martyn Baker and Tony Duggan). See it at https://tinyurl.com/y7tsxg5c

The RSGB also worked with ICQ Podcast at the National Hamfest, and you can find Martin Butler's interviews with Tony Kent (Exam changes) and John Mattock (Planning advice) at https://tinyurl.com/y7w39fyu and https://tinyurl.com/y9tm7vt2

Cricket World Cup Marathon

The RSGB Contest Club, which is a special interest group within the RSGB Membership, is planning to organise an International Amateur Radio Marathon on the HF bands to celebrate the ICC Cricket World Cup that is being held in England and Wales between 30 May and 14 July.

Special UK and international callsigns will be activated on 9 HF bands and 3 VHF bands using SSB, CW & digital modes. Participants worldwide will earn award certificates based on the number of QSOs they achieve with the special stations. We are looking for volunteers who can help with the administration of the marathon plus it would be good to have an indication from those who would like to be involved in activating a Special UK callsign. Please email ContestClub@rsgbcc.org to register interest.

Nick Totterdell, G4FAL
RSGB HF Contest Committee Chair

Spring
Sale
On Now
See pages 80 & 81 for details

RSGB SHOP
NEW

RadCom 2018 Archive

In 2018 there were more than 1200 pages of *RadCom* with its usual mix of the very best amateur radio information available. If you want easy way look back over equipment reviews, construction articles, antenna features and much more, then the *RadCom 2018 Archive* is for you. Every page of all twelve *RadCom* editions produced in 2018 is presented in the easy to use and fully searchable PDF format.

Everything page of *RadCom 2018* is included on the archive. You will find over 60 Construction & Technical Features more than 20 Antenna Features alongside a huge number of Reviews and Feature articles. You will find the in - depth technical review of the popular Icom IC-7610 by Peter Hart, G3SJX along with a number of SDR radio reviews and a host of other equipment. Antenna features covered every band imaginable and these are reproduced as are all the regular *RadCom* columns, from Antennas to VHF/UHF. Simply everything printed in *RadCom* in 2018 is included, even the adverts are provided. The PDF format allows you to print any of the pages and search for those specific items you want.

Bonus Material: The *RadCom 2018 Archive* not only contain *RadCom* but also samples of some of the RSGB books produced including *SDR – Software Defined Radio, 60 Antennas, Power Supplies Explained* and *The Voices*. It doesn't stop there either, as there are samples of other *RadCom* archives so you even can read copies of the *'Bull'* from yesteryear. Don't forget you also get a copy of the very latest *Acrobat Reader DC*.

If you want to every page from *RadCom* in 2018 and much more besides, the *RadCom 2018 Archive* is great way to store and look back on another amateur radio year.

CD & USB Options
The *RadCom Archive 2018* is available as either the traditional CD version or in the USB Memory Stick version. Both versions are easy to use and contain the mass of material *RadCom* produced in 2018 along with all the bonus material.

Non Members' Price: £14.99
RSGB Members' Price: £12.74

Also available

RadCom Archive Sets CD/DVDs, 1925-2010

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RC7680	RadCom 1976-1980 DVD
RC7075	RadCom 1970-1975
RC6469	RadCom 1964-1969 DVD
RC5363	RadCom 1953-1963 DVD
RC3953	RadCom 1939-1953 DVD
RC2539	RadCom 1925-1939 DVD

Non Members' Price: £19.99 Each
RSGB Members' Price: £16.99 Each

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RC13	RadCom 2013
RC12	RadCom 2012
RC11	RadCom 2011

Non Members' Price: £14.99 Each
RSGB Members' Price: £12.74 Each

RSGB Members only offers

Buy complete *RadCom* archive sets and save money

All twelve archive sets of the *RadCom* and *Bulletin* CD/DVDs (1925-2010) **ONLY £179.00** (saving over £60 off individual rrps)

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E&OE (All prices shown plus p&p)

Jack Moseley, G2CIW, Silent Key

Jack Moseley, G2CIW, passed away at the Gloucester Royal Hospital on 5 November 2018, just six days short of his 95th birthday. At the age of 14 he began his working life in his father's bike shop. His interest in radio began after reading *Practical Wireless* and he went on to build a receiver that started him on the road to amateur radio. He first began to copy DX commercial broadcast stations but it was the amateur signals that really excited his interest. He soon met local amateurs, taught himself Morse code and went on to build all his own equipment.

In early 1939 he obtained his amateur licence, 2CIW. His shack was in the garden shed but activities were cut short in September, 1939 on the outbreak of WWII, when his transmitter was confiscated – but his skill with Morse code, which included the teaching of Air Cadets, had been noted. He was approached by the authorities with a view to his joining the Radio Security Service (RSS) and becoming a Voluntary Interceptor (VI). He readily accepted the job and, after signing the Official Secrets Act would, when not working in the bike shop or on ARP duty, sit in his shack listening for German signals. Those evening and night time activities attracted the attention of neighbours who reported Jack to the local police. This was a common problem amongst the VIs; fortunately the police were aware that VIs were not enemy spies.

It soon became clear to the authorities that it was necessary to have full time RSS stations to copy the enemy signals and in 1941/42 Hanslope Park in Buckinghamshire became the first such station. Jack joined Hanslope Park in February 1942 where he met many other VIs including my father Bill Windle, G8VG. In 1943 Jack was sent to Gibraltar, a highly secure military base, where, toward the end of the war, he and a friend operated on the bands using the call EA7AB. Shortly after his return to Hanslope in August 1945, where Betty had been working preparing Rockex encryption key tapes, she and Jack met at a dance. They were married on 12 April 1947 at Fenny Stratford, near Bletchley.

Jack was FOC member No 34 from 1955 to 2007 and for his last few years he lived, like many of us, in an apartment where his radio activity was severely limited – but he still managed to put a signal on the bands using a stealth antenna. His last entry in his log was 17 June 2018.

Jack was appointed to the rank of *Chevalier* in the *Ordre national de la Légion d'honneur* (the highest French order of merit for military and civil merits) by decree of 18 June 2018, recognising his "engagement and steadfast involvement in SIGINT activities during the Second World War … responsible for saving countless Allied lives and played a key role in the Liberation of France … we must never forget the heroes like you … we owe our freedom and security to your dedication".

RIP Jack, you will be greatly missed.

Peter Windle, G8VG

Jack's funeral took place in Gloucester on 5 November 2018, attended by a representative from the French Embassy and General Poincignon, who presented Jack's son, David, with the award. David informed us, via Peter, G8VG, that the award was symbolic, in the sense that Jack received it on behalf of the Radio Security Service operators of his generation.

Congratulations

To the following Members whom our records show as having reached 60 or 50 years' continuous Membership of the RSGB.

60 Years

Mr J W Heaviside	G3NYX
Mr R J Powell	G3OGP
Mr B D Simpson	G3PEK
Mr L S Margolis	G3UML

50 Years

Mr P Kirby	G3XUD
Mr A C Boyne	G3YVH
Mr G W Wale	G4BCG
Mr V Cracknell	G4KPZ
Mr J Ray	G8DZH
Mr S M Sherratt	G8FAK
Mr H Davidson	GI4BTG
Mr K Jones	G4AHO

The RSGB welcomes to the RSGB family the following new Members who have joined their voice to ours, helping to keep the RSGB strong.

Mr P Collier, 2W0EZS
Mr G Wilby, 2D0PEY
Mr G Frogley, 2E0GJF
Mr L Jordan, 2E0GZR
Mr T Hare, 2E0HTJ
Mr R Clark, 2E0NQA
Mr R Brown, 2E0RYR
Mr S Lacey, 2E0WDR
Mr J Parry, 2E0XGX
Mr C Set, 2E0XZW
Mr G Howell, 2W0GGH
Mr J Record, AD0YO
Mr B Ryan, AI2H
Mr J Chollet, F1TDO
Miss C Whitaker, GI0IPJ
Mr C Taylor, G0WTZ
Mr J Crowther, G3KMM
Mr C Bracewell, G4HVF
Mr D Bentley, G6LKZ
Mr D Poulet, G7NUC
Mr P Cattanach, G7RGA
Mr M Carlone, IZ2FME
Mr J Boette, K1IWZ
Mr L Westerman, K2JVX
Mr J Hinschberger, KD9LLA
Mr F Nesci, KW4OL
KW Electronics, M0KW
Mr S Cilliers, M0LOX
Mr E Pestano, M0LXI
Mr M Saunders, M3OHM
Stewart Bryant RS, M5SB
Mr J Smith, M6LME
Mr R Yilmaz, M6OVS
Ms I Frogley, M6WPF
Mr B Davies, M7ACK
Mr N Watson, M7ATT
Mr D Shaw, M7DSH
Mr G Hodgson, M7GBH
Mr J O'Connell, M7JOC
Mr R Johnston, M7LFC
Mr N Triantafyllou, M7NIC
Mr P Kelly, MI0PKO
Mr A Young, MM0TAI
Mr C Beamish, MW6GHY
Ms K Kohls, N5TLE
Mr E Dols, ON4ADE
Mr S Edelmann, OZ6SI
Mr G van Loo, PA2LO
Dr R Evans, RS315660
Mr T Holden, RS319985
Mr S Leonard, RS320542
Mr J van Gog, RS320695
Mr A Nairn, RS320746
Mr R Yarrow, RS320788
Mr R Collins, RS320859
Mr T Holt, RS320866
Mr D Young, RS320891
Mrs C Collins, RS320932
Mr D Shelsher, RS320955
Mr D Le Gresley, RS320956
Mr J Clifford, VP8CWQ
Mr D Reid, W6KL
Mr R Lincoln, WA4DOU

The RSGB would like to welcome back the following Members who have rejoined the Society.

Mr J McKenzie, GM6UCN
Mr M Rea, 2E0MEQ
Mr P R Saripo, 2E0PYG
Mr K W Hamer, G0FSR
Mr R C Hurt, G0HDS
Mr S Lexton, G1UGO
Dr N Shaxted, G4OGI
Mr P K Short, G4WJJ
Mr D Bentley, G6LKZ
Mr N Parr, G6MRN
Mr H Kernohan, GI0JEV
Mr N Parker, M0NKL
Mr J T Elgar, M6JTE
Mr H J Kers, RS192375
Mr D Fant, W5SWL

BYLARA's 40th anniversary

On 29 April, BYLARA (British Young Ladies Amateur Radio Association) will be 40. To celebrate the anniversary, the ladies have arranged a social get-together in Blackpool that weekend. Additionally, the NARSA group have kindly offered a room at the Norbreck Hotel, for setting up GB40BYL on Sunday 28 April. The callsign GB40BYL has been requested for the entire year and members of the committee have offered to take responsibility for activating the callsign, one month at a time. There will be two certificates on offer. The first features 12 YL spaces. The challenge will be to work as many BYLARA YLs, using M0BYL, as possible within a 12-month period. Additional awards will be issued for multiples of 12. A photograph of the YL, their own callsign and BYLARA number will feature on the certificate. The second award will be for different 40 contacts with GB40BYL. Again, additional certificates will be issued for multiples of 40. YLRL will be designing an award to run at the same time, with a callsign of their own – as an act of support. More details may be found at www.bylara.org.uk

BATC Mini Convention

British Amateur Television Club (BATC) decided to hold a number of mini-conventions in various regions of the country during 2019. The first of these is in Bristol on 31 March at SHE7 building, Braemar Crescent, Filton, Bristol BS7 0TD. These are not rallies with traders, but a technical meeting for ATV enthusiasts and those thinking of making a start in this aspect of the hobby. There will be a full day of talks and demonstrations and the opportunity to meet some of the most active ATV enthusiasts. There will also be test equipment on hand to test and align visitors' projects.

Moonraker Rewards Programme

The Moonraker Rewards Programme is designed to enable all registered retail customers the opportunity to earn and redeem free product credits known as 'Watts'. To enrol and receive Programme benefits, you will first need to create an account at www.moonraker.eu. You receive Watts on every qualifying product purchase, when you refer a new customer, if you write a product review and do certain social media activities. Please visit the website for full terms and conditions. www.moonraker.eu/rewards-programme

Nevada Open Day

In November, Nevada, in partnership with Waters & Stanton, held their first ever, combined Open Day in Portsmouth.

The large warehouse was opened to customers with a display of used and vintage radios equipment, plus pallets full of clearance items at discount prices. There were also working displays of all the latest equipment, with representatives from Icom, Kenwood, Yaesu and SDRplay, on hand to answer questions and show their latest products.

Well over 200 attendees made the trip with some travelling from as far as Manchester, Coventry and Kent. Customers all received a free hot dog or burger and hot drink. A free raffle was held for two Yaesu FT-70DE dual band digital handheld transceivers, generously donated by Yaesu UK. Icom ran special 'add on' promotions for Icom radios purchased on the day.

The Open Day was supported by the RSGB Regional team and members of RSGB staff. www.nevadaradio.co.uk

RSGB Tender

The RSGB is currently looking at improving the RSGB 'bookstalls at rallies' operation. This is currently an outsourced function that entails warehousing RSGB books and equipment, combined with a weekly pick and pack operation. Deliveries and collections are made by couriers and pallet delivery companies. We believe that this would suit an individual or company with suitable storage space (that may on occasion need to accept pallets of stock) who has experience of distribution. This exercise is being conducted by an informal tender that closes on 28 February. If you are interested or would like to know more about what is required please email sales@rsgb.org.uk for more information.

Worked All Britain Awards

In 2019, the Worked All Britain Awards Group (WAB) celebrates its Golden Jubilee. To commemorate this event, three special awards, based around the number 50 will be available, for this year only. Full details of the awards are on the WAB website, www.worked-all-britain.org.uk

ML&S annual Open Day

December 2018 saw another successful Hog Roast and Open Day at the ML&S superstore in Staines. Despite the rain, it certainly didn't keep the customers away, partly due to the waft of fresh hog roast floating up Drake Avenue as this year it was cooked on a real wood burning fire – started at 1am!

The showroom was packed by 9am and the entire event was live streamed on the MIandS.tv YouTube channel. Representatives from the RSGB Regional team and RSGB staff were there too. The hog roast was sponsored by Icom, Kenwood and Yaesu who attended along with bhi providing expert help on a wide range of amateur radio products. See www.MLandS.co.uk

5-band Yagi installation

Brigg & District ARC has installed an InnovAntennas XR5, 5-band compact HF Yagi. It has a very short boom of only 11' (3.4m) but full sized elements for each of the five HF bands between 20 and 10m. The XR5 is substantially built with large diameter centre elements and fast taper to ensure harsh weather suitability. It has a single feed point and all 5 bands can be used at once so it is ideal for SDR radios and SO2R operation. Although only installed a few short weeks, the club are enjoying their new antenna and worked 5R8UM on 17m with just 30W. www.innovantennas.com

Dave Goodwin, VE9CB, winner of the 2018 Commonwealth Contest, is seen with the miniature trophy for his Open Section win. Dave said. "Thank you very much for the miniature Rose Bowl. It arrived in the mail and now has a place of honour in my ham shack, beside other trophies and awards for my previous efforts in the Commonwealth Contest. Winning BERU in 2018 was a great thrill and one of my proudest accomplishments in my amateur radio career." Thanks to Peter Hobbs, G3LET, for sponsoring the miniatures. The 2019 Commonwealth Contest will take place on 9 and 10 March. https://berucontest.wordpress.com/about/

Royal Signals ARS

During 2011 the Royal Signals ARS celebrated its 50th anniversary, with special calls working members, and non-members, around the world. All who took part had a great time. In the year 2020 it is the Royal Corps of Signals Centenary and plans are in hand for similar enjoyment for RSARS members in Australia, Canada, Cyprus, Falkland Islands, France, Germany, Gibraltar, Holland, Hungary, Italy, Malaysia, New Zealand, Philippines, Spain, USA and every part of the UK. Members when travelling usually have a rig with them and Vietnam, Jamaica, Rwanda, Kenya, Norway, Iceland, Sweden and others have been recently activated. Serving and ex-regular army personnel from any Corps or Regiment, Army reservists, Army Cadet Force – past and present, army employed civilians plus other Services attached to army units at some time are eligible to apply for RSARS membership. Check out https://rsars.org.uk If you are interested in membership, please contact George, G3VBE, via email to RSARSMemSec@virginmedia.com.

5MHz Newsletter

The latest edition of *The 5MHz Newsletter* is now available for free pdf download. This edition includes 5MHz news from 10 countries, features the latest number of CEPT countries on 5MHz, Exercise Blue Ham 100 and an article on Taking Care on 5357. Get it from the 'External Links' section of the RSGB 5MHz page, http://rsgb.org/main/operating/band-plans/hf/5mhz/

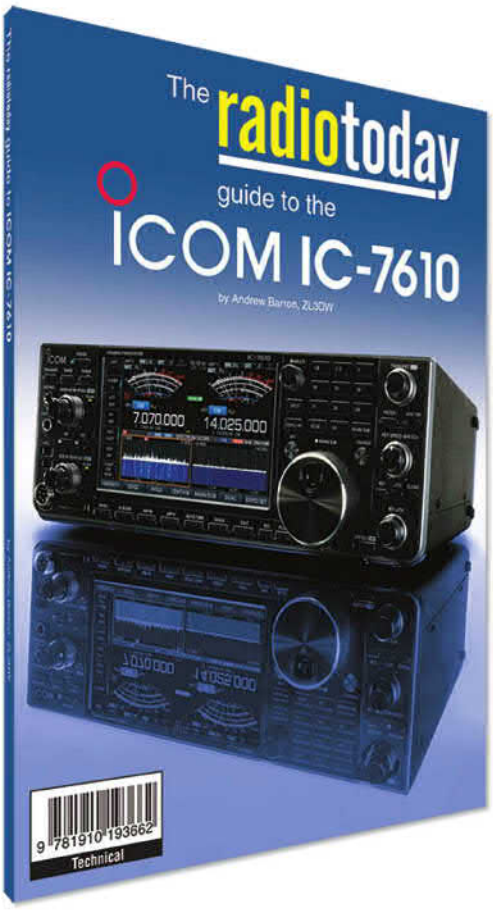
5 & 50MHz in Turkey

Turkey's telecom regulator, BTK, in a government gazette notice on 29 November 2018, released two new amateur radio allocations. The new WRC-15 60m Secondary allocation of 5351.5 – 5366.5kHz with a power limit of 15W EIRP. All modes are allowed and a 6m allocation of 50 – 52MHz, all modes allowed, with a power limit of 75W.

Spring Sale On Now

See pages 80 & 81 for details

RSGB SHOP NEW



radiotoday Guide to the Icom IC-7610

By Andrew Barron, ZL3DW

Within a few short months of the launch the Icom IC-7610 radio, it became a 'best seller' and one of the most popular radios on the market today. This SDR - based radio has simply become the measure by which other radios are being judged. However, getting the most from this radio, as it is for many new radios, is increasingly difficult. Andrew Barron, ZL3DW, an acknowledged SDR expert, sets out in this book to highlight the myriad of options available to the users of this fabulous radio.

On opening the box of the Icom IC-7610 not only will you be excited but perhaps you will surprised by how many settings and controls there are to learn. This should not deter you as this is where this book comes in. From the first steps with the panadapter display and its 'FIX' spectrum display mode where you can see the whole band or just a section of the band such as the CW segment, this book guides you. The biggest advantage that the IC-7610 offers over its rivals at a similar price level is the two completely independent receivers, so Andrew explains the changes this makes to the way you operate the radio. The touchscreen controls are explained so you get to know the radio through using it and through delving into every control and menu setting. There are tips on troubleshooting and guides to particular modes of operation and much more besides.

The IC-7610 is a truly exceptional radio and if you are interested in purchasing one or even already have one this guide provides invaluable reading. Many features are also applicable to other Icom SDR radios and the insight into the art of the possible with SDR radios is illuminating for all.

Size 174x240mm, 160 pages
ISBN 9781 9101 9366 2
Non Members' Price: £12.99
RSGB Members' Price: £11.04

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FROM FREE P&P on orders over £30. See Page 74

E&OE (All prices shown plus p&p)

radcom@rsgb.org.uk

New Products

New Bearcat scanning receiver

The Uniden Bearcat SDS-100E is a wide band true IQ scanning receiver covering 25 to 1300MHz (with gaps), capable of decoding both analogue and digital transmissions. The SDS-100E is capable of decoding DMR, NXDN and ProVoice digital modes. In the basic version these are not turned on as a default, instead an additional licence has to purchased to activate the required modes. Nevada will also be selling a digitally enabled version, with DMR and NXDN already activated.

The radio is rugged and weatherproof to IPX4 specifications, it is also fully featured including Close call RF capture, location based scanning and PC programmable with free software. The Bearcat SDS-100E comes complete with a 5,400mAh Li-ion battery, 8GB SD card, USB cable, mains adaptor, SMA to BNC antenna adaptor. The basic SDS-100E sells for £599.95, whilst the DMR/NXDN enabled version is £649.95. The radio is available from Nevada Radio www.nevadaradio.co.uk or 02392 313 090.

Free Software

SD by EI5DI is a computer logging system for radio amateurs for CW and SSB contacts in HF contests. It supports RSGB contests and hundreds of others worldwide, including the new 40m QSO Party. SD runs on Windows, Linux, and on Raspberry Pi 3 and is now free and unrestricted. It supports rig control, serial and parallel keying – and integrates with WinKey to eliminate CW timing issues caused by Windows. It offers instant 'full-screen' editing of any QSO in your log. All SD's files, including the log, are standard ASCII text files and can be viewed with any text editor. Following any QSO edit, no matter how complex, SD checks your complete log for consistency, and instantly updates all relevant QSOs. This includes setting and unsetting dupe and multiplier flags, and updating area codes (zones), and points, in all QSOs as required. The information shown in the Summary Score window is correct at all times. It may be downloaded from www.ei5di.com.

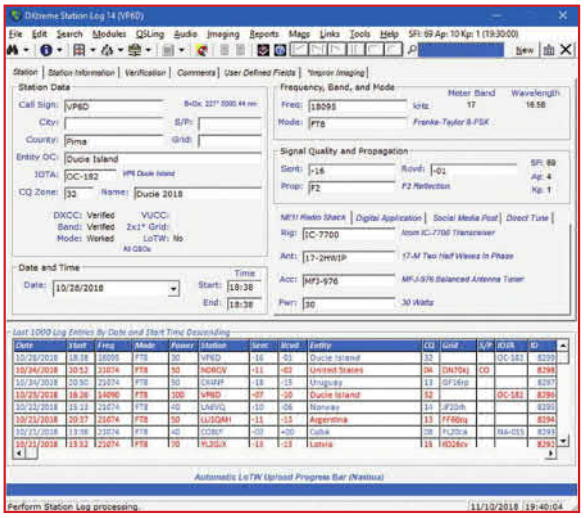
SD by EI5DI

Tactical Mini Compact Telescopic Mast

Radio amateurs who like to take their radio outdoors are always looking for better options to support antennas in areas where there are no trees. Telescopic fibreglass masts are a popular choice.

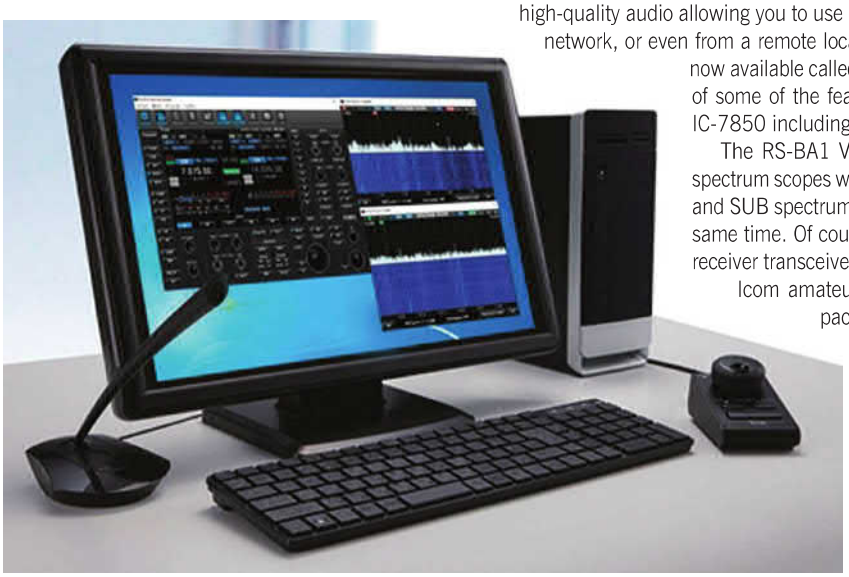
The Tactical Mini is a new addition to the SOTABEAMS line of masts. Designed specifically for radio use, it combines a very short packed length (ideal for carry-on baggage and rucksacks) with a useful 6m (19.6ft) extended length. It's a strong mast too; ideally suited for supporting wire dipoles and vertical antennas. The Tactical Mini is supplied with a camouflage bag. The Tactical Mini is likely to be a popular choice for SOTA activators. Priced at £39.95, more details at www.sotabeams.co.uk

DXtreme Station Log 14



DXtreme Software™ has released a new version of its popular logging program for amateur radio operators: DXtreme Station Log 14™. With this new version, users can switch between Rich Site Feed and Grid Feed by clicking a tab on the window. The Rich Site Feed displays the actual, continuous feed from the Telnet server, and lets users interact with the server to set options like server-side filters and to perform queries. The new Grid Feed displays 10 to 50 rows (user's choice) of DX spots in a structured, resizable, alternating-color grid. Grid-Feed spots can be displayed on a rotating basis (erase then continue) or by overwriting spots already displayed, as selected on the DX Spot Checker toolbar. Users can set fonts and colors for both feeds. Users can also have DXtreme Station Log 14™ manage the pre- and post-log-entry population of the WSJT-X and JTDX log files, letting users perform all logging operations on the Station Log 14™ window while keeping their eyes glued to the WSJT-X or JTDX interfaces for worked-before status indications. This feature is important when using quick modes like FT8. When users add a JT log entry via JT Log Entry Processing, the Digital Application Used field is populated automatically with either WSJT-X or JTDX as appropriate. When using other applications, users can edit this field manually. And they can assign digital applications to pre-existing log entries by mode globally, filtered or unfiltered by date and band. Users can create Club Log records in a special workfile automatically when adding or modifying log entries. The workfile can be viewed and edited, if needed, and uploaded via the Club Log website. DXtreme Station Log 14™ runs in 32- and 64-bit versions of Microsoft® Windows® 10, Windows 8.1, Windows 8, Windows 7, Windows Vista®, and Windows XP. It retails for $89.99 worldwide for Internet distribution. Reduced pricing is available for upgrading users. All prices include product support by email. For more information, visit www.dxtreme.com or contact bobraymond@dxtreme.com.

RS-BA1 Version 2 Dualwatch Remote Control Software



The RS-BA1 remote control software gained popularity by allowing radio amateurs to operate selected Icom radios from a PC via IP. The RS-BA1 offers real-time operation with low latency, high-quality audio allowing you to use an Icom radio installed in another room using your home network, or even from a remote location over the Internet. A new version of this software is now available called RS-BA1 Version 2 that will allow users to take advantage of some of the features of HF radios such as the IC-7610, IC-7851 and IC-7850 including dual-watch operation and dual spectrum scope.

The RS-BA1 Version 2 will allow the dual-watch operation and dual spectrum scopes with waterfall functions to be used on your remote PC. MAIN and SUB spectrum scopes can be observed on the RS-BA1 Version 2 at the same time. Of course, the RS-BA1 Version 2 can be used with Icom single receiver transceivers. The RS-BA1 Version 2 is available from all authorised Icom amateur radio dealers. Two versions are available including a packaged version with the RC-28 remote controller with a suggested retail price of £282 inc VAT. A standalone RS-BA1 Version 2 upgrade for previous users of the RS-BA1 Version 1 is available with a suggested retail price of £84 inc VAT. To find out more go to https://icomuk.co.uk/RC-28-V2/IP-Remote-Control-System/Amateur_Radio_Ham_Base_Stations

Five new Klingenfuss products

Klingenfuss has launch five new publications for 2019, *Guide to Utility Radio Stations, Shortwave Frequency Guide, Super Frequency List on CD, Frequency Database for the Perseus LF-HF Software-Defined Receiver* and *Digital Data Decoder Screenshots on USB Stick*. All pre-ordered copies have been sent out

Currently, more than 300 Kiwi-SDRs worldwide covering the complete 0-30MHz spectrum are linked at www.sdr.hu, offering a total of 1200+ or even 2400+ fully independent reception channels. The new Time Difference on Arrival (TDOA) software tool now even allows HF direction-finding to locate unidentified radio stations. This is simply great for the reception and identification of HF utility radio stations, and even NAVTEX on MF, from interesting locations all over the world. Hundreds of new digital data decoding screenshots have again been published on the website and many more full A4 size sample pages of all publications can be found on there too. www.klingenfuss.org

You can download the new 2019 catalogue as well as detailed product descriptions and a list of dealers worldwide. Alternatively, you may request a free 24-pages 2019 printed catalogue to your postal address.

Antennas

The Controlled Feeder Radiation Dipole

The circumstances at a particular location may suit installing an end fed antenna arrangement rather than a centre fed antenna. The controlled feeder radiation (CFR) dipole is an example of an end fed arrangement that conveniently maintains the advantages of a centrally fed dipole, while avoiding having a conspicuous feeder cable running centrally down from the antenna.

CFR dipole

The controlled feeder radiation technique was described by Bill Sykes, G2HCG several years ago [1]. Peter Pegler, G3ENI and Dan Sharpe, G3ZUN used the CFR technique as a basis for portable 5MHz near vertical incident skywave (NVIS) antenna experiments [2]. This dipole antenna comprised an electrical quarter wavelength (λ/4) long wire soldered to the inner conductor of the coaxial cable (coax), with an RF choke situated an electrical λ/4 down the coax forming the other leg of the dipole. The concept of this form of CFR dipole is shown in **Figure 1**.

PHOTO 1: The CFR dipole's RF choke formed from 12 turns of coax cable.

CFR dipole design overview

Following requests from several readers for clarity with regards to the published antenna equations, to follow is an overview which is also relevant to the CFR dipole.

The current distribution along a resonant standing wave antenna is approximately sinusoidal. By convention, the value of the radiation resistance is referred to the point of maximum RF current and is where the feeder is usually connected. As an example, a centre-fed half wave (λ/2) dipole in free space has a slightly inductive radiation resistance. Making the length of the dipole slightly shorter introduces a capacitive effect, cancelling the inductance, leaving a radiation resistance of about 73Ω resistive.

There are a number of factors that can affect the physical length of the antenna for true resonance, including the effect of radiation and the wire's dielectric coating, which collectively cause a slight retardation of the wave's velocity on the wire. The wire's end-insulators can also introduce additional capacitance at the antenna's extremities, affecting the antenna's length and is termed 'end-effect'. An approximate equation [3] suitable for multiple half wavelength (λ/2) wire antennas, in metres (m), is:

$$\text{Length (m)} = \frac{150(n-0.05)}{f}$$

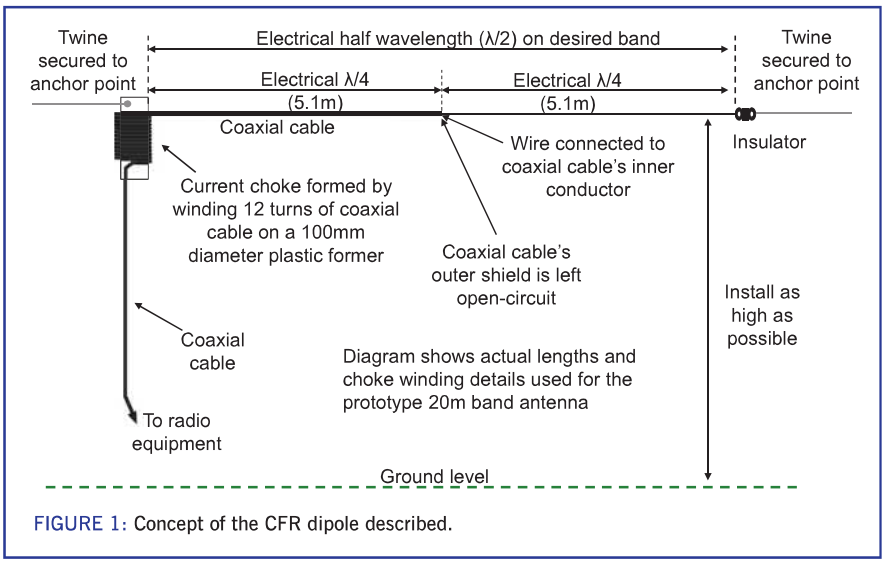


FIGURE 1: Concept of the CFR dipole described.

Mike Parkin, G0JMI
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PHOTO 2: G8JPC's CFR dipole ready to be packed up after use.

where *n* is the number of complete half-wavelengths in the antenna and *f* is the frequency in megahertz (MHz). For a half-wave dipole *n* is equal to 1, so the previous equation becomes:

$$\text{Length (m)} = \frac{150 \times 0.95}{f}$$

For a wire λ/2 dipole antenna, some antenna books [4] use a simplification of this equation:

$$\text{Length (m)} = \frac{143}{f}$$

Common mode currents

The CFR dipole's operation relies upon the flow of common mode current along the outer surface of part of the coax's screen. A coax cable's concentric construction means it is inherently unbalanced. Skin effect [5] causes the inner and outer surfaces of the coax's shield to behave as if they were *two entirely independent conductors*. When connected to an antenna, the outside of the shield is, in effect, not coupled to the antenna in the same way as its inner surface and central conductor. **Figure 2a** shows the concept of how skin effect allows current I_2 to flow along the inside of the screen and this is equal but opposite to I_1. When reaching the feed point, I_2 could either flow into the antenna or along the outside of the shield as I_3. If the shield's outside impedance is low, then I_3 flowing down the shield could be significant and is termed a common mode current. With I_3 flowing along the outside of the coax's shield, the coax's screen becomes part of the antenna when transmitting or receiving.

The CFR dipole's coax outer screen end is left open-circuit, consequently all of I_2 flows as I_3 along the screen's outer surface as shown in **Figure 2b**. If an RF choke is placed an electrical λ/4 down the coax, then this section of the cable forms a dipole along with the electrical λ/4 wire soldered to the coax's inner conductor as shown in Figure 1.

A CFR dipole for 20m

A CFR dipole, centred on 14.15MHz, was made up from 15m of RG-58 coax terminated in a PL259 plug, 17A rated insulated stranded copper wire, a former made from the 100mm diameter plastic inner from a cable drum and a dog-bone type insulator.

Using the equation described earlier, the design length of the dipole was calculated as:

$$\lambda/2 \text{ dipole (m)} = \frac{150}{14.15} \times 0.95 = 10.07\text{m}$$

The RF choke is needed to introduce a suitably high impedance, of at least 1000Ω, into the coax's outer screen to enable the antenna to work. Using 12 closely spaced turns of the RG58 coax, wound onto the 100mm diameter plastic former, giving a coil length of 60mm, provided an inductance [6] of approximately:

$$L(\mu\text{H}) = \frac{100^2 \times 12^2}{(457.2 \times 100) + (1016 \times 60)} \approx 13.5\mu\text{H}$$

This gave a calculated reactive impedance (X_L) at 14.15MHz of approximately:

$$X_L = 2\pi \times 14.15\text{MHz} \times 13.5\mu\text{H} \approx 1200\Omega$$

The actual value of the impedance is difficult to determine owing to the loading effect of the coax cable extending either side of the RF choke. However, this arrangement provided an adequate RF choke for the antenna to perform. Cable ties passed through holes in the former held the 12 coax turns in place as shown in **Photo 1**.

Around 30mm of the external insulation and the braid screen were removed from the open end of the coax cable, exposing the coax cable's inner. Around 12mm of the inner insulation was removed to expose the central conductor. About 12mm of the insulation from the ends of the 17A stranded wire were removed and soldered. One end of the stranded wire was soldered to the coax cable's inner conductor. Several layers of plumbers' PTFE tape were then wrapped over the joint and the exposed coax's outer screen to protect them. Two overlapping lengths heatshrink were shrunk over the PTFE tape and coax to provide additional protection.

The other end of stranded wire was also protected using plumbers' PTFE tape and heatshrink. The wire end was passed through the dog-bone insulator, folded back and held with two cable ties to secure it.

Installation and testing

The antenna was installed for testing at 6m above ground level (AGL). A small hole was drilled into the RF choke's plastic former opposite from where the coax, forming the dipole leg, extended away from the former and a length of nylon twine tied to hoist the antenna up at this end. Similarly, a length of nylon cord was attached to the dog-bone insulator to enable the other end to be hoisted up. The antenna was tuned at 14.15MHz using an MFJ antenna analyser connected to the end of the coax cable. The length of the wire and the coax cable dipole legs were equally adjusted for minimum SWR, giving both a length of 5.1m as shown in Figure 1. This was an iterative process made possible by adjusting the coax and wire lengths through the cable ties, that were firmly tightened when the minimum SWR was obtained.

Having signed on, the antenna was initially tested using a 10W CW signal at 14.15MHz. The SWR was measured as 1.2:1 referred to 50Ω from 14.005 to 14.300MHz. The RF power was increased to 100W and the SWR remained the same over this bandwidth.

Over the next few weeks, the antenna enabled several 20m band contacts to be made using 100W SSB ranging from the east of North America to the United Arab Emirates.

G8PJC CFR dipole

John McDonald, G8PJC has kindly supplied a picture of his 20m band CFR dipole that he uses for portable use, see **Photo 2**. John's CFR dipole is a good example of how easily the antenna can be rolled up and stored when not in use.

Conclusion

The CFR dipole described provided a fairly inconspicuous lightweight antenna that could be easily hoisted up and down, making

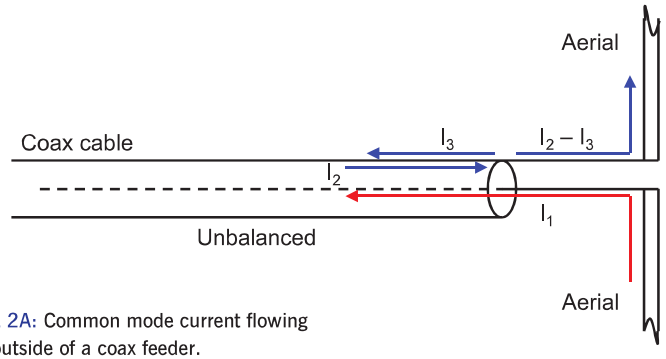

FIGURE 2A: Common mode current flowing on the outside of a coax feeder.

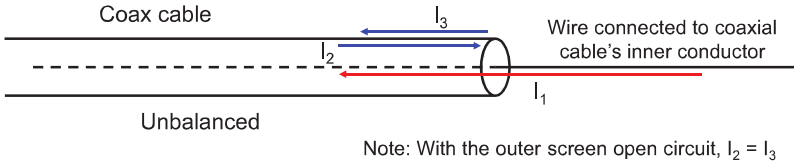

FIGURE 2B: Concept of CFR dipole RF current flow.

the antenna suitable for both fixed and portable use. The antenna performed well considering it was installed at 6m AGL and the poor HF radio conditions encountered. It is intended to continue this theme next month with a VHF CFR dipole design for 6m.

Acknowledgment

Following the August 2018 Antennas column, my thanks are passed to John McDonald, G8JPC for his help and time with the material forming the basis for *this* Antennas column. John sent in several references and pictures of CFR antennas he has made, providing invaluable background to this month's column.

Reader feedback

Following the July 2018 Antennas column, thanks are passed Robin McNeill, ZL4IG who has provided some helpful tips based his experience of using G3PZF type traps. In summary:

"There are a few things that will make life happier if you use G3PZF traps:

"1. Should you build the trap (as per Figure 5 in the July 2018 Antennas column), the soldered joints may fail as the trap moves around in the wind. Therefore, all stress on the soldered coaxial cable joints needs removing.

"2. It is impossible to tune the trap as it stands. A solution was to solder a 'gimmick' capacitor **[7]** made from two lengths of high voltage insulated wire twisted half a dozen times connected across the length of the trap. Twisting or untwisting the capacitor soon gets the trap tuned. Design the trap to operate a few kHz high to accommodate the gimmick capacitor.

"3. Tune the trap by using a grid dip oscillator with a receiver listening in to track the resonant frequency. This is best done on the workbench.

"4. Liberally apply insulation tape to the ends of the coax and all soldered joints, then give everything a couple of coats of outdoor acrylic paint. Denso grease-impregnated cloth is a cure-all – messy, but is reliable.

"5. Don't underestimate the voltage across the trap if more than 100W is applied to the feeder. If anything gets damp, smoke and charring can be expected, worsening the SWR from then on."

Many thanks for this, Robin.

References

[1] Controlled Feeder Radiation, Bill Sykes, G2HCG, *RadCom* May 1990, p 40-41
[2] Antennas, *RadCom* September 2012, p 22-23
[3] RSGB *Radio Communication Handbook* 5th edition, Chapter 12, HF Antennas, p 12.3
[4] *HF Antennas for Everyone*, edited by Giles Read, G1MFG, Chapter 1, HF Antennas, p 18
[5] RSGB *Radio Communication Handbook* 13th edition, Section 1, Principles, p 1.17
[6] Ditto, Appendix A, General Data, Coil Winding, Page A3
[7] 'gimmick' is the traditional name for a small-value capacitor made from twisting two pieces of insulated wire together. The value is in the order of 0.04pF per mm and can be adjusted by the tightness of the turns and the overall length.

Contesting

The new series of 80m Club Championship contests starts this month, and remember the new MGM Activity Contests.

The very first session of the 2019 80m Club Championship series is SSB on Monday 4th. There are two trophies awarded for the series, the G5RV Memorial Shield for Local Clubs and the Horace Freeman Trophy (2017) for National Clubs. 'Assisted' and 'Unassisted' categories are being introduced into this series this year, the HFCC definition of 'Assisted' being "…an operator is using support in order to locate and identify callsigns. Examples are the DX Cluster, RBN, local or remote multi-channel decoder such as CW Skimmer, internet spotting applications, receiving an SMS from another person on the whereabouts of stations, etc." The first HF Championship contest of the year is the First 1.8MHz Contest, which takes place on the evening of Saturday 9th. After that we return to the 80m Club Championships, with datamodes on Wednesday 13th and CW on Thursday 28th.

The final event in the 2018-19 Super League series is 70cm AFS, which runs for four hours on Sunday 3rd. On Tuesday 5th we have three 2m events. The FMAC and the new MGMAC take place at the same time, so enter whichever you prefer. Then, after a five minute pause, the UKAC takes place. On Tuesday 12th the 70cm FMAC runs for 55 minutes, and after a five minute pause is followed by the 70cm UKAC. On Thursday 14th we have one of the new 6m MGMACs, followed by the 6m UKAC. On Tuesday 19th we have the 23cm UKAC and on Thursday 21st we have the 4m UKAC (with no preceding FMAC any more). The first of this year's series of 4m Cumulatives takes place on the morning of Sunday 24th. There will be five sessions over the coming months. Finally, the SHF UKAC is on Tuesday 26th.

The G5RV Memorial Shield.

The UKEICC series of 80m contests continues, with an SSB session on Wednesday 6th. The first of this year's series of WPX (Worked all Prefix) contests is RTTY, which runs for 48 hours over the weekend 9-10th. The PACC (Dutch) Contest runs for 24 hours over the same weekend, on CW and SSB. The CW leg of the ARRL (American) International DX Contest runs for 48 hours over the weekend 16-17th. The CQ Worldwide 160m DX Contest runs for 48 hours, starting 2200 on Friday 22nd. The REF (French) contest runs for eighteen hours over the weekend of 23rd-24th. Finally, this month's CW leg of the UKEICC 80m series is on Wednesday 27th.

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RSGB HF Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Mon 4 Feb	80m Club Championships	2000-2130	SSB	3.5	RS + SN
Sat 9 Feb	1st 1.8MHz *	1900-2300	CW	1.8	RST + SN + District
Wed 13 Feb	80m Club Championships	2000-2130	Data	3.5	RST + SN
Thu 28 Feb	80m Club Championships	2000-2130	CW	3.5	RST + SN

RSGB VHF Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
Sun 3 Feb	432MHz AFS §	0900-1300	All	432	RS(T) + SN + Locator
Tue 5 Feb	144MHz FMAC	1900-1955	FM	144	RS + SN + Locator
Tue 5 Feb	144MHz MGMAC	1900-1955	MGM	144	RST + 4-character Locator
Tue 5 Feb	144MHz UKAC	2000-2230	All	144	RS(T) + SN + Locator
Tue 12 Feb	432MHz FMAC	1900-1955	FM	432	RS + SN + Locator
Tue 12 Feb	432MHz UKAC	2000-2230	All	432	RS(T) + SN + Locator
Thu 14 Feb	50MHz MGMAC	1900-1955	MGM	50	RST + 4-character Locator
Thu 14 Feb	50MHz UKAC	2000-2230	All	50	RS(T) + SN + Locator
Tue 19 Feb	1.3GHz UKAC	2000-2230	All	1.3G	RS(T) + SN + Locator
Thu 21 Feb	70MHz UKAC	2000-2230	All	70	RS(T) + SN + Locator
Sun 24 Feb	70MHz Cumulative #1	1000-1200	All	70	RS(T) + SN + Locator
Tue 26 Feb	SHF UKAC	1930-2230	All	2.3-10G	RS(T) + SN + Locator

Best of the Rest Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange (info)
Wed 6 Feb	UKEICC 80m	2000-2100	SSB	3.5	4-character Locator
Sat/Sun 9/10 Feb	CQ WW WPX RTTY	0000-2359	RTTY	3.5-28	RST + SN
Sat/Sun 9/10 Feb	PACC Contest	1200-1200	CW, SSB	1.8-28	RS(T) + SN (PAs send Province)
Sat/Sun 16/17 Feb	ARRL International DX	0000-2359	CW	1.8-28	RST + tx power (Ws send State, VEs Province)
Fri-Sun 22-24 Feb	CQ WW 160m DX	2200-2200	SSB	1.8	RS + CQ Zone (Ws send State, VEs Province)
Sat/Sun 23/24 Feb	REF Contest	0600-1800	SSB	3.5-28	RS + SN (Fs send Dept No. or overseas prefix)
Wed 27 Feb	UKEICC 80m	2000-2100	CW	3.5	4-character Locator

* HF Championship event § Super League event. For all the latest RSGB contest information and results, visit www.rsgbcc.org

Old Timers' Honour Roll

On 31 December 2018, the following had unbroken Membership of the Society for 50 years or more.

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Mr J E T Lawrence, GW3JGA
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Mr J E Mulye, G0VEH
Mr M E Lambeth, G2AIW
Mr J Hoban, G3EGC
Mr R Page-Jones, G3JWI
Mr J E Smith, G3JZF
Mr G E Mackrell, G3KAX
Mr R Bray, G3KEL
Mr B Alderson, G3KJX
Mr D G Alexander, G3KLH
Mr D G Enoch, G3KLZ
Mr J Greenwood, G3KRZ
Mr G P Rigby, G3KTJ
Mr J B Butcher, G3LAS
Mr M Hayward, G3LGA
Mr G Taylor, G3MDC
Mr C A Hogg, G3NRZ
Mr R Scaife, G3RSB
Dr T R Skrbic, G3TOE
Mr J C Alford, G4DOE
Mr J H Birkett, RS20842
Mr J H Reisert, W1JR

62 Years
Mr P Craw, G3CCX
Mr P C Cole, G3JFS
Dr K L Smith, G3JIX
Mr M Street, G3JKX
Mr C H Noden, G3JPB
Mr K G Grover, G3KIP
Mr D H Plumridge, G3KMG
Mr J D Davies, G3KZE
Mr D A Shepherd, G3LCS
Mr R J Cooke, G3LDI
Mr C B C Hill, G3LGS
Mr D Webber, G3LHJ
Dr M J Underhill, G3LHZ
Mr O Jackson, G3LKZ
Dr A Hodgkinson, G3LLJ
Mr R Scrivens, G3LNM
Mr G Dale, G3MFH
Mr P Burt, G3NBQ
Mr D W Stevens, G3NWG
Mr A J Balmforth, G3RKQ
Mr A R Stevenson, G3YNT
Mrs B A Long, G8FKY
Mr A Kettlety, G8HTN
Mr F Claytonsmith, GM3JKS
Mr V W Stewart, GM3OWU
Dr J C Craig, VO1FB

61 Years
Mr F L Wiseman, G3GRY
Mr M Harrison, G3HKH
Mr L J Loveland, G3KZX
Mr R L Gerrard MBE, G3LAZ
Mr B E Gee, G3LDG
Mr R D Muir, G3LHN
Mr C H Evans, G3LUO
Mr F Griffiths, G3MED
Mr A V H Davis, G3MGL
Mr D Johnson, G3MPN
Mr K Ashcroft, G3MSW
Mr F E Garrett, G3MVZ
Mr R J Weaving, G3NBN
Mr C R Burchell, G3NKQ
Mr D Thom, G3NKS
Mr M E Slater, G3NML
Mr J Hogg, G3NUA
Mr A B Plant MBE, G3NXC
Mr S J Gilbert, G3OAG
Mr R M G Maule, G3OEF
Mr D W Thompson, G3OXG
Mr R W Fisher, G3PWJ
Mr D E Waller, G3SUL
Mr J E C Baldwin, G3UHK
Mr W J C Pinnell, G3XWK
Mr A V Evans, G3ZZX
Mr J Juleff, G4MXU
Mr W Clinton, G8KZN
Mr D B Whitfield, G8VMY
Mr J F Gray, GM3LRG
Mr M Williams, GW3LCQ
Mr G H Price, GW3LXI
Mr J E Orme, RS21408
Mr R N Jones, RS25982

60 Years
Mr G R Watts, G0EVW
Mr R J Oram, G0FXI
Mr P K Hamblett, G0TKT
Mr D Blake, G2FT
Mr R W Emery, G3FYX
Prof L W Barclay, G3HTF
Mr D G Pinnock, G3HVA
Mr P M Rackham, G3IRQ
Mr R T Bowden, G3IXZ
Mr J Cleeve, G3JVC
Mr J E Symes, G3LNN
Mr R Brown, G3LQP
Mr P K Blair, G3LTF
Mr P Buck, G3LWT
Mr M Scott, G3LYP
Mr J D Masters, G3MBM
Mr B Vaughan, G3MCV
Mr W J Kennedy, G3MCX
Mr J S E Pearce, G3MEC
Mr R E Piper, G3MEH
Mr E J Landon, G3MHT
Dr T Langdon, G3MHV
Mr G A Whiting, G3MMS
Mr H J Benjamin, G3MNB
Mr D L Byne, G3MRQ
Mr R Strafford, G3MRT
Mr G F Gott, G3MUO
Mr D Beales, G3MWO
Mr C K Richardson, G3NAE
Mr G Mallinson, G3NAK
Dr J E Larson, G3NBL
Mr C R Fry, G3NDI
Mr J T Leviston, G3NFB
C L Desborough, G3NNG
Mr M T George-Powell, G3NNO
Mr D Foster, G3NRU
Mr D Bemister, G3OBX
Mr R P Welch, G3OFX
Mr J Rose, G3OGE
Mr R A Hargreaves, G3OHH
Mr J Sleight, G3OJI
Mr M W Plaster, G3OJL
Mr A J Hobbs, G3OJX
Mr D A Skye, G3PLR
Mr C Thomas, G3PSM
Mr I G Dufour, G3PWB
Mr R Parkes, G3REP
Rev J L Marshall, G3RKH
Mr M S Box, G3RZG
Mr M Shardlow, G3SZJ
Mr L P Best, G3THM
Mr J R Shewan, G3UZB
Mr R I Buckby, G3VGW
Mr M D Watson, G3WMQ
Mr R J Lister, G8IXP
Mr D Young, G8TVW
Mr T Sorbie, GM3MXN
Prof J D Last, GW3MZY
Mr W J M Hume, RS26142
Mr A C Doty Jr, W7ACD
Mr J Blackman, ZS1PM

59 Years
Mr H Perkins, EA5SX
Mr E Chicken MBE, G3BIK
Mr M J Stevens, G3CPN
Mr R L Chidzey, G3IOM
Mr A Shannon, G3KKJ
Mr P Whitford, G3MME
Dr G H Grayer, G3NAQ
Mr W K Ginder, G3NAS
Mr L R Beckwith, G3NFP
Mr G L Quarterman, G3NHX
Mr G Munden, G3NIL
Mr H White, G3NKW
Mr E Collin, G3NQV
Mr J W Heaviside, G3NYX
Mr R J Powell, G3OGP
Mr I Jackson, G3OHX
Dr R A Simpson, G3OMS
Mr J Denman, G3OND
Mr R Burns, G3OOU
Mr D Evans, G3OUF
Mr J G Wilcox, G3OYF
Mr G J Petrie, G3PDG
Mr B D Simpson, G3PEK
Mr A L Gray, G3RBG
Mr R G Dobdinson, G3RGD
Mr J A Strutt, G3SAS
Mr A Hewitt MBE, G3SVD
Lt Col J G Barber, G3TTJ
Mr H M Davison, G3TVW
Mr M D Leighton, G3UKM
Mr L S Margolis, G3UML
Mr M A Hall, G3USC
Mr M Foster, G3VOF
Mr P Beecroft, G3WVY
Mr P L A Burton, G3ZPB
Mr H R Perrin, G4AFY
Dr B Chambers, G8AGN
Mr M J Bonner, G8ALB
Mr M Hearsey, G8ATK
Mr M Wallace, G8AXA
Mr R H Chambers, G8BCA
Mr T Harrison, GM3NHQ
Mr A E Gwynne, GW3LNR
Dr B G Taylor, HB9ANY
Mr E J Kelly, KG6XF
Mr G G Gemmill, RS22502
Mr H J Randall, RS25603
Mr D M Willoughby, RS27261

58 Years
Mr A Prichard, G0CPA
Mr J Crerar, G3BYV
Mr G D Lively, G3KII
Mr S J W Freeman, G3LQR
Dr A E Wilson, G3MAE
Mr B C Gibbs, G3MBN
Mr R Wheeler, G3MGW
Mr E K Tunstall, G3MSO
Mr K A Morgan, G3NWX
Mr A Melia, G3NYK
Mr T Haydu Jones, G3OAD
Mr W A Jeffs, G3OAF
Mr C Bowden, G3OCB
Mr D A G Martin, G3ODC
Mr M S Beer, G3OGZ
Mr G Badger, G3OHC
Mr J C G Parker, G3OLX
Mr P E Judkins, G3OMJ
Mr D S Moffatt, G3RAU
Mr D C Sylvester, G3RED
Mr D R Mullins, G3RGM
Dr A J Shepherd, G3RKK
Mr M J T Smith, G3RMN
Mr A Notschild, G3RSF
Mr A T James, G3RUV
Mr R W L Limebear, G3RWL
Mr P J Cort-Wright, G3SEM
Mr P Hart, G3SJX
Mr L P J Lethbridge, G3SXE
Mr R Mason, G3TDM
P W Myers, G3UWT
Mr J Greaves, G3UXM
Mr W McClintock, G3VPK
Mr P Barville, G3XJS
Mr J Kasser, G3ZCZ
Mr M Duce, G4BQF
Mr N J L Lockett, G4EMB
Mr G P Gaunt, G4IJO
Mr L Arnold, G8AHE
Mr R A Fuller, G8CEZ
Mr J Pink, G8MM
Mr F C Thorogood, G8ORV
Mr G Hodgkinson, GI7TPO
Mr L Woolf, GJ3RAX
Dr A Masson, GM3PSP
Mr J F Kelly, GM3TCW
Mr G R Kelly, GM8MST
Mr R Howe, GW3PLB
Mr A Richards, GW3SFC
Mr D W Bowers, GW4AVC
Mr A J Richards, GW4RYK
Mr G Lander, HB9AJU
Mr D Gray, M0DLL
Mr M A Hoare, RS22800
Mr M J J Dawe, RS23071
Mr M T Bland, RS24640
Dr D Harvey, RS25435

57 Years
H Hensler, DL6DZ
Mr P O'Kane, EI5DI
Mr A Martin, F5VAI
Mr E L Masters, G0KRT
Mr D Beattie, G3BJ
Mr J W Swift, G3CTP
Mr J France, G3KAF
Mr A M Pomfret, G3LZZ
Mr C D Stephens, G3MGS
Mr B S Collins, G3MXA
Mr J R Vickers, G3ORI
Mr R G Titterington, G3ORY
Mr D Westbury, G3OXL
Mr D Swainson, G3OXN
Mr J Holstead, G3OZC
Mr R E A German, G3OZT
Mr J J Davies, G3PAG
Mr J Rabson, G3PAI
Mr A J Baker, G3PFM
Mr H A Buckenham, G3PGN
Mr J J Morris, G3PHA
Mr P Day, G3PHO
Mr P Chandler, G3PID
Mr J E Hoare, G3PJI
Dr B Whelan, G3PJT
Mr R Cox, G3PLP
Dr R G Fenby, G3PLS
Mr J P Martinez, G3PLX
Mr A J Feist, G3PMV
Mr A Floyd, G3PNQ
Rev I S Partridge, G3PRR
Mr J L Green, G3PYF
Mr R J Parsons, G3RBP
Mr D C Griffiths, G3RDQ
Mr R V Southern, G3RST
Dr J S J Craig, G3SGR
Mr R G Pett, G3SHK
Dr J R Whittington, G3SHZ
Mr R L Turner, G3SMD
Mr W M Furness, G3SMM
Mr K F Jessop, G3TAA
Mr W B Bickham, G3TJH
Mr M J Nicholas, G3TOI
Mr G Grimshaw, G3TQX
Mr R T Collins, G3TRC
Mr A C L Coates, G3TVV
Prof M Harrison, G3USF
Mr J Delves, G3VHH
Mr A Davis, G3VTR
Mr G Oakes, G3WRK
Mr C J Langley , G3XGK
Mr R G Davy, G3XVF
Mr R Cutbush, G4ADK
Mr R J Taylor, G4BEL
Mr R Wells, G8BNR
Mr H Skelhorn, G8BPU
Mr G F Wilks, G8DVJ
Mr M T Bowen, G8DWA
Mr D L Edmonds, G8EWN
Mr N E Brown, G8NCK
Mr A Foster, GM3OXA
Mr J Carson, GM3OXK
Mr C S Penna, GM3POI
Mr J G Walford, GM3POT
Mr N J Dudman, GW8GGW
Mr P W Whipps, M0PWW
Mr D S Kendall, N6HEQ
Mr M E Kensdale, RS23278
Mr T G B Hobbis, RS24754
Mr T P Flinn, RS30993
Mr J A Fuge, VP9FI

56 Years
Mr D K McDermott, EI4DW
Mr B W N Harris, G3GTF
Mr B J Newman, G3MMN
Mr R Harris, G3OTK
Mr C J W Thomson, G3PEM
Mr L G Sear, G3PPT
Mr L D Rooks, G3PUO
Mr J B W Braithwaite, G3PWK
Rev A Speight, G3PYW
Mr E D Hodgson, G3RAR
Mr A F Stagles, G3RBY
Mr H Neale, G3REH
Mr K Randall, G3RFH
Mr D Thomson, G3RGS
Mr D Carden, G3RIK
Mr N Ackerley, G3RIR
Mr C M Garland, G3RJT
Mr M Vann, G3RLV
Mr R Collins, G3ROC
Mr J Pennington, G3RTP
Mr M A Sanders, G3RWV
Mr G D Aram, G3SET
Mr P J Casemore, G3SGF
Mr B Naylor, G3SHF
Mr I B Hamill, G3SMF
Mr P Torry, G3SMT
Mr R H Jennings, G3SOE
Mr R Smith, G3SVW
Mr P Whitchurch, G3SWH
M A Trundle, G3TCG
Mr O S Tillett, G3TPJ
Mr R Farrance , G3TRH
Mr N Cawthorne, G3TXF
Mr R Constantine, G3UGF
Mr M I Vincent, G3UKV
Mr P B Johnson, G3UMV
Mr M Farmer, G3VAO
Mr C W Westwood, G3VFD
Mr R Bailey, G3WCQ
Mr R Lapthorn, G3XBM
Mr F Bourne, G3YJQ
Mr M J Quee, G3ZWW
Mr D J Jarvis, G4CEU
Mr B J Payne, G4CJY
Rev J A Wardle, G4CVA
Mr D Berry, G4DFB
Mr M J Cooke, G4DYC
Dr J C Axe, G4EHN
Mr R Singleton, G7OXP
Mr R S Boardall, G8AJZ
Mr M R Perry, G8AKX
Mr C Towns, G8BKE
Mr J P Abbott, G8CWJ
Mr W S Steer, G8CYG
Mr H Parker, G8GUN
Mr R J C Davey, G8MRI
Mr C G Bristow, GI3PSQ
Mr D H Guest, GM3TFY
Dr R D Harkess, OBE, GM3THI
Mr R H Weaver, GW3KXX
Mr J Jones, GW3TMP
Dr C G Potter, M0DDT
Mr H R Tyreman, VK2BHT
Mr J Kaplan, W9QKE

55 Years
Mr L P Purcell, EI6D
Mr B J Giddings, G1JLG
Mr R G Heslop, G3KMQ
Mr R W Nolan, G3KWK
A R Preedy, G3LNP
Mr P W F Darragh, G3MNV
Mr S Kay, G3OMA
Mr D Beakhust, G3OSQ
Mr J Garrett, G3RHP
Mr B Turner, G3RLE
Mr W Hall, G3RMX
Mr T J Venn, G3RPV
Mr P Lewis, G3RQX
Mr P M Madagan, G3RQZ
Mr R H Crowe, G3RVA
Mr J M Walch, G3RVI
Mr C I B Trusson, G3RVM
Mr P Henwood, G3RWF
Mr P Chadwick, G3RZP
Mr R C Marshall, G3SBA
Rev G A Stanton, G3SCV
Mr R Brown, G3SCZ
Mr J J Bottom, G3SDG
Dr B R H King, G3SGK
Mr R Cottrell, G3SHY
Mr J C Burbanks, G3SJJ
Mr G M Smith, G3SNO
Mr E Taylor, G3SQX
Mr P H McPherson, G3TEL
Mr P J Walters, G3THW
Mr E Ross, G3TJC
Mr G C Wynes, G3TLV
Dr R Butcher, G3UDI
Mr D M Browning, G3UEY
Mr D G Mason, G3USD
Mr R A J Smith, G3VKT
Mr D Aslin, G3WGN
Mr J Hartley, G3WGQ
Mr Z Skrobanski, G3XDZ
Mr R G Harris, G3ZFR
Mr P D Hall, G4AQA
Mr T Giles, G4CDY
Mr J A Cobley, G4RMD
Mr J N Houldridge, G6KYD
Mr D Mann, G8ADM
Mr G Smith, G8AOJ
Mr G Swan, G8ASJ
Mr N D Fisher, G8ATO
Mr R B Harbison, GI3PDN
Mr H A Sinclair, GI4GOS
Mr B B Nelson OBE, GJ4KBM
Dr H Brash, GM3RVL
Mr I M G Miller, GM4JAE
Mr A Gordon, GM6RXQ
Mr D M Thomas, GW3RWX
Mr R Alban, GW3SPA
Mr S Hulme, GW3SRM
Mr B Carter, GW8AAG
Mr F R Hopwood, GW8BIA
Mr J H Tait, GW8MGF
Mr J Willerton, RS19211
Mr S B Harrison, RS20102
Mr C A Cooper, RS25672
Mr P V Lingham, RS38098
Mr D Dunn, VK3DBD

54 Years
Mr P Stepponat, DL7BAT
Mr R A Ball, GOINZ
Mr T H Gonsalves, GOOYJ
Mr S Revell, G3PMJ
Mr D M Gresswell, G3PWY
Mr I Walker, G3RJF
Mr S M Cherry, G3SJK
Mr P D Lee, G3SPL
Mr J J Jarvis, G3SUG
Mr D Coltart, G3SYM
Mr B C Ward, G3SZV
Mr C J Lambert, G3TA
Mr J C Boydell, G3TAX
Mr J D Cree, G3TBK
Mr A S Bye, G3TCI
Mr G F Kimbell, G3TCT
Mr C R Bonner, G3TGF
Mr D R Stimson, G3THC
Mr D R French, G3TIK
Mr P S Duncan, G3TKA
Mr R A W Stevens, G3TVI
Mr I D Brown, G3TVU
Mr D Fill, G3UBB
Mr J P H Burden, G3UBX
Mr D Houghton, G3UPY
Mr P Carey, G3UXH
Mr C Pedder, G3VBL
Mr R G Luckock, G3VDX
Mr D N Davison, G3VFX
B R G Hutchinson, G3VGH
Mr D Aldridge, G3VGR
Mr E J Harland, G3VPF
Mr D T M Clemens, G3VXM
Mr I Peterkin, G3WDU
Mr K Griffiths, G3WIC
Mr J W Hall, G3WLD
Mr P Smith, G3WPB
Mr S W Powell, G3WRA
Mr P G Brooker, G3WXC
Mr A Strong, G3WXI
Mr J K Gibson, G3WYN
Mr G J Bedwell , G3XYX
Mr F Wilson, G3YQA
Mr H Tabberer, G3YVK
Mr P J Marcham, G3YXZ
Mr J Yu, G3ZQT
Mr J P Billingham, G4AGQ
Mr D J Butler, G4ASR
Mr G E Austin, G4DPA
Mr T Jewell, G4ELM
Mr J M Butcher, G4GWJ
Mr B Coleman, G4NNS
Mr J O Haile, G8ADC
Mr P Helm, G8AEN
Mr C G Partridge, G8AUU
Mr G D Drinkwater, G8GCU
Mr E S Campbell, G8PHS
Mr A K Sinclair, GD3TNS
Mr M J W Hamilton, GM3TAL
Mr V Budas, GM3VTB
Dr B W Flynn, GM8BJF
Mr R Volck, GW3RKV
Mr K Winnard, GW3TKH
Mr C S Carver, GW4EYO
Mr G Ferguson, RS26003
Mr W Inglis, RS26642
Mr E D Moustakas, SV1AN

53 Years
Mr A Cobb, G0WJK
Mr G F Brown, G2BJK
Mr R E McHenry, G3NSM
Mr T Boucher, G3OLB
Mr A Ash, G3PZB
Mr F L Curtis, G3SVK
Mr R Thompson, G3TKF
A Robinson, G3TQA
Mr R D Allan, G3TQZ
Mr K M Orchard, G3TTC
J E Harknett, G3TVH
Mr M H Roach, G3TWJ
Mr T Morgan, G3UAS
Mr R Stansfield, G3UAX
Mr E A Sweetman, G3UAZ
Mr D I Gould, G3UEG
S V Knowles, G3UFY
Mr B T Davis, G3UJB
Mr R M M Heath, G3UJV
Mr P A Hopwood, G3UKH
Mr M Newton, G3UKW
Mr M Hibbitt, G3ULN
Mr J F Wilson, G3UUT
Mr M R G Simpson, G3UVM
Mr J S Curry, G3UVU
Mr P Kemble, G3UYK
Mr R Hemmings, G3VCT
Mr T Chipperfield, G3VFC
Mr M E Deutsch, G3VJG
Mr J E Longhurst, G3VLH
Mr M G Pritchard, G3VNQ
Mr J S Wright, G3VPW
Mr P R Lamb, G3VRW
Mr B E Ellis, G3VXF
Mr J Doswell, G3VYE
Mr R G Chamberlain, G3VYU
Mr D C Holland, G3WFT
Mr S Williamson, G3WGU
Dr G Bulger, G3WIP
Mr G Macnaught, G3WOV
Mr D Minett, G3WPP
Mr K A M Fisher, G3WSN
Mr M K Taylor, G3WTA
Mr J P Smith, G3WTS
Mr D Dade, G3XCT
Mr G Everest, G3XUP
Mr P W Crust, G3XYC
Mr D Woodhall, G3ZGZ
Mr P Rodmell, G3ZRS
Mr R Dunham, G3ZSQ
Mr I Sneap, G3ZYC
Mr G Dover, G4AFJ
Mr D P Warner, G4AFQ
Mr K R Punshon, G4APJ
Mr P Bradshaw, G4CTE
Mr R A Harris, G4FFA
Mr C R Caine, G4IWS
Mr P Senior, G4JNL
Mr K Hancock, G4KIY
Mr D Ross, G4LOO
Mr S L Berry, G4LRT
Mr P Collett, G4LYC
Mr C Trayner, G4OKW
Mr T E J Toth, G4ORF
Mr D Fillingham, G4OVR
Mr B T Collins, G4ULA
Mr S Birkill, G8AKQ
Mr H Bate, G8AMD
Mr C D Plummer, G8APB
Mr I R G Gurton, G8ASP
Mr A J Whittaker, G8BFM
Mr A Marshall, G8BUR
Mr C D Jameson, G8CDJ
Dr J G Davies, G8EBJ
Mr G Diacon, G8EWT
Mr T G Lambert, G8EZL
Mr I Gracey, GI3WEM
Mr E K Dons, GM0AXY
Mr J McCall, GM3HGA
Mr W G Cecil, GM3KHH
Mr I Drysdale, GM3TYS
Mr W P Wright, GM3UCH
Mr C Weston, GM3VAP
Mr D Cossar, GM3WIL
Mr M D Collar, GM8AGM
Mr J M Briscoe, GM8AOB
Mr D J Ozanne, GU3UMX
Mr P P le Boutillier MBE, GU3UOQ
Mr A E Peake, GW3SRG
Mr I Jones, GW3TLP
Mr K E Godfrey, GW3VEW

Mr M A Shelley, GW3XJQ
Mr R J Gregory, GW8FNO
Mr G Moda, I7SWX
Dr D A Nicole, M0CYJ
Mr D Earnshaw, NR3Y
Mr D D Kaye, RS26890
Mr H Pitchford, RS27350
Mr C R Baker, VK3GMR
Mr B Pope, VK4BAP
Mr M J Rogers, ZS1RZ

52 Years
Mr J Purfield, EI2CI
Mr A Wickham, G3IAZ
Mr R H Medcraft, G3JVM
Mr R Balister, G3KMA
Mr G F Firth, G3MFJ
Mr R Sykes, G3NFV
Mr R Jones, G3NKL
Mr G Suggate, G3NPI
Mr C Draper, G3TSK
Mr R B Heaton, G3UGX
Mr D Hampton, G3UHU
Mr M J Peake, G3UIJ
Mr C P Haddock, G3UZM
S T E Boyce, G3VBV
Mr R L Pickles, G3VCA
Mr P A Kalas, G3VCN
Mr D Prout, G3VCV
Flt Lt R Evans, G3VHE
Mr H Buttress, G3VHL
Mr G Wood, G3VIP
Mr F Turner-Smith, G3VKI
Mr G H S Jones, G3VKV
Mr T W Beamond, G3VLF
Mr C Linnell, G3VLT
Mr C Davis, G3VMU
Mr E Searle, G3VMY
Mr D A Lane, G3VOM
Mr R B Cottrell, G3VOS
Mr M J Fereday, G3VOW
Mr H Pinchin, G3VPE
Mr P J Lennard, G3VPS
Mr P Burgess, G3VPT
Mr J E Pitt, G3VRY
Mr G O Jones, G3VSB
Mr J A Arscott, G3VSL
Mr R S West, G3VSQ
Mr M P Coombs, G3VTO
Mr R Wilkinson, G3VVT
Mr A R Clemmetsen, G3VZJ
Mr J Elliott, G3WFK
Mr F J P Connor, G3WMR
Mr I R Cutler, G3XFV
Mr R Hutchinson, G3XHF
Mr D Powell, G3XLW
Mr C J Marsden, G3XSO
Dr M George, G3XYG
Mr D B Gething, G3XZK
Mr R Vale, G3YHI
Mr R Yaxley, G3YHO
Mr D M Kirkwood, G3YQO
Mr M Baker, G3ZBP
Mr D R Lax, G4AHN
Mr R Payne, G4AWA
Mr P Bolton, G4CXE
Mr D W Cannings, G4DWC
Mr I R Butson, G4HKC
Mr R D Sexton, G4IZS
Mr D Featherstone, G4JFD
Mr E Bailey, G4LUE
Mr G L Fitton, G4MDT
Mr R C Whattam, G8ACQ
Mr D L Woolley, G8AMJ
Mr S R Lucas, G8APZ
Mr J A Jones, G8AZT
Mr D Gardiner, G8BAS
Mr J Owen, G8BFT
Mr A Grove, G8BJG
Mr C G Clark, G8BKQ
Mr R Gape, G8DQX
Mr S Haseldine, G8EBM
Mr J Hunt, G8JPA
Mr J P Reeve, G8ROD
Mr R T Sherrard, GI3VAW
Mr M McFadden, GI3VCI
Mr A MacFarlane, GM0MAC
Mr F Baxter, GM3VEY
Mr C W Tran, GM3WOJ
Mr M A Hall, GM8IEM
Mr A Richmond, GU3ONJ
Mr C Jenner, GW0PPO
Mr B Cushing, M0DJQ
Mr D Bowers, M0DKV
Mr S A Spencer, RS28095
Mr C Inman, RS29943
Mr R Luther, VK7GN
Mr R Soifer, W2RS
Mr S Cammies, ZS1XG

51 Years
Mr M Holden, EA7JVZ
Mr J L McHugh, EI8BR
Mr J Laffont , F1RJ
Mr I G Tutt, G0PEC
Mr D D Bottomley, G3GAQ
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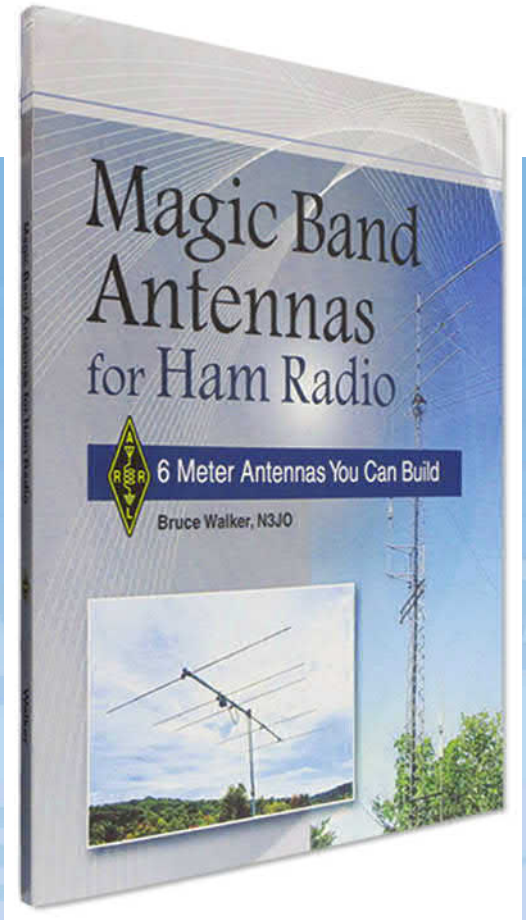

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RSGB Band Plan 2019

The following band plan is largely based on that agreed at IARU Region 1 General Conferences with some local differences on frequencies above 430MHz.

EFFECTIVE FROM 1st JANUARY 2019 UNLESS OTHERWISE SHOWN

136kHz	NECESSARY BANDWIDTH	UK USAGE
135.7-137.8kHz	200Hz	CW, QRSS and Narrowband Digital Modes

Licence Notes: Amateur Service – Secondary User. 1 watt (0dBW) ERP.
R.R. 5.67B. The use of the band 135.7-137.8kHz in Algeria, Egypt, Iran (Islamic Republic of), Iraq, Lebanon, Syrian Arab Republic Sudan, South Sudan and Tunisia is limited to fixed and maritime mobile services. The amateur service shall not be used in the above-mentioned countries in the band 135.7-137.8kHz, and this should be taken into account by the countries authorising such use. (WRC-12).

472kHz (600m)	NECESSARY BANDWIDTH	UK USAGE
IARU Region 1 does not have a formal band plan for this allocation but has a usage recommendation (Note 1).		
472-479kHz	500Hz	CW, QRSS and Narrowband Digital Modes

Note 1: Usage recommendation – 472-475kHz CW only 200Hz maximum bandwidth, 475-479kHz CW and Digimodes.
Note 2: It should be emphasised that this band is available on a non-interference basis to existing services. UK amateurs should be aware that some overseas stations may be restricted in terms of transmit frequency in order to avoid interference to nearby radio navigation service Non-Directional Beacons.
Licence Notes: Amateur Service – Secondary User. Full Licensees only, **5 watts EIRP maximum.** Note that conditions regarding this band are specified by the Licence Schedule notes.
R.R. 5.80B. The use of the frequency band 472-479kHz in Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia and Yemen is limited to the maritime mobile and aeronautical radionavigation services. The amateur service shall not be used in the above-mentioned countries in this frequency band, and this should be taken into account by the countries authorising such use. (WRC 12).

1.8MHz (160m)	NECESSARY BANDWIDTH	UK USAGE
1,810-1,838kHz	200Hz	Telegraphy
1,838-1,840	500Hz	Narrowband Modes
1,840-1,843	2.7kHz	All Modes
1,843-2,000	2.7kHz	Telephony (Note 1), Telegraphy 1,836kHz – QRP (low power) Centre of Activity 1,960kHz – DF Contest Beacons (14dBW)

Note 1: Lowest LSB carrier frequency (dial setting) should be 1,843kHz. AX25 packet should not be used on the 1.8MHz band.
Licence Notes: 1,810-1,850kHz – Primary User: 1,810-1,830kHz on a non-interference basis to stations outside of the UK. 1,850-2,000kHz – Secondary User. 32W (15dBW) maximum.
Notes to the Band Plan: As on page 30.

3.5MHz (80m)	NECESSARY BANDWIDTH	UK USAGE
3,500-3,510kHz	200Hz	Telegraphy – Priority for Inter-Continental Operation
3,510-3,560	200Hz	Telegraphy – Contest Preferred. 3,555kHz – QRS (slow telegraphy) Centre of Activity
3,560-3,570	200Hz	Telegraphy 3,560kHz – QRP (low power) Centre of Activity
3,570-3,580	200Hz	Narrowband Modes
3,580-3,590	500Hz	Narrowband Modes
3,590-3,600	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
3,600-3,620	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended), (Note 1)
3,600-3,650	2.7kHz	All Modes – Phone Contest Preferred, (Note 1). 3,630kHz – Digital Voice Centre of Activity
3,650-3,700	2.7kHz	All Modes – Telephony, Telegraphy 3,663kHz May Be Used For UK Emergency Comms Traffic 3,690kHz SSB QRP (low power) Centre of Activity
3,700-3,775	2.7kHz	All Modes – Phone Contest Preferred 3,735kHz – Image Mode Centre of Activity 3,760kHz – IARU Region 1 Emergency Centre of Activity
3,775-3,800	2.7kHz	All modes - Phone contest preferred Priority for Inter-Continental Telephony (SSB) Operation

Note 1. Lowest LSB carrier frequency (dial setting) should be 3,603kHz.
Licence Notes: Primary User: Shared with other user services.
Notes to the Band Plan: As on page 30.

5MHz (60m)	AVAILABLE WIDTH	UK USAGE
5,258.5-5,264kHz	5.5kHz	5,262kHz – CW QRP Centre of Activity
5,276-5,284	8kHz	5,278.5kHz – May be used for UK Emergency Comms Traffic
5,288.5-5,292	3.5kHz	Beacons on 5290kHz (Note 2)
5,298-5,307	9kHz	
5,313-5,323	10kHz	5,317kHz – AM 6kHz maximum bandwidth
5,333-5,338	5kHz	
5,354-5,358	4kHz	Within WRC-15 Band
5,362-5,374.5	12.5kHz	Partly within WRC-15 band, WSPR
5,378-5,382	4kHz	
5,395-5,401.5	6.5kHz	
5,403.5-5,406.5	3kHz	

Unless indicated, usage is All Modes (necessary bandwidth to be within channel limits).
Note 1: Upper Sideband is recommended for SSB activity.
Note 2: Activity should avoid interference to the experimental beacons on 5290kHz.
Note 3: Amplitude Modulation is permitted with a maximum bandwidth of 6kHz, on frequencies with at least 6kHz available width.
Note 4: Contacts within the UK should avoid the WRC-15 band (5351.5 - 5366.5 kHz) if possible
For the latest current guidance refer to the RSGB website
Licence Notes: Full Licensees only, **Secondary User, 100 watts maximum**. Note that conditions on transmission bandwidth, power and antennas are specified in the Licence. For the latest current guidance, refer to the RSGB website
Notes to the Band Plan. As on page 30.

7MHz (40m)	NECESSARY BANDWIDTH	UK USAGE
7,000-7,040kHz	200Hz	Telegraphy – 7,030kHz QRP (low power) Centre of Activity
7,040-7,047	500Hz	Narrowband Modes (Note 2)
7,047-7,050	500Hz	Narrowband Modes, Automatically Controlled Data Stations (unattended)
7,050-7,053	2.7kHz	All Modes, Automatically Controlled Data Stations (unattended), (Note 1)
7,053-7,060	2.7kHz	All Modes, Digimodes
7,060-7,100	2.7kHz	All Modes, SSB Contest Preferred Segment Digital Voice 7,070kHz; SSB QRP Centre of Activity 7,090kHz
7,100-7,130	2.7kHz	All Modes, 7,110kHz – Region 1 Emergency Centre of Activity
7,130-7,200	2.7kHz	All Modes, SSB Contest Preferred Segment; 7,165kHz – Image Centre of Activity
7,175-7,200	2.7kHz	All Modes, Priority For Inter-Continental Operation

Note 1: Lowest LSB carrier frequency (dial setting) should be 7,053kHz.
Note 2: PSK31 activity starts from 7,040kHz. Since 2009, the narrowband modes segment starts at 7,040kHz.
Licence Notes: 7,000-7,100kHz Amateur and Amateur Satellite Service – Primary User.
7,100-7,200kHz Amateur Service – Primary User.
Notes to the Band Plan: As on page 30.

10MHz (30m)	NECESSARY BANDWIDTH	UK USAGE
10,100-10,130kHz	200Hz	Telegraphy (CW) 10,116kHz – QRP (low power) Centre of Activity
10,130-10,150	500Hz	Narrowband Modes Automatically Controlled Data Stations (unattended) should avoid the use of the 10MHz band

Licence Notes: Amateur Service – Secondary User.
Notes to the Band Plan: As on page 30.
The 10MHz band is allocated to the amateur service only on a secondary basis. The IARU has agreed that only CW and other narrow bandwidth modes are to be used on this band. Likewise the band is not to be used for contests and bulletins. SSB may be used on the 10MHz band during emergencies involving the immediate safety of life and property, and only by stations actually involved with the handling of emergency traffic. The band segment 10,120-10,140kHz may only be used for SSB transmissions in the area of Africa south of the equator during local daylight hours.

14MHz (20m)	NECESSARY BANDWIDTH	UK USAGE
14,000-14,060kHz	200Hz	Telegraphy – Contest Preferred 14,055kHz – QRS (slow telegraphy) Centre of Activity
14,060-14,070	200Hz	Telegraphy 14,060kHz – QRP (low power) Centre of Activity
14,070-14,089	500Hz	Narrowband Modes
14,089-14,099	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
14,099-14,101		IBP – Reserved Exclusively for Beacons
14,101-14,112	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
14,112-14,125	2.7kHz	All Modes (excluding digimodes)
14,125-14,300	2.7kHz	All Modes – SSB Contest Preferred Segment 14,130kHz – Digital Voice Centre of Activity 14,195 ±5kHz – Priority for DXpeditions 14,230kHz – Image Centre of Activity 14,285kHz – QRP Centre of Activity
14,300-14,350	2.7kHz	All Modes 14,300kHz – Global Emergency Centre of Activity

Licence Notes: Amateur Service – Primary User. 14,000-14,250kHz Amateur Satellite Service – Primary User.
Notes to the Band Plan: As on page 30.

18MHz (17m)	NECESSARY BANDWIDTH	UK USAGE
18,068-18,095kHz	200Hz	Telegraphy – 18,086kHz QRP (low power) Centre of Activity
18,095-18,105	500Hz	Narrowband Modes
18,105-18,109	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)

18,109-18,111		IBP – Reserved Exclusively for Beacons
18,111-18,120	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
18,120-18,168	2.7kHz	All Modes, 18,130kHz – SSB QRP Centre of Activity 18,150kHz – Digital Voice Centre of Activity 18,160kHz – Global Emergency Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User. The band is not to be used for contests or bulletins.
Notes to the Band Plan: As on page 30.

21MHz (15m)	NECESSARY BANDWIDTH	UK USAGE
21,000-21,070kHz	200Hz	Telegraphy 21,055kHz – QRS (slow telegraphy) Centre of Activity 21,060kHz – QRP (low power) Centre of Activity
21,070-21,090	500Hz	Narrowband Modes
21,090-21,110	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
21,110-21,120	2.7kHz	All Modes (excluding SSB) – Automatically Controlled Data Stations (unattended)
21,120-21,149	500Hz	Narrowband Modes
21,149-21,151		IBP – Reserved Exclusively For Beacons
21,151-21,450	2.7kHz	All Modes 21,180kHz – Digital Voice Centre of Activity 21,285kHz – QRP Centre of Activity 21,340kHz – Image Centre of Activity 21,360kHz – Global Emergency Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User.
Notes to the Band Plan: As on page 30.

24MHz (12m)	NECESSARY BANDWIDTH	UK USAGE
24,890-24,915kHz	200Hz	Telegraphy 24,906kHz – QRP (low power) Centre of Activity
24,915-24,925	500Hz	Narrowband Modes
24,925-24,929	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
24,929-24,931		IBP – Reserved Exclusively For Beacons
24,931-24,940	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
24,940-24,990	2.7kHz	All Modes, 24,950kHz – SSB QRP Centre of Activity 24,960kHz – Digital Voice Centre of Activity

Licence Notes: Amateur and Amateur Satellite Service – Primary User. The band is not to be used for contests or bulletins.
Notes to the Band Plan: As on page 30.

28MHz (10m)	NECESSARY BANDWIDTH	UK USAGE
28,000-28,070kHz	200Hz	Telegraphy 28,055kHz – QRS (slow telegraphy) Centre of Activity 28,060kHz – QRP (low power) Centre of Activity
28,070-28,120	500Hz	Narrowband Modes
28,120-28,150	500Hz	Narrowband Modes – Automatically Controlled Data Stations (unattended)
28,150-28,190	500Hz	Narrowband Modes
28,190-28,199		IBP – Regional Time Shared Beacons
28,199-28,201		IBP – World Wide Time Shared Beacons
28,201-28,225		IBP – Continuous-Duty Beacons
28,225-28,300	2.7kHz	All Modes – Beacons
28,300-28,320	2.7kHz	All Modes – Automatically Controlled Data Stations (unattended)
28,320-29,000	2.7kHz	All modes 28,330kHz – Digital Voice Centre of Activity 28,360kHz – QRP Centre of Activity 28,680kHz – Image Centre of Activity
29,000-29,100	6kHz	All Modes
29,100-29,200	6kHz	All Modes – FM Simplex – 10kHz Channels
29,200-29,300	6kHz	All Modes – Automatically Controlled Data Stations (unattended) 29,270kHz – Internet Gateways Channel 29,280kHz – UK Internet Voice Gateway (unattended) 29,290kHz – UK Internet Voice Gateway (unattended)
29,300-29,510	6kHz	Satellite Links
29,510-29,520	Guard Channel	
29,520-29,590	6kHz	All Modes – FM Repeater Inputs (RH1-RH8)
29,600	6kHz	All Modes – FM Calling Channel
29,610	6kHz	All Modes – FM Simplex Repeater (parrot) – input and output
29,620-29,700	6kHz	All Modes – FM Repeater Outputs (RH1-RH8)

Licence Notes: Amateur and Amateur Satellite Service – Primary User: 26dBW permitted. Beacons may be established for DF competitions except within 50km of NGR SK985640 (Waddington).
Notes to the Band Plan: As on page 30.

50MHz (6m)	NECESSARY BANDWIDTH	UK USAGE
50.000-50.100MHz	500Hz	Telegraphy Only (except for Beacon Project) (Note 2) 50.000-50.030MHz reserved for Synchronised Beacon Project (Note 2) Region 1: 50.000-50.010; Region 2: 50.010-50.020; Region 3: 50.020-50.030 50.050MHz – Future International Centre of Activity 50.090MHz – Inter-Continental DX Centre of Activity (Note 1)
50.100-50.200	2.7kHz	SSB/Telegraphy – International Preferred 50.100-50.130MHz – Inter-Continental DX Telegraphy & SSB (Note 1) 50.110MHz – Inter-Continental DX Centre of Activity 50.130-50.200MHz – General International Telegraphy & SSB 50.150MHz – International Centre of Activity
50.200-50.300	2.7kHz	SSB/Telegraphy – General Usage 50.285MHz – Crossband Centre of Activity
50.300-50.400	2.7kHz	MGM/Narrowband/Telegraphy 50.305MHz – PSK Centre of Activity 50.310-50.320MHz – EME 50.320-50.380MHz – MS
50.400-50.500		Propagation Beacons only
50.500-52.000	12.5kHz	All Modes 50.510MHz – SSTV (AFSK) 50.520MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.530MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.540MHz – Internet Voice Gateway (10kHz channels), (IARU common channel) 50.550MHz – Image/Fax working frequency 50.620-50.750MHz – Digital communications 50.630MHz – Digital Voice (DV) calling 50.710-50.890MHz – FM/DV Repeater Outputs (10kHz channel spacing) 51.210-51.390MHz – FM/DV Repeater Inputs (10kHz channel spacing) (Note 4) 51.410-51.590MHz – FM/DV Simplex (Note 3) (Note 4) 51.510MHz – FM Calling Frequency 51.530MHz – GB2RS News Broadcast and Slow Morse 51.650 & 51.750MHz – See Note 5 (25kHz aligned) 51.770 & 51.790MHz – See Note 5 51.810-51.990MHz – FM/DV Repeater Outputs (IARU aligned channels)

Note 1: Only to be used between stations in different continents (not for intra-European QSOs).
Note 2: 50.0-50.1MHz is currently shared with Propagation Beacons. These are due to be migrated by Aug 2014 to 50.4-50.5MHz, to create more space for Telegraphy and a new Synchronised Beacon Project.
Note 3: 20kHz channel spacing. Channel centre frequencies start at 51.430MHz.
Note 4: Embedded data traffic is allowed with digital voice (DV).
Note 5: May be used for Emergency Communications and Community Events.
Note 6: Digital experiments to support innovation may occur at 50.6, 51.0 or 51.7MHz with a 100kHz maximum bandwidth
Licence Notes: Amateur Service 50.0-51.0MHz – Primary User. Amateur Service 51.0-52.0MHz – Secondary User. 100W (20dBW) maximum. Available on the basis on non-interference to other services (inside or outside the UK).
Notes to the Band Plan: As on page 30.

70MHz (4m)	NECESSARY BANDWIDTH	UK USAGE (NOTE 1)
70.000-70.090MHz	1kHz	Propagation Beacons Only
70.090-70.100	1kHz	Personal Beacons
70.100-70.250	2.7kHz	Narrowband Modes 70.185MHz – Cross-band Activity Centre 70.200MHz – CW/SSB Calling 70.250MHz – MS Calling
70.250-70.294	12kHz	All Modes 70.260MHz – AM/FM Calling 70.270MHz MGM Centre of Activity
70.294-70.500	12kHz	All Modes Channelised Operations Using 12.5kHz Spacing 70.3000MHz 70.3125MHz – Digital Modes 70.3250MHz – DX Cluster 70.3375MHz – Digital Modes 70.3500MHz – Internet Voice Gateway (Note 2) 70.3625MHz – Internet Voice Gateway 70.3750MHz – See Note 2 70.3875MHz – Internet Voice Gateway 70.4000MHz – See Note 2 70.4125MHz – Internet Voice Gateway 70.4250MHz – FM Simplex – used by GB2RS news broadcast 70.4375MHz – Digital Modes (special projects) 70.4500MHz – FM Calling 70.4625MHz – Digital Modes 70.4750MHz 70.4875MHz – Digital Modes

Note 1: Usage by operators in other countries may be influenced by restrictions in their national allocations.
Note 2: May be used for Emergency Communications and Community Events.
Licence Notes: Amateur Service 70.0-70.5MHz – Secondary User: 160W (22dBW) maximum. Available on the basis of non-interference to other services (inside or outside the UK).
Notes to the Band Plan: As on page 30.

144MHz (2m)	NECESSARY BANDWIDTH	UK USAGE
144.000-144.025MHz	2700Hz	All Modes – including Satellite Downlinks
144.025-144.100	500Hz	Telegraphy (including EME CW) 144.050MHz – Telegraphy Centre of Activity 144.100MHz – Random MS Telegraphy Calling, (Note 1)
144.110-144.150	500Hz	Telegraphy and MGM EME MGM Activity (Note 7)
144.150-144.400	2700Hz	Telegraphy, MGM and SSB 144.200MHz – Random MS SSB 144.250MHz – GB2RS News Broadcast and Slow Morse 144.260MHz – See Note 10 144.300MHz – SSB Centre of Activity 144.370MHz – MGM MS Calling

144.400-144.490		Propagation Beacons only
144.490-144.500		Beacon guard band 144.491-144.493 Personal Weak Signal MGM Beacons (BW: 500Hz max)
144.500-144.794	20kHz	All Modes (Note 8) 144.500MHz – Image Modes Centre (SSTV, FAX, etc) 144.600MHz – Data Centre of Activity (MGM, RTTY, etc) 144.6125MHz – UK Digital Voice (DV) Calling (Note 9) 144.625-144.675MHz – See Note 10 144.750MHz – ATV Talkback 144.775-144.794MHz – See Note 10
144.794-144.990	12kHz	MGM Digital Communications (Note 15) 144.800-144.9875MHz – MGM/Digital Communications 144.8000MHz – Unconnected Nets – APRS, UiView etc (Note 14) 144.8125MHz – DV Internet Voice Gateway 144.8250MHz – DV Internet Voice Gateway 144.8375MHz – DV Internet Voice Gateway 144.8500MHz – DV Internet Voice Gateway 144.8625MHz – DV Internet Voice Gateway 144.9250MHz – Digital Usage 144.9375MHz – Digital Usage 144.9500MHz – Digital Usage 144.9625MHz – FM Internet Voice Gateway 144.9750MHz, 144.9875MHz To Be Decided (Note 11)
144.990-145.1935	12kHz	FM/DV RV48-RV63 Repeater Input Exclusive (Note 2 & 5)
145.200	12kHz	FM/DV Space Communications (eg ISS) – Earth-to-Space 145.2000MHz – (Note 4 & 10)
145.200-145.5935	12kHz	FM/DV V16-V47 – FM/DV Simplex (Note 3, 5 & 6) 145.2250MHz – See Note 10 145.2375MHz – FM Internet Voice Gateway (IARU common channel) 145.2500MHz – Used for Slow Morse Transmissions 145.2875MHz – FM Internet Voice Gateway (IARU common channel) 145.3375MHz – FM Internet Voice Gateway (IARU common channel) 145.5000MHz – FM Calling (Note 12) 145.5250MHz – Used for GB2RS News Broadcast. 145.5500MHz – Used for Rally/exhibition Talk-in 145.5750MHz, 145.5875MHz (Note 11)
145.5935-145.7935	12kHz	FM/DV RV48-RV63 – Repeater Output (Note 2)
145.800	12kHz	FM/DV Space Communications (eg ISS) – Space-Earth
145.806-146.000	12kHz	All Modes – Satellite Exclusive

Note 1: Meteor scatter operation can take place up to 26kHz higher than the reference frequency.
Note 2: 12.5kHz channels numbered RV48-RV63. RV48 input = 145.000MHz, output = 145.600MHz.
Note 3: 12.5kHz simplex channels numbered V16-V47. V16 = 145.200MHz.
Note 4: Emergency Communications Groups utilising this frequency should take steps to avoid interference to ISS operations in non-emergency situations.
Note 5: Embedded data traffic is allowed with digital voice (DV).
Note 6: Simplex use only – no DV gateways.
Note 7: EME activity using MGM is commonly practised between 144.110-144.160MHz.
Note 8: Amplitude Modulation (AM) is acceptable within the All Modes segment. AM usage is typically found on 144.550MHz. Users should consider adjacent channel activity when selecting operating frequencies.
Note 9: In other countries IARU Region 1 recommends 145.375MHz.
Note 10: May be used for Emergency Communications and Community Events.
Note 11: May be used for repeaters in other IARU Region 1 countries.
Note 12: DV users are asked not to use this channel, and use 144.6125MHz for calling.
Note 13: Not used.
Note 14: 144.800 use should be NBFM to avoid interference to 144.8125 DV Gateways.
Licence Notes: Amateur Service and Amateur Satellite Service – Primary User. Beacons may be established for DF competitions except within 50km of TA 012869 (Scarborough).
Notes to the Band Plan: As on page 30.

146MHz IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
146.000-146.900MHz	500kHz	Wideband Digital Modes (High speed data, DATV etc) 146.500MHz Centre frequency for wideband modes (Note 1)
146.900-147.000MHz	12kHz	Narrowband Digital Modes including Digital Voice 146.900 146.9125 146.925 146.9375 Not available in/near Scotland (see Licence Notes & NoV terms) 146.9500 146.9625 146.9750 146.9875

Note 1: Users of wideband modes must ensure their spectral emissions are contained with the band limits.
Licence Notes: Full Licensees only, with NoV, 50W ERP max – not available in the Isle of Man or Channel Isles. Note that additional restrictions on geographic location, antenna height and upper frequency limit are specified by the NoV terms.
It should be emphasised that this band is UK-specific and is available on a non-interference basis to existing services. Upper Band limit 147.000MHz (or 146.93750 where applicable) are absolute limits and not centre frequencies. The absolute band frequency limit in or within 40km of Scotland is 146.93750MHz – see NoV schedule
Notes to the Band Plan: As on page 30.

430MHz (70cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
430.0000-431.9810MHz All Modes	20kHz	430.0125-430.0750MHz – FM Internet Voice Gateways (Notes 7, 8) 430.250-430.300 MHz UK DV 9 MHz reverse-split repeaters - Outputs 430.4000-430.7750 – UK DV 9MHz Split Repeaters – inputs
Digital Links 430.6000-430.9250		430.8000MHz – 7.6MHz Talk-through (Note 10)
Digital Repeaters		430.8250-430.9750MHz – RU66-RU78 7.6MHz Split Repeaters – outputs See Licence Exclusion Note; 431-432MHz 430.9900-431.9000MHz – Digital Communications 431.0750-431.1750MHz – DV Internet Voice Gateways (Note 8)
432.0000-432.1000 Telegraphy, MGM	500Hz	432.0000-432.0250MHz – Moonbounce (EME) 432.0500MHz – Telegraphy Centre of Activity
432.1000-432.4000 SSB, Telegraphy MGM	2700Hz	432.2000MHz – SSB Centre of Activity 432.3500MHz – Microwave Talkback (Europe) 432.3700MHz – FSK441 Calling Frequency
432.4000-432.4900	500Hz	Propagation Beacons only
432.4900-432.9940 All Modes Non-channelised	25kHz (Note 11)	432.491-432.493 MHz Personal Weak Signal MGM Beacons (BW: 500Hz max) 432.5000MHz – Narrowband SSTV Activity Centre 432.6250-432.6750MHz Digital Communications (25kHz channels) 432.7750MHz 1.6MHz Talk-through – Base TX (Note 10)
432.9940-433.3810 FM repeater outputs in UK only (Note 1)	25kHz (Note 11)	433.0000-433.3750MHz (RB0-RB15) – RU240-RU270 FM/DV Repeater Outputs (25kHz channels) in UK Only
433.3940-433.5810 FM/DV (Notes 12, 13) Simplex Channels	25kHz (Note 11)	433.4000MHz U272 – IARU Region 1 SSTV (FM/AFSK) 433.4250MHz U274 433.450MHz U276 (Note 5) 433.4750MHz U278 433.5000MHz U280 – FM Calling Channel 433.5250MHz U282 433.5500MHz U284 – Used for Rally/Exhibition Talk-in 433.5750MHz U286
433.6000-434.0000 All Modes 433.8000MHz for APRS where 144.8000MHz cannot be used	25kHz (Note 11)	433.6250-6750MHz – Digital Communications (25kHz channels) 433.7000MHz-433.7750MHz (Note 10) 433.8000-434.2500 MHz Digital communications & Experiments 434.0000 Low Power Non-NoV Personal Hot-Spot usage
434.0000-434.5940	25kHz (Note 11)	433.9500-434.0500MHz – Internet Voice Gateways (Note 8) 434.3750MHz 1.6MHz Talk-through – Mobile TX (Note 10) 434.4750-434.5250MHz DV Internet voice gateways (Note 8)
434.5940-434.9810 FM repeater inputs in UK only & ATV (Note 4)	25kHz (Note 11)	434.6000-434.9750MHz (RB0-RB15) RU240-RU270 FM/DV Repeater Inputs (25kHz channels) in UK Only (Note 12)
435.0000-438.0000	20kHz	Satellites and Fast Scan TV (Note 4) 437.0000 Experimental DATV Centre of Activity (Note 14)
438.0000-440.0000 All Modes	25kHz (Note 11)	438.8000 Low Power Non-NoV Personal Hot-Spot usage 438.0250-438.1750MHz – IARU Region 1 Digital Communications 438.2000-439.4250MHz (Note 1) 438.4000MHz – 7.6MHz Talk-through (Note 10) 438.4250-438.5750MHz RU66-RU78 – 7.6MHz Split Repeaters – inputs 438.6125MHz – UK DV calling (Note 12) (Note 13) 438.8000 Low Power Non-NoV Personal Hot-Spot usage 439.2500-439.3000MHz UK DV 9MHz reverse-split repeaters – Inputs 439.6000-440.0000MHz – Digital Communications 439.4000-439.7750MHz – UK DV 9MHz split repeaters - Outputs

Note 1: In Switzerland, Germany and Austria, repeater inputs are 431.0500-431.8250MHz with 25kHz spacing and outputs 438.6500-439.4250MHz. In Belgium, France and the Netherlands repeater outputs are 430.0250-430.3750MHz with 12.5kHz spacing and inputs at 431.6250-431.9750MHz. In other European countries repeater inputs are 433.0000-433.3750MHz with 25kHz spacing and outputs at 434.6000-434.9750MHz, ie the reverse of the UK allocation.
Note 4: ATV carrier frequencies shall be chosen to avoid interference to other users, in particular the satellite service and repeater inputs.
Note 5: In other countries IARU Region 1 recommends 433.4500MHz for DV calling.
Note 7: Users must accept interference from repeater output channels in France and the Netherlands at 430.0250-430.5750MHz. Users with sites that allow propagation to other countries (notably France and the Netherlands) must survey the proposed frequency before use to ensure that they will not cause interference to users in those countries.
Note 8: All internet voice gateways: 12.5kHz channels, maximum deviation ±2.4kHz, maximum effective radiated power 5W (7dBW), attended only operation in the presence of the NoV holder.
Note 10: May be used for Emergency Communications and Community Events.
Note 11: IARU Region 1 recommended maximum bandwidths are 12.5 or 20kHz.
Note 12: Embedded data traffic is allowed with digital voice (DV).
Note 13: Simplex use only - no DV gateways.
Note 14: QPSK 2 Mega-symbols/second maximum recommended.
Licence Notes: Amateur Service – Secondary User. Amateur Satellite Service: 435-438MHz – Secondary User. Exclusion: 431-432MHz not available within 100km radius of Charing Cross, London. Power Restriction 430-432MHz is 40 watts effective radiated power maximum.
Notes to the Band Plan: As on page 30.

1.3GHz (23cm)	NECESSARY BANDWIDTH	UK USAGE
1240.000-1240.500MHz	2700Hz	Alternative Narrowband Segment – see Note 7 – 1240.00-1240.750MHz
1240.500-1240.750		Alternative Propagation Beacon Segment
1240.750-1241.000	20kHz	FM/DV Repeater Inputs
1241.000-1241.750 All Modes	150kHz	DD High Speed Digital Data – 5 x 150kHz channels 1241.075, 1241.225, 1241.375, 1241.525, 1241.675MHz (±75kHz)
1241.750-1242.000 All Modes 1242.000-1249.000	20kHz	25kHz Channels available for FM/DV use 1241.775-1241.975MHz TV Repeaters (Note 9)

ATV		New DATV Repeater Inputs Original ATV Repeater Inputs: 1248, 1249
1249.000-1249.250	20kHz	FM/DV Repeater Outputs, 25kHz Channels (Note 9) 1249.025-1249.225MHz
1250.00		In order to prevent interference to Primary Users, caution must be exercised prior to using 1250-1290MHz in the UK
1260.000-1270.000		Amateur Satellite Service – Earth to Space Uplinks Only
Satellites 1290.000		
1290.994-1291.481	20kHz	FM/DV Repeater Inputs (Note 5) 1291.000-1291.375MHz (RM0-RM15) 25kHz spacing
1291.494-1296.000 All Modes	All Modes	Preferred Narrowband segment
1296.000-1296.150 Telegraphy, MGM	500Hz	1296.000-1296.025MHz – Moonbounce 1296.138MHz – PSK31 Centre of Activity
1296.150-1296.800 Telegraphy, SSB & MGM	2700Hz	1296.200MHz – Narrowband Centre of Activity 1296.400-1296.600MHz – Linear Transponder Input
(Note 1)		1296.500MHz – Image Mode Centre of Activity (SSTV, FAX etc) 1296.600MHz – Narrowband Data Centre of Activity (MGM, RTTY etc) 1296.600-1296.700MHz – Linear Transponder Output 1296.741-1296.743MHz Personal Weak Signal MGM Beacons
1296.800-1296.994		1296.750-1296.800MHz – Local Beacons, 10W ERP max 1296.800-1296.990MHz – Propagation Beacons only Beacons exclusive
1296.994-1297.481	20kHz	FM/DV Repeater Outputs (Note 5) 1297.000-1297.375MHz (RM0-RM15)
1297.494-1297.981	20kHz	FM/DV Simplex (Notes 2, 5 & 6) 25kHz spacing 1297.500-1297.750MHz (SM20-SM30)
FM/DV simplex (Notes 2, 5, 6)		1297.725MHz – Digital Voice (DV) Calling (IARU recommended) 1297.900-1297.975MHz – FM Internet Voice Gateways (IARU common channels, 25kHz)
1298.000-1299.000 All Modes	20kHz	All Modes General mixed analogue or digital use in channels 1298.025-1298.975MHz (RS1-RS39)
1299.000-1299.750 All Modes	150kHz	DD High Speed Digital Data – 5 x 150kHz channels 1299.075, 1299.225, 1299.375, 1299.525, 1299.675MHz (±75kHz)
1299.750-1300.000 All Modes	20kHz	25kHz Channels Available for FM/DV use 1299.775-1299.975MHz
1300.000-1325.000 ATV		TV Repeaters (UK only) (Note 9) New DATV Repeater Outputs Original ATV Repeater Outputs: 1308.0, 1310.0, 1311.5, 1312.0, 1316.0, 1318.5MHz

Note 1: Local traffic using narrowband modes should operate between 1296.500-1296.800MHz during contests and band openings.
Note 2: Stations in countries that do not have access to 1298-1300MHz may also use the FM simplex segment for digital communications.
Note 3: IARU Region 1 recommended maximum bandwidth is 20kHz. See also Note 7.
Note 4: deleted.
Note 5: Embedded data traffic is allowed with digital voice (DV).
Note 6: Simplex use only – no DV gateways.
Note 7: 1240.000-1240.750 has been designated by IARU as an alternative centre for narrowband activity and beacons. Operations in this range should be on a flexible basis to enable coordinated activation of this alternate usage.
Note 8: The band 1240-1300MHz is subject to major replanning. Contact the Microwave Manager for further information.
Note 9: Repeaters and Migration to DATV, inc option for new DATV simplex are subject to further development and coordination.
Note 10: QPSK 4 Mega-symbols/second maximum recommended.
Licence Notes: Amateur Service – Secondary User. Amateur Satellite Service: 1,260-1,270MHz – Secondary User Earth to Space only. In the sub-band 1,298-1,300MHz unattended operation is not allowed within 50km of SS206127 (Bude), SE202577 (Harrogate), or in Northern Ireland.
Notes to the Band Plan: As on page 30.

2.3-2.302GHz IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
Access to this band requires an appropriate NoV, which is available to Full licensees only. Please note that the current NoVs last for up to three years prior to expiry.		
2300.000-2300.400MHz	2.7kHz	Narrowband Modes (including CW, SSB, MGM) 2300.350-2300.400MHz Attended Beacons
2300.400-2301.800MHz	500kHz	Wideband Modes (NBFM, DV, Data, DATV, etc) Note 1
2301.800-2302.000MHz	2.7kHz	Narrowband modes (including CW, SSB, MGM) EME Usage

Note 1: Users of wideband modes must ensure their spectral emissions are contained within the band limits.
Note 2: Full licensees only with NoV, 400 watts maximum, not available in the Isle of Man. Note additional restrictions on usage are specified by the NoV terms. It should be emphasised that this is UK-specific and is available on a non interference basis to existing services.
Notes to the Band Plan: As on page 30.

2.3GHz (13cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
2,310.000-2,320.000MHz (National band plans)	200kHz	2,310.000-2,310.500MHz – Repeater links 2,311.000-2,315.000MHz – High speed data Preferred Narrowband Segment
2,320.000-2,320.150	500Hz	2,320.000-2,320.025MHz – Moonbounce
2,320.150-2,320.800	2.7kHz	2,320.200MHz – SSB Centre of Activity
2,320.800-2,321.000		2,320.750-2,320.800MHz – Local Beacons, 10W ERP max 2,320.800-2,320.990MHz – Propagation Beacons Only
Beacons exclusive 2321.000-2322.000 2,322.000-2,350.000 2,390.000-2,400.000 2,400.000-2,450.000MHz Satellites	20kHz	FM/DV. See also Note 1 Wideband Modes including Data, ATV All Modes 2,435.000MHz ATV Repeater Outputs 2,440.000MHz ATV Repeater Outputs

Note 1: Stations in countries which do not have access to the All Modes section 2,322-2,390MHz, use the simplex and repeater segment 2,320-2,322MHz for data transmission.
Note 2: Stations in countries that do not have access to the narrowband segment 2,320-2,322MHz, use the alternative narrowband segments 2,304-2,306MHz, 2,308-2,310MHz and 2400-2402MHz.
Note 3: The segment 2,433-2,443MHz may be used for ATV if no satellite is using the segment.
Licence Notes: Amateur Service – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 2,400-2,450MHz – Secondary User. Users must accept interference from ISM users. Operation in 2310-2350 and 2390-2400 MHz are subject to specific conditions and guidance In the sub-bands 2,310.000-2,310.4125 and 2,392-2,450MHz unattended operation is not allowed within 50km of SS206127 (Bude) or SE202577 (Harrogate). ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 30.

3.4GHz (9cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
3,400.000-3,401.000MHz	2.7kHz	Narrowband Modes (including CW, SSB, MGM, EME) 3,400.100MHz – Centre of Activity (Note 1)
3,400.800-3,400.995		3,400.750-3,400.800MHz – Local Beacons, 10W ERP max 3,400.800-3,400.995MHz – Propagation Beacons Only
3,400.000-3,401.000MHz 3,402.000-3,410.000 All Modes (Notes 2, 3)	200kHz	3,401.000-3,402.000MHz Data, Remote Control Wideband Modes including DATV Repeater Outputs

Note 1: EME has migrated from 3456MHz to 3400MHz to promote harmonised usage and activity.
Note 2: Stations in many European countries have access to 3400-3410MHz as permitted by ECA Table Footnote EU17.
Note 3: Amateur Satellite downlinks planned.
Licence Notes: Amateur Service – Secondary User. Subject to specific conditions and guidance.
Notes to the Band Plan: As on page 30.

5.7GHz (6cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
5,650.000-5,668.000MHz Satellite Uplinks		All Modes Amateur Satellite Service – Earth to Space Only
5,668.000-5,670.000 5,670.000-5,680.000 5,755.000-5,760.000	2.7kHz	5,668.200MHz – Alternative Narrowband Centre All Modes All Modes
5,760.000-5,762.000	2.7kHz	Narrowband Modes (including CW, SSB, MGM, EME) 5,760.100MHz – Preferred Centre of Activity
5760.800-5760.995		5,760.750-5,760.800MHz – Local Beacons, 10W ERP max 5,760.800-5,760.995MHz – Propagation Beacons Only
Propagation Beacons 5,762.000-5,765.000 5,820.000-5,830.000 5,830.000-5,850.000 Satellite Downlinks		All Modes All Modes All Modes Amateur Satellite Service – Space to Earth Only

Licence Notes: Amateur Service: 5,650-5,680MHz – Secondary User. 5,755-5,765 and 5,820-5,850MHz – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 5,650-5,670MHz and 5,830-5,850MHz – Secondary User. Users must accept interference from ISM users. Unattended operation is permitted for remote control, digital modes and beacons, except in the sub-bands 5,670-5,680MHz within 50km of SS206127 (Bude) and SE202577 (Harrogate). ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 30.

10GHz (3cm) IARU Recommendation	NECESSARY BANDWIDTH	UK USAGE
10,000.000-10,125.000MHz All Modes		Note 4 10,065MHz ATV Repeater Outputs
10,225.000-10,250.000 All Modes 10,250.000-10,350.000 Digital Modes		10,240MHz ATV Repeaters
10,350.000-10,368.000 All Modes		10,352.5-10,368MHz Wideband Modes (Note 2)
10,368-10,370MHz Narrowband Telegraphy EME/SSB	2.7kHz	10,368-10,370 Narrowband Modes (Note 3) 10,368.1MHz Centre of Activity
10,368.800-10,368.995		10,368.750-10,368.800MHz – Local Beacons, 10W ERP max 10,368.800-10,368.995MHz – Propagation Beacons Only
Propagation Beacons 10,370.000-10,450.000 All Modes 10,450.000-10,475.000 All Modes & Satellites		10,371MHz Voice Repeaters Rx 10,425 ATV Repeaters 10,400-10,475MHz Unattended Operation 10,450-10,452MHz Alternative Narrowband Segment (Note 3) 10,471MHz Voice Repeaters Tx

10,475.000-10,500.000
All Modes and satellites — Amateur Satellite Service ONLY

Note 1: Deleted.
Note 2: Wideband FM is preferred between 10,350-10,400MHz to encourage compatibility between narrowband systems.
Note 3: 10,450MHz is used as an alternative narrowband segment in countries where 10,368MHz is not available.
Note 4: 10,000-10,125MHz is subject to increased Primary user utilisation and NoV restrictions.
Note 5: 10,475-10,500MHz is allocated ONLY to the Amateur Satellite Service and NOT to the Amateur Service.
Licence Notes: Amateur Service – Secondary User. Foundation licensees 1 watt maximum. Amateur Satellite Service: 10,450-10,500MHz – Secondary User. Unattended operation is permitted for remote control, digital modes and beacons except in the sub-bands 10,000-10,125MHz within 50km of SO916223 (Cheltenham), SS206127 (Bude), SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 30.

24GHz (12mm) IARU Recommendation	UK USAGE
24,000.000-24,050.000MHz	
Satellites	24,025MHz Preferred Operating Frequency for Wideband Equipment
	24,048.2MHz – Narrowband Centre of Activity
	24,048.750-24,048.800MHz – Local Beacons, 10W ERP max
24,048.800-24,048.995	24,048.800-24,048.995MHz – Propagation Beacons Only
Propagation Beacons	
24,050.000-24,250.000	
All Modes	

Licence Notes: Amateur Service: 24,000-24,050MHz – Primary User: Users must accept interference from ISM users. 24,050-24,150MHz – Secondary User. May only be used with the written permission of Ofcom. Users must accept interference from ISM users. 24,150-24,250MHz – Secondary User. Users must accept interference from ISM users. Amateur Satellite Service: 24,000-24,050MHz – Primary User: Users must accept interference from ISM users. Unattended operation is permitted for remote control, digital modes and beacons, except in the sub-bands 24,000-24,050MHz within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
ISM = Industrial, scientific and medical.
Notes to the Band Plan: As on page 30.

47GHz (6mm) IARU Recommendation	UK USAGE
47,000.000-47,200.000MHz	47,088.2MHz – Centre of Narrowband Activity
47,088.000-47,090.000	47,088.8-47,089.0MHz – Propagation Beacons Only
Narrowband Segment	

Licence Notes: Amateur Service and Amateur Satellite Service – Primary User. Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 30.

76GHz (4mm) IARU Recommendation	UK USAGE
75,500-76,000MHz	
All Modes (preferred)	75,976.200MHz – IARU Region 1 Preferred Centre of Activity
76,000.000-77,500.000	
All Modes	
77,500-78,000	77,500.200MHz – Alternative IARU Recommended Narrowband Segment
All Modes (preferred)	
78,000-81,000	
All Modes	

Licence Notes:
75,500-75,875MHz Amateur Service and Amateur Satellite Service – Secondary User.
75,875-76,000MHz Amateur Service and Amateur Satellite Service – Primary User.
76,000-77,500MHz Amateur Service and Amateur Satellite Service – Secondary User.
77,500-78,000MHz Amateur Service and Amateur Satellite Service – Primary User.
78,000-81,000MHz Amateur service and Amateur Satellite Service – Secondary User.
Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).
Notes to the Band Plan: As on page 30.

134GHz (2mm) IARU Recommendation	UK USAGE
134,000-134,928MHz	
All Modes	
134,928 -134,930	IARU Region 1 Preferred Centre of Activity
Narrowband Modes	134,928.800-134,928.990 – Propagation Beacons Only
134,930 -136,000	
All Modes	

Licence Notes: 134,000-136,000MHz Amateur Service and Amateur Satellite Service – Primary User. Unattended operation is permitted for remote control, digital modes and beacons, except within 50km of SK985640 (Waddington) and SE202577 (Harrogate).

THE FOLLOWING BANDS ARE ALSO ALLOCATED TO THE AMATEUR SERVICE AND THE AMATEUR SATELLITE SERVICE

122,250-123,000MHz – Amateur Service only, Secondary User
136,000-141,000MHz – Secondary User
241,000-248,000MHz – Secondary User
248,000-250,000MHz – Primary User
Notes to the Band Plan: As on page 30.

NOTES TO THE BAND PLAN

ITU-R Recommendation SM.328 (extract)

Necessary bandwidth: For a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

Foundation and Intermediate Licence holders are advised to check their Licences for the permitted power limits and conditions applicable to their class of Licence.

All Modes: CW, SSB and those modes listed as Centres of Activity, plus AM. Consideration should be given to adjacent channel users.

Image Modes: Any analogue or digital image modes within the appropriate bandwidth, for example SSTV and FAX.

Narrowband Modes: All modes using up to 500Hz bandwidth, including CW, RTTY, PSK, etc.

Digimodes: Any digital mode used within the appropriate bandwidth, for example RTTY, PSK, MT63, etc.

Sideband usage: Below 10MHz use lower sideband (LSB), above 10MHz use upper sideband (USB). Note the lowest dial settings for LSB Voice modes are 1843, 3603 and 7043kHz on 160, 80 and 40m. Note that on (5MHz) USB is used.

Amplitude Modulation (AM): AM with a bandwidth greater than 2.7kHz is acceptable in the All Modes segments provided users consider adjacent channel activity when selecting operating frequencies (Davos 2005).

Extended SSB (eSSB): Extended SSB (eSSB) is only acceptable in the All Modes segments provided users consider adjacent channel activity when selecting operating frequencies.

Digital Voice (DV): Users of Digital Voice (DV) should check that the channel is not in use by other modes (CT08_C5_Rec20).

FM Repeater & Gateway Access: CTCSS Access is recommended. Toneburst access is being withdrawn in line with IARU R1 recommendations.

Beacons Propagation Beacon Sub-bands are highlighted – please avoid transmitting in them!

MGM: Machine Generated Modes indicates those transmission modes relying fully on computer processing such as RTTY, AMTOR, PSK31, JTxx, FSK441 and the like. This does not include Digital Voice (DV) or Digital Data (DD).

WSPR: Above 30MHz, WSPR frequencies in the band plan are the centre of the transmitted frequency (not the suppressed carrier frequency or the VFO dial setting).

CW QSOs are accepted across all bands, except within beacon segments (Recommendation DV05_C4_Rec_13).

Contest activity shall not take place on the 5, 10, 18 and 24MHz (60, 30, 17 and 12m) bands.

Non-contesting radio amateurs are recommended to use the contest-free HF bands (30, 17 and 12m) during the largest international contests (DV05_C4_Rev_07).

The term 'automatically controlled data stations' include Store and Forward stations.

Transmitting Frequencies: The announced frequencies in the band plan are understood as 'transmitted frequencies' (not those of the suppressed carrier!).

Unmanned transmitting stations: IARU member societies are requested to limit this activity on the HF bands. It is recommended that any unmanned transmitting stations on HF shall only be activated under operator control except for beacons agreed with the IARU Region 1 Beacon Coordinator, or specially licensed experimental stations.

472-479kHz: Access is available to Full licensees only – see licence schedule for additional conditions.

1.8MHz: Radio amateurs in countries that have a SSB allocation ONLY below 1840kHz, may continue to use it, but the National Societies in those countries are requested to take all necessary steps with their licence administrations to adjust phone allocations in accordance with the Region 1 Band Plan (UBA – Davos 2005).

3.5MHz: Inter-Continental operations should be given priority in the segments 3500-3510kHz and 3775- 3800kHz. Where no DX traffic is involved, the contest segments should not include 3500-3510kHz or 3775-3800kHz. Member societies will be permitted to set other (lower) limits for national contests (within these limits). 3510-3600kHz may be used for unmanned ARDF beacons (CW, A1A) (Recommendation DV05_C4_Rec_12). Member societies should approach their national telecommunication authorities and ask them not to allocate frequencies other than amateur stations in the band segment that IARU has assigned to Inter-Continental long distance traffic.

5MHz: Access is available to Full licensees only – see licence schedule for additional conditions.

7MHz: The band segment 7040-7060kHz may be used for automatic controlled data stations (unattended) traffic in the areas of Africa south from the equator during local daylight hours. Where no DX traffic is involved, the contest segment should not include 7,175-7,200kHz.

10MHz: SSB may be used during emergencies involving the immediate safety of life and property and only by stations actually involved in the handling of emergency traffic.
The band segment 10120kHz to 10140kHz may be used for SSB transmissions in the area of Africa south of the equator during local daylight hours.
News bulletins on any mode should not be transmitted on the 10MHz band.

28MHz: Member societies should advise operators not to transmit on frequencies between 29.3 and 29.51MHz to avoid interference to amateur satellite downlinks.

Experimentation with NBFM Packet Radio on 29MHz band: Preferred operating frequencies on each 10kHz from 29.210 to 29.290MHz inclusive should be used. A deviation of ±2.5kHz being used with 2.5kHz as maximum modulation frequency.

146-147MHz & 2300-2302MHz
Access to these bands requires an appropriate NoV, which is available to Full licensees only.

430MHz
The use of Amplitude Modulation (AM) is acceptable in the all modes segments but users are asked to consider adjacent channel users.

1.3GHz
The band is subject to re-planning. It is also shared with air traffic radar.

2.3GHz (2310-2350 & 2390-2400MHz)
Operation is subject to specific licence conditions and guidance – see also the Ofcom PSSR statement.

3.4GHz (3400-3410MHz)
Operation is subject to specific licence conditions and guidance — see also the Ofcom PSSR statement.

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IC-9700

VHF/UHF/23CM ALL-MODE SDR TRANSCEIVER

Be one of the first to get this exciting new rig with a retail price of

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RM

Amplifiers

The RLA 600 is a wideband compact linear amplifier for the HF bands and 6m, from 1.8 to 54 MHz. Using Freescale MRF6VP3600, Output 500W Quad MOS Control, Pair PWM Mode 600-TR/TX-600 switching enables QSK operation, 2x16 LCD Display for Amplifier Status, Separate LED displays for power and antenna VSWR, Input drive from 1W to mid-max of 40W, 3 user configurable Antenna Output connectors, Dual large diameter MCU controlled, multispeed cooling fans for efficient cooling

£1999.95

RLA350 1.8-30MHz 300w mains powered solid state amplifier **£800.00**

RLA300V 1.8-30MHz 250W professional amplifier with LCD **£949.95**

RLA300A+ 1.8-50MHz 300W all mode amplifier with tuner **£499.95**

RLA150A+ 1.8-30MHz 150W all mode amplifier with tuner **£399.95**

LA230W 144-148MHz 200W professional amplifier with LCD **£549.95**

RLA100 420-440MHz 100W compact linear for 70cms **£449.95**

LDG

Tuners

LDG Z-817 1.8-54MHz ideal for the Yaesu FT-817	**£129.95**
LDG Z-100 Plus 1.8-54MHz the most popular LDG tuner	**£169.95**
LDG IT-100 1.8-54MHz ideal for IC-7100	**£159.95**
LDG Z-11 Pro 1.8-54MHz great portable tuner	**£179.95**
LDG KT-100 1.8-54MHz ideal for most Kenwood radios	**£169.95**
LDG AT-100 Pro II 1.8-54MHz	**£229.95**
LDG AT-200 Pro II 1.8-54MHz	**£269.95**
LDG AT-1000 Pro II 1.8-54MHz continuously	**£519.95**
LDG AT-600 Pro II 1.8-54MHz with up to 600W SSB	**£364.95**
LDG YS-200 1.8-54MHz 200W for FT-450D/FT-DX10/FT-DX101D & FT-DX101MP	**£244.95**
LDG YS-100 ideal for your Yaesu FT-891	**£199.95**
LDG RT-600 1.8-54MHz 5-600W remote ATU	**£499.95**
LDG RBA-1 Balun 1:1 high quality	**£34.99**
LDG RBA-4 Balun 4:1 high quality	**£34.9**

MFJ

Antenna Tuners

See our website for full details.

Automatic Tuners

MFJ-16020 remote Mobile ATU 1.8-30MHz 200W	**£329.99**
MFJ-929 Compact with Random Wire Option 1.8-30MHz 200W	**£249.95**
MFJ-921B 1.8-30MHz 150W SSB/100W CW ATU	**£249.95**
MFJ-993B 1.8-30MHz 200W SSB/150W CW ATU	**£299.95**
MFJ-994B 1.8-30MHz 600W SSB/300W CW ATU	**£399.95**
MFJ-998 1.8-30MHz 1.5kW	**£799.95**

Manual Tuners

MFJ-16010 1.8-30MHz 20W random wire tuner	**£79.95**
MFJ-902B 3.5-30MHz 150W mini travel tuner	**£124.95**
MFJ-902H 3.5-30MHz 150W mini travel tuner with 4:1 balun	**£134.95**
MFJ-904 3.5-30MHz 150W mini travel tuner with SWR/PWR	**£144.95**
MFJ-904B 3.5-30MHz 150W mini travel tuner with SWR/PWR 4:1 balun	**£169.95**
MFJ-4010 1.8-30MHz 200W Versa tuner	**£199.95**
MFJ-971 1.8-30MHz 300W portable tuner	**£139.95**
MFJ-945E 1.8-54MHz 300W tuner with meter	**£149.95**
MFJ-941E 1.8-30MHz 300W Versa tuner 2	**£184.95**
MFJ-949 1.8-30MHz 300W deluxe Versa tuner	**£189.95**
MFJ-949E 1.8-30MHz 300W deluxe Versa tuner with EL	**£209.95**
MFJ-974 1.8-30MHz 300W tuner complete with artificial GND	**£229.95**
MFJ-974B 3.5-54MHz 300W tuner with 6-meter SWR/WATT	**£229.95**
MFJ-989 1.8-54MHz 3000W all band tuner	**£249.95**
MFJ-993 1.8-30MHz 1500W high power tuner	**£349.95**
MFJ-986 1.8-30MHz 3000W high power differential tuner	**£399.95**
MFJ-989D 1.8-30MHz 1500W high power roller tuner	**£439.95**
MFJ-976 1.8-30MHz 1500W balanced line tuner with 6-Meter SWR/WATT	**£549.95**

Analysers

MFJ-259B 530 KHz to 230MHz **£329.95**

World's most popular SWR analyser is super easy-to-use. It gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance 530 KHz to 230 MHz continuously with no gaps

Power Supplies

PS30SWB 30A pulse switching power supply provides 13.8 VDC at 30 Amps continuous, 35 Amps surge. The output voltage is adjustable from 9 to 15 VDC. Red and black terminals on rear panel (DIN)

SPECIAL OFFER ~~£79.95~~ **£69.95**

PS30SWM switching power supply provides 13.8 VDC at 20 Amps continuous, 30 Amps surge. The LCD digital panel meter simultaneously displays voltage and current. There is a Noise Off-Set control that can be adjusted to eliminate pulse noise from the power supply

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PS30SWB 25A continuous switch mode PSU with variable output voltage and cigar socket also includes noise offset function

SPECIAL OFFER! ~~£34.95~~ **£29.95**

QJE QJEX35B 35 AMP Linear PSU, no noise issues with the good old school power supply unit, nice digital display and heavy as you like, so you feel like you bought something and not after this month

SPECIAL OFFER ~~£249.95~~ **£119.95**

QJE QJPS30B 30 AMP Switch Mode Power Supply Unit

Includes noise offset control to eliminate the pulse noise of the switching circuit. This potent panding function is specially designed for communication equipment use. Rectifier/transistor may vary depending on the frequency and mode

SPECIAL OFFER ~~£79.95~~ **£69.95**

QJE QJPS30B 50 AMP Switch Mode Power Supply Unit

Same as above but in a 50amp version

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INRICO T320 4G/WIFI Network Handheld Radio ~~£229.00~~ **£189.00**

This radio is exclusive as you're like a mobile talkie between the cellular network as a repeater! This means hand held to hand held or handheld to mobile comms around the world. Companion Rico ID after a suitable sim with EU roaming from £3.50 a month or if you are in the UK Freedom pop is available otherwise you can use Rico Wifi using Apps like Zello & Tacomapack you can talk privately for just the cost of your sim!

Key Features: Intelligent Global Intercom ▪ More than 80 Hours standby time ▪ Dual chamber speaker to give Enhanced audio ▪ GPS built in ▪ More 5 pin side line ▪ Supports MP3 & WAV ▪ 2.4 Inch High Quality Screen ▪ Extended memory up to 32GB ▪ Waterproof IP54

INRICO T100 Network Handheld Radio ~~£199.00~~ **£99.95**

The Inrico T100 network radio transceiver is a hand held portable 'communities' network radio device with programmable rotary channel selection knob, side mounted PTT button, five programmable function buttons, 'dual port socket' for external speaker-mic or separate external headphone & mic. The external GSM/3G antenna works well but can be replaced with a high gain antenna to extend operating range

INRICO TM-7PLUS 4G/WIFI Network Mobile Radio **£199.95**

The Inrico TM-7plus is the first 4G mobile network radio. Great for amateur radio use with the new HM platform, for Zello, Team Speak 3 and Echolink via 3G or WiFi. And it works as WiFi hotspot too!

SenHaiX

SenHaiX SPTT-M80 3G Network Mobile Radio **£249.95**

SenHaiX SPTT-M80 is a 3G network android mobile radio with wifi, bluetooth, radio, sos, phone function, gps function, with touch screen and large LCD

Key Features: 100% Compatible with PTT-M8 and Zello ▪ Palm Size Mini Mobile Radio ▪ Support 3G/WCDMA, 2G/GSM network ▪ Support Group Call, Single Call, Intelligent selective call ▪ 180 Degrees Rotatable Screen ▪ LCD Display ▪ GPS Built In ▪ 5Watts 1W loudspeaker ▪ Mobile Phone Call/SMS function ▪ Requires a 13.8V Power Supply

4G Version **£299.95**

BOXCHIP

BOXCHIP ST100 4G/WIFI Network Handheld Radio **£399.95**

BoxChip ST100 is an advanced professional handheld 4G LTE radio. All-round means of communication, real-time control for the two-way customers to bring a strong business ability, stable and reliable real-time communication response, and more excellent integration experience is the best communications partners for industry customers!

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Yagi Antennas

All Yagis have high quality gamma match fittings with stainless steel fixings! (excluding YSA-20)

YG27-3S Dual band 3/3 element 3.5/12.5 dBd gain with one feed!	£79.95
YG4-20 1 metre 4 Element (Boom 49") (Gain 7dBd)	£89.95
YG5-2 2 metre 5 Element (Boom 63") (Gain 10dBd)	£99.95
YG8-2 2 metre 8 Element (Boom 125") (Gain 12dBd)	£99.95
YG3-4 4 metre 3 Element (Boom 65") (Gain 6dBd)	£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)	£89.95
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 98cm, Gain 9.5dBd	£99.95
ZL7-2 2 Metre 7 Ele, Boom 150cm, Gain 11.5dBd	£129.95
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Brilliant 2 element beams … ideal for portable use

HB9-2	£34.95
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Our most popular compact antennas, great base, mobile, portable, or whatever!

HLP-4 4 mtr (box approx 600mm square)	£44.95
HLP-6 6 mtr (box approx 800mm square)	£49.95

QRP Antennas

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

Whizz Whip HF/40/80M 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 20-40m 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 "packet" size antenna. Ideal for indoor or out and can be packed away and all for just £89.95

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

Base Antennas

Simple plug and play HF antennas mobile from end of a great price

GP2500 All Band 80-6M Vertical TX 80-6M RX 2-30MHz, Power 250W Length 7.15M £199.95
GPA-80 budget version of GP2500 80-6M Length 8.6M £99.95

Portable HF Kits

Great dual band kits for portable use, two compact dipoles on an upto 14th mast just requires coax

PK1217 HF Kit for 12/17M	£140.95
PK1520 HF Kit for 15/20M	£140.95
PK2060 HF Kit for 20/60M	£154.95
PK4080 HF Kit for 40/80M	£150.95

(please note each kit requires two leads)

Mobile Antenna Mounts

TRIMAG-S Triple magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – ideal for those larger antennas just £99.95
TRIMM-S single 17/8mm magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – will suit most antennas upto 5/8 £19.95
BOOTMD-SO Heavy duty hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95
MINIMD-S Mini hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95

Multiband Mobile

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

SPX-100 8 Band plug n' go portable, 6/10/12/15/17/20/30/40/80m, Length 102cm retracted just 0.5m, Power 50W complete with 3.5m PL259 or BNC fitting to suit all applications, mobile portable or base - brilliant £44.95
SPX-200S 8 Band plug n' go mobile, 6/10/15/20/40/80m, Length 133cm, Power 120W, PL259 fitting £64.95
SPX-300S 8 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80m, Length 155cm, High Power 200W, PL259 fitting £69.95

VHF/UHF Mobiles

CP151 Glass Mount 2/70cm, Gain 2.5/4.5dBd, Length 70cm complete with 4m cable and PL259 £29.95
MM6-100 MICRO MAG 2/70cm, Gain 0.5/3.0dBd, Length 55cm, 1" magnetic base with 4m coax and BNC £19.95
MM700 2/70cm, Gain 0/5.0dBd, Length 50cm, 3/8 fitting £9.95
MM777 2/70cm, Gain 2.5/5.5dBd, Length 150cm, 3/8 fitting £19.95
MM9525 2/70cm, Gain 0.5/3.5dBd, Length 43cm, PL259 fitting (high quality) £19.95
MM9500 2/70cm, Gain 3.2/5.0dBd, Length 89cm, PL259 fitting (high quality) £29.95
MM9750 2/70cm, Gain 5.5/8.5dBd, Length 150cm, PL259 fitting (high quality) £39.95
MM9600 6/2/70cm Gain 3.0dBd/5.0/7.5dBd, Length 150cm, PL259 fitting (high quality) £39.95
MM9273 2/70/23cm Gain 3.5/5.5/7.5dBd, Length 65cm, PL259 fitting (high quality) £49.95
MM9000 10/6/2/70cm Gain 10m (2.15dBi) 6m(2.5dBi) 2m (2.5dBi) 70cm (5.5dBi) **Longlife** 125cm PL259 fitting £49.95

Coax Switches

CS201 2 Way Switch 3 X SO239, 250W 1-1000MHz £19.95
CS201N 2 Way Switch 3 X N-Type, 250W 1-1000MHz £24.95

Lightning Arresters

SS-1 SO239 to PL259 adaptor with earth wire connection £4.95
GDX-1 Lightning Arrester 2 X SO239 sockets 400W £19.99

Dummy Loads

DL-15 PL259 DC-600MHz 15W CW 30W 50 Ohms £24.95
DL-15N N-Type DC-600MHz 15W CW 30W 50 Ohms £29.95

SWR Meters

SWR-100 Frequency 26-30MHz 100W 50 Ohms £16.95
SWR-270 Frequency 125-530MHz 100W 50 Ohms £29.95

Ferrites

High quality ferrites to suit all the popular cables

FCS-S to suit 6mm cable such as RG58 £1.95
FCS-M to suit 7mm cable such as MiniB £2.95
FCS-L to suit 9mm cable such as RG213 £3.95

GRP Fibreglass Base Antennas
Diamond quality – Moonraker pricing

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

SGBM100P 2/70cm 3.0/6.0dBd, FX 25-2000MHz, Length 100cm SO239 £49.95 special offer £39.95
SGBM200P 2/70cm, Gain 4.5/7.5dBd, FX 25-2000MHz, Length 150cm, SO239 £59.95 special offer £44.95
SGBM300P 2/70cm, Gain 6.0/9.0dBd, FX 25-2000MHz, Length 250cm, SO239 £74.95 special offer £59.95
SGBM1000P 6/2/70cm, Gain 3.0/6.2/9.4dBd, FX 25-2000MHz, Length 250cm, SO239 £84.95
SGBM223H 2/70/23cm, Gain 4.5/7.5/10.5dBd, FX 25-2000MHz, Length 150cm, N-Type £79.95
SGBM401DP Deerband 10/6/2/70cm Gain 2.5/3.0/3.0/5.5dBd Length 120cm £69.95
SGBM801DP Deerband 10/6/2/70cm Gain 2.5/3.0/3.0/5.5dBd Length 120cm £69.95
SGBM4080DP Deerband 6/4/2/70 Gain 2.5/3.0/5.0/5.5dBd Length 120cm £69.95

HF Wire Antennas

All our HF wire antennas are made with complete weatherproof pothead baluns and high quality "weighted" flat reverse antenna wire.

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

HF Mobiles

Get great results with the Moonraker range of HF mobiles! Prices 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
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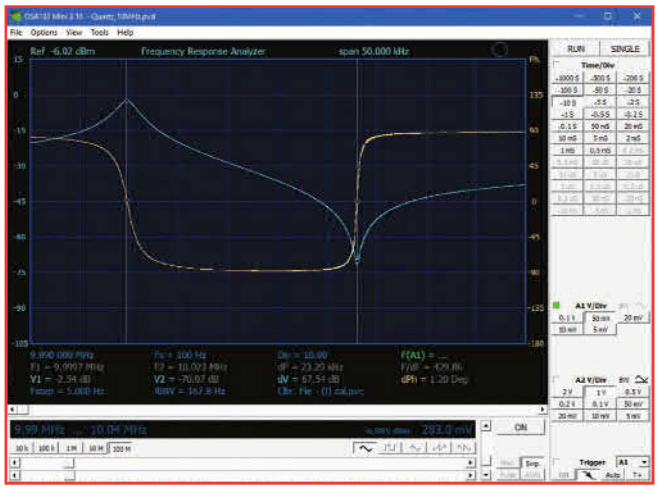
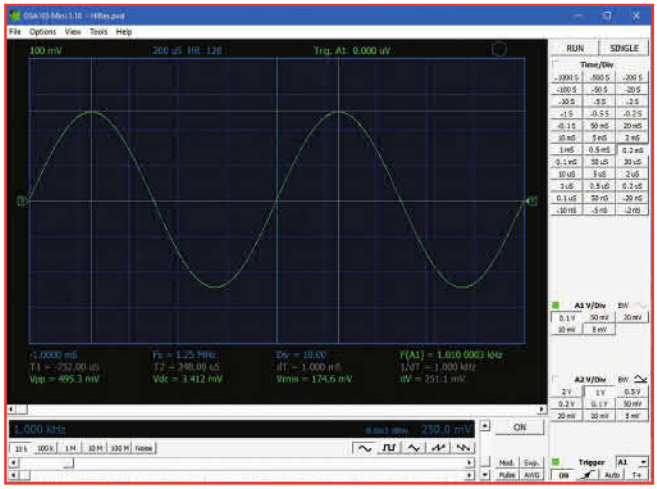


The OSA103 mini used as a frequency response analyser.



The OSA103 mini used as an oscilloscope.

The panadapter display from 'small box' and 'dongle' type SDR receivers can be used as a spectrum analyser over the frequencies that the receiver is able to cover.

The main problem with using an SDR in this way is that the software running on the PC lacks the adjustable markers and automatic level and frequency measuring that a 'real' spectrum analyser has. To paraphrase a little, "the hardware is willing but the software is weak." Still, you can use a cheap SDR to perform many useful measurements at a fraction of the price of buying a commercial spectrum analyser.

Some SDRs are marketed specifically for use as spectrum analysers rather than as general-purpose receivers. A good example is the Signal Hound range of spectrum analysers and SDR receivers. Micro power SDR transceivers can be used as vector network analysers and as spectrum analysers. Examples include the Pocket VNA [1] and the miniVNA from Mini Radio Solutions [2]. These devices come bundled with excellent PC software and they perform very well. But they are rather expensive unless you plan to use them a lot.

One enterprising company has seen a gap in the market. They have developed a small 'flea power' SDR transceiver and written some good free software to enable you to utilise the device as a cheap and effective radio test instrument. The radio is called the 'OSA103 mini' and it comes from Russia. When I saw it discussed on an online ham radio news site, I had to have one. There is an English language website at [3]. At this stage, you can only buy this board by contacting the company at the email address displayed on the website and arranging payment to the same email address via Paypal. I was a little concerned about the lack of a 'store-front,' but the process went smoothly and no problems were encountered. Prices range from US$160 to $165, depending on the connector option you choose and it includes shipment worldwide. For an additional US$8 you can buy what is called on the website an 'acrylic case'. This turned out to be two precision cut pieces of Perspex with some screws and standoffs, which allows you to form a protective sandwich around the circuit board.

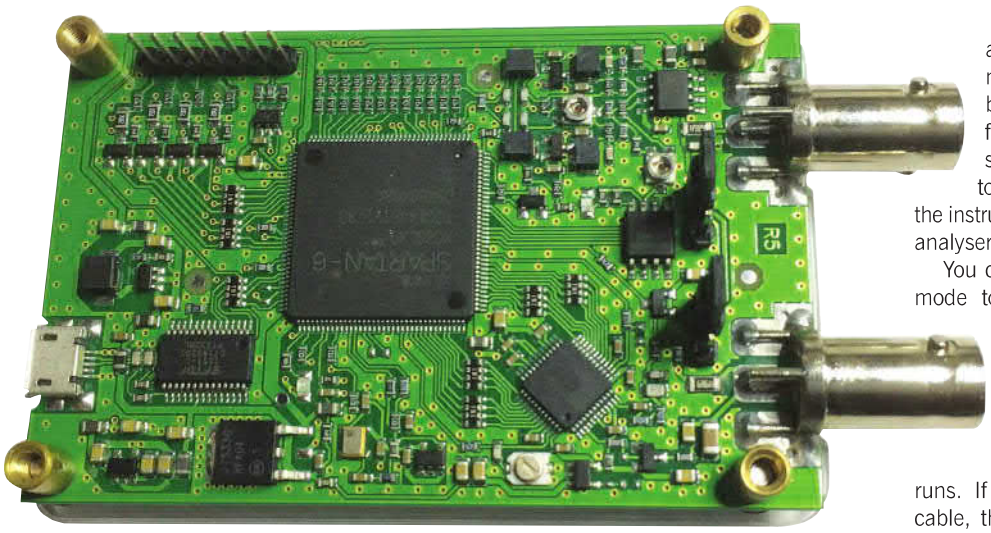
With the freely downloadable OSA103 software, the card can be used as an oscilloscope, function generator, frequency meter, spectrum analyser, vector network analyser, antenna analyser, LC meter, or with come constraints as an RF signal generator. The website has some photos showing screenshot examples of the tests that can be performed.

Using SDR software such as HDSDR, the card can be also used as an SDR receiver, or with the addition of a few additional components, as a flea power transceiver (+5dBm max). I don't really recommend using the radio in this role. There are better options. I feel that the board is best used as a test instrument using the bundled OSA103 software. Like a lot of other small SDRs, if you want to use third-party SDR software, you will need to download the 'ExtIO_Osa.dll' file from the OSA103 website and copy it into the SDR software directory. ExtIO.dll acts as an interface between the software and the radio card. HDSDR does not require you to rename the file.

You need to be aware that the OSA103 mini does not have an anti-aliasing filter. This means that the radio is wide open to frequencies above the 0 to 100MHz first Nyquist zone. You can use the ability to receive signals in the higher Nyquist zones to your advantage and receive signals up to 400MHz, but note that frequencies between 100 and 200MHz and between 300Hz and 400MHz will be inverted and the panadapter will be backwards. For example, a signal received at 120MHz will appear on the panadapter at 80MHz and in HDSDR also at 120MHz. To use the radio as a 3mW SDR transceiver you will need to add a microphone, audio amp, external antenna switching and band-pass or low-pass filters.

The receiver sensitivity (minimum discernible signal) in a 500Hz bandwidth is quoted as being better than -97dBm, I measured about -100dBm on the 20m band, with a noise level in the audio channel of about -107dBm. The HDSDR panadapter has a maximum usable bandwidth of 62kHz and a noise floor of about -92dBm. It is reasonably unusual for the panadapter to perform worse than the audio bandwidth. It is probably due to the radio using an 8-bit ADC. The ADC sampling frequency is 200MHz derived from a 20MHz voltage controlled TXCO.

The OSA103 is supplied as an assembled printed circuit board with a choice of either BNC connectors or SMA connectors. It is powered via the USB connection to the PC, so no separate power



The OSA103 mini, a small, 'flea power' SDR transceiver, capable of so much more.

supply is needed. The board measures 82.4mm x 53mm (3¼" x 2"). It is dominated by the large FPGA chip, which I believe is programmed by the PC software every time the software is run. The small flash RAM stores configuration data but not the FPGA code.

The test instrument software is switchable between English and Russian. Strangely when switched to Russian some of the controls remain labelled in English, but that is no issue if, like me, you need the English version. Unfortunately, the OSA103 mini manual is in Russian and there is currently no English translation. This is a major obstacle and I had trouble configuring the radio for some of the tests. I started to translate the manual into English using Google Translate, but as soon as I understood the configuration jumper options I lost interest in completing the translation. I got up to page 12. The manual is 41 pages long. The website has links to Russian, Polish, and German language forums. The videos are in Russian as well, but the images are interesting. Google Translate works quite well and once you work out what position the two small jumpers need to be in, the rest of the operation is fairly straightforward. For the record, put both jumpers in position 1-2 for use as an oscilloscope (50Ω input), signal generator, frequency counter, spectrum analyser or VNA. Put both jumpers into position 2-3 to use the instrument as a single port device for the measurement of inductance or capacitance with the LC meter, or for use as an antenna analyser or reflectometer. Having jumper J1 open and jumper J2 set to 1-2 makes the input high impedance. The same 'two-port' measurements as having both jumpers set to 1-2 can be performed. Whether you can be bothered struggling with the Russian manuals is up to you. I was seduced by the capabilities that you get for the price that you pay, so I believe it was worth the effort.

RF operations that use the RF signal generator, such as frequency measurement, spectrum analyser and antenna analyser measurements, are accurate up to 50MHz and usable up to 100MHz. The oscilloscope has four digital inputs and one analogue input with a 50Ω input impedance, or a high impedance if you move jumper J1. You could use a standard high impedance 10MΩ scope probe on the 50Ω port. The sample rate for the analogue channel is 200MHz and the maximum display sensitivity is 0.1V per division. Maximum input level is +22dBm (150mW) for the analogue BNC input channel and 3.5V for the four digital channels, (ie 3.3V logic levels).

The RF signal generator can be fixed or swept over any range from 0 to 100MHz. It can also be AM or FM modulated with a tone ranging from 0 to 100MHz. Unfortunately, there is no facility for two-tone testing. The sweep rate is adjustable and it matches the oscilloscope display so that the images are synchronised. The RF output is adjustable but it is too high for receiver testing. The adjustment is also rather coarse. You could do receiver testing if you use an external fixed or step attenuator. It is a pity that a software controlled step attenuator for the transmitter output has not been included on the board.

The board has a voltage controlled TXCO with a frequency accuracy of 1ppm, so the frequency measurement accuracy is only about the same as the display on most receiver or transceivers. But this is 'close enough' for a basic test setup and you can't expect miracles for less than two hundred dollars. The spectrum analyser has a noise floor of -92dBm, the same as the SDR panadapter. There are no span or frequency controls. The only adjustments are the sweep speed, which limits the frequency range and a zoom control. I found this to be fiddly and not user-friendly. The generator has two slide controls that are unused in the spectrum analyser mode. I believe that these should be repurposed as span and centre frequency controls, with the sweep speed being adjusted automatically to suit the selection. This would make the instrument work more like a 'real' spectrum analyser.

You can use the two-port vector analyser mode to check filters, or amplifiers with suitable attenuation to protect the devices. You can use the single port antenna analyser mode to check antennas. The 'Reflectometer' mode can be used to check the length and loss of your coax feeder runs. If you have a faulty antenna feeder cable, the reflectometer can determine and the distance to the fault. You need to set the instrument to send very short duration pulses for this measurement. The LC meter can read capacitance from 0.5pF to 30,000μF and inductance from 50nH to 3H.

A nice feature of the software is that if you load one of the many example files, it will set the controls correctly for the test that is being displayed. This has the benefit that you don't have to remember how to set up the controls for tests that you don't use very often. If you save a test result, you automatically save the instrument settings as well.

The main reason that I wanted to buy the OSA103 mini was to use it as an antenna analyser. It works well and you can display the results as either an SWR or Return Loss trace. At the same time, you can also display a choice of complex impedance, phase impedance, Q, series or parallel resistance and series or parallel reactance. If you are a sucker for punishment you can present the results on a Smith chart, but I never learned how to read one, so I don't use that function. You can set the reference source impedance to 25, 50, 75, or 100Ω. The default setting is 50Ω. The sweep can be set to any range between 100Hz and 60MHz. You can do tests above 60MHz up to 100MHz but the accuracy may be reduced.

Andrew Barron is the author of *SDR, Software Defined Radio for Amateur Radio Operators and Shortwave Listeners,* available from the RSGB bookshop.

Websearch

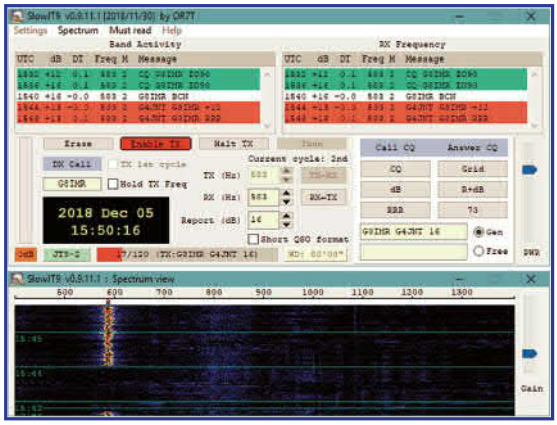
[1] www.pocketvna.com
[2] http://miniradiosolutions.com
[3] www.osa103.ru/en/main-page

Andrew Barron, ZL3DW
Andrew.Barron@broadspectrum.com

Data

SlowJT9

Propagation on the LF bands, 137kHz and 475kHz, usually picks up during the winter and activity rises, but recently there has been disquiet voiced about the lack of good slow data modes for use down there. Originally we had WSPR-15 for beaconing, with its 0.18Hz signal bandwidth and 15 minute transmission period, but when WSPR was incorporated into WSJT-X this got left out. Stations wanting to use WSPR-15 have to use the old WSPR-X software with a slightly sub-optimum decoder.



Screenshots of the *SlowJT9* software by Rik, ON7YD.

Then to cap that, while the first version of the JT9 mode had the slow modes JT9-2 and JT9-5 with 2- and 5-minute overs, these also disappeared during a WSJT-X update cycle. The LF community is somewhat peeved! Rik, ON7YD raised this question in the WSJT-X developers group and he says "…there was no intention to implement these modes again, as the focus was more on the developing of newer modes. Having a closer look at the WSJT-X source code I noticed that the JT9 decoding was done in a separate executable and with some assistance from Joe, K1JT, I managed to write an application that used this executable for decoding.

"As the executable only decodes JT9 signals, not JT9-2 and JT9-5, I had to use a little trick. Speeding up a JT9-2 recording by a factor 2 results in a JT9 signal (at double the tone frequency) that can be fed to the JT9 decoder. The same can be done for JT9-5 (now speeding it up 5 times). Some tests showed that this way a JT9-2 signal could be copied at a 2.5dB better S/N threshold compared to JT9-1. Not completely the theoretical 3dB, but 2.5dB can often be the difference between a failed or successful QSO. JT9-5 hasn't been tested yet. All this was done manually and was rather time consuming, so I decided to write an application that I named *SlowJT9*. It takes care of all the conversions and frequency shifts. Besides JT9-2 and JT9-5 it also supports standard JT9 for convenience."

The aim of that first-release beta version was to test if the application worked properly; to find out if JT9-2 and JT9-5 have a sufficient S/N advantage over JT9-1 and to find out if there is sufficient interest to continue the project. Feedback on the various LF groups pointed out that that version was not compatible with the original on the baud rates: in the first versions of *SlowJT9* the baud rate ratios between JT9-1, JT9-2 and JT9-5 were round numbers; JT9-2 had half the speed of JT9; for JT9-5 it was one fifth.

Rik continues, "I hadn't looked at the initial JT9-2 and JT9-5 parameters and was not aware that they were different. Eric, NO3M, pointed that out. For the last release (v0.9.10) I used the original JT9-2 and JT9-5 parameters as can be found in the WSJT-X v1.00 users' guide **[1]** which, to my knowledge, is the last version of WSJT-X that supported the slower JT9 submodes. It was felt important to keep backwards compatibility for those other users who were using old software or had standalone beacon sources.

"The aim of this release is to find out how to continue with *SlowJT9*, and in fact nothing has been settled yet, but I hope this will be in the near future. Both have their advantages and disadvantages. For the original parameters: **Advantage**: they make better use of the transmission cycle (slightly slower baud rate) and thus have a theoretical S/N advantage (0.46dB for JT9-2, 0.74dB for JT9-5). **Disadvantages**: the odd baud rate ratios make the averaging in conversion to JT9 process a bit more complicated.

"JT9(-1), JT9-2 and JT9-5 transmissions end at the same moment (±1 second), which can complicate simultaneous decoding of all (or at least more than one) of the JT9 submodes. For the parameters used in the first versions, the advantages/disadvantages are the opposite (easier averaging, easier simultaneous decoding but a slight theoretical disadvantage in S/N). As for frequency shifts, the tone spacing is in all cases 1/baud rate."

At the time of writing (early Dec 2018), a full installation for the latest version 0.9.11 can be found at **[2]**. An updated version of the.exe file (overwrite that from [2] to get Ver 0.9.11.1) can be found at **[3]**. The latest version also includes a 10 minute JT9-10.

An incidental disadvantage of the audio scaling process is that the slower modes are limited in the audio frequencies to and from the radio. For example, JT9-10 has an audio tone upper limit of only 414Hz. All is explained in the software's help files.

Reader input

After reading my Design Notes plea for reader input, Mark Herson, N2MH wrote in to say: "Perhaps you should look into Mesh Networking for something new. A good place to start is the Amateur Radio Emergency Data Network (AREDN) site at **[4]**. AREDN has produced firmware that can be flashed into several brands of commercial Wi-Fi gear to turn it into a Mesh node capable of discovering other nodes and creating a self-forming high speed data network. They support Ubiquiti, TP-Link, and now some Microtik equipment. Bands covered are 900MHz (where available), 2.4, 3.5 and 5.8GHz, with some channels on each band solely in the amateur segments. Individual link speeds ranging up to 50Mbps are possible. With this kind of bandwidth, streaming video is possible, along with VoIP. In particular, I have devised a worldwide telephone network that links individual PBXs together. This Mesh stuff makes packet radio at 1200bps look like switched DC. Take a look at Mesh and give it a go."

Websearch

[1] https://tinyurl.com/DN-0219A
[2] http://472khz.org/SlowJT9/SlowJT9_setup.exe
[3] http://472khz.org/SlowJT9/SlowJT9.zip
[4] www.arednmesh.org

Andy Talbot, G4JNT
andy.g4jnt@gmail.com

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Alinco DJ-MD5

Dual band dual mode DMR/analogue handheld

The Alinco DJ-MD5 dual band DMR/analogue radio features a clear, easy to read colour screen and positive-action pushbuttons.

Introduction

I've been involved with many aspects of amateur radio over the years, but I have never looked at Digital Mobile Radio (DMR) seriously before. I have used Echolink, D-Star and Network Radios though, so how hard could it be? I'll leave you to be the judge on that.

When I was approached to review this radio, I decided it would be a good opportunity to learn about DMR. Thus, it is important to note that this review is written from the perspective of an absolute beginner. If you're already a DMR user then you'll already know most of the pitfalls; likewise, it is very important to note that most of the things I found difficult are nothing to do with the DJ-MD5 itself. The box on page 44 gives an overview of the basics of DMR.

What's in the box?

The DJ-MD5 comes well packed in a stiff brown cardboard box, with separate compartments for the various component parts: body, aerial, belt clip, 1500mAh 7.4V Li-ion battery, charger base and UK PSU. Each item comes in its own plastic bag. There is also a very thin manual; more on that later.

Having a charger base supplied as standard is a bonus in my opinion. The 5V 1000mA switch mode PSU has a coaxial DC plug that connects to the charger base. However, the radio has a Micro-USB socket (like on a phone) so the charger PSU can't be plugged straight into the radio. It doesn't seem possible to charge the battery via the USB socket. You are not supposed to use the radio whilst it is in the charger base, which is a bit odd. In fact, you physically can, but I guess it's not supported.

That said however, the radio having a standard Micro-USB connector is a major bonus as far as I am concerned as it means you don't have to invest in an expensive proprietary cable to communicate with and program the radio.

The antenna has a SMA female connector that screws into the male on the radio body. I had to get a SMA to BNC adapter to connect it to my station antenna, but these are not expensive accessories (and you may well already have one in your collection).

Hardware

The DJ-MD5 is a nice-looking radio. It feels solid in the hand and the buttons have a positive action that give good feedback when you press them. It weighs around 256g, but is not intended to be a shirt pocket radio. Internally, it appears that a die-cast chassis is used so it should be fairly rugged, though it doesn't have an IP rating and the manual contains warnings about not getting the radio wet or dusty. Though not guaranteed weatherproof I'd happily use it outdoors.

The radio is switched on using the volume control and there is a delay of some 8 seconds before the colour LCD screen lights up. Once powered up, the radio listens on two channels simultaneously (this behaviour can be changed), but only one is active for transmitting. The display shows both channels, with the active one displayed using a larger font. The screen is of a good size (4.5cm diagonal) and is readable in all the lighting conditions that I tried.

On the left flank are three buttons: PTT and two programmable function (PF) buttons. Out of the box, pressing the middle PF key

The complete set, comprising the charger PSU, drop-in charger, radio, manual and antenna.

swaps which of the two displayed channels is selected for transmission, whereas pressing the bottom one opens the (digital) squelch. I half-expected the channels to swap over on the display when I changed active channel (like most HF rigs do when swapping VFOs), but they didn't. Instead, the active channel is displayed using a larger font (see photo, left).

On the right flank are the Micro-USB programming socket and 3.5 + 2.5mm sockets for a headset or earpiece (not supplied). All are normally snugly covered by a rubber plug (see photo on front cover).

The battery has charging studs that mate with the desk charger. I'm not sure how well these are protected (eg if the bottom of the radio got wet or plonked down on some steel wool). As with many handheld radios, these studs are connected straight to the battery terminals and are 'live' (+7.4V nominal) all the time. The battery clips on firmly but is very easy to put on and off.

The only challenging aspect of the radio is the belt clip. It took several attempts and a few minutes scrabbling on the floor for lost screws before I had it installed. Unusually, the clip is attached to the battery rather than the body, so if you opt for a second battery you'll need a second belt clip as well.

Briefly, the radio has four selectable output powers from 200mW to 5W, covers 2m and 70cm (plus broadcast FM receive – a nice touch), a VOX and, depending on model, a built-in GPS receiver. RX sensitivity is fine.

Setting up from scratch

As indicated in the box on page 44, the heart of any DMR radio is the 'codeplug'. Unfortunately, the radio I received had a very sparse, early codeplug with only a few random frequency pairs programmed in. Therefore, out of the box the radio did (literally) nothing. Unfortunately, I found the supplied manual useless. It is 26 pages long, consisting mostly of warnings and disclaimers. Just one page covers the layout and buttons. The two(!) pages that are devoted to operation cover only how to switch the radio on and change channel. There's nothing on programming, nothing on the menu system. Totally inadequate for such a complex radio and a big black mark in my book. At the very least, I'd expect the printed manual to contain a URL to a more detailed manual that could be viewed online or downloaded. *[A much more comprehensive* UK Operations Guide *that covers programming the radio is now available free from the distributor (Nevada) but was not available when our reviewer started work – Ed].*

From the forums, I managed to find the programming software. Thankfully it's a free download and the radio can be connected using a standard USB cable, so no need to buy a programming cable as you do with some manufacturers. As far as I can see, the radio can only be programmed from a computer. There is very little that can be done from the keypad.

With the software installed and the radio connected, I was finally able to see the contents of the codeplug. Once the initial sense of panic had subsided, I started to research how I could make the radio do something.

I gather that the usual approach is to take somebody else's codeplug (preferably for the same radio) and modify it to suit your needs *[see later – Ed]*. Eventually, I found a codeplug intended for users in Ohio, so I started with that. I copied the Digital Contact List and Talk Groups from the Ohio codeplug and used the Ohio channels as templates for my local repeaters. Unfortunately, I still couldn't get anything to work, but a fellow member of the Huntingdon Amateur Radio Society, Richard, 2E0FRQ, was able to get some channels programmed so that I could make progress. Thank you, Richard! I also programmed in my local FM analogue repeater, GB3OV.

At last, I had a radio that received something! Transferring the modified codeplug for the first time took a long time, mainly because of the enormous Digital Contact List. Luckily, you can opt to not transfer this each time.

My location does not permit access to any of the local repeaters using a handheld's rubber duck, but connecting the DJ-MD5 to my station collinear let me open both local repeaters easily.

Audio quality

First impressions were not very favourable. It's a small radio and necessarily has a small loudspeaker, which sounded a bit 'tinny' to my ears. There was plenty of volume though and it was OK on FM. As with *all* DMR radios, the digital voice mode sounded characteristically 'computerised', almost Dalek-like. This is due to the CODEC used by the DMR system and not a criticism of the DJ-MD5. Using a headset or external speaker removes the 'tinniness'. It's interesting to note that there is a menu option to limit headset volume.

Ease of use

Once programmed, the radio is very simple to use. The channels are grouped into Zones (in my case based on geographical location). You select the Zone via the menu system and then use the rotary control to select channels within that Zone. One useful feature is Receive Group Call Lists. With these, you add a number of channels into a group and then tell the radio to listen on all channels in the group simultaneously. Whenever there is traffic on one of the channels, the squelch opens and the channel is identified on the display. As many channels seem to be silent most of the time, at least you feel you are getting something for your money!

Summary

The DJ-MD5 is a good radio. It feels robust, and fits the hand well (particularly so if you omit the belt clip). The included drop-in charger is a delight to use. The only possible extra bit of hardware that could be added would be a BNC adapter, but these are available cheaply on eBay and elsewhere.

At around £140 (or £160 with the GPS option) it's not a bad price for a decent radio from a well-established manufacturer.

Gareth Howell, M5KVK
gareth.m5kvk@gmail.com

The SMA aerial conector accompanies the channel and volume controls on the top panel.

Final comment on DMR

Setting aside the codeplug problems I experienced, I wasn't very impressed by DMR. It seems to have suffered from the problem of over sub-division of the DMR community. I guess that the overall design assumed there would be so much simultaneous traffic that it just *had* to be corralled into Talk Groups covering small localities. The result is the proliferation of many mostly-silent Talk Groups that serve only a small number of amateurs, resulting in isolation and no critical mass. I left the radio connected to the worldwide talk groups and they were silent for most of the day. Not even idents to let you know they are working. I rarely heard anything on the channels I had access to. Even when I put out calls, I seldom had any response. Only on a pre-scheduled DMR net run by HARS did I find any activity, and then it was only three stations.

Contrast this with the approach adopted by the (admittedly 'non-amateur radio') Network Radios, ie having a small number of global channels, increased as and when the existing ones get busy.

These observations relate to DMR as a whole rather than the DJ-MD5. Hopefully, somebody will invest some time developing a UK-wide codeplug for this and other radios. There is more than adequate storage space in the codeplug to have all UK repeaters pre-programmed with all the Talk Groups they can access. Until that happens, I think most amateurs will find DMR a steep hill to climb. *[Nevada tells us that since this review was written a UK-specific codeplug has been developed for the DJ-MD5 and is freely available – Ed].*

Thanks

We'd like to thank Nevada Radio for the loan of the sample Alinco DJ-MD5. Full details are at www.nevadaradio.co.uk or on 02392 313 090.

What *is* Digital Mobile Radio?

Digital Mobile Radio (DMR) is a system that allows devices to be connected together and exchange voice and data over digital radio links and the internet. As such, it is very similar in concept to D-Star and the combination of Yaesu System Fusion plus WIRES-X. DMR is defined in a series of open standards defined by the European Telecommunications Standards Institute (ETSI) and is used widely in commercial environments as a replacement for the (older), analogue, private mobile radio (PMR). As with PMR, there are many suppliers of commercial DMR radios.

Most commercial (professional) DMR radios are designed for minimal interaction by the operator: they are push-to-talk black boxes, perhaps with a few switchable pre-defined channels. The growing number of DMR radios produced for the amateur market adapt this philosophy by adding analogue voice capability, more comprehensive displays and (some) programmability, but otherwise they are still black boxes (albeit with a colour display).

At the physical level, DMR uses time division multiple access (TDMA) to divide the 4kHz baseband signal into two *Time Slots*: TS1 and TS2. The repeater treats each *Time Slot* as a separate 'virtual' repeater, so each physical repeater is actually two; though only one can be in use at a time.

Each *Time Slot* is usually connected logically to a *Talk* Group. In principle, the *Time Slot* could be connected to any one of the 160,000 *IDs* or 1000 *Talk Groups*, allowing (eg) GB3PY TS1 to be connected to a *Talk Group* serving a group of repeaters in Washington, DC. In practice, each *Time Slot* defaults to a preset *Talk Group*; though the user can override this temporarily if they wish. A *Time Slot* also uses a particular "*color*". This is analogous to analogue Digital Code Squelch (DCS) and serves the same purpose: preventing activation of multiple repeaters.

Importantly, each potential user (radio amateur) *has to* register on the DMR network before they can use it. This can be done at [1], where the user is allocated one the 160,000 *Digital Contact IDs*.

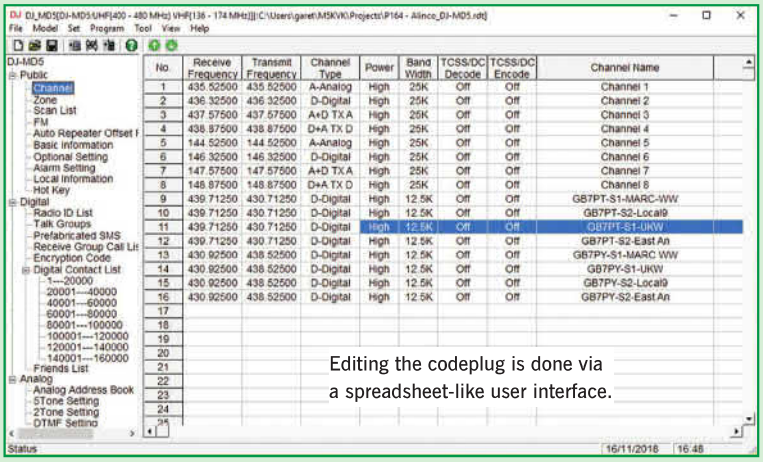
Zones are used to group the channels into logical sets: usually by locality, so that all channels in an area are grouped into a single zone, but it's up to the person programming the radio.

Many amateurs are familiar with programming analogue radios with repeater details. You enter the name, input and output frequency, CTCSS information and so on. A similar principle applies in DMR except there are a *lot* more variables – and they all have to be programmed before the radio will do anything whatsoever. This information – known as a "*codeplug*" even though it isn't any sort of *physical* plug – is a set of rules that defines what a radio will actually do. Just to make life interesting, *codeplugs* are usually manufacturer- (and even model)-specific and even a *codeplug* from an identical radio will normally require at least *some* tailoring to make it "yours". Amongst other things, the *codeplug* contains:

- *Channels* that define a combination of *Repeater*, *Time Slot*, *color* and either a *Talk Group* or another *Digital Contact*. The DJ-MD5 supports up to 4000 *Channels*.
- *Zones* into which the channels are grouped for convenience (up to 250, each with up to 160 *Channels*)
- *Digital Contact IDs* – a directory of individual radio stations (radio amateurs) registered on the DMR network (up to 160,000 – see **[1]** for the current list of *IDs*)
- *Talk Groups* – meeting places where groups of users can talk to each other (the DMR equivalent of analogue repeater 'nets' or D-Star 'conferences'. There can be up to 1000 of these).

Most *Talk Groups* are intended for country or regional use (eg one covering East Anglia), but a few are defined for world-wide use. A list of current *Talk Groups* is at **[2]**.

The DMR infrastructure comprises a global network of digital repeaters, connected to each other over the internet. My local DMR repeaters are GB7PY (Cambridge) and GB7PT (Royston). Just like analogue repeaters, each operates on a frequency pair. Unlike their analogue equivalents though, by choosing the right *Talk Group* a user of GB7PY could communicate with a DMR-equipped radio amateur in just about any country or region of the world. But the *Talk Group* has to be 'in' the *Codeplug* or you won't see it.



Editing the codeplug is done via a spreadsheet-like user interface.

Websearch
[1] www.radioid.net
[2] www.dmr-marc.net

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- Four different Tone-burst tones
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Roofing filters

History

Post WWII, radio amateurs benefited considerably from ex-military HF receivers like the HRO and AR88. Both of these valved receivers used two RF stages and a single frequency conversion to an intermediate frequency (IF) around 455kHz. This resulted in poor image rejection on the higher frequency bands, limited selectivity from the single crystal filter and relatively poor dynamic range due to several stages of amplification or mixing before the channel filter.

Since then, ongoing commercial developments have resulted in significant improvements in the provision of good channel selectivity using mechanical and crystal filters and a better understanding of dynamic range issues. We now know that the channel selectivity should be provided as close to the front end as possible and with a minimum amount of gain before that selectivity. The availability of higher frequency crystal filters enabled the use of a first IF with some channel selectivity above 30MHz – referred to as up-conversion. This also addressed the issues of poor image rejection by moving the image frequency a long way from the incoming signal frequency. Up-conversion architectures, still in use today, have a second frequency conversion to a lower frequency where much better channel filters and high signal gain may be provided.

The filters used in the first IF of an up-conversion receiver (or transceiver) are generally called roofing filters and provide some overall channel selectivity depending on the mode in use. In lower cost designs, a single roofing filter will be provided with a passband sufficiently wide to pass the widest required bandwidth signal mode which might be FM, AM or SSB. In higher cost designs, several roofing filters will be provided, each with different bandwidths to match each required mode. **Table 1** shows the minimum receiver overall bandwidths for various common modes of operation. The required bandwidth for CW can be (significantly) less than 100Hz, depending on the keying speed.

Typical commercial roofing filter frequencies are 35.4MHz, 37.3MHz, 40MHz, 45MHz and higher. 45MHz filters with bandwidths of 7.5kHz and 15kHz are relatively common. The other frequencies appear for sale occasionally but the supply is infrequent and unpredictable, leaving the constructor the remaining option of making their own. The choice of frequency depends on which HF/VHF bands are to be covered. For example, 45MHz would be fine for the HF bands but it is a bit too close to the 50MHz band unless extra RF filtering is provided.

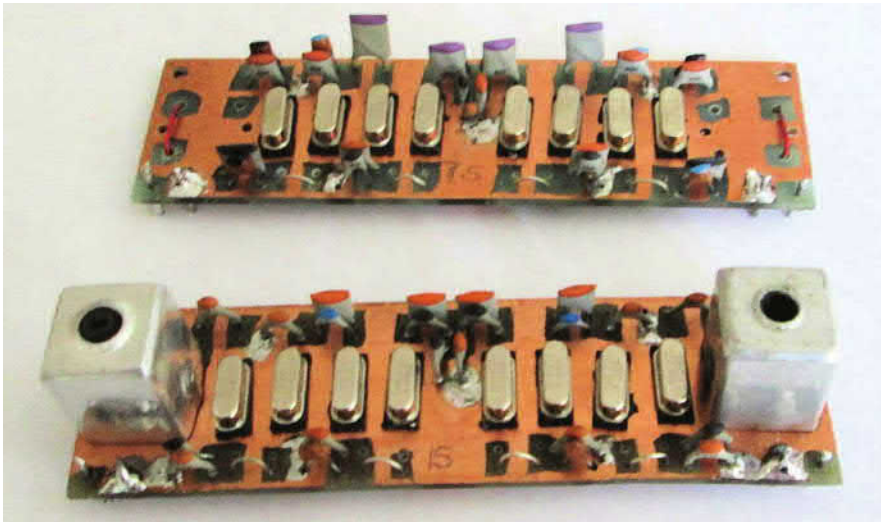

PHOTO 1: Two prototype filters, 7.5kHz at the back and 15kHz in the foreground.

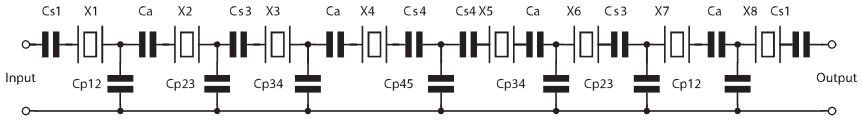

FIGURE 1: Eight-section ladder filter. X1 to X8 are nominally identical crystals.

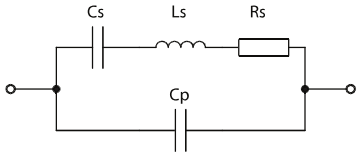

FIGURE 2: Equivalent circuit of a quartz crystal.

A practical filter

Figure 1 shows a generic circuit diagram of an eight-section ladder filter using eight identical crystals. Each filter consists of two identical four section filters connected in series with a capacitor coupling network. The component numbering scheme is the same as that provided by the two design packages in the references at the end of this article so some numbers in a numerical sequence may be missing. For example, CS1 is the series capacitor in filter section 1, CP12 is the parallel (shunt) capacitor between section 1 and section 2 etc. There is no CS2 in the original filter design and the capacitors labelled Ca are only required to raise the centre frequency, discussed later.

Ladder filters are relatively easy to construct and there are design packages available to save constructors a lot of maths [1]. It should be noted that third overtone crystals provide relatively narrow

TABLE 1: Minimum bandwidths by mode. § = chanellised, with the channel spacing noted.

Mode	Minimum passband width
25kHz§ FM	15kHz
20kHz§ FM	12kHz
12.5kHz§ FM	7.5kHz
AM	6kHz
SSB	2.1kHz
CW	<100Hz

TABLE 2: Calculated design values and those that were actually used.

BW	CS1	Ca	CS3	CS4	CP12	CP23	CP34	CP45	Model B/W	F_{centre} (MHz)	Zo
7.5kHz calc	88.4	-	328.3	283	71.6	88.4	91.6	92.3	8.3kHz†	37.4893	50.5Ω
7.5kHz used	82+6.8	link	330	270+12	68+3.3	82+6.8	82+10	82+10			
15kHz calc	39.2	-	145.6	125.7	31.8p	39.2	40.6	40.9	15kHz	37.4949	113Ω
15kHz used	39	link	120+22	120+5.6	27+4.7	39	39+1.5	39+1.8			

† see text for note on bandwidth (BW).
Capacitor values are in pF; some are shown as two standard values in parallel (eg 88.4p uses 82pF+6.8pF).
Zo is the characteristic impedance of each filter.

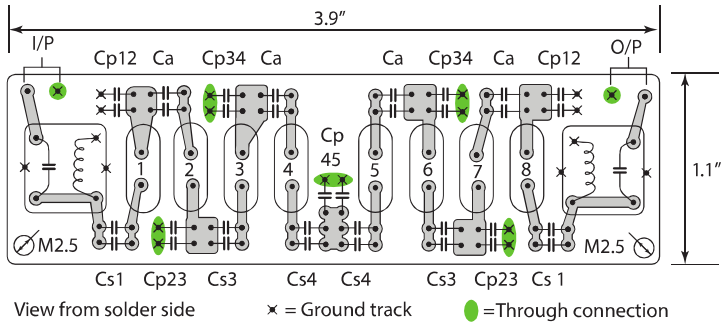

FIGURE 3: Layout of the prototype PCB shown in Photo 1. Material is 1.6mm FR4 or G10 copper clad circuit board. Top copper layer is ground plane. Mounting screws are grounded.

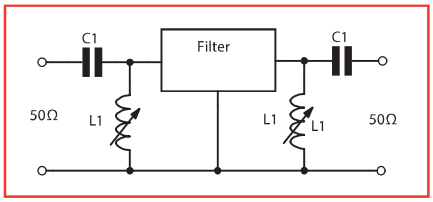

FIGURE 4: Matching networks (see text).

maximum bandwidth ladder filters compared to fundamental mode crystals of the same frequency due to the significantly different values of the motional components [2].

The recent availability of low cost fundamental mode crystals above 30MHz has provided an opportunity to overcome the bandwidth limitation as their motional component values provide much increased maximum bandwidths in ladder filters.

I purchased a batch of twenty 37.5MHz fundamental crystals from a Hong Kong supplier with a view to using them in ladder roofing filters. All crystals were checked for their spread of series resonant frequencies and a few crystals were measured in detail to enable their average motional parameters to be determined. These were Lm=1.399mH, Cm=12.8862fF and Cp=4.567pF. (Note that 1fF = 1/1000pF).

Figure 2 shows the equivalent circuit of a fundamental quartz crystal (ignoring any overtone modes). Cs is the series motional capacitor, Ls is the series motional inductor and Rs the equivalent series loss resistance. Cp is the parallel capacitance due to the holder strays and metal plating on each side of the crystal.

Two eight-section filters were designed with bandwidths of 7.5kHz and 15kHz. I chose a ripple figure of 0.5dB as a compromise between pass band ripple and the rate of attenuation into the stopband. The design packages require you to make some basic measurements on the crystals and then place those results into data entry boxes, from which the motional parameters of the crystals can be calculated. You then choose the number of filter sections, 6dB bandwidth and ripple required. The results are then calculated and presented in a manner that lets them be saved and/or printed. **Table 2** shows the values I came up with.

Prototype filters were constructed in 'dead bug' formats to prove the overall designs, as seen in **Photo 2** and then a printed circuit board (PCB) was laid out (**Figure 3**). Two PCBs were cut, drilled and etched and filters constructed using the nearest standard E12 capacitor values. Each single capacitor position was provided on the PCB as two capacitors in parallel so that the total capacitance could be made a close as possible to the calculated values. The capacitors used were 2.5% or 5% plate ceramic types in the E12 range with mostly 0.2" (5mm) lead spacing.

The PCB is double sided copper clad 1.6mm fibreglass, with the top side being a ground plane. As I wasn't able to make a plated through hole (PTH) board, most through couplings use L762 Tucker Eyelets, which have sufficient space for a component lead through the eyelet centre. The PCB pins are double sided types from Vero, soldered both sides where appropriate. The crystals arrived with the connecting tags laid flat on a layer of black insulation so they could be surface mounted on the solder side. However, it was possible to gently raise the tags so that they could be through hole mounted – they are brittle so do not over-bend them. Connecting the crystal cases to ground did not appear to make a significant difference to the overall frequency response. The completed assembly should be screened and well grounded for best stop band results.

Testing

A Rigol DSA815 1.5GHz spectrum analyser and tracking generator was used to make all measurements, which are subject to the inherent amplitude and frequency specifications of that instrument.

The 15kHz filter measured results were extremely close to the calculated values, with a 6dB bandwidth of 15.22kHz and a stopband better than –70dB. However, the 7.5kHz filter showed a bandwidth of 6.8kHz, which may have been due to crystal parameter measurement errors or the use of randomly selected crystals. The filter model was recalculated based on a bandwidth of 8.3kHz, which resulted in a measured bandwidth of 7.66kHz and a stopband of better than –72dB. The worst case 6 to 60dB shape factor was 2.05:1. **Table 3** shows the results.

Lossy resistive matching to and from the 50Ω test equipment that was used during development was replaced with the L section matching networks shown in **Figure 4** (for which there are spaces on each PCB – a matching network was not required for the final version of the 7.5kHz filter). The screened inductor assemblies were hand wound Neosid types that were commonly used in the 1960s UK mobile radio industry and are still available on PC boards at rallies, but could be replaced by more modern dust iron toroids with a tie-wrap or other suitable mounting arrangement. **Table 4** shows the component values used for the matching network. The 0.43μH inductor can be made from approximately 8 turns of 26SWG enamelled copper wire on a Neosid 7100 style inductor assembly.

Inductor L1 has a fairly flat tuning characteristic when looking at the signal output amplitude from the filter but a much sharper characteristic when looking at the return loss from the filter. Adjust for the best combination of low pass band ripple and low return loss in the pass band.

The filter bandwidths were chosen to allow 12.5kHz and 25kHz channel spaced FM signals to be received as well as narrower mode signals if required. AM 6kHz and SSB 3kHz wide filters were calculated out of interest but not constructed.

Spurious responses

The completed filters are shown in Photo 1. The matching capacitors in the 7.5kHz filter have been replaced with wire links and the matching inductors omitted. **Figure 5** and **Figure 6** show the close-in and wide frequency responses for the 7.5kHz filter; **Figure 7** and **Figure 8** show the same for the 15kHz filter.

The crystals were obviously intended for oscillator applications, as some spurious resonances about 20dB down on the

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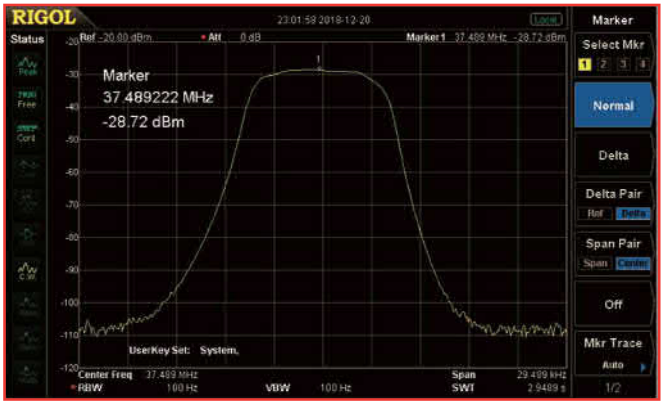

FIGURE 5: 7.5kHz filter narrow scan frequency response. Centre frequency 37.489407MHz, span 35.2kHz.

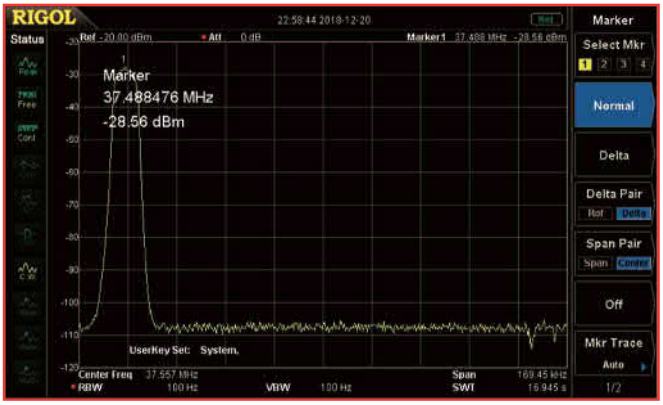

FIGURE 6: 7.5kHz filter wide scan frequency response. Centre frequency 37.505200MHz, span 129.7MHz.

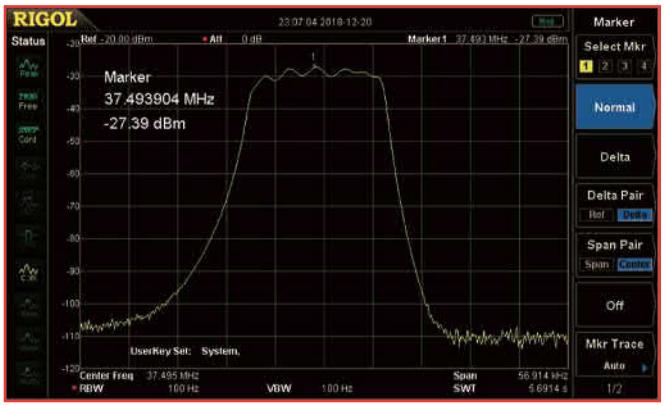

FIGURE 7: 15kHz filter narrow scan frequency response. Centre frequency 37.492092MHz, span 50.502kHz.

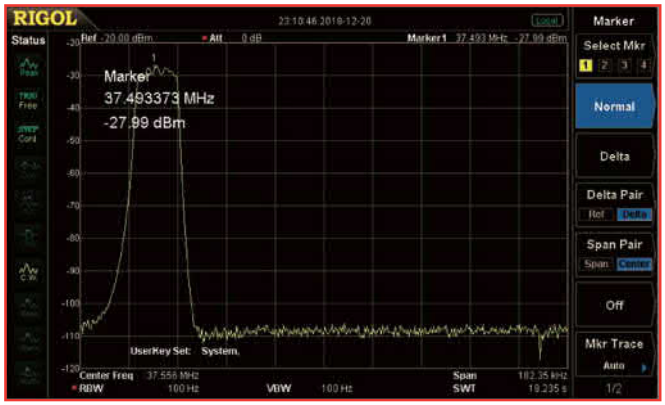

FIGURE 8: 15kHz filter wide scan frequency response. Centre frequency 37.508976MHz, span 123.79MHz.

main series resonant response were noted around 50-130kHz on the high side of the series resonance, which would have been unacceptable in filter applications. These spurious responses are only just visible in the high frequency stop band of the eight section filters (see right hand side of Figure 7 and Figure 9). They are increasingly bad in six- and four-section versions of the filters. Selecting crystals with different spurious frequencies may alleviate this problem.

Centre frequencies

As the low frequency edge of a ladder filter is related to the series resonant frequency of the crystals, two different bandwidth filters made using the same crystals will have similar low frequency edges but different high frequency edges and therefore different centre frequencies. The narrower filter will have a lower centre frequency. If the two filters are to be used in the same receiver then this difference can be corrected by placing low value capacitors in series with each crystal in the narrower filter.

Experiments suggest that 15-18pF series capacitors would be required with these crystals to raise the centre frequency by about 5kHz but this may have some effect on the filter bandwidth and passband ripple so the reader is left to complete this task based on their individual requirements. The circuit diagram in Figure 1 and PCB layout in Figure 3 have four capacitors labelled Ca that are not required in the original filter design and should be replaced with wire links. However, they *are* required to increase the filter centre frequency.

Capacitors CS4 and CP45 control the coupling factor between the two halves of the filter, so these were left as they were. Capacitors CS1 and CS3 will be new values calculated from the original values of CS1 and CS3 in series with the additional tuning capacitor using the formula

$$Cn = \frac{C1 * Cx}{C1 + Cx}$$

where Cn is the new value, C1 is the original value of CS1 or CS2 and Cx is the value of the additional tuning capacitor. It may be possible to model this change using the AADE or LT Spice software packages but I have not yet tried this option.

Temperature tests

At the suggestion of a member of the Technical Panel, I investigated the temperature stability of the 7.5kHz filter at -18, +20 and +55°C using, respectively, a domestic freezer, ambient air, and a homebrew thermal testing oven (which may become the subject of a further article if readers express interest – please email me).

The results of the temperature testing are shown in **Figure 9**. Subject to measurement errors, the greatest frequency move is 400Hz across the whole 73°C temperature range. The analyser noise threshold with a 100Hz bandwidth made the –80dB results more difficult to measure accurately. Measured frequencies were rounded to the nearest 100Hz. The insertion loss changed by approximately ±0.5dB over the full temperature range. I would expect the performance of the 15kHz bandwidth filter to be broadly comparable.

As few people are likely to operate one of these filters in a homebrew transceiver at anything like these temperature extremes, it's reasonable to suggest that the performance of the design is, to all intents and purposes, 'stable'.

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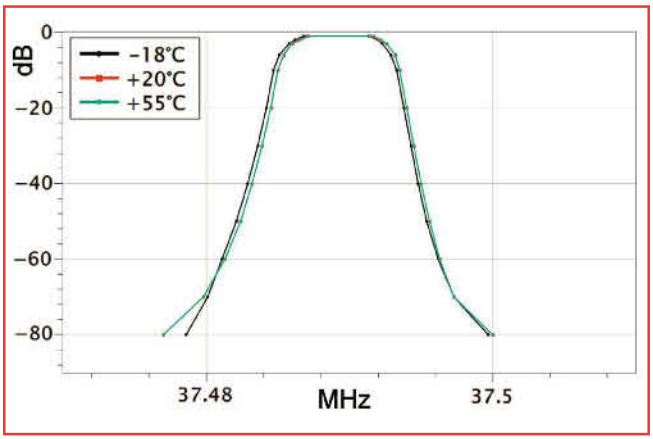

FIGURE 9: 7.5kHz filter performance at varying temperatures.

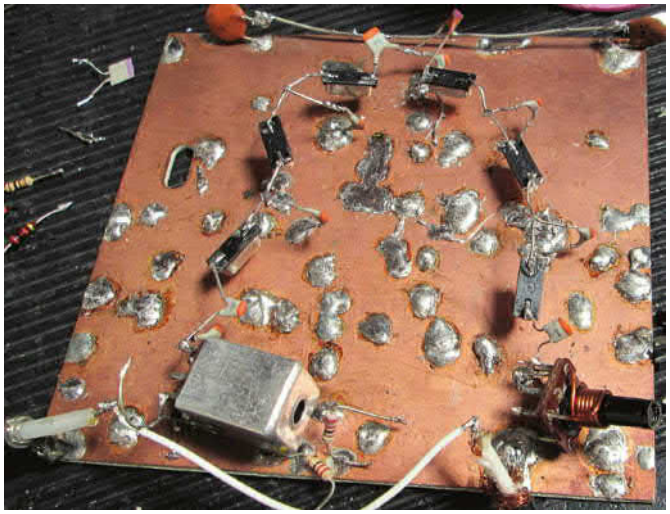

PHOTO 2: An early prototype six section filter in dead bug construction.

Conclusions

Health warning: these results are based on a single batch of crystals with a claimed 20 parts per million specification. Prospective constructors should check a selection of their own crystals for the motional values and make any changes required to meet their desired specifications. Crystal selection may be required, but a big bag of surplus crystals doesn't cost much.

It is perfectly possible to construct usable ladder filters above 30MHz using fundamental mode crystals but more care is required in making the crystal measurements and designing the PCB compared to lower frequencies like 9MHz.

The choice of a second IF will depend on the modes to be received and the availability of filters or filter designs for those modes and frequencies. Ceramic filters are available at 455kHz and there's a good supply of crystals to make filters at 9MHz or lower (although the maximum bandwidth in a ladder format will be limited to 10kHz or less, so ladder filters of 15kHz bandwidth for 25kHz channel FM will be impossible to implement). New and secondhand 9MHz filters are available.

Possible improvements

The 2.5dB insertion loss in the 15kHz wide filter is surprisingly good but the 5.7dB loss in the 7.5kHz wide filter may be too high in some HF applications. So what could be done to improve the numbers? A lot depends on the type of mixer in use. An active mixer (with some gain) may not require any changes to obtain an adequate sensitivity on the HF bands. There are several options for a passive ring diode or FET switching mixer followed by a diplexer (with its approximately 6dB overall insertion loss):

- Least preferred would be an amplifier ahead of the mixer, as this would compromise the dynamic range of the overall front end.
- Use an amplifier between the diplexer and the eight section filter – the mixer would be terminated in 50Ω but the amplifier would still be exposed to the wideband output of the mixer (reduced somewhat by the diplexer selectivity).
- Use a four section version of this filter, which should halve the insertion loss, followed by a preamplifier and then a further four section filter (to achieve the same overall selectivity). The amplifier would now only be exposed to the signals passed by the 7.5kHz bandwidth of the first filter but you need to take into account that the mixer would see a significant variation in load impedance outside the passband of the first filter.
- For the best wide band impedance match in the previous option the first four section filter after the mixer could be composed of two four section filters with quadrature hybrid couplers, which would minimise the impedance changes presented to the mixer outside of the filter passband.

In all cases the amplifier should have a low noise factor, a gain of around 12-15dB, high dynamic range, and input and output impedances of 50Ω. Use only sufficient gain to achieve the desired sensitivity – any more just decreases the dynamic range.

TABLE 3: Measured frequency response results. Frequencies are in MHz unless otherwise stated.

	7.5kHz filter			15kHz filter		
Insertion loss	Low side	High side	Bandwidth	Low side	High side	Bandwidth
-3	37.48687	37.49202	5.95kHz	37.48743	37.50049	13.06kHz
-6	37.48543	37.49309	7.66kHz	37.48677	37.50199	15.22kHz
-20	37.48448	37.49391	9.43kHz	37.48535	37.50290	17.55kHz
-40	37.48307	37.49491	11.84kHz	37.48302	37.50407	21.05kHz
-60	37.48065	37.49633	15.68kHz	37.47937	37.50565	26.26kHz
Stopband	-72dB min			-70dB min		
Centre freq	37.48926			37.49438		
Insertion loss	5.7dB			2.5dB		

Further reading material

Colin Horrabin, G3SBI (and associates) developed the CDG2000 high performance receiver [3]. Martein Bakker, PA3AKE has published a substantial amount of work on high performance receivers [4].

References

[1] Two free ladder filter design packages: a web based design at www.giangrandi.ch/electronics/crystalfilters/xtalfilters.shtml and a downloadable Windows executable at http://warc.org.uk/?page_id=387

[2] A table of example quartz crystal and ceramic resonators and their corresponding ladder filter maximum bandwidths may be seen at www.qsl.net/g3oou/crystalsforiffilters.html

[3] http://warc.org.uk/?page_id=81

[4] https://martein.home.xs4all.nl/pa3ake/hmode/index.html

TABLE 4: Matching network values.

Item	7.5kHz filter	15kHz filter
Filter Z	50.5Ω	113Ω
C1	Wire link	75.16pF (68pF + 6.8pF)
L1	Not required	0.43μH

EMC

Brexit and EMC

At the time of writing (19 Dec 2018) there is much uncertainty about what will happen if and when the UK leaves the European Union and after any transition period has ended. CE marking is part of the Single European Market so, whatever happens, the UK would need to continue to apply these rules if it wishes to continue to trade with the EU.

The possible outcome for trade with countries *outside* the EU (and for internal trade within the UK) is less clear, however. It is possible to envisage a scenario where trade deals for non-EU trade could lead to a relaxation of technical standards for goods, including relaxation of EMC standards for electronic products. We await developments with interest – and some trepidation.

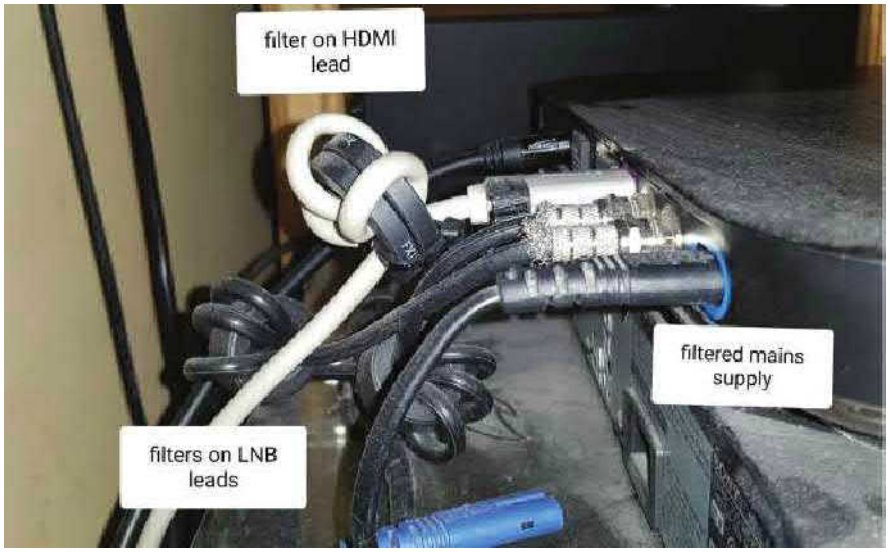

PHOTO 1: Ferrite ring cores fitted to cables on a Sky 'Q' box.

Satellite TV boxes

Following the item in the December 2018 EMC, we have received further reports about Sky 'Q' satellite TV boxes. Simon, G0FCU has a Sky 'Q' box plus a Sky 'Q' Mini Box. Due to the distance between the boxes, these are connected by Ethernet cable to a central Netgear Ethernet switch to which the other Ethernet ports and the VDSL router in the house are also connected. His Sky 'Q' box does not have any option to enable powerline communication. The Sky 'Q' boxes broadcast SSIDs for their 2.4GHz Wi-Fi connections but Wi-Fi is not used due to using wired Ethernet.

Simon lives in a quiet RF location in the Surrey Hills, in the centre of a village but well shielded from urban locations and also well shielded from HF and VHF/UHF signals. He reports that at this relatively quiet location, he does not experience interference from the Sky 'Q' boxes from LF through to HF but he does suffer interference from the VDSL broadband signals on the overhead phone lines from 3750kHz up to about 5200kHz.

Tony, G8PBH reports that in his case, the main source of RF noise appeared to be the box itself and not the VDSL line. As an existing Sky customer he was offered one of these boxes as an upgrade a couple of years ago as soon as they were introduced. Prior to the upgrade, he had enjoyed low noise on the amateur bands but as soon as the box was installed the 14MHz band was rendered almost unusable due to an S9 noise level.

The noise had no particular characteristic that would point to a switching power supply; it was more like a huge increase in the background 'white' noise level. The noise was received at a similar level on both his aerials, a horizontal dipole with its feed point about 20m from the Sky box and his vertical at the end of the garden, about 40m from the box.

The link between the main box and the upstairs box is via Wi-Fi. Powerline communication is not used but Tony is not sure whether it is enabled or not. Tony reports that when he unplugged the Sky 'Q' box, the noise disappeared but when it was powered, the noise level was the same whether the box was operating or in standby mode. **Photo 1** shows how he managed to tame the noise: the greatest effect was had by adding the ferrite ring filter to the HDMI lead to the TV. Adding filters to the coaxial cables leading to the LNBs gave a further improvement and filtering the mains cable had a very small (but noticeable) effect.

Tony reports that, in his case, these modifications reduced the noise level from the Sky 'Q' box from S9 to below the atmospheric noise on 14MHz, S1. This improvement only lasted a short time however as a neighbour upgraded *their* Sky box to Sky 'Q'. Now Tony reports a constant S3-S5 noise level compared to S1 at his previously-quiet location.

There is also a related post by G4LNA on the RSGB EMC Matters Forum **[1]** about a Sky Plus box where an HDMI cable appeared to be radiating interference. G4LNA reports some noise on 14037kHz and about 1kHz either side that

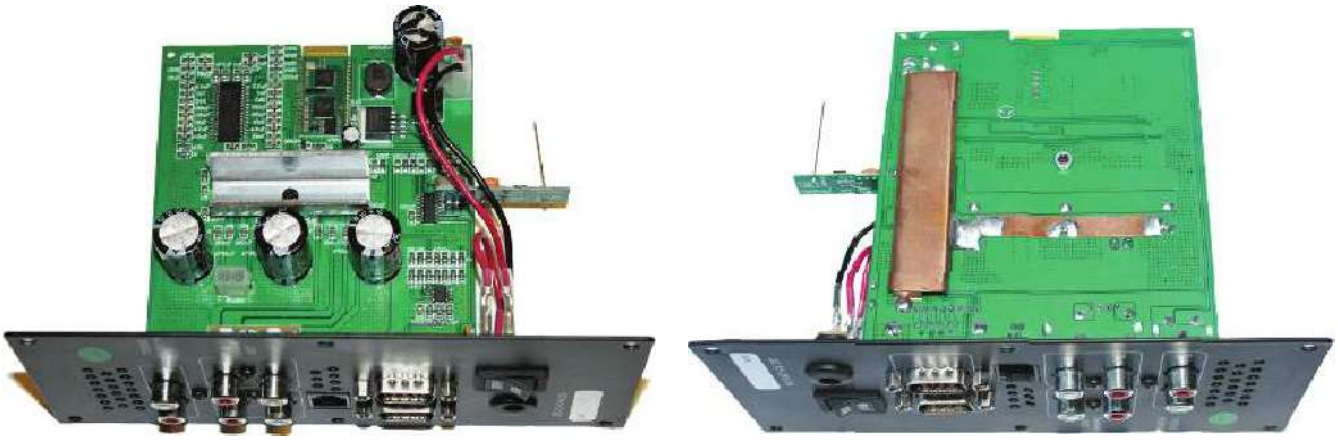

PHOTO 2: Class D audio amplifier, component side (left) and solder side (right). The radio boards are at the centre top and sticking out of the side.

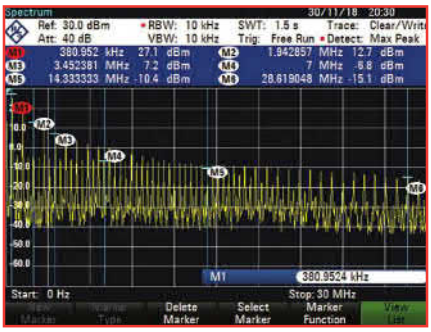

FIGURE 1: Class D audio amplifier frequency spectrum 0-30MHz.

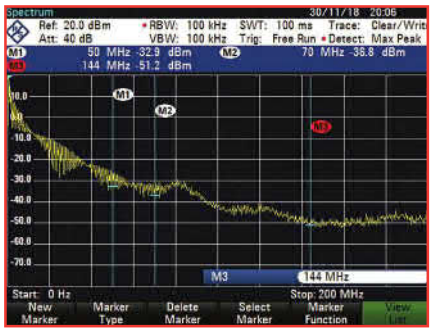

FIGURE 2: Class D audio amplifier frequency spectrum 0-200MHz.

FIGURE 3: Class D audio amplifier frequency spectrum 50-52MHz.

appeared to be coming from the HDMI cable that connects his Sky Plus box to his Sony Bravia TV. After trying ferrite cores and different cables, it appeared that the source was actually the TV, not the Sky Plus box. It was also found that, for this particular case, it made a difference which HDMI port was used. Connecting to HDMI Port 4 produced a staggering 18dB less noise than HDMI Port 1.

Based on these reports it appears that there may be more than one version of the Sky 'Q' box. It is also possible that different configurations of HDMI cable, different display settings or different TVs may affect the interference radiated on 14MHz, if HDMI is the source. If the HDMI cable is poorly screened then it could well radiate 'hash', although it is not clear whether this would continue when the box is on standby.

Some types of Sky 'Q' box are known to have powerline communications capability built in and can drive communication signals onto the mains. It appears that the use of this capability was not supported by Sky and the ability to enable it was subsequently removed from the hidden engineers' settings menu. Nevertheless, I would be interested to hear of any other reports of RF noise from Sky 'Q' boxes. *[Instructions on how to access the hidden menus are readily available on the internet – Ed]*

Class D audio amplifiers

Historically, most audio power amplifiers have operated in Class AB (with a few in Class A) **[2]**. An alternative that is becoming more popular is Class D, which uses pulse width modulation (PWM) with a switching frequency well above audio frequency. An early PWM audio amplifier was the Sinclair Radionics X10 in the mid-1960s. This used a switching frequency of 50kHz but it had no low pass filter in series with the loudspeaker output, so it relied on the inductance of the loudspeaker coil to reduce currents at the switching frequency and its harmonics. This did not prevent the unscreened speaker cables from radiating harmonics of the switching frequency, including the fourth harmonic around 200kHz, close to the frequency of the BBC Light Programme, then on 1500 metres (200kHz) Long Wave. The later Sinclair X-20 made "…any near-by AM radio unusable. Furthermore, you cannot use them as a stereo pair because they interfere with each other…" **[3]**.

More recently, Class D audio amplifiers have become available with higher output power and higher switching frequencies. One such amplifier is used for the audio in a 'Media TV Bed' where the foot of the bed has a mechanism to raise a built-in flat screen TV. It has been reported that some media TV beds can radiate harmonics across the MF and HF radio spectrum (and, when the TV is in use, that these harmonics are modulated with the audio from the TV programme or DVD playback). At first this was thought to come from the TV itself but then the source was found to be a separate audio amplifier module built into the bed. A Member has kindly loaned such an amplifier to the EMC Committee for testing.

Photo 2 shows the Class D audio amplifier, which drives four loudspeakers that are built into the bed. The aluminium heatsink is for the Class D audio amplifier chip but there are no RF interference filtering inductors in series with the loudspeaker outputs. There are also two radio modules. The one on the right with a short wire antenna is a UHF remote control receiver (rather than using infrared). The one at the top with a zig-zag PCB antenna is for 2.4GHz Bluetooth. The right side of Photo 2 shows the solder side of the PCB, which has two substantial copper strips soldered on. The purpose of these is likely to be to improve grounding and reduce radiated emissions of RF interference at VHF and UHF.

The audio inputs from the TV and the amplifier outputs to the loudspeakers all use Phono (also known as RCA) connectors. The ground side of the input connectors is connected to the 0V track on the PCB as would be expected but the loudspeaker outputs are driven by a bridge arrangement so neither side is grounded. The switching signals on the two sides of each speaker should be equal and opposite so, in theory, if everything is perfectly balanced at RF then the speaker cables shouldn't radiate RF interference. In practice however, there could be some unbalance at RF that would cause the speaker cables to radiate interference. The worst case would be if one side of one speaker is grounded. This might happen if the audio input and speaker output cables are plugged in incorrectly, causing substantial RF circulating currents around the cable screens via the TV.

To assess the potential for RF interference with an unbalanced loudspeaker load, the amplifier was tested by connecting an RF spectrum analyser with DC blocking capacitor between one side of a speaker output and ground on the front panel. The results are shown in **Figure 1**, **Figure 2** and **Figure 3**.

The fundamental switching frequency is 381kHz and the power into a 50Ω load to ground is +27.1dBm (0.513 watts). That was measured with a 12V DC supply to the amplifier, but it is rated 12 - 24V. With a 24V supply, the power into a 50Ω load to ground is +32.2dBm (1.66W)!

For this particular switching frequency, there are harmonics in MF/HF amateur bands at 1.943MHz, 7.000MHz, 14.333MHz, 20.905MHz and 28.619MHz. Figure 3 shows multiple harmonics in the 50-52MHz amateur band including 50.717MHz and 51.502MHz but these are quite broad.

It is not clear whether the amplifier tested was intended for the European market. One way to find out would be to look at the frequency of the radio remote control transmitter. A model intended for European use would operate on 434.92MHz, whereas 315MHz is a USA FCC allocation.

I would be interested to receive any other reports about interference from Class D audio amplifiers.

Websearch

[1] http://forums.thersgb.org/index.php?forums/emcmatters/
[2] https://en.wikipedia.org/wiki/Power_amplifier_classes
[3] http://diy.torrens.org/Sinclair/inside/Duncan.php

Dr David Lauder, G0SNO
emc.radcom@rsgb.org.uk

Design Notes

Feedback

After November's comments, Andy Palmer, G4VDF wrote to say "Firstly thank you and the many other writers for the very interesting technical articles that have appeared in *RadCom* over the years. I have written a couple of articles for the British Vintage Wireless Society magazine so I know full well that these things take far longer to research and write than they do for the reader to read. Your continuing efforts are very much appreciated!

"I noticed your appeal for possible subjects for discussion in November and a couple of things sprung to mind. I've been involved with the Farnham VHF and UHF repeaters for many years (GB3FN 70cm, GB3FM 23cm and GB3FX 6m, plus μwave beacons run by others). I have noticed in recent years that operating has become far more 'casual' and some signals lack a decent level of modulation. The users of these under-modulated radios seem unaware of the impact on signal to noise ratio and the difficulties that this often entails for the receiving station. As I grow older and my hearing becomes less acute I am perhaps more conscious of this effect than younger operators. So where's this leading?

"How about an article outlining potential rough and ready frequency modulation (FM) monitoring methods? It appears that both an 'old school' hardware approach and an SDR-based approach ought to be considered. For the hardware approach, I have in mind a simple unit that gives a rough idea of peak deviation on say four LEDS that light at various levels, perhaps 45%, 60%, 75% and 90% of the nominal deviation? The arrangement that first sprang to mind was a mixer, one input from a small RF sense antenna and the other input from a local oscillator with its output fed to a PLL chip. The PLL control voltage would contain the demodulated audio signal that would be detected and fed to a series of level comparators, each one driving an LED as the appropriate audio level is reached. I hasten to add that obviously this basic idea is not mine as FM demodulators based on PLLs have been around for donkey's years but an old article on the web by Lloyd Butler, VK5BR **[1]** set me thinking.

"Providing the PLL had a wide enough frequency range I don't see why the local oscillator would even need to be crystalled, so a VFO might suffice. Perhaps even an 'olde-worlde' CMOS 4046 / 74HC4046 would be usable if the resulting IF is only a few hundred kHz? The emphasis to my mind is simplicity, portability and low power consumption so it could run from a small battery. It might even form the basis of a useful Buildathon unit for students? What do you reckon, is this approach too old school for 2018 and nearly 2019?

"Alternatively, many of us now have access to SDRs, which have the potential to be very useful pieces of test equipment. Modulation monitoring is just one thing that they could be used for. I recently employed my SDRPlay to calibrate the FM modulator of the signal generator section of my Stabilock 4018 test set after I had done some repairs on its VCOs and it had lost calibration.

By monitoring the output from the signal generator with the SDRPlay I was able to use the property of Bessel functions (whereby the carrier magically falls to zero at certain modulation index figures, eg 2.405, 5.520, 8.654 etc). A few years ago I'd have needed a full blown spectrum analyser to do this, although I have seen it done by using a receiver set to CW mode and tuned to the carrier frequency. Providing the CW filter is narrow enough to exclude the sidebands, this method can also give a good indication of carrier null.

"I'm sure there are lots of other test equipment type uses for an SDR as well. My SDRPlay is surprisingly linear and accurate at measuring signal levels and seems to cope from under -110dBm up to -30dBm or more in comparison with a calibrated signal generator."

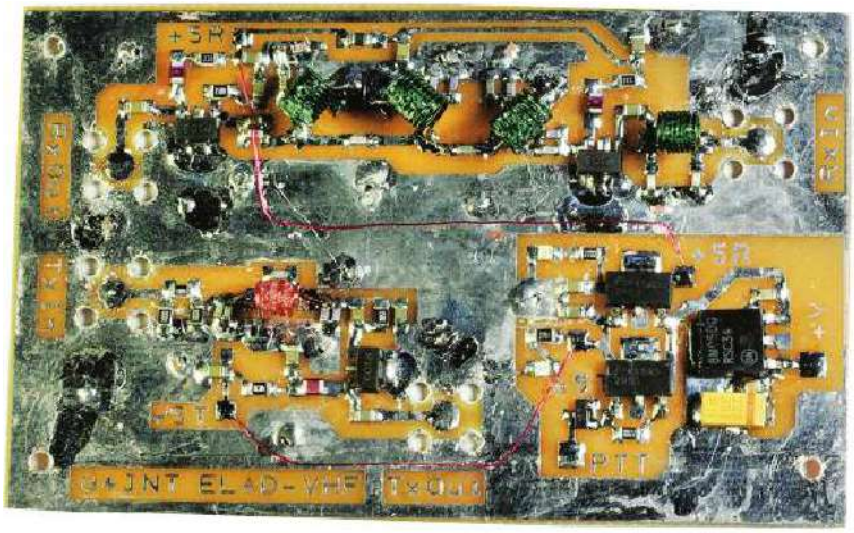

PHOTO 1: PCB design for the VHF interface. This version shows components for 70MHz operation but the 144MHz one is identical apart from the filter components.

VHF interface for the Elad FDM-DUO and the BATC MiniTioune Rx

Last month we looked at how this modern direct sampling SDR can be used at frequencies well above its Nyquist limit by making use of alias products. So let's turn those ideas into real hardware for filtering and amplification. On 144MHz we saw we had to provide enough gain to overcome a 30dB noise figure, with sufficient filtering to kill alias responses, especially the 100MHz product that sits on top of the Band 2 Classic FM broadcast. The circuit diagram in **Figure 1** is a complete 144MHz interface module. Let's look at each stage in turn.

On Rx we want about 35 to 40dB of gain and a low noise figure if this is to end up as a half-decent 2m receiver. The PGA-103 monolithic amplifier **[2]** is an ideal 50Ω gain-block for such purposes. It has more than 21dB gain at V/UHF frequencies, a sub-1dB noise figure and on Tx can deliver at least 50mW with good linearity. The obvious choice is two of these on receive; the surplus gain then allows for any losses in the filtering. The main image filter sits between the two gain blocks so its loss doesn't degrade the overall noise figure, whilst at the same time the second stage is protected against strong out-of-band signals that could drive it into non-linearity. On transmit, a single PGA-103 raises the 0dBm output from the Elad to the 50mW or so maximum output of this device. An input attenuator of 3 to 5dB is needed to match drive level to device gain at this output level.

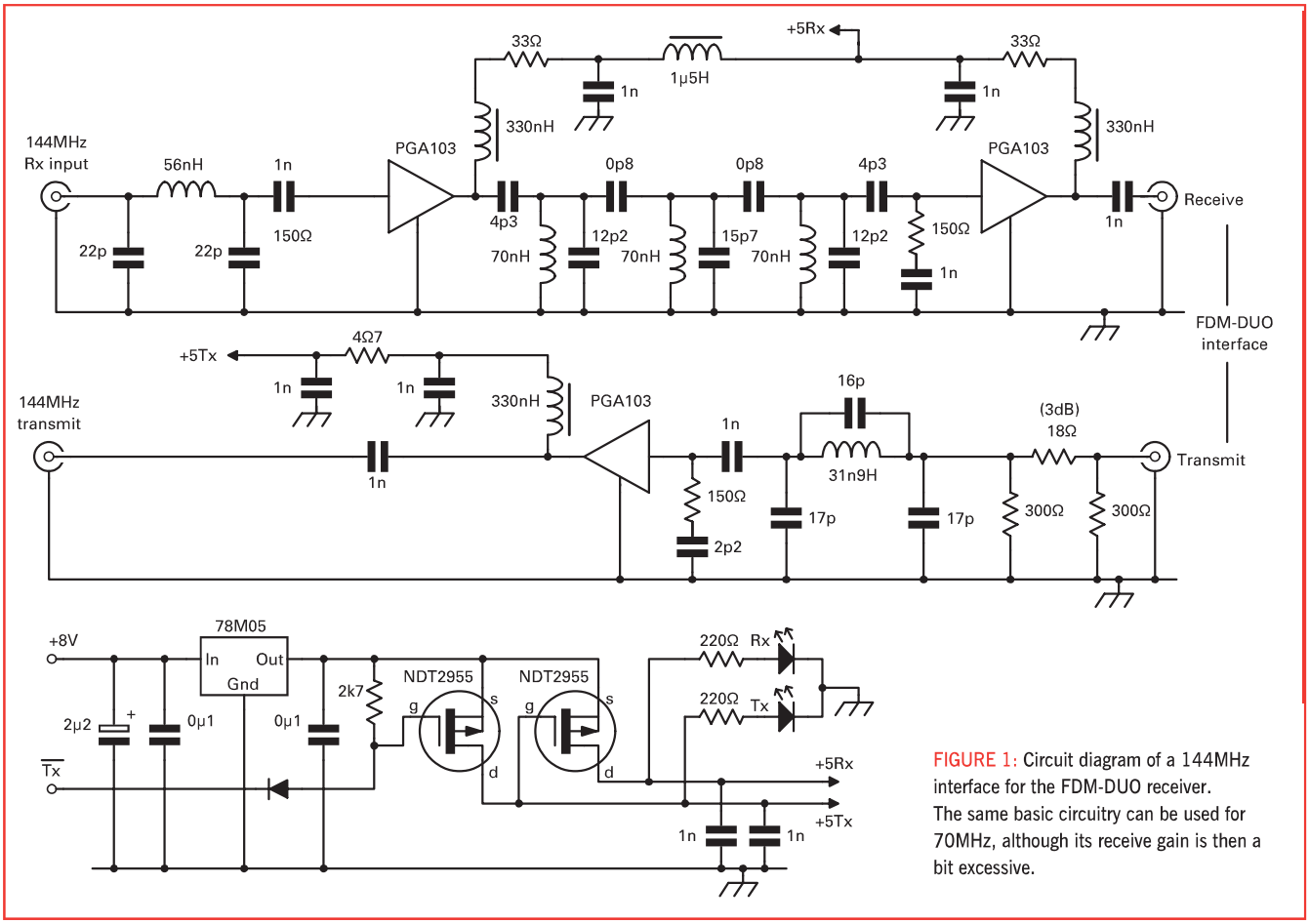

FIGURE 1: Circuit diagram of a 144MHz interface for the FDM-DUO receiver. The same basic circuitry can be used for 70MHz, although its receive gain is then a bit excessive.

Filtering

Several filters are needed for the complete unit. The main task is to pass a band around 145MHz and give enough attenuation at the other alias frequencies, especially at the troublesome 100MHz. AADE Filter Designer [3] was used to simulate a few designs before committing them to hardware.

Requirements could be met with a three section top-coupled resonator centred on 145MHz with 10MHz bandwidth, the response is shown in **Figure 2**. A theoretical rejection of the troublesome 100MHz alias of around 80dB *should* be possible, but without building the filter into a sealed and compartmentalised module this would probably be impossible to fully achieve. As there is so much gain present in the Rx chain, there is no need to make this a particularly low loss filter so small air-wound inductors can be used. Using such low-Q inductors does not degrade the stopband response, but does tend to smooth out and round off the passband. It also makes for an easy 'tune for maximum smoke'. Using air wound coils keeps things simple; they can be tuned by squeezing or stretching the coils to get the wanted response. If rejection of 100MHz is still insufficient, an additional bandpass filter can be inserted in the path to the Rx output. To make the most of this it will need to be in its own screened box. For an alternative solution to filtering, G0API just used three coils placed next to each other with proximity coupling and tuned for maximum signal. If a narrowband peaky response is all you want, this simple approach will suffice.

As well as the main receive filter, a smaller low pass filter in included on the receive input – its loss is insignificant. The main purpose for this filter is to kill off any high frequency inputs from cell phone base stations. The PGA-103 has appreciable gain up to well above 2GHz and if operated near to a cell tower, overload of the first stage may occur.

The remaining filter is on the transmit input. As we saw last time, the Tx signal is generated at a sampling rate three times that of the receiver, so the low frequency alias products are not present. There is, however, the first alias at 368.64-145MHz, or around 223MHz, that must be attenuated. The neatest way to do this is to use a simple three stage elliptic filter low-pass with its zero, the stopband null generated by the parallel L and C in the series arm, adjusted to sit on the unwanted alias. **Figure 3** shows the predicted response for the component values shown.

PTT switching and a power amplifier

Two P-Channel MOSFETs interface the ground-to-transmit output from the DUO to give switched Rx and Tx power rails. The PGA-103 devices run from 5V so an on-board voltage regulator is included. Total current consumption is around 120mA on receive and about 60mA on transmit.

A single block RA07M1317M 7W power amplifier module was used (as I happened to have one) but any similar module will do as they all have an input drive in the 10 – 40mW region. A few dB of input attenuation is needed to optimise drive level. As the switched 5V Tx signal is stabilised with a voltage regulator, it was used directly through a potential divider to supply the PA bias. The main PA supply needs its own 7V regulator, but does not need to be controlled between

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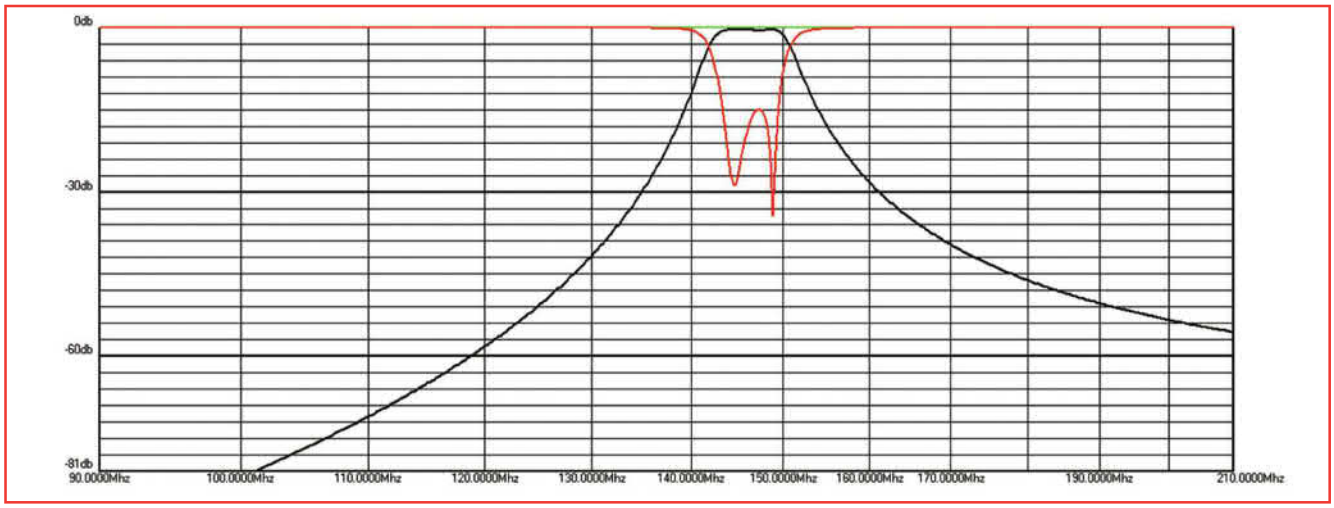


FIGURE 2: AADE Filter Designer plot showing the predicted response of the 145MHz top-coupled bandpass filter.

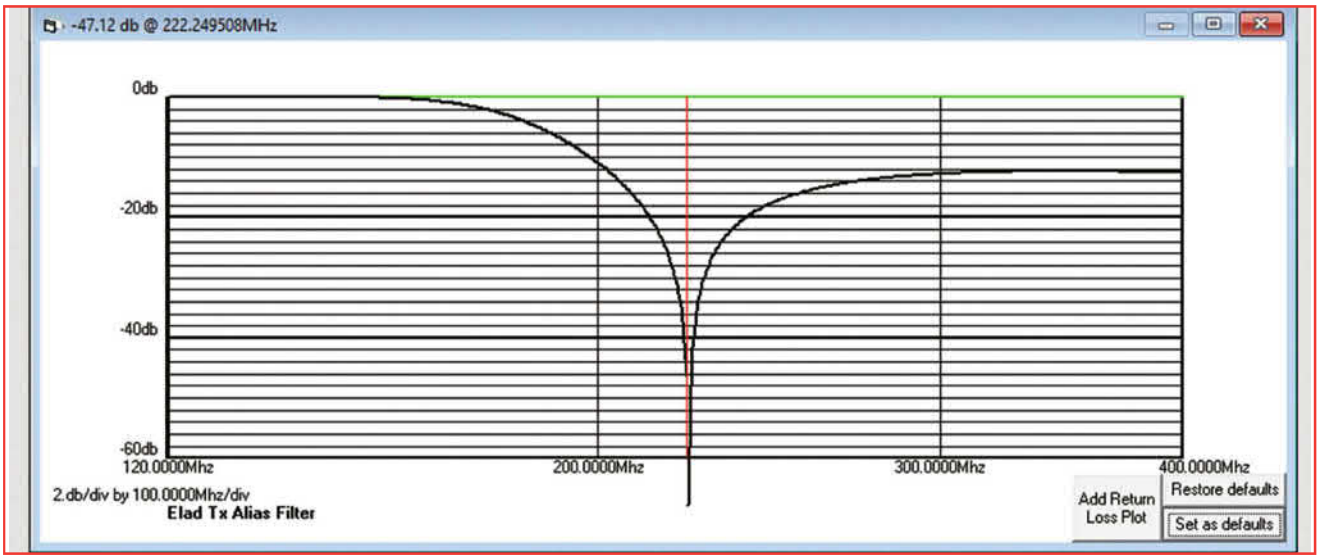


FIGURE 3: The 144MHz transmit input filter response, designed specifically to cut out the first alias at 223MHz.

Tx/Rx as the switched bias supply serves to control the PA.

Hardware, and use at 70MHz

Photo 1 shows a PCB carrying the complete unit. The one shown runs at 70MHz as my 144MHz one was an older PCB design, much too hacked-around to show here.

An identical design can be used for 70MHz, although the SINC(X) response is higher and 40dB of gain is a bit excessive. Ideally, we only need around 25 to 30dB, which is still too much to get from one gain stage. The filtering requirement is slightly trickier as the main problem is with the fundamental at 51MHz. This was also solved using a three section top coupled bandpass filter, this time with a bandwidth of 5MHz. However, to optimise attenuation at the alias frequency, the response was centred on 72MHz so the wanted 70 – 71MHz band falls on its lower edge. This is not a perfect solution in practice as the rounded shoulders of the real filter – an artefact of the small inductors – means there is a bit of slope in the response, about 0.5dB over the wanted band. However, with the excess gain to hand this is not a problem in actual use.

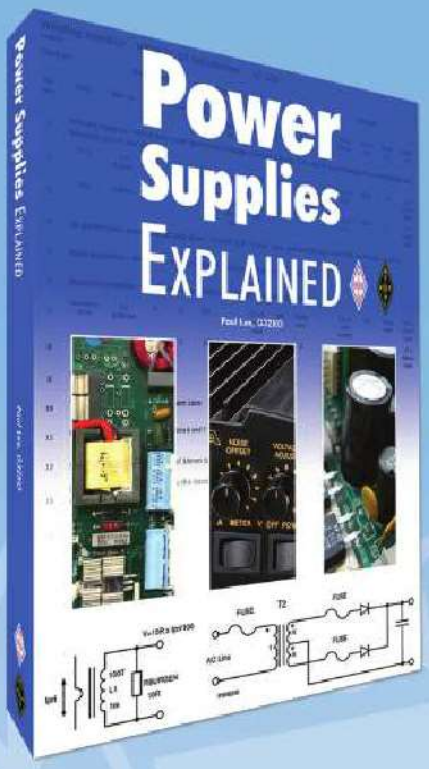
A similar Rx input filter again gives protection from high frequencies. On the transmit side, the first alias now lies at nearly 300MHz so the filter components are altered to match this requirement. Component values for the 4m version can be found at **[4]**.

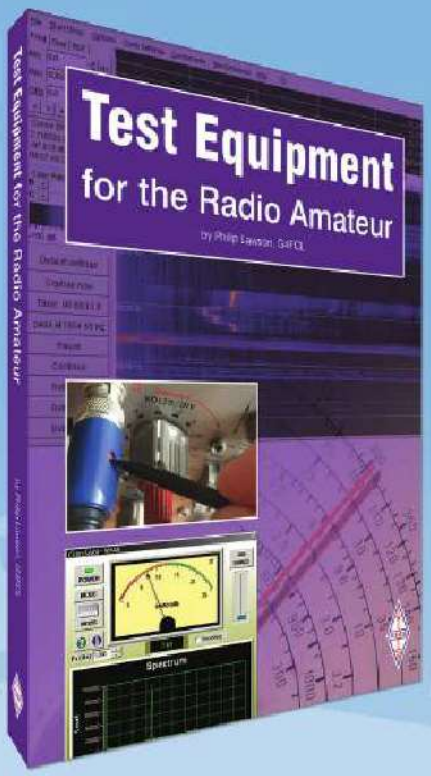
Other uses

The Elad transceiver is not the only hardware that needs this sort of accessory. The digital ATV *MiniTiouner* hardware, previously mentioned in the ATV column of *RadCom*, also benefits from some low noise input amplification and filtering at 146MHz for reduced bandwidth DATV. The tuner doesn't work as low as 71MHz but this interface will provide all the filtering and gain to be able to drive a simple upconverter. This could be just a diode ring mixer and crystal oscillator to raise the input up to some frequency the receiver does cover.

Websearch

[1] VK5BR Deviation Meter – http://users.tpg.com.au/ldbutler/DeviationMeter.htm
[2] PGA-103 Details – https://ww2.minicircuits.com/pdfs/PGA-103+.pdf
[3] AADE Filter Designer – http://www.ke5fx.com/aadeflt.htm
[4] More details of the VHF interface module, including component values for the 70MHz version. http://www.g4jnt.com/FDM-DUO_at_VHF.pdf





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Power Supplies Explained

By Paul Lee, G3ZKO

A power supply is something that is often overlooked by radio amateurs, as for many it is simply the box that provides stable DC voltage. A modern power supply is though much more, combining theory that dates back to the nineteenth century incorporating the latest techniques in digital control, with a wealth of electronics practice in between. *Power Supplies Explained* sets out to explain what that box is doing, through to designing your own bespoke power supply.

Beginners are wary of the challenging mixture of digital, analogue, magnetics and control loops, with cooling, EMC and safety to contend with as well. *Power Supplies Explained* seeks to detail how circuits are chosen for the application and how circuits are designed including their inductors and transformers. Calculations are outlined in a simple way so that the reader can use them as a basis for their own designs.

Chapters include descriptions of 'linear' supplies and a wide range of 'switched-mode' types from simple buck converters to the latest off-line high-efficiency topologies. Examples are based around typical radio amateur requirements and are versions of commercial products that the author has successfully designed. There are also chapters on magnetics theory, control loops, EMC, practical construction techniques, test equipment and much more. High voltage power supplies are included with comprehensive guidance on safety.

Power Supplies Explained sets out to dispel the mystery and encourage readers to 'have a go' with their own designs.

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Test Equipment for the Radio Amateur

By Phillip Lawson, G4FCL

This book is aimed at the radio amateur, listener and electronic enthusiast who wants to make a variety of measurements without necessarily spending a fortune on expensive test equipment. It is a very practical book, designed to help you develop care and skill in making the most common and important measurements, quickly, safely and affordably.

In this new fifth edition of *Test Equipment for the Radio Amateur*, the reader will find, for the first time, extensive links to internet sources for access to the very latest information on construction projects, equipment and measurements. The sections on commercial and home-brew equipment have been separated for clarity, new items added and some dated items removed. Timeless reference data has been retained; some items of technical theory have been given their own section, and extended, for those who wish to deepen their understanding of these areas. This book is designed to give an overview of how each item of test equipment works, what it can be used for and even how much it might cost. Many general measurements, plus specific measurements on transmitters and receivers, are described in detail. Matters such as the effect of the test equipment on the circuit to be measured are especially considered, so that the measurement results may be interpreted correctly. A large section of the *Test Equipment for the Radio Amateur* is devoted to home construction, as it is frequently possible to make an extremely useful item of test equipment for a fraction of the price of its commercial counterpart.

Test Equipment for the Radio Amateur is a practical guide to getting the most out of your equipment and understanding exactly how your station is performing. It is simply a must have book for every radio amateur.

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Demystifying the Smith Chart

or *How to train your antenna*

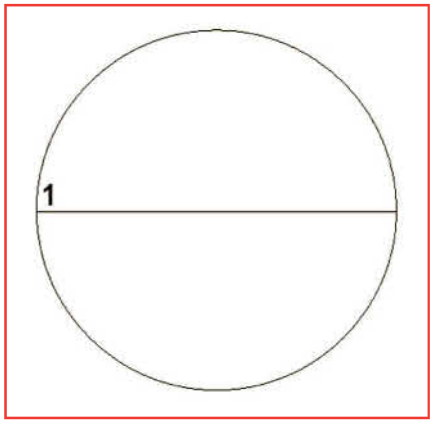

FIGURE 1: Beginning the chart. Your circle should be 1 *foj* in diameter (see text).

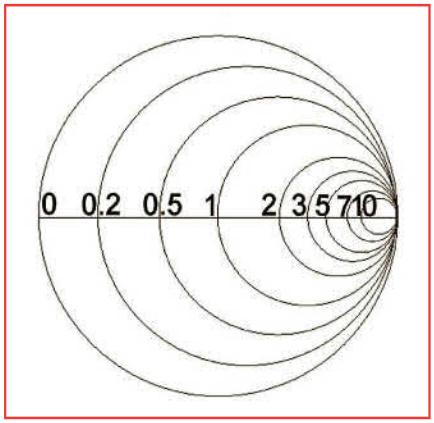

FIGURE 2: Resistance circles.

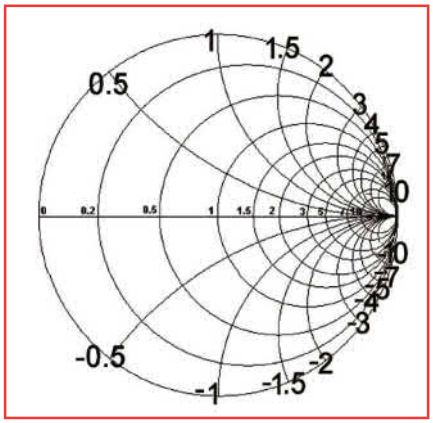

FIGURE 3: Reactance circles added.

First things first

Please be familiar with antenna impedance Z = R +j X (or at least its resistance R and reactance X, and the meaning of transmission line impedance Zo). Since Smith Charts are used with transmission lines of any impedance, they use normalised ratios, r = R/Zo, x =X/Zo, and z = Z/Zo. Note also your objective: to get the antenna impedance equal to Zo.

Suppose you've run 50Ω coax from your rig to an antenna. You soon notice the antenna's SWR – actually, the SWR on the coax. It ought to be 1:1, but, if it's too high, your transmitter may not reach full power output. What to do? What do to? And – how? The *how* of it is easy to understand and do with special graph paper called a *Smith Chart* [1]. So, let's draw one, using the 'doodling' skills we learned back in primary school.

How to draw the chart

The Smith Chart is based on a sequence of overlapping circles.

Part 1: Resistance circles, r

Put a standard sheet of paper on the table. It's about 8 inches wide. Draw a circle on it one *foj* in diameter.

A *foj*?? What on Earth is a *foj*?? Well, a *foj* (pronounced 'fudge') is a measurement of length, like the inch or centimetre or smoot. It doesn't matter exactly what size it is – 6" or 150mm is handy in this instance – but the *foj* is a variable unit of measure and could be, say, about the length of a bed if you're trying to sketch a room, or maybe the length of your mains extension lead (although those, like ladders, have a habit of being about 0.9 *foj*).

The point is, here, one *foj* is the *exact* diameter of your circle, and will be used as a scale factor for more circles that will shortly appear. If you have a large piece of paper you could make your *foj* half a metre or more.

Draw a horizontal diameter across the circle. Pencil-in a small numeral 1 just above the line at its left end, inside the circle. It'll look like **Figure 1**.

Draw a smaller circle 1/2 *foj* in diameter, touching the first at the right side of the diameter. Pencil-in a small 2 just outside this circle, above the diameter.

Continue drawing similar smaller circles with diameters 1/3 *foj*, 1/4 *foj*, 1/5 *foj* etc and in the same way label them with numerals equal to the inverse of *foj*: ie, 3, 4, 5 etc.

Draw another such circle 2/3 *foj* in diameter, and label it 3/2 (or 1.5), again touching all the others at the right side, and similarly a circle 5/6 *foj*, labelled 6/5, (or 1.2).

The progression of labels, from left to right, is 1, 1.2, 1.5, 2, 3, 4, etc. Rewrite all labels (in ink this time if you like) by subtracting 1 from each to get the sequence 0, 0.2, 0.5, 1, 2, 3, etc. You now have the resistance circles, r = R/Zo, before you, as shown in **Figure 2**.

Part 2: Reactance circles, x

Next, draw circles, all above the line that touch the diameter at its right side. Make their diameters, measured in *foj*, equal to 2, 1, 2/3, 1/2, 1/3, 1/4, etc. You need not draw the whole circle – just the part inside the largest resistance circle. Label these just to the left of them and inside the large resistance circle. The labels are 1/*foj*, to wit: 0.5, 1, 1.5, 2, 3, 4, etc. These are positive (inductive) reactance circles, x = X/Zo.

Draw another set of these, all below the line, again all touching the diameter at the right side. These are *capacitive reactance* circles. Place a minus sign in front of each of their labels. You have before you a rudimentary Smith Chart – yes, really! And that horizontal line, the line where there is no reactance, has a name – it's called the *real axis*. The chart, to this point, appears in **Figure 3**.

Part 3: An angle scale

Finally, add an angle scale around the edge of the chart, starting with 0° at the left side, 45° at the top, 90° at the right side, and 135° at the bottom. This completes a workable, functioning Smith Chart, and by adding angle tick marks every fifteen degrees, it becomes **Figure 4**. A full clockwise, 360° rotation about the chart corresponds to a

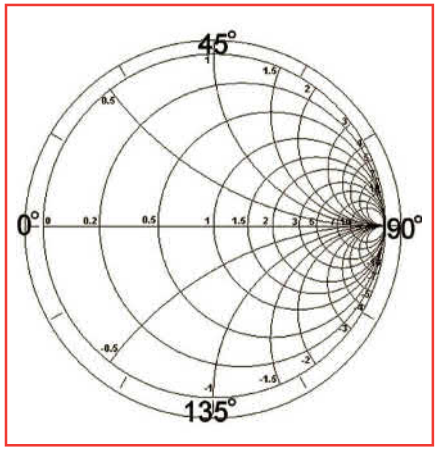

FIGURE 4: Angle scale added.

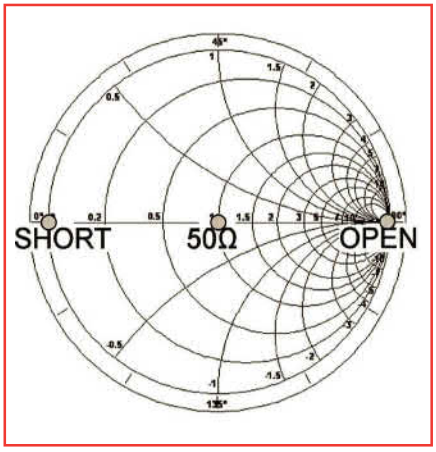

FIGURE 5: Open, short and 50 ohms.

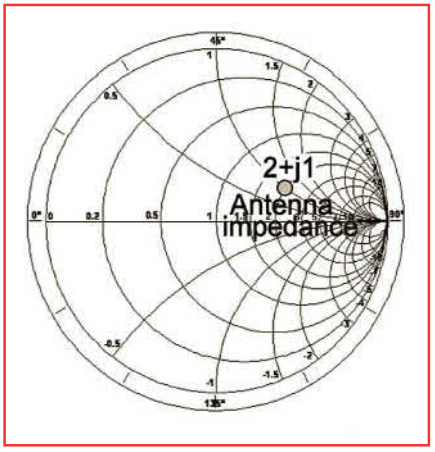

FIGURE 6: Antenna impedance.

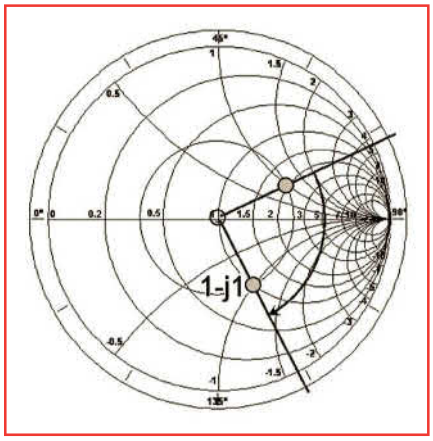

FIGURE 7: 45° move along the coax.

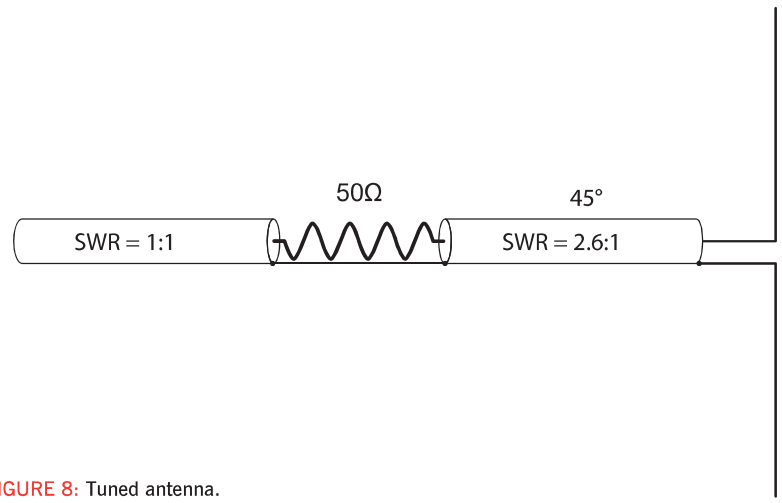

FIGURE 8: Tuned antenna.

half-wave, or 180°, move along the coax toward the transmitter.

What?

This is "de-mystified?" So far all I've done is drawn the chart. Of what use is it? Trust me a bit more when I tell you it helps tune the antenna. To see how, let's borrow a special antenna analyser, a *vector network analyser*, or *VNA* [2]. This measures resistance (R) and reactance (X) of a load, and displays the results on a computer-like screen as a Smith Chart. My VNA assumes coax impedance Zo to be 50 ohms.

When connected to nothing, a dot appears at the right side of the real axis. This is on the largest r circle at x = 0 – an open circuit. When the connector is shorted, the dot appears at the left side, at the r = 0, x = 0 point, a short circuit.

When a 50 ohm load is connected, the dot appears in the middle, at r = 1, x = 0 point. This is the point where the impedance is exactly 50 ohms resistance, with no inductive or capacitive reactance: perfect. These points are plotted on **Figure 5**.

Antenna tuning

I'll assume your antenna is a slightly too-long, half wave dipole that, when connected to the VNA, produces a dot on the r = 2 resistance circle and the x = +1 inductive reactance circle, as on **Figure 6**. This tells us the antenna impedance is a resistor of 2x50 ohms, in series with a coil with reactance of 1x50 ohms. Let's tune this antenna.

Draw a circle centred at the chart's centre that passes through the antenna impedance. It crosses the real axis at 2.6, which tells us the SWR on the coax is 2.6:1. Circles about the chart's centre are circles of constant SWR, whose value is the value of r = R/Zo where the circle crosses the real axis at the right side. We can lower this SWR a bit.

Let's move an eighth wavelength along the coax and cut it there. Using the angle scale, we find this to be a 45° clockwise move along the coax toward the transmitter. The SWR does not change. See **Figure 7**.

Connecting the end of this short coax stub to the VNA will show a normalised impedance of z = 1-j1: it's become capacitive! But the impedance now is 50 ohms resistance in series with 50 ohms of capacitive reactance: Z = 50-j50 ohms, as in Figure 7.

To cancel this capacitance, put a 50 ohm (pure) inductance in series with the coax. The SWR from this point back to the transmitter will be 1:1 – ideal! This simple antenna 'tuner' appears in **Figure 8**. Since there is always a point along the coax where z = 1+jx, *this technique can tune any antenna impedance*! All that is needed is a series coil or capacitor of the proper value after a series coax stub of the right length, and the Smith Chart tells us both of these values.

Michael J Toia, K3MT
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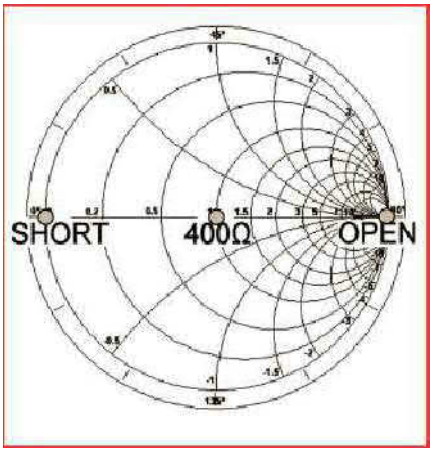

FIGURE 9: Quarter wave 400Ω shorted line.

Another application: a cable balun

A dipole fed with coax should have a balun to keep the RF 'inside' the coax, not 'outside'. *[See also this month's Antennas – Ed].* Let's make a simple example. From the chart, notice that a quarter-wave transmission line, shorted at one end, has a high impedance at the other end.

So – take the coax from the antenna and bend it into a "U" shape, a quarter of a wavelength deep. Space it about five diameters across, thus forming a shorted, parallel-wire transmission line 'Q section' of about 400 ohm line. It will then produce a very high impedance at the antenna as in **Figure 9**, and keep current 'off the outside' of the coax.

You may think this 'balun' has been in the handbooks and other writings since, well, Marconi. But look more closely – many of the others are *4:1 impedance shifting*, balanced-to-unbalanced transformers. *This one is not*! It does a 1:1 balanced-to-unbalanced shift. So don't get confused about how to connect it – most diagrams in the handbooks do something different. **Figure 10** shows this arrangement.

Adding more circles to the chart

To add resistance circles for any r, calculate their diameters: dia = 1/(r+1). For example, if r = 0.4 (R = 20 ohms when Zo = 50 ohms), dia = 1/(1.4) (or 0.71 *foj*).

To add other reactance circles x, calculate their diameter from dia. = 1/x. Thus, if x = 0.2 (X = +10 ohms when Zo = 50 ohms), dia = 1/0.2 (or 5 *foj*). Using this simple arithmetic, you can fill in as many circles as you wish. **Figure 11** shows a typical 'professional-grade' Smith Chart of the sort beloved for decades by engineers the world over. With luck you can now see that it's just a version of the one we've drawn here, just with a few more circles and other details added.

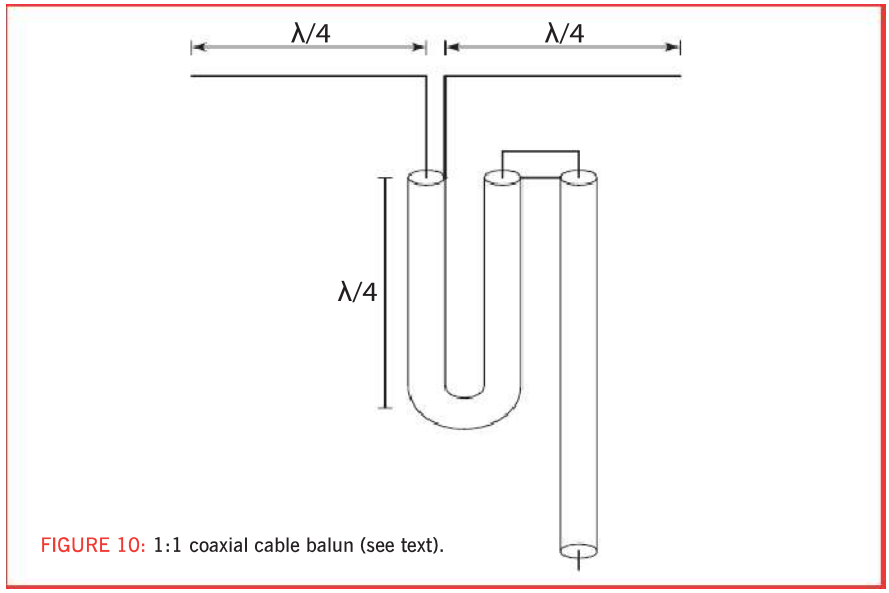

FIGURE 10: 1:1 coaxial cable balun (see text).

Wrapup

Now you know how to draw a Smith Chart, have a fair idea of what it is and how to use it. There's *much* more information on the matter in print and on the internet, a tad more complex than what we've seen here, and there are many more ways to design antenna tuners, all explained and assisted with a Smith Chart. The Smith Chart also has many other uses besides the two simple examples given here. This article is but a brief – but hopefully accessible – introduction to the subject. Enjoy your new knowledge!

References

[1] Philip H, Smith, *Electronics Magazine*, Jan 1939

[2] If you can't borrow one, don't worry. You can use an antenna analyser and work things backward to plot the point on a paper chart.

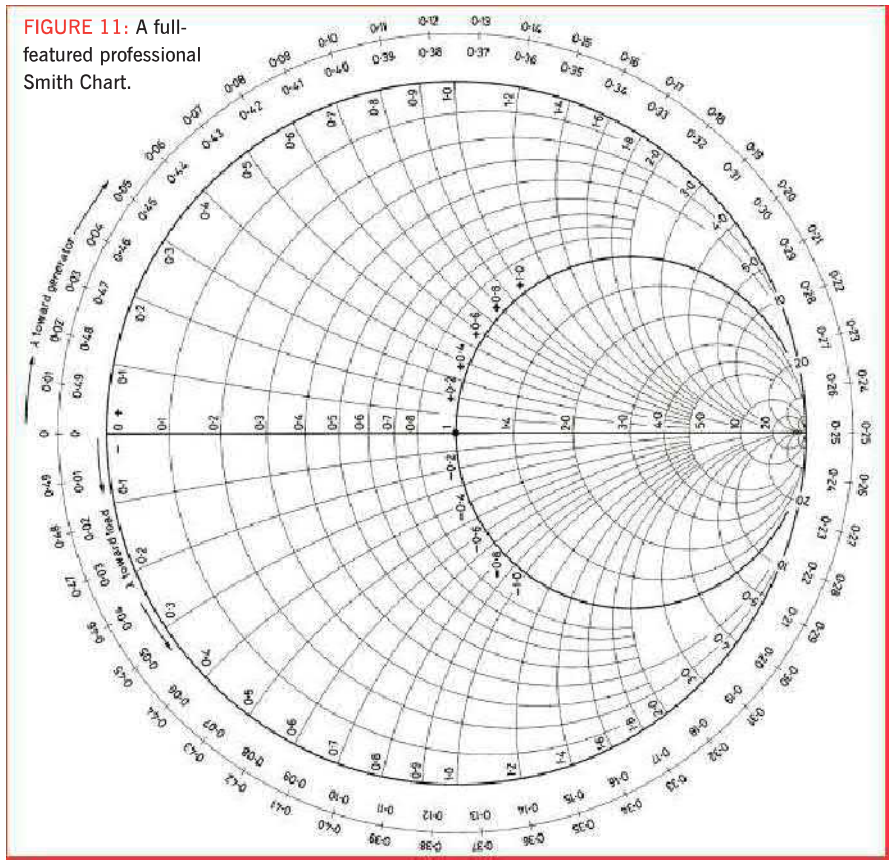

FIGURE 11: A full-featured professional Smith Chart.

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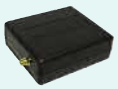

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Jamboree on the Air 2018

Torbay ARS. Che, Kerry and the Scouts test the antennas.

Sheffield ARC operated GB2HW at Hesley Wood Scout Activity Centre.

Jamboree On The Air, or JOTA, took pace over the weekend of 21 and 22 October. It's an annual event involving Scouts, Cubs and Beavers around the world with local radio clubs helping by providing the equipment and expertise to get the young people on the air.

Furness ARS

Special event station GB2FSR was set up at the 17th Barrow St Perran's Scout Group headquarters in Barrow-in-Furness. Furness club members operated on the 40m band to assist the Cubs and Scouts in sending greetings messages. With just one day of operating, 20 other JOTA stations were worked (plus many other non JOTA stations), with dozens of greetings messages passed and received. One QSO with a station in the Netherlands stands out. It lasted over one hour, with the messages being translated from English into Dutch for the Dutch Scouts to understand.

Other activities included a CW practice station, creating their own phonetic alphabet and a 5.6GHz 'helmet-cam'. The helmet-cam is always a popular draw at JOTA – one Scout wears a helmet with a camera and transmitter and is sent out into the field, whist other Scouts watch the received signal on a TV and use a directional antenna to improve the signal in the Scout hut. PMRs are used to allow the Scouts to communicate with each other.

Chris, M0KPW

South Kesteven ARS

South Kesteven ARS had a fun-packed day with around 50 Scouts, Cubs and Beavers from Grantham & District using GB1GDS. Stewart, M0SDM logged 26 QSOs on 80m using the brand new club FT-450D rig supplied by the prize voucher from Waters & Stanton for winning the RSGB small Club of the Year trophy. Not a bad result, given many of them were long QSOs, not quick 59 contacts! Steve, 2E0WCG and Konrad, M0KVF demonstrated an FT8 setup as well as putting out 2m calls that were answered within a few seconds by amateurs willing to respond to messages passed on by the audience.

Conditions were exceptionally good that day as some French stations were heard early in the day. Sean, 2E0ENN and Andrew, M0NRD were also on hand to help during the day. The star of the day for many of the Scouts, Cubs and Beavers had to be Brian, M0YBX who was demonstrating Morse code as well as bringing radio waves to life using a Tesla coil!

Steve, 2E0WCG

Dundee ARC

Over the JOTA weekend, members of Dundee ARC held two JOTA calls GB2AMS (Arbroath & Montrose Scouts) and GB2SAS (South Angus Scouts). The Cubs and Scouts worked towards their Communications badges, with several achieving this goal. We would like to thank all those who worked us, especally LY4A, who spoke to one of the Scouts in their native Latvian tongue. This really made the Scout's evening.

Martin, 2M0KAU

Peterborough & District ARC

PADARC took part with Market Deeping Scouts. We set up on the 19th with a 70ft mobile lattice tower supporting three antennas – 40m Moxon, Carolina Windom for 80m and a 2/70 white stick on top. The radio stations, in the rear hall, were two TS-590 driving the HF antennas and an IC-746 for VHF. A 4m station was set up for PSK 31 and voice while the other stations were for voice only. Before JOTA, three club members spent time preparing the Scouts for the event, which paid dividends over the weekend. The Scouts were soon on the radios passing their pre-prepared messages to other JOTA groups and amateurs on all three bands. Some Scouts even used PSK 31 on 40m. The Scouts also got involved in a coding/decoding game using laptops with virtual Enigma machines and a Morse code challenge game. We made 115 contacts over the weekend in 18 countries, 36 were JOTA stations. A very successful event. Those who took part would like to thank the Scout leaders for looking after our food and drink needs, also thanks to Market Deeping Scouts for their good manners and excellent radio procedure

Tony, G0IAG

Braintree & District ARS

1st Castle Hedingham Scouts invited Braintree & District ARS to collaborate in JOTA from their North Essex premises using GB0CHS. Club members set up antennas and equipment on Friday afternoon and, over the weekend, greetings messages were exchanged between 19 contacts on 2m (6 JOTA); 24 on DMR, including from New Zealand and America (1 JOTA) and 22 contacts on 40 and 80m, including from the

Netherlands, Belgium and Germany (10 JOTA). Cubs and Scouts experienced a range of modes of operation: voice, FT8 and PSK31. Such was the enthusiasm shown, that at the end of the weekend one Cub, two Scouts and a leader showed an interest in gaining their Foundation licences and our club is now working towards facilitating this.

Geoff, G1WRH

Cornish RAC

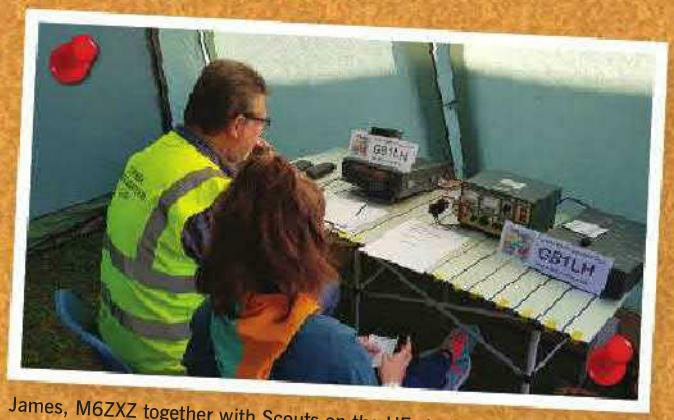
Cornish RAC took part from the headquarters of the 1st Lanner Hill Scouts in Lanner, Redruth. Before the event the club explained to the Scouts and their leaders what was involved in JOTA. Steve, G7VOH, James, M6ZXZ, Rick, G4PGD, Terry, 2E0LDW, Trevor, M0WDO and Bill, 2E0HCM, his wife and daughter all volunteered. The callsign was GB1LH. Around eight or so Beavers, Cubs and Scouts together with their leader, Stephen Butterworth arrived for the event. HF contacts used a TS-570D, GP2500 vertical and Cushcraft R5 vertical. The FT8 demonstration used an FT-450D. There was a presentation on amateur radio, a CW staion, a VHF station in a car outside and a project assembling little receiver kits that involved no soldering just screwed contacts. The receiver kits brought by Trevor, M0WDO proved to be by far the most popular activity of the day and most were taken home by the Scouts.

James, M6ZXZ

Torbay ARS

JOTA is always an eagerly anticipated event on the TARS Training Team's calendar. Che, 2E0MRC and Lin, M0TCF liaised with the Group Scout Leader from 1st Bradninch Scouts and asked for volunteers from the club. Friday was spent setting up our station and antennas. Working steadily through the morning (fortified with many cups of coffee) the team of four managed to get five masts up – a dual band, trapped dipole system for 20 and 40m, an 8-band inverted 'L' Marconi type antenna and a 20, 30, 40 SOTA trapped dipole. There were three indoor operating points – SSTV, datacomms and HF SSB. Slade, 2E0SQB worked outside on satellite comms and John, 2E0SPS ran his D-Star station on Saturday. Time was scheduled with Beavers visiting us first for an hour or so, followed by the Cubs for an hour and a half or so, then Scouts and Explorers for the whole afternoon and evening. We weren't overwhelmed by youngsters, but those who did visit us were attentive and interested. Our theme for this year was 'Spyies & Spying' and two of our activities went really well, one was to ask each age group to create their own banner for broadcasting via SSTV (this really caught their imagination and we had some very dedicated artistic talents demonstrated) and the other was a simple 'Code Wheel' - one complete Alphabet, set inside another, which could be rotated and used for a substitution code. Later we were able to introduce the Scouts and Explorers to an Enigma Machine Emulator based on a Pringles crisp tube. Things got even better when we were able to give them the opportunity of using some 'electronic' emulators as well. After an initial practice they were away (using PMRs),

Cornish RAC helped the 1st Lanner Hill Scouts assemble their receiver kits.



James, M6ZXZ together with Scouts on the HF station in Redruth.

Using GB60CDS, Colchester Scouts were back on the air for another JOTA.

Roz, M6WEY, Oliver grandson of Tony, G3MAE and Ian, 2E0GBA operating GB5WSC.

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passing messages encrypted on the Pringles tubes and decrypted on the electronic versions and vice versa. We also got a group of the Scouts making antennas from 'weird' stuff – in our case it was copper slug tape and an acrylic board. We suggested two designs for them to experiment with, a Moxon Square and Yagi. Both were laid out, one on either side of the acrylic (in hindsight, we could've just as well used cardboard) and then taken outside and tested. Remarkably, the Yagi worked extremely well, at both VHF & UHF and the operators were able to open up a number of repeaters including GB3TR, GB3EW and GB3EX – not bad for bits of copper backed sticky tape and a bit of old coax. I would like to offer my sincere thanks to all the team who turned out to help run GB1FBS.
Lin, M0TCF

Southgate ARC

Barnet District Scouts asked Southgate ARC to operate a JOTA station from their campsite near Mill Hill. The main HF station used GB6BBS and a second station using GB9BBS used HF SSB, HF FT8 digital, FM satellite and 2m FM voice. Graeme, G8DVJ set up a Raspberry Pi looking at Hack Green's webSDR receivers. For aerials we had the 40m delta loop plus an off centre fed dipole for 80m, 40m, 20m and 10m supported by a second mast. We later put up a 20m vertical and a 2m vertical well away from the other HF aerials. G0KUX operated the satellites with various handheld Yagis and used his little Xiegu X5105 rig on HF. Over the two days, G0KUX attempted to operate GB9BBS through the 4 FM satellites, AO-85, AO-91, AO-92 and SO-50. Using a homemade hand held beam consisting of 2 elements on 2m parasitically feeding 2 elements on 70cm with a dual-band Wouxun KG-UV2D handheld radio at 5W, good signals were heard from all four satellites once the satellite had reached 10° or greater above the horizon. In total, 6 successful contacts were made via the satellites, best DX being Italy. About 12 youngsters came along on Saturday and over 30 on Sunday, making it rather hectic, but the multiple stations could usually find someone to contact. My thanks to all those who came along and helped in any way: we couldn't do it without you. Operators were Mike, M0ASA, Peter, G0KUX, Nigel, G0RPM and Keith, G8RPA, assisted by Graeme, G8DVJ, John, G0ESF and Donald, G4DFB.
Keith, G8RPA

Essex Ham supported JOTA at the Belchamps Scout Activity Centre.

GB1BEL was part of the Essex Ham JOTA activities.

Southgate ARC worked with Barnet District Scouts operating GB6BBS and GB9BBS.

Hartlepool ARC joined forces with the Tees Valley North District Scouts.

Hambleton ARS

Hambleton ARS put on GB5WSC from the Watson Scout Centre Carlton in Cleveland. Ian, 2E0GBA and Tony, G3MAE operated the FT-857D with LDG tuner into a full size G5RV working several stations over the day on 7-14 and 18MHz. 7MHz was the better in the afternoon, especially for inter-G contacting some other JOTA stations. Cubs and Scouts enjoyed some radio operating with contacts into Europe and special thanks to Juha, OH6JJ in Finland for his patience and consideration working several Cubs for us. Brian, G8AOE used his radio into a vertical to work and demonstrate the digital mode FT8 to the group with over 50 contacts. Tony, G3MAE demonstrated and took the Cubs and Scouts through the Morse code giving out certificates to add more interest. It proved to be very successful day.
Ian, 2E0GBA

Arron and Simon sticking slug tape down making antennas with Tobay ARS.

Peterborough & District took part with Market Deeping Scouts.

Hartlepool ARC

Hartlepool ARC joined forces with leaders from Tees Valley North District Scouts to operate GB0TVS from the Scout Centre, Hartlepool. Very good numbers of Beavers, Cubs and Scouts along with their respective Leaders and parents visited the station over the weekend. Notable visitors included Assistant County Commissioner for Cubs, Peter Chaney; County Scout Chairman Ian Railton; the Mayor of Hartlepool, Councillor Allan Barclay and the Mayor of Stockton, Councillor Eileen Johnson, who surprised the station operators with her proficient sending of Morse. GB0TVS operated two HF stations, the first using the club's FT-920 plus FL-2100 linear running 400W to a Hustler 4BTV vertical for 40/20m. The second a FT-897 with 100W to a full size G5RV for 80m SSB and all bands CW. Local contacts were made on VHF FM to a collinear. Band conditions over the weekend were the worst that anyone could remember. But, 94 contacts were made on HF SSB/CW, 10 contacts on VHF FM and this year for the first time, we tried SSTV, making 10 contacts on this mode. Twenty of the stations contacted were Scout stations. No real DX was worked but, contacts on 40m with the Azores and Gibraltar impressed the visitors. The poor band conditions gave more time to explain radio, teach the phonetic alphabet and send names in Morse. As a result, 30 Beavers and 75 Cubs all completed their Communications badges. One Cub, 10-year-old Jamie, who had visited JOTA for the last 5 years, was awarded his Cub Communication Instructor badge after spending most of the weekend instructing Beaver and Cubs in the phonetic alphabet and Morse. JOTA must be one of the most useful events for radio amateurs to bring our hobby to the notice of the general public; more clubs should get involved with their local Scouts – spread the word!

Stan, G7VGM

Colchester RA

Five members of the Colchester Radio Amateurs club assisted 63 Scouts, Beavers and Cubs, at the request of Scout leader Richard, G7BIV using GB2CDS at the Scout HQ in Stanway. Following a short presentation by Jonathan, G4DVJ, the assorted groups were shown technical aspects of modern day radio operating by Garry, M0MGP, 2m operation and message passing by Mark, M0LTG, FT8 operation and messaging by Caroline, 2E0SXH and 40m message passing by Jonathan, G0DVJ. Kevan, 2E0WMG assisted setting up and stripping down the stations. Several operators took time to have QSOs with our groups including Dorothy, M0LMR and David, M1ECC using GB1BEL, many thanks. The group were also shown a selection of QSL cards, certificates of achievement, contest certificates and RSGB info sheets. Richard, G7BIV thanked CRA members and said that the groups had a wonderful day and see you next year.

Garry, M0MGP

Sheffield ARC

Hesley Wood Scout Activity Centre operated GB2HW, with support from the Sheffield ARS, with operations on on PSK and other datamodes, SSTV and D-Star. In addition we had a ARDF activity running, which proved to be the most popular activity over the weekend with all sections and age groups taking part. We made use of the County PMR radios, using this activity to train the young people in the correct operating procedure when sending and receiving messages. The young people split into small groups, building a Lego model then describing, over the radio, to the other group how to construct the same model. The event was very successful and we have already had our first planning event for next year's JOTA with some new exciting activities planned.

Stewart, G6VUE

Essex Ham

Essex Ham supported the event at the Belchamps Scout Activity Centre, Hockley. Over 200 Beavers, Cubs and Scouts were in attendance. The two-day event included a range of radio activities: a 2m station for greetings messages, two HF stations, a DMR station, sending QSL cards designed by the youngsters locally via SSTV, a Your Name in Morse demo, a numbers-station code-breaking activity, a demonstration of a Clansman military setup (from Gareth, M6MZC and Jenson, M6OIU), ADSB aircraft tracking on a Raspberry Pi and RSGB videos and leaflets. Using GB1BEL, the event was organised by Essex-based scout leader Derek, M0SCE.

The four stations were busy – a stream of youngsters keen to try 2m and a lot of interest in both HF and DMR. Thanks to all the stations who helped with greetings messages, and it was great to be able to make contact with Sasha, PH6YOTA in The Netherlands, Brian, EI0YOTA in Dublin, Geoff, GM8OFQ in Orkney and other JOTA stations including GB0CBS, GB0WHT, GB0TCS, GB1CDS, GB1UUS, GB2NS and GB2FSR.

The finale to the event was a live data contact with the ISS. The youngsters gathered outside to tune in to packets being sent from space, whilst a greetings message from the 2m JOTA station was sent to the ISS digipeater. The message was successfully sent on 145.825MHz during an overhead pass, which was successfully digipeated by the ISS, being heard by ON7EQ in Belgium.

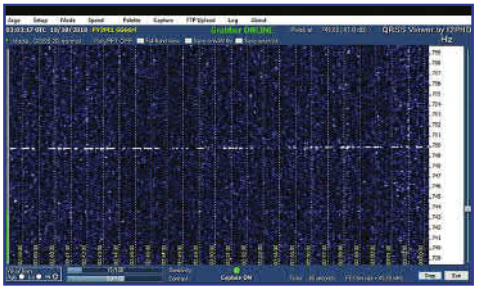
Pete, M0PSX

Callington ARS

Callington ARS established and operated GB1CSG in support of the 1st Callington Scout Group. Contacts were made with JOTA stations in the UK and overseas giving the youngsters the opportunity to exchange messages with their counterparts in other groups. In addition to radio, the Beavers, Cubs and Scouts participated in other activities devised by CARS including simple code making and breaking, and the exchange of Morse code messages. A number of the youngsters and Scout leaders showed interest in learning more about the hobby of amateur radio.

John, G4PBN

LF



CX2DDP as received by PY2PLL.

Experimental Rogowski coil on a piece of garden hose.

This time of year is always good for low-band work and recent results are certainly up to expectations.

We started the autumn with a 17.2kHz transmission from SAQ, the UNESCO World Heritage listed station in Grimeton, Sweden. Laurence, KL7L (Wasilla, Alaska) was among the DX reporters, he had a clear 559 copy of the CW message. Not bad for a 94 year-old mechanical transmitter.

Up on 472kHz, the conditions have also been very good. The season opened in October with PA0A's WSPR transmission reaching JA3TVF. LU1DOW in Buenos Aires, Argentina then joined in and got WSPR reports from several European stations including DL4RAJ, IK1HSS and LA3EQ, almost 12,000km distant. Many trans-Atlantic contacts have been made using JT9 and a multitude of WSPR spots have been seen across the pond.

In Uruguay, the first DX has been achieved by CX2DDP when his CW signals were copied by PY2PLL in San Pablo, Brazil. He later tried QRSS and PY2PLL received the signals again.

VO1NA has been continuing his 136kHz OPERA transmissions with great success. In Europe, DK7FC and DF9RB received the signals on many occasions and DF9RB also saw some good QRSS traces from Joe. It just goes to show how effective QRSS is, even against the newer modes.

New, old, mode

JT9 is a derivative of the popular JT65 mode, optimised for narrower bandwidth and used widely on the LF bands. When it was first introduced there were some slower adaptations for use on 136kHz but later versions of the WSJT-X package don't include these. JT9-1 had 1 minute time slots, JT9-2 transmitted for 2 minutes and JT9-5 for 5 minutes. The current version of WSJT-X, V2.0.0, has an improved decoder that some felt would be advantageous when used with these slow versions, but the developers have so far not been convinced that it's worth devoting time to this niche facility. Some resourceful members of the LF community have been experimenting with a modified version of K1JT's software that can route the slower speed modes through the new decoder to achieve better results. Chief developer for this experiment is Rik, ON7YD and a keen participant is Paul, N1BUG who has been transmitting alternately in JT9-1, JT9-2 and JT9-5. Early results seem to be promising with Geoff, G0LUJ receiving Paul's JT9-2 transmissions 16 times whereas he only received 4 of the JT9-1 transmissions. Some tests suggest that JT9-2 yields about 2dB advantage, rather than the theoretical 3, but any advantage is worth having. Development of the software is ongoing so make sure you download the latest version at Rik's site at http://www.472khz.org/SlowJT9/ (make sure to include the capital letters). There's more on this in this month's Data column, see p36.

Real medium wave

In Germany, AM broadcasts on medium and long wave bands have ceased, leaving an opportunity for amateur experimenters. Ralph, DL2NDO has obtained a permit to operate on 1476kHz with low power for 'museum and educational purposes'. The transmitter site is at the Fraunhofer Institute premises just north of Nuremberg and is described as a quarter-wave so should be quite efficient. Ralph built a 3W AM transmitter and started experiments by radiating 1 second bursts of 1kHz tone 24hrs a day. Even in the crowded medium wave band this little signal has been picked up all over Europe. I heard the tones quite clearly on my remote station in SW Scotland one afternoon. Best DX so far is an amazing 9,943km from PY2PLL who detected the very accurate carrier in amongst some drifting broadcast stations.

Such encouraging results have given rise to an idea of applying some low bit-rate phase modulation to the carrier so that it can be detected afar, even when it goes over to relaying the local student radio station. The Tx will be back on the air for more experiments soon.

Rogowski coils

When tuning up an LF system, the primary concern is to maximise the antenna current. There are several ways of measuring RF current, such as thermocouple ammeters and current probes, but one that has largely been forgotten is the Rogowski coil. This consists of a long thin coil of wire, say 20cm long and 2cm diameter, with one end passed back through the centre so that both ends of the wire are at the same end of the coil.

If wound on a flexible former, this coil can be bent round to encircle an antenna wire and to sense the current flowing in it. An active integrator circuit is required to give a voltage out that is proportional to the current in the wire. The open-ended construction allows for the coil to be folded around any part of an antenna without disconnecting it.

VK beacon back on

The Caboolture Radio Club beacon, VK4RBC, on 137.444kHz has been restored to its full power of 1W EIRP and is operating 24 hours a day using WSPR with a CW ident. The station is now solar powered and the transmit duty cycle is to be increased slowly from 20 to 50% while battery capacity is checked. The two 12V, 160Ah deep cycle batteries are charged by a 180W solar panel. Beacon keeper Roger, VK4YB says that he is not expecting to get a spot from Europe, but a spot from Japan or the West Coast USA is a possibility. The antenna is 1500 feet long, rising to 120 feet and follows the course of Lagoon Creek.

Lowest of the low

Stefan, DK7FC continues to QSY LF, this time right down to 470Hz. In this experiment he used his 'ground loop' system – two earth points 900m apart – to transmit the signal. Powered by a 120Ah LiPo battery, Stefan's transmitter was running 460W DC input, which gave an RF current of 2.2A. He looked for signals on his tree-mounted receiver 57.6km away that has both e-field and loop antennas. The loop doesn't work very efficiently below 1kHz so the best signal was received on the e-field probe. This time the signal didn't quite reach the level required for an unambiguous detection so further improvements need to be made. Incidentally, the wavelength on 470Hz is 638km so 57km is still in the near field. At the time of writing he is experimenting on 80Hz; I am waiting for him to try DC!

New RSGB LF Group

The email reflector for discussion of LF topics has moved from Yahoo to Groups.io, if you are already a member you should have been transferred. If you would like to join you can find it by searching for rsgb-lf-group on groups.io.

Dave Pick, G3YXM
daveyxm@gmail.com

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Count on us!

HF

This is the time of year when the bands below 14MHz are at their best for DX, though the higher bands should not be forgotten as there have been brief openings up to 21MHz.

Rich, GM3PPG's 9 element 80m phased vertical array on the west coast of North Uist.

Sunspots were few and far between in December and the solar flux index (SFI) bumped along around the 70 mark.

The Stew Perry Top Band contest took place at the end of December and conditions were not as good as people hoped. There were early openings across the Atlantic around 2300 but stations rapidly weakened before strengthening again before dawn. Don, G3BJ made around 500 QSOs – about 30% with North America. Derek, G3RAU pointed out online that the dip in propagation matched the rotation of the auroral zone into the trans-Atlantic path.

The Excellence Award from the Yasme Foundation is presented to individuals and groups who, through their own service, creativity, effort and dedication, have made a significant contribution to amateur radio. Recipients in 2018 included DXer Zorro Miyazawa, JH1AJT for his extensive promotion of amateur radio in developing countries and Stu Phillips, K6TU for contributions to amateur radio through his Propagation and DX Strategy website www.k6tu.net. Other recipients last year were involved in disaster relief via amateur radio. The Yasme Foundation was originally created to support the DXpeditions of British sailor Danny Weil, VP2VB in the early 1960s. It was boosted by a bequest from Lloyd and Iris Colvin, W6KG & W6QL, in 1998 and continues generally to support amateur radio and DXing to this day. See www.yasme.org.

Islands

This is the time of year to remind IOTA enthusiasts to submit updates to their checkpoints before the end of January if they want their latest scores to show in the next Honour Roll and Annual Listing. Don't forget that the iota-world website lets you claim credit for IOTA Contest QSOs if the other stations submitted logs and will also provide numerous credits via Club Log matches. If you are starting from zero but have already put your logs on Club Log then you may find you already qualify for several IOTA awards.

It is probably also worth reminding people that the IOTA Board is completely independent from the RSGB and is an international team consisting of Roger Balister, G3KMA, Cezar Trifu, VE3LYC, Charles Wilmott, M0OXO, Dan Sullivan, W4DKS, Hans-Georg Goebel, DK1RV, Jim Nakajima, JA9IFF and Ghis Penny, ON5NT.

The last few months were busy for island chasers. Soon after the announcement of new groups at the RSGB Convention, Dave, EI9FBB was active from one of them – the Puerto Rico coastal group (NA-249) – making 5000 QSOs. A few weeks later Col, MM0NDX, Jonathan, MM0OKG, and Eric, EL2EF were QRV from Telengbe Island (AF-111) off the coast of Liberia as EL2EF/4 – an unactivated but not a newly announced one. They made 4500 contacts and raised £3000 in donations for the Mission Aviation Fellowship for humanitarian flights. The EP6RRC team were also busy in November from unactivated Shif Island (AS-189).

Cezar, VE3LYC and Adrian, KO8SCA ended 2018 with fireworks for the IOTA Programme by operating from French Polynesia as TX0M from newly-announced Morane Atoll (OC-297), and as TX0A from the super-rare Acteon group (OC-113). See the photo on the Contents page. Using multi-band verticals and amplifiers running 500 and 750W, they made about 7500 and over 5100 QSOs respectively, with over 4700 and 3400 unique stations. Since propagation to Europe on 20m provided marginal results, they focused on 30 and 40m to give EU chasers a chance at logging these very rare IOTA references. Overall, a total of 31 and 33% of all contacts were with EU, of which G 71/56, GI 4/3, GM 5/1, and GW 1/1. These islands are in the golden area around Pitcairn that normally provides easy QSOs from the UK – but though 30m and 40m delivered the goods for many hours per day, 20m was surprisingly poor with only a brief long path opening in the afternoon on most days.

There is much more island activity to come. An expedition to Djibouti is being planned for 14-20 April by Col, MM0NDX and Jonathan, MM0OKG as J20DX and the guys hope to activate AF-053 and AF-059. Mike, K9AJ & Bruce, KD6WW are finalising plans for an operation from newly announced Yakutat County Group Alaska (NA-250P) from 10-13 May. If you missed NA-249 last year then KP3RE will be active from 22-24 February. And R7AL and RA1ZZ have plans for the newly announced AS-204 and AS-205 during July/August.

A large team of DL ops will be QRV from Macao as XX9D from 13-26 February. This is the same callsign and location as in 2017. Their location apparently counts as AS-075 for IOTA.

Guenter, DL2AWG, Hans, DL6JGN, Heye, DJ9RR, Wolf, DM2AUJ, Joe, DK5WL and Ronald, PA3EWP, are planning a DXpedition to Kanton Island (OC-043) in Central Kiribati from 16 February to 5 March. The team will be operating on 1.8 through

Col, MM0NDX and Jonathan, MM0OKG loading the boat to Telengbe Island, AF-111, in Liberia.

28MHz on CW, SSB, RTTY and some FT8 using the call T31EU. Before and after the DXpedition team members will be QRV from Tarawa, Western Kiribati (T30). See http://www.kanton2019.de for info.

Phil, F6OBD will be active holiday style as FK/F6OBD from New Caledonia (OC-032) until 10 February, mainly on digital modes.

Mike, OE6MBG will be active as S79AA from Mahe (AF-024), Seychelles until 2 February. He will operate CW and SSB with a focus on the low bands.

Neil, G0RNU will be visiting 6Y5NZ (G7BNZ) from 12-26 February and will be active from Jamaica (NA-097) on all HF bands as G0RNU/6Y (more likely as 6Y/G0RNU). He hopes a newly installed 5 band Yagi will be available but if not he plans dipoles and verticals.

Correspondence

Rich, GM3PPG sent me details of his 9-ele 80m phased vertical array on the west coast of North Uist. He is able to work VA2GU in Quebec when it is mid-day halfway across the Atlantic! The array also allows him to investigate skewed paths from ZL and W7.

G4CCZ finished the year with an extra 20 band/mode slots and a total of 3057 slots and 108 DXCCs.

Paul, G3XKQ reported on his worldwide 40m CW QSOs including: 5R8IC, 5Z4/LZ4NM, 9V1YC, CE1TBW, DU3LA, HS0ZNY, KL7SB, PY0FW, TG9ADM, TZ4AM, VK7BO and XE1RK.

Andy, G3SVD found a few short skip signals on 15-10m but the DX was all on lower bands: 17m – YN4RRC, VP2MLB, XT2BR, VK5GR, VK3EW, HC5DX, VP8LP, VI70MDRC; 20m – P4/DL6RAI, H7/RC5I, PY0FW, YN4RRC, XV1X, ST2NRD, 5A0YL, ZL6YOTA, 7Z1IS, BD7DT, 9L1YXJ; 30m – P4/DL6RAI; 40m – ZLRMF; 80m – YN4RRC, PJ2ND.

Ken, CT7AGZ had his best year since obtaining his CT call in 2012. He had hoped to achieve 9 Band DXCC in 2018 but fell short on 160m. In December he found: 12m – ZL2IFB, VP8NO, XT2BR; 15m – 9J2BO, ZL2IFB; 17m - 9L1YXJ, Z81D, 5B4AGN, 9Q6BB, PY0FW, FS/K9EL; 20m – SU9VB, CX2AQ, Z66DH, FS/K9NU, XT2BR, 4J100RO, VP2MSK, YN4RRC; 30m – V31MA, ZS2Y, XT2BR, 4L8A, FS/W9MK; 40m – A61Q, PY0FW, H7/RC5A; 80m – K6NA, Z66DH, HK7AAG, YV5JLO, HP3/NL8F.

Fred, G3SVK was active mainly on 20 and 40m last month: 20m – PJ4/KU8E, EP6RRC, V26K, 5X1XA, HR9/LZ5VV, TI7W, 5Z4LS, ZF2MJ, J8NY, P4/DL9RAI, SU9VB, OH0Z, PJ2/K2PLF; 40m – VK3CWB, PJ4/K4BAI, VP2EAB, FM5KC, J68GU, CP4BT, HC5M, CX9AU, ZF2MJ, ZL/DL1MGB, PZ5T, J8NY, C6AQQ, OD5ZZ, 5U9AMO, HI3T, H7/RC5A, XT2BR, H7/R4WAA, HP3SS, 6V1A, 8P6BE, Z66BH, 5R8UI, ZL6YOTA, TZ4AM.

Peter, G3HQT found: 17m – A61Q; 20m – SU9VB; 40m – H7/RC5A

Peter, G4XEX hopes that 2019 will mark the end of solar minimum. While waiting for it he worked: 17m – 3B8CF, 9X9PJ; 20m – D41C, TO5A, 9X4XX, 6V7A, TI7W, PJ2T, PZ5T, PJ4K, 5Z4LS, V47T, FY5FY, XT2BR.

Andy, G0SFJ draws attention to K1IBV's site www.dxawards.com/veryshort.html that lists awards that can be gained by working a special event station or group of stations commemorating some national event or historical achievement. Diplomas in your station's callsign are usually available for download in image or document form from the DX website when the required number of contacts has been reached. In the shack, Andy had a quiet December, but bagged XT2BR and YN4RRC on 20m CW, both ATNOs to him.

Gordon, G3PXT writes that his 2018 log contains 30,500 QSOs. I wonder if that's a UK record? He found a lot of DX (mostly on FT8) including: 12m – 3B8FA; 15m – VP8NO, PY; 17m – A91UAE, VE, HI, VU, 3B8FA; 20m – A92GE, XT2BR, 9Q6BB, SU9VB, YI1QEA, 4S7AVR; 40m – BD3PXM, VU, VK, YB, DU6/PE1NSQ, DS3DNT, 7Z1IS, 9V1SV, C5YK, 9M2; 80m – VK, V31MA, CO, ZLs, HP3/NL8FF.

Correspondence

Thanks as always to my correspondents, to DX-World, 425 DX News and Daily DX.

Table 1: 2018 worked DXCC entities (final 2018 scores).

Call	CW	SSB	Data	All
G4TUK	170	157	228	268
M0NKR	173	207	180	265
G0DWV	176	175	168	252
G3TBK	243	156	129	246
G3PXT	115	131	210	225
CT7AGZ	201	1	173	225
G3SVD	144	148	0	204
GI4DOH	181	9	101	201
G3SVK			199	199
G4XEX	103	95	126	178
G3HQT	171	0	0	171
G4CCZ				108

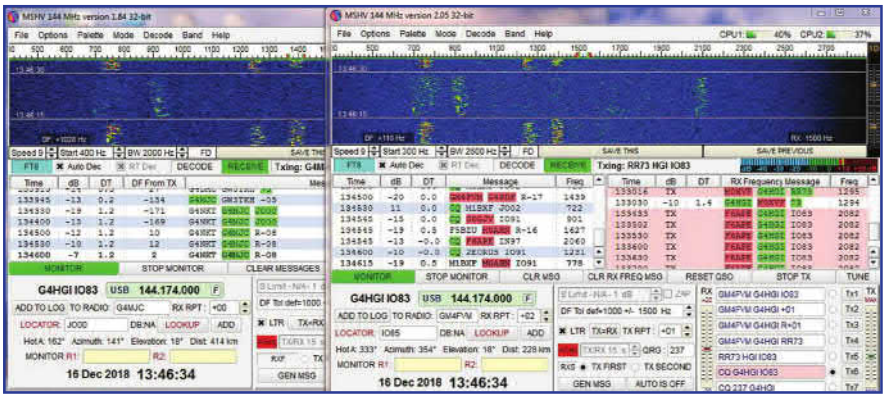
TABLE 2: Forthcoming DX activity.

18 Jan – 14 Feb	9X2AW
31 Jan – 11 Feb	P29 IOTAs by G3KHZ et al
12-26 Feb	6Y/G0RNU
13-26 Feb	XX9D
16 Feb – 5 March	T31EU
22-24 Feb	KP3RE
1-15 March	7P8 by LA7THA team
27 Feb – 6 March	HD8M
14-20 April	J20DX
10-13 May	KL7 NA-250
August 2019	St Paul Island
October 2019	VP6 Pitcairn

Martin Atherton, G3ZAY
g3zay@btinternet.com

VHF/UHF

Some productive tropo DX conditions appeared in December, which is unusual, and there were also reasonable meteor scatter conditions.



MSHV Version 1.84 and 2.05 being run in tandem.

At the end of December 2018 yet another lingering high pressure system saw the rise to 1033mb and beyond. To top off a quite exceptional DX year there was excellent DX from the UK to South Western France, Spain and also over to Germany and the Benelux countries.

A very interesting station appeared in a 'wet square' running FT8. Yuri, UT1FG/MM was active from IN66 and was inundated with calls on 144.174MHz. As the captain of an oil tanker, Yuri can be seen being spotted on the DX Cluster from many locations around the world [1]. In this case, the tanker was preparing to pass through the English Channel, the North Sea and Baltic area with the final destination of Riga.

The Geminids meteor shower was active from 4 to 16 December, with the peak late in the evening of 13th to the early hours of the 14th. The shower statistics were ZHR: 120, Velocity: 22 miles (35km)/sec. The parent object is an asteroid, Phaethon 3200, that accounts for the medium-slow velocity and, in reflection terms, due to the material make up produces low and slow bursts where 5, 10 or 20 seconds are very common. Generally it is reliable in the Northern Hemisphere and there can be excellent displays for meteor watchers. It was interesting to note that due to the length of the bursts there have been numerous decodes of full periods of FT8 at this QTH over MS distances.

The Ursids shower was active from 17 to 23 December with the peak during the night of 21st/22nd. The shower statistics were ZHR: 10, Velocity: 20 miles (32km)/sec. The parent object is a true meteor, 8P/Tuttle, and has delivered occasional outbursts with rates approaching 25/hour. Often neglected during the month with Geminids being the main show, the Ursids do provide reliable reflections for MS enthusiasts particularly on the lower VHF bands of 6 and 4m.

WSJT-X FT8 MSK144 developments

In December 2018, the WSJT Development Group announced that the WSJT-X software would be released in a full form and not as a beta test as in WSJT-X Ver2- rc2. The rc2 version is now redundant and if tried to run will not launch. An announcement appeared on the WSJT-X website on 10 December [2].

"The FT8 and MSK144 protocols have been enhanced in a way that is not backward compatible with older program versions. The new protocols become the world-wide standards starting on December 10, 2018, and all users should upgrade to WSJT-X 2.0 by January 1, 2019. After that date, only the new FT8 and MSK144 should be used on the air. A study of the release notes shows the improvements that the WSJT Team have made to the software usable in European contests with the ability to exchange full contest information ie 59 001 IO83PL."

This actually took a lot of people by surprise – including me. However, a download of the new version and installation of the software was seamless. Unfortunately, the news didn't travel very fast and there were a number of stations still using the old versions unaware of the non compatibility with pre Ver 2.0 software packages. In essence, anyone using FT8 and MSK144 within the package will have to download and install the new version as soon as possible.

There are two other major software packages suited to VHF/UHF operation available that have kept pace with developments [3], [4]. As someone who only uses one screen in the shack, the MSHV software provides everything on one screen. Quite a blessing in the end as during the RSGB #2 MGM Contest over the weekend of 15-16 December, I had to use Ver 2.05 and 1.84 as it was clear that a lot of very good signals were not decoding.

The work of the WSJT Development Group has been extraordinary over recent years to once again deliver a fully DX and Contest compatible software package. As someone who used the very first FSK441 software that was produced by K1JT back in 2001 the progress and increase in digital activity has been remarkable.

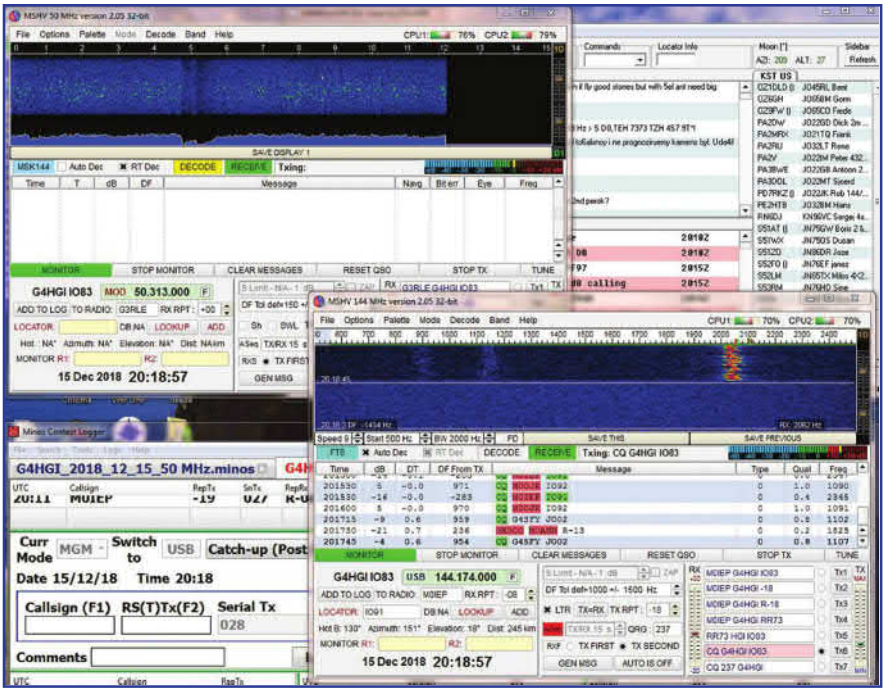
Whilst there are numerous opinions about the new FT8 operation it is hard to ignore the increase in usage on 6, 4 and now 2m during 2018. There is concern that the digital tide will kill off traditional modes like SSB/CW. A counter argument to this is that I have seen callsigns using digital modes never worked before. In essence, FT8/MSK144 etc should just be a another tool in the DXers kit to keep valuable spectrum used. Plus there is a considerable amount of experimentation – and QSOs are certainly not all 'automatic' that some folk would have you believe. The algorithms, source code, look-and-feel of WSJT-X and related programs, and protocol specifications for the modes FSK441, FT8, JT4, JT6M, JT9, JT65, JTMS, QRA64, ISCAT, MSK144, are © 2001-2017 by one or more of the following authors: Joseph Taylor, K1JT; Bill Somerville, G4WJS; Steven Franke, K9AN and other members of the WSJT Development Group.

2nd RSGB MGM contest

To coincide with the end of the Geminids meteor shower, the 2nd RSGB MGM contest (machine generated mode) was held over the weekend of 15/16 December. The term MGM is quite a broad brush as there are so many facets to this interesting and expanding area of VHF operating.

The first session, held in April and timed to coincide with the April Lyrids, had the potential to provide Sporadic-E propagation. The December event produced some reasonable conditions for 2m MS plus the use of FT8. Some stations chose stay on FT8 for the whole contest, others mixed and matched depending on the band and conditions prevailing at the time.

Trying to operate on two bands and multimode proved quite a challenge. Also there were the additional issues of WSJT-X version changes and also logging on two bands as well.



A very busy screen during a dual band 2 and 6m MGM contest.

As previously mentioned, the re-install of the software was easy and rather than using the ADIF log file from either WSJT-X, MSHV or JTDX, the RSGB Contest Committee Minos package did the job admirably and there were no issues uploading the logs to the RSGB VHFCC website after the contest [5]. Even if there was no possibility to use a compatible logging program, logs can be submitted manually to the RSGB VHFCC website [6].

Conditions were reasonable with some nice Geminid end of shower bursts on 2m. MSK144 and FT8 seemed to be the main modes in use followed by FSK441 primarily on 2m.

Sadly at this QTH, 6m was a write off due to S9 noise. However, 2m produced some nice MS QSOs with S51AT, DK5EW, EB5AL and DK3XT. The FT8 centre frequency 144.174MHz was very busy and it seemed that stations started to spread out a ±2kHz to avoid QRM.

Looking forward to 2019, dates for these contests are 20/21 April and 14/15 December. Please note these contests are open to all, whether Members of the RSGB or not.

Dual band operating

The software packages have their own styling and operating differences. One reason that I use MSHV is that when there is a dual band contest or even monitoring the bands it may be required to run two instances of the same software at once plus all the supporting software with two separate rigs for 6 & 4m plus 2m & 70cm. This can also be problematic if you try to run the same installation twice – eg CAT issues and problems with audio input/output streams. This can be overcome by two full clean installs – in separate root directories – with shortcuts to the desktop enabling complete separation. I currently have 6 & 4m and 2 & 70cm on different installations.

Band Reports

Bob, G8HGN (JO01) said of December, "All FT8 on 144 this month, with only 88 QSOs in total due to family commitments, etc. Did manage some time on during the 2nd MGM contest. The roll out of V2.0.0 of WSJT-X did slightly confuse some, but generally most weren't using the built in contest mode or changed to plain mode. For the month overall, 10 QSOs over 600km, 3 over 700km and just one over 800km including DF6PW (JO40), F1NZC (JN15), F6FUZ (JN05), F6CVY, F1EFW (JN26), DL4AO (JO42), DL3TW (JO44), F6CIS (IN94), DH8IAT (JN49) and highlight F1BFF in JN24.

Nick, G4KUX (IO94) has been at his current QTH (IO94BP) for many years and he describes the excellent tropo conditions in November as some of the best in all those years. Nick completed tropo QSOs with OH stations, which is a very rare occurrence, having happened only on a couple of other times over the 36 years he's been active from his QTH. The QSO with OH5IY was the best of the bunch at 1810km. He has an excellent take off over North Sea confirmed with extracts from his November log to Scandinavia and Eastern Europe. OZ1DLD (JO45), OZ9PZ, OZ4VV, OZ1JMN, OZ2ND (JO46), OZ5AGJ (JO47), OZ1OY, OZ3Z (JO55), OZ1MAX, SM6NZV (JO57), SM7MMQ (JO65), SF6F, SM6MVE, SM6CEN, SM6MUY (JO67), SM4GGC (JO69), SM7MBH (JO75), SM7THS (JO76), SM7NDX (JO77), SM6LPF (JO78), SM5DIC (JO89), SM0MLZ (JO99), SP2ORL (JO93), SP2SCQ, SP2CHY (JO94), OH1MN (KP10), OH1ND (KP00) and OH3LWP in KP21 all worked between 1-18 November.

Sign Off

There have been a lot of column inches devoted to the growth of digital modes particularly FT8 over the last year. I remember a comment made at the Lincoln Hamfest in September that Joe Taylor, K1JT didn't realise how popular FT8 would become in all communities, be it HF/VHF/UHF and microwaves. Turning the clock back to 2000, when meteor scatter techniques relied on (slow) high speed CW, this part of the hobby was revolutionised by the introduction of FSK441 (primarily for 2m) in the first K1JT release even though the PC based OH5IY and 9A4GL software MS programs were paving the digital path on VHF. JT6M soon followed specifically designed for MS operation on 6m and this again revolutionised operation on 6m. JT44 and its later development JT65 followed again bringing the world of EME into the reaches of what could be called 'normal' stations. It wasn't necessary to own serious real estate and massive Yagi groups any longer. Clearly the level of 'difficulty' is the issue with critics extolling the virtues of taking 1-2 hours to complete an MS sked. In this day and age of instant everything, the digital developments go hand in hand with the pace of consumer electronics and attitudes. So rather than accelerating the demise of the hobby, has FT8 actually brought operational interest back to appeal to younger operators?

Websearch

[1] www.qrz.com/lookup UT1FG
[2] https://physics.princeton.edu/pulsar/k1jt/wsjtx.html
[3] http://lz2hv.org/mshv
[4] www.jtdx.tech/en/
[5] http://minos.sourceforge.net/
[6] www.rsgbcc.org/vhf/howto.shtml

Richard Staples, G4HGI
g4hgi@live.com

GHz Bands

Activity

December was a quiet month with no significant tropo and just a bit of rainscatter (RS). On the 5th, the RS was good enough for me to chat with G4ASR (IO81MX) on 10GHz SSB and FM over a 219km obstructed path. Dave is usually a difficult QSO on CW during the UK Activity Contests (UKAC). Activity-wise, hardly any DX QSOs were reported on the cluster but the 2.3 and 10GHz UKAC contests each attracted 23 entries, so the stations *are* there.

I can only conclude that many people are busy working on satellite equipment after the successful launch of Es'Hail Sat 2 in November. This is confirmed by the high level of 'chat' on the subject on the new ukmicrowaves.io email reflector. I'm not going to list links to all the work that's been done on modifying LNBs as 10GHz downconverters, as I'd fill my page with them! Just search for 'Octagon 10GHz LNB Eshailsat' and you'll find plenty of information about injection locking these PLL LNBs to an external reference. I'm using an Octagon 'Oslo' single LNB **[1]** modified for an external 25MHz reference. My simple mod involves carefully prising off the plastic case and removing two screws to open up the metal can inside. I drilled a 2mm hole in the can close to the crystal and injected about +7dBm at 25MHz to the left-hand side of the crystal closest to the 2 of its 25.00H628 marking, via a leaded 1k resistor and 1nF capacitor. Both fit inside the plastic case. These connect to the outside world via a small SMA female flying lead.

Beacons

On 11 December 2018, a new 13cm beacon, GB3FNM, came on the air on 2320.920MHz. It is located in IO91OF and runs 40W EIRP to a slotted waveguide antenna. Main lobes beam 120° and 300° and it runs an FSK CW ident. Digimodes are planned for a future upgrade. Barry, G4SJH tells me that all the key RF parts (synthesiser, intermediate and final amplifiers, filter) are recycled items. The major purchase was the antenna from Bert, PE1RKI. Zdenek, OK1DFC donated the 10W PA. As well as being a very important foothold in a threatened band, the beacon is a fine example of European co-operation!

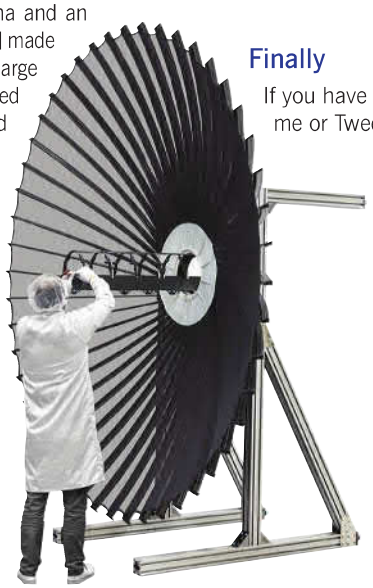
Deployable dishes

Ever noticed the similarity between your dish antenna and an umbrella? Well, the 'stress dish' reflector arrangement **[2]** made famous by EME pioneer Al Katz, K2UYH is really just a large umbrella with a mesh surface instead of fabric. It is based on the fact that if a flexible rod is fixed at one end and pulled from the other it forms into a reasonable parabola shape. This allows a dish to be packed away in to a very small volume for transport and quick deployment. My attention was recently brought to a UK company based at the Harwell Space Cluster, who have taken a similar idea and made it in to a viable product for satellite communications. Oxford Space Systems (OSS) **[3]** produce what they call 'unfurlable reflector antennas', not quite *stress* dishes but dishes that appear to deploy and open almost like a Chinese fan. There is a very impressive short video at **[4]** showing the antenna deploying in seconds. To quote their website, "based upon flight-proven high-strain composites, the Oxford Space Systems 'wrapped-rib' antenna offers a solution where recurrent volume costs are critical". We are all surely aware that physical space and weight costs money on a satellite mission and antennas can take up lots of both. Antennas need to be stowed then deployed once in orbit. This is rather like the requirement for a GHz EME DXpedition where space and weight are at a premium in luggage. The OSS design uses "uniquely profiled ribs to maximise stowage efficiency without compromise to deployment reliability." They offer options of Cassegrain or offset reflector configuration from 0.5m – 5m diameter operating up to Ka Band (26.5-40GHz) and are designed for data relay systems, synthetic aperture radar and telecoms. While the OSS antennas are surely way beyond the budget of most radio amateurs, the principle of unfurlable antennas and stress dishes are worth investigating for lightweight operation on the GHz bands.

PHOTO 1: New GB3FNM 2320MHz beacon. Photo courtesy G4SJH.

Events

Shaun, G8VPG advises of a new event for this year that will certainly have GHz bands content. At their AGM in September, the British Amateur Television Club (BATC) decided to hold a number of 'mini-conventions' around the country during 2019. The first will be in Bristol on 31 March. These are technical meetings modelled on the Microwave Round Table pattern. There will be a full day of talks and demonstrations and the opportunity to meet some of the most active ATV enthusiasts. There will also be test equipment on hand to help set up visitors' projects. It will run from 10am to 4pm at North Bristol ARC, SHE7 building, BS7 0TD. Full programme details will be published on the BATC Forum **[5]**. Further information from Shaun, email g8vpg@aol.com.



The unfurlable reflector antenna from Oxford Space Systems. Photo courtesy OSS.

Finally

If you have anything to contribute to the GHz discussion, email me or Tweet @g4bao and @ukghz using #GHz_bands.

Websearch

[1] www.pabr.org/radio/lnblineup/lnblineup.en.html section 6.1
[2] www.nitehawk.com/432_MHz_EME/stress_dish.pdf
[3] https://oxford.space (yes, .space)
[4] https://vimeo.com/277723554
[5] https://forum.batc.org.uk

John C Worsnop PhD CEng MIET, G4BAO
john@g4bao.com

Book Review

RadCom 2018 CD and USB stick

As usual, as the December edition of *RadCom* rolled off the presses we gathered together the master files for all twelve of the year's *RadCom*s and, pausing only to turn them into easily-accessed PDF files, put them together in a much more compact form than the original print versions. And lo, another year's *RadCom* CD and USB stick are born.

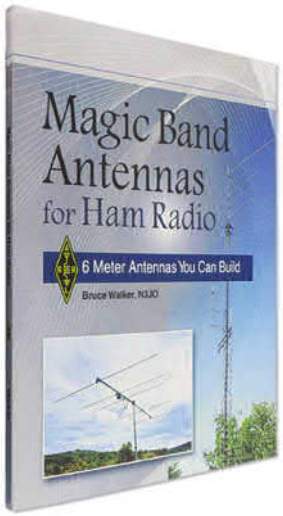
Every single word, drawing, photograph and advert is included and, unlike the paper version, the PDFs can easily be searched for any keyword you like. We've been slipping the word 'aardvark' into one or more editions in recent years, however our word of 2018 was 'meerkat' and it appeared at least once in every issue. But which had it *twice*? I sincerely doubt you spotted it at the time. But the search facility means you can easily check in a matter of moments for anything you want in the hundreds of pages of news, reviews, reports, technical articles and club information.

In addition to the *RadCom* 2018 content, you'll also find samples from RSGB books and samples from other RSGB archive to give you a feel for some of the other publications on offer from the Society.

Non Members' Price: £14.99
RSGB Members' Price: £12.74

Magic Band Antennas for Ham Radio

by Bruce Walker, N3JO



What's in a name? Well, for the Magic Band, the clue *is* in the name. 6m (50MHz) is a band that capable of stunning performance. It's often said to – magically – combine the best bits of HF and VHF, with the small(ish) aerials of VHF yet the DX potential of lower frequencies. Certainly, when the conditions are right (as they often are), transatlantic or other long-haul operating can be a doddle. But, as with all radio operations, the secret to exploiting conditions is to have a good aerial.

Bruce, N3JO is certainly well-placed to offer advice on that front. He's the ARRL VHF Awards Manager and has been a radio enthusiast since his early teens. 6m is one of his favourite bands and his experience and enthusiasm shines through, with personal stories that accompany the technical stuff.

In the 20 chapters you'll find a wealth of antennas you can build, plus a fair bit of advice that applies to 6m and beyond. The antenna projects range from quite straightforward designs such as various dipoles and a J-Pole (Slim Jim), right through to an 8 element beam. The really nice thing about the book is that it contains the constructional information you need to put these aerials together, plus some of the theory behind what's going on. But the emphasis is strongly practical – there's essentially no maths, just a little easy arithmetic you can do if you choose, and you won't find page after page of simulation results either. It's just good, solid, practical stuff, and as such is to be loudly applauded.

Whether you're a newcomer to the Magic Band or a seasoned old hand, you're sure to find a lot in this book to reward your purchase.

Size: 183x228mm, 112 pages
ISBN: 9781 6259 5098 7
Non Members' Price: £22.99
RSGB Members' Price: £19.54

The radiotoday guide to the Icom IC-7610

by Andrew Barron, ZL3DW

The Icom IC-7610 is an amazing radio full of top-notch technology. In his review for *RadCom*, Peter Hart, G3SJX said that it incorporates "an unprecedented level of built-in features and functions". But there's the rub: although the basic operation is straightforward, the sheer volume of features and options means an equally wide array of controls, knobs, dials and menu options. Where to begin?

Whilst Icom's user manuals have a deservedly high reputation, there is no substitute for having someone walk you through how to use something *from an amateur's point of view.* And that's exactly what Andrew Barron does. A widely experienced writer and long-standing amateur, he has the gift of being able to communicate really clearly and concisely, thoroughly exploring his subject in a logical and digestible form.

The book is laid out nice and clearly with intelligent use of highlighting, a sensible and above all consistent method of identifying functions, button and menu names. The clear text is supplemented by a number of screendumps that show precisely what's going on, often with particular areas marked to draw your attention to the precise function being explained.

A particularly nice touch is a comprehensive glossary of terms and abbreviations at the back of the book so there's no need to worry if you don't know what things like '.dll', 'dBc', 'DR3' or 'RBW' actually mean: these terms, and many others, are clearly explained.

If you have treated yourself to an IC-7610, are thinking of doing so, or simply want an in-depth look at what this marvel of technology can do, then this is the book for you.

Size 174x240mm, 160 pages
ISBN 9781 9101 9366 2
Non Members' Price: £12.99
RSGB Members' Price: £11.04

Giles Read, G1MFG
giles@rsgb.org.uk

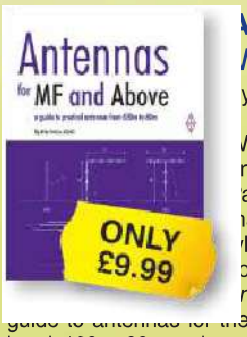
60 Antennas You will want to build!

Edited by Giles Read, G1MFG

Whatever the type of antenna, there is always a sense of achievement when you build one yourself. This book sets out to provide a huge array of designs that the home constructor can attempt and build.

Selected from around the amateur radio World and from some of the great names of antenna design there is much here that will inspire 'You to want build!' your next antenna.

Size 174x240mm, 288 pages
ISBN: 9781 9101 9355 6
Price: £9.99



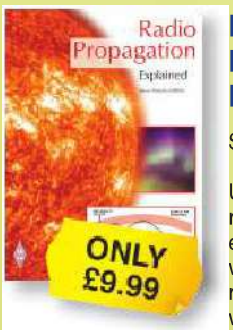
Antennas for MF and Above

By Mike Parkin, G0JMI

Written by *RadCom* antennas guru Mike Parkin this is a book that provides exactly what is says on the cover. *Antennas for MF and Above* is a practical guide to antennas for the relatively new 630m band, 160m, 80m and equally new 60m band.

If you are interested in experimenting with the bands below 40m, you are sure to find much to interest you in this book. *Antennas for MF and Above* is without doubt one of amateur radio's standard reference works.

Size 174x240mm, 112 pages
ISBN: 9781 9101 9346 4
Price: £9.99



Radio Propagation Explained

By Steve Nichols, G0KYA

Understanding radio propagation is essential for anyone with an interest in radio communications, wanting to know how signals travel from A to B. In *Radio Propagation Explained* ,Steve Nichols, G0KYA provides everything you need to know.

Radio Propagation Explained is thoroughly recommended reading for everyone who wants to understand radio propagation.

Size 240x174mm, 128 pages
ISBN 9781 9101 9328 0
Price: £9.99

SWR Explained

By Reg Irish G4LUF

Many are familiar with the concept of the Standing Wave Ratio (SWR) and its effect on transmission and reception of signals. Few however understand much about it beyond the adjustment of an antenna tuning unit to the reduce SWR.

SWR Explained sets out to fill that gap and provide the context that makes electromagnetic Waves, transmission Lines and VSWR comprehensible.

174x240mm, 64 pages
ISBN: 9781 9050 8699 3
Price: £4.99

Low Power - Spratbook

QRP - the art and science of low-power operation - is one of the most popular aspects of amateur radio. In the UK, the G QRP Club has been a leading light in this area of operation since its formation in is recognised as one of the world's leading QRP publications and it has now reached its 150th edition. This milestone is marked by this publication of this book, which is a selection the best of nearly four decades of low-power amateur radio circuits and ideas that have been published in SPRAT

Size: 320 pages, 174x240mm.
ISBN: 9781 9050 8686 3
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Fort Bridgewoods From Victorian Fort to WWII Y Station

By Stephen G Small, G4HJE

Victorian Fort that became one of the most secret places the realm. Here of radio became a vital weapon. Without the work of its civilian intercept operators, Bletchley Park may well have failed to break the Enigma code.

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Edited by Colin Latham and Anne Stobbs

Arnold "Skip" Wilkins one of the unsung heroes of the British effort to develop radar. *The Birth of British Radar* book combines the memoirs of Skip with an overview of the historical importance of his work.

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ISBN: 9781 9050 8675 7
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By Susie Boniface

This new edition of the *Bluffer's Guide to Social Media* is as the name suggests an insight into all things social media. This fun guide is packed with interesting information, insights and tips, making it perfect for both pros and those who are new to social media.

Written by experts and offering readers the opportunity to pass off appropriated knowledge as their own, the *Bluffer's Guides* provides hard fact masquerading as frivolous observation.

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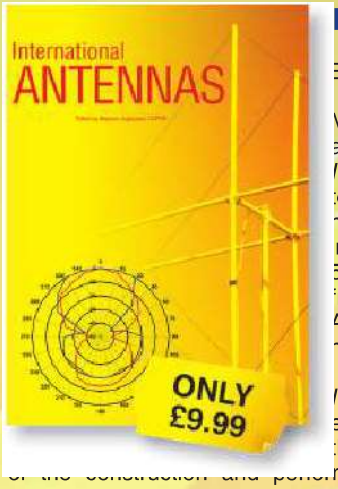

International Antennas

Edited by Stephen Appleyard G3PND

Much is published across the world about amateur radio antennas. *International Antennas* brings together some of the very best material that has been published in recent years. There are over 50 articles included with authors from Australia, Scandinavia, South Africa, United Kingdom, USA and more.

International Antennas has an emphasis is on practical rather than theoretical. You will find descriptions of the construction and performance of antennas enabling the reader to build their own versions. These articles have been written by experienced radio amateurs who have been so pleased with the performance of their particular antenna, that they have been moved to put pen to paper to share this experience.

There is a huge range of antennas included in this book, covering 17 bands from VLF through to 70cm. You will find articles covering the 'stealthy' antennas through to novel approaches to classic antennas. There are verticals, loops, beams and a host of unusual designs. There is so much in fact that the editor has provided a cross reference to see at a glance the bands antennas are designed for and if they are intended for fixed use or mobile/portable operation.

Size: 200 x 234mm, 176 pages
ISBN: 9781 9101 9335 8
Price £9.99

RSGB Yearbook 2018

By James Cooper

If you are a follower of Robot Wars is the highly successful TV series or not, this Hardback book is very well written and incredibly detailed. This Haynes manual is produced in a similar style to the familiar 'how to' guides for cars but doesn't just include details about building robots but much more.

This *Haynes - Build Your Own Robot Manual* provides a unique behind-the-scenes look at the show - the arena, and both house and competitors robots. Lavishly illustrated with high quality pictures there are step-by-step extensively illustrated instructions for building three project robots, from a simple 'self-navigating' robot, to a fully controllable Robot Wars challenger.

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A power meter for up to 8GHz

We are used to using a power meter to measure the output of our transmitters but these usually are usually in the range of tens or hundreds of watts. It is also very useful to be able to measure RF power at much lower levels, perhaps around the milliwatt (mW) level (0dBm) or less. This is especially true in microwave applications where systems are routinely made of building blocks; being able to measure accurately the power being produced from each block becomes quite essential. For many years I achieved this with a HP431C with external RF head (bolometer). These bolometers are quite susceptible to damage from excess power, which I found to my cost one day. I was trying to find out why a 432MHz preamp was failing when used with a transfer relay. In the end I discovered that the transfer relay was switching very slowly and also seemed to have 'make before break' contacts. Needless to say, like the preamp, the bolometer head did not survive. At least the preamp could be repaired!

So, a replacement was required for my HP431C and bolometer. This is not a trivial task, as the original instrument is specified and calibrated up to 10GHz. An internet search found that a number of RF measurement devices are available from various manufacturers. (My years of professional experience make me lean towards Analog Devices (AD) products but there are many fine alternatives). Four different devices from AD were seen as possible candidates, the AD8307, AD8310, AD8317 and AD8318. Datasheets for these are at www.analog.com.

Internally, all of these devices are demodulating logarithmic amplifiers based on the progressive compression (successive detection) technique, which provides a wide dynamic range. The dynamic range depends on the device and frequency of use. They all produce a DC voltage output that changes linearly with the input power *in dBm*. This DC voltage can be applied to an analogue to digital converter (ADC) and subsequent processing system. Converting the resulting binary value to dBm is a relatively simple task.

Although each data sheet specifies a maximum useful frequency for each device, careful reading shows that a lower maximum frequency is realistically achievable within my design target, an accuracy of ±1dB. **Table 1** shows the relevant characteristics of the devices considered, including the lower maximum frequencies for ±1dB accuracy.

PHOTO 1: The Mk 2 power meter system.

All four devices listed in Table 1 are available from China on small ready assembled PC boards for around £10 each. This made the assembly of a prototype system a lot easier as it did not require me to solder the very small devices! These boards are about 30 x 20mm and the connections needed are just +5V power, the analogue output signal and the RF input signal – the latter via an SMA connector.

The Mk1, prototype system

A prototype system was designed using a PIC16F1507 as the processing engine. This is a very low-cost processor and easy to program but, with hindsight, perhaps the SMD version I used was not the best choice as its very close pin spacing made it hard to solder onto a board. Also it does not contain the usual debugging facilities of more powerful devices.

The prototype system carried just one RF head and used a simple 2x16 character display for the measured power. It indicated power levels accurate to within ±1dB over the desired frequency and power range. There was no user interface and no facilities for calibration; the calibration constants were hard coded in the firmware. At about this time I had some discussions with members of the Caen Radio Club (F6KCZ) who were working on creating something similar but possibly using an Arduino rather than a truly bespoke system. These discussions culminated in the Mk 2 version that has the added facility of being able to support any two of the devices listed in Table 1 by using two ADC channels in the PIC. Other desirable features that came out of the discussions meant that a more powerful PIC would be required and a rotary encoder necessary for its control. Hence the Mk 2 version came into existence.

The Mk 2 system

The Mk 2 system uses the same 2x16 character display, can select one of the two RF measuring devices, has a built-in user interface and provides a calibration facility. It uses a PIC16F887, which has an 8k code space (four times as much as the Mk1 system). Another suggestion from our French friends was the facility of indicating power in watts (auto-scaling) as well as dBm, so the extra code space would be very useful for the floating point mathematics. Even when using only 24-bit floating point (the norm being 32, 64 or 80-bit), the floating point library still eats up the code space. The PIC16F887 also has a serial interface which would be very useful for calibration purposes.

Figure 1 shows the circuit diagram of the Mk 2 system. A PCB was designed that was the same footprint as the display. Prototype boards were made and assembled and the result is shown in **Photo 1**.

The two RF sensing heads are fitted onto one side of the PCB, with the display on the other side. The display is connected by a mating 16-way plug/socket arrangement, which makes for easy assembly/disassembly. The display and rotary encoder both came from China and together cost less than £1.60! A multiway plug connects to the rotary encoder. The encoder incorporates a push switch on its shaft that is used to enter and navigate around the user interface menu (short press) and to exit the menu system (long press).

A small connector on the rear is used for debugging and programming the PIC and the connector nearby (labelled CAL) is a serial interface used for calibration.

There is nothing special about rotary encoders; they have been described extensively before. The way I interface

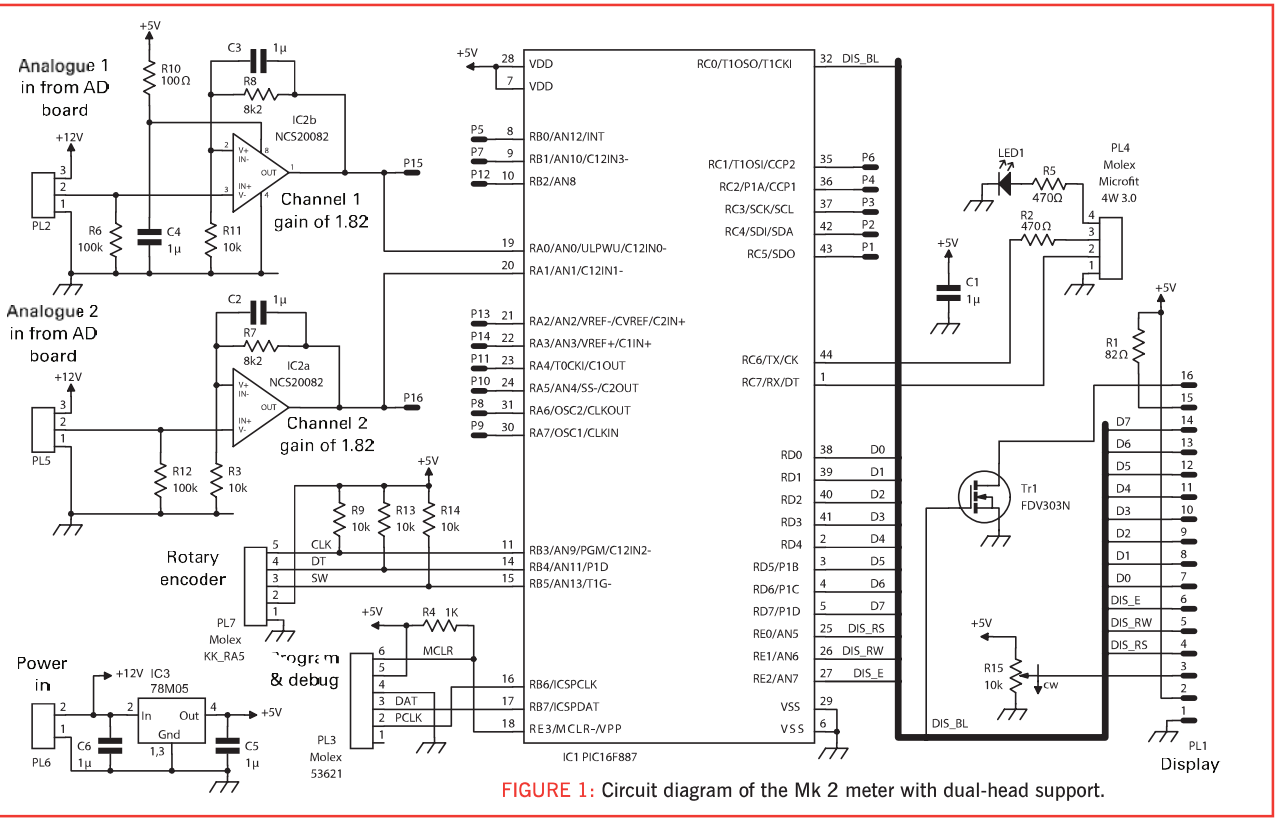

FIGURE 1: Circuit diagram of the Mk 2 meter with dual-head support.

them into the software – and any other user operator switch – is, however, somewhat different. Two different ways of reading the state of a switch, rotary encoder included, seem to be widely used: via hardware interrupts or simple polling. Both methods have their problems but I have found that the best approach is a combination of the two, which I have successfully used professionally for many years. Enable a timer interrupt running at some suitable rate – typically 10Hz. At each timer 'tick' the switch states are read by the timer Interrupt Service Routine (ISR) and compared with the switch states read at the *last* timer 'tick'. If the states are different, then a switch has changed state and it can be evaluated to see what has changed. This method automatically de-bounces the switch by using the timer interrupt. Software 'flags' can then be left by the timer ISR that can be read and acted upon by the normal 'background' task. The rotary encoder needs two of these flags, one to indicate that one pin has changed state and the second to remember the state of the second pin when the first pin changed. These two flags can then be used to determine when the rotary encoder has been turned and in which direction. Another two flags are used to indicate that the push switch on the encoder shaft has been pressed or released. Note that a timer interrupt of only 10Hz will limit the increment of any value via the rotary encoder also to 10 a second. This is fine for this application, but if you wanted to use the rotary encoder for (say) tuning a receiver, then this increment rate is not enough. I have successfully used interrupt rates up to and exceeding 1kHz. However, be careful to keep the code within the ISR to the barest minimum as its overhead can become a substantial fraction of the overall processor bandwidth!

The push-button on the rotary encoder shaft is dealt with in a very similar fashion.

The addition of a rotary encoder allows a user interface menu system and that opens up endless possibilities. Members of the Caen Radio Club were very keen to be able to select the measured power units to be either dBm or watts (the latter auto-scaling). This produced an interesting problem, as on the face of it, this would require a $\log_{10}$ function. This is something you do *not* want to do when using a simple 8-bit processor as the program space overhead would be unacceptable. However, a simpler system was devised that was easy to use and that gives a power level in watts (auto-scaled) with sufficient accuracy. The code for this is in the second part of the article.

Very simply, this code assumes that 0dBm is 1mW and, for every 3dB above 0dBm, the power is doubled – and conversely for every 3dB below 0dBm the power is halved. The last 1 or 2dB power ratios then come from a look-up table.

Another feature suggested by our friends in Normandy was to allow the insertion of an attenuator in the RF input. This attenuator dB value can be entered into the user interface and this value is then added to the value measured from the RF measurement device. The displayed RF power value in either dBm or W is then equal to the power incident on the input of the attenuator.

Next month

This article will conclude in March with details of the user interface and calibration.

TABLE 1: Selected characteristics of devices identified as potentially suitable.

Device	Quoted frequency range	±1dB range	Dynamic range
AD8307	DC to 500MHz	~180MHz	-75 to +17dBm
AD8310	DC to 440MHz	~140MHz	-78 to +17dBm
AD8317	1MHz to 10GHz	~1.9GHz	-53 to -3dBm
AD8318	1MHz to 8GHz	~1.5GHz	-58 to -1dBm

Mike Stevens BSc, MIET, G8CUL/F4VRB
mikeg8cul@gmail.com

Please send news reports to radcom@rsgb.org.uk. To get future events listed here and put on GB2RS, email details of your meetings as early as possible to radcom@RSGB.org.uk Include your club name, RSGB Region number, contact name, callsign & phone number, date and details of meeting. **Example:** Fraser Road Radio Club, Region 9, Steve, M1ACB, 01234 832 700, 29 Oct, talk on Meerkat Farming, Phil, G9ABC. We normally acknowledge all submissions within 3 working days: if you don't hear from us, please phone. We don't normally include 'closed', 'TBA' or 'every Tuesday'-type entries. **The deadline for the March edition is 23 January and for April it's 20 February.** For GB2RS, the deadline is 10am Thursday before broadcast.

CLUB EVENTS CALENDAR

INTERNATIONAL

Pafos Radio Club, Cyprus
Richard, 5B4AJG, 00 357 97 857 891, 5b4ajg@gmail.com www.cyhams.org
Meets 3rd Thursdays at the Hole in the Wall Restaurant, Coral Bay, 6 for 6.30. Visitors welcome.

International Federation of Railway Radio Amateurs (FIRAC) www.firac.org.uk
Nets Sun 14.320MHz at 0830UTC, Wed 21.3MHz at 1430UTC. g4gnq@hotmail.co.uk.

NATIONAL

Amateur Radio Caravan & Camping Club, membership@arcc.org.uk
www.aarc.org.uk

AMSAT-UK – http://amsat-uk.org/
Open net every Sunday, 10am, 3.780MHz (±)

British Railways ARS
Ian, G4EAN, www.brars.info
Nets: Tuesday 7pm on 3.68MHz, Friday 4pm on 3.685MHz

British Young Ladies Amateur Radio Association www.bylara.org.uk
Net Thurs, 3.688MHz±, 6.30pm. All YLs welcome.

Civil Service Amateur Radio Society
Weekly net every Tuesday, 8pm, 3.763MHz

CDXC – The UK DX Foundation – cdxc.org.uk
For all interested in HF DX and contesting

Radio Amateur Old Timers' Association
MemSec@RAOTA.org, www.RAOTA.org
Diamond Jubilee year. Nets: see website

Worked All Britain Awards Group
www.worked-all-britain.org.uk
Nets most evenings, 3.760MHz±, time variable with propagation. Non-members welcome.

REGION 1: SCOTLAND SOUTH & WESTERN ISLES

RR: Anthony Miles, MM0TMZ, RR1@rsgb.org.uk

Cockenzie & Port Seton ARC
Bob, GM4UYZ, 01875 811 723
1 Club night

Lothians RS
Mike, MM0MLB, secretary@lothiansradiosociety.com
13 Munros on the Air, James, GM4WZP
27 Club night

Mid Lanarkshire ARS
Joseph, 2M0JHY, mlarsclub@gmail.com
1, 8, 15, 22 Club night and tuition

West of Scotland (Glasgow) ARS
Jack, GM4COX, www.wosars.org.uk
1 Electric Car - DC Motors, Scott, GM4CLQ
6, 13, 20, 27 Solder Group
8, 22 Club night
15 13cm on SOTA, Andy, MM0FMF (Provisional)

Wigtownshire ARC
Bob, GM4DLG, info@gm4riv.com
7 WSPR, plus RSGB Q&A session, Len, GM0ONX
14, 21, 28 Club night

REGION 2: SCOTLAND NORTH & NORTHERN ISLES

RR: Andrew Burns, MM0CXA, RR2@rsgb.org.uk

Aberdeen ARS
Fred, GM3ALZ, 01975 651 365
7 Junk sale
14, 21 Oscillators & Buffers Part 1 & 2, Graham Sangster
28 Construction & on the air

Dundee ARC
Martin, 2M0KAU, 0776 370 8933
5 VHF contest / club night
12 Equipment check
16-17 Thinking day OTA
19, 26 Club night Foundation training

Inverness & District ARS
John, GM0OTI, 01463 791 444
6, 20 Club night
27 Club net, 8pm 145.575MHz & GB7BI slot 1

REGION 3: NORTH WEST

RR: Kath Wilson, M1CNY, RR3@rsgb.org.uk

Central Lancs ARC
Peter, G3UCA, g3uca@blueyonder.co.uk
2 Monthly club meeting, 11am
3, 10, 17, 24 Club net, 1.940MHz, 11am

Oldham Radio Club
Mike, M1CVL, 0740 276 3203
3, 17 D-Star Net – REF 14B, 9.30am
6, 13, 20, 27 2m FM Net, 8pm
7, 14, 21, 28 Club night & Foundation course
10, 14 C4FM Net, FCS004-55, 9.30am
21 Antennas and propagation, Mike, 2E0MEQ
28 Construction Group

South Manchester R&CC
Ron, G3SVW, 01619 693 999
3, 10, 17, 24 Net, 10.15am, 3,637kHz SSB
5, 12, 19, 26 Net, 8pm, around 145.575MHz FM
21 Discussion on receiver methods
28 Club quiz

Stockport Radio Society
Heather, M6HNS, 0750 690 4422
1, 8, 15, 22 Net, 7.30pm, 433.575MHz
2 Foundation course part 3 and exam
5 HF propagation essentials, Ron, G3SVW
9-10, 23-24 Intermediate course part 1&2, 3&4
12 Net, 7.30pm, 51.550MHz FM
14, 27 Net, 7.30pm, 145.375MHz FM
19, 26 Radio night/Skills night

Thornton Cleveleys ARS
John, G4FRK, 01253 862 810
4 Natter night /practical/club on air
11 Whatever the weather, Stephen Musgrave
18 Project night
25 Auction

REGION 4: NORTH EAST

RR: Ian Douglas, G7MFN, RR4@rsgb.org.uk

Denby Dale RC
Darran, G0BWB, 0797 442 3227
2 Foundation class
3, 10 Club net via GB3HD, 10.30am
6 Club night

Hambleton ARS
John Earland, M6BHP, 0798 000 3293
6 Talk on operating practice on the ISS
20 Operating night

Hartlepool ARC
Stan, G7VGM, stan.g7vgm@gmail.com
1, 22 Club night/training
8 Prep for Thinking Day on the air
15 Set up TDOTA station GB0HG
16-17 TDOTA station GB0HG

Sheffield & District Wireless Society
Krystyna, 2E0KSH, 0788 406 5375, info@sheffieldwireless.org
3 432MHz AFS Contest
6 Coax, David, G8EQD

Spen Valley ARS
Russell, G0FOI, 01274 875 038
7 Shack meeting
21 Shack meeting/on air

Tynemouth Amateur Radio Club
mail@g0nwm.com
1 Closed
8 Working amateur satellites
15 Club night

REGION 5: WEST MIDLANDS

RR: Martyn Vincent, G3UKV, RR5@rsgb.org.uk

Burton ARC
Rob, G6EIH, 0781 214 6333
3, 10, 17, 24 Open net, 10am, 145.575MHz
6, 13, 20, 27 Open club night
7, 14, 21, 28 Open net, 8pm, 145.575MHz

Cheltenham ARA
Derek, G3NKS, 01242 241 099
3, 10, 17, 24 Net, 8.30pm, 50.220MHz SSB
5, 12, 19, 26 Slow CW, 8pm, 3540-3550kHz
19 Lunch
21 Table top sale, 8pm, new venue: Robin's Nest, Cheltenham FC

Coventry ARS
John, G8SEQ, 0795 877 7363
1 Construction competition
8 Basic antennas
15 Club night
22 Mini lectures

Gloucester AR&ES
Anne, 2E1GKY, 01242 699 595 daytime
1, 8, 13, 20, 27 Club net, 7.30pm, 432.220MHz SSB
4 SDR on a shoestring, Mike, G60TP
6 Club net, 7.30pm, 145.475MHz FM
7, 14, 21, 28 Club net, 7.30pm, 145.475MHz, then 80m SSB
11 Informal activities & exam night
18 Closed
25 Informal activities

Malvern Hills RAC
Dave, G4IDF, 01905 351 568
12 Test equipment evening
26 Informal meeting

Midland ARS
Norman, G8BHE, 0780 807 8003
6 Open meeting, training classes
13 Committee meeting, training classes

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www.kenwoodcommunications.co.uk

20 General meeting, on the air, training
27 Planning for local rallies; training

Salop ARS
Eamonn, M0MEB,
salopamateurradio@gmail.com
5, 12, 19, 26 Club CW net, 144.070MHz, 4.30pm
6, 13, 20, 26, 27 Club net, GB3LH, 8.30pm
7 Committee meeting/natter night
14 Digital TV: G8VZT
21 First Aid/CPR refresher, Eamonn, M0MEB
28 Fox hunt talk

South Birmingham RS
Gemma, M6GKG,
gemmagordon.m6gkg@gmail.com
5, 12, 19, 26 Shack coffee morning, 11am, all welcome
8, 22 Sorting rally stock for Wythall Hamfest
14, 21, 28 Training classes with Dave, G8OWL
18, 25 Open meeting

Stratford upon Avon & District RS
Clive, G0CHO, 01608 664 488
4, 18 Club net, 8pm, 145.275MHz FM
11 RSGB Regional rep, Martyn Vincent, G3UKV
25 Review of Yaesu FT-991A 'shack in a box', Ron

Sutton Coldfield ARS
Robert Bird, rob2e0zap@gmail.com
4, 18 Open net, 7.30pm, 145.250MHz, 7.30pm, all welcome
11, 25 Club meeting
12 Open net, 7.30pm, 70.475MHz
26 DMR open net, 7.30pm, slot/local 2 GB7FW

Telford & District ARS
John, M0JZH, 0782 473 7716
6 Committee meeting
13 Bowls evening
20 HF & VHF baluns & ununs
27 Under a Fiver competition

Wythall Radio Club
Chris, G0EYO, 0771 041 2819
3 Club net, 8pm, 145.225MHz or GB3WL

REGION 7: SOUTH WALES

RR: Glyn Jones, GW0ANA, RR7@rsgb.org.uk

Aberystwyth & District ARS
Ray, GW7AGG, 01970 611 853
14 Intro to radio for Foundation candidates
28 Club net, starting on 145.500MHz

Blackwood & District ARS
Rob, MW0CVT, 0797 471 7152
28 End of the Pixie Challenge

Llanelli ARS
Steve, MW6CCG, 0787 849 4337
4 On the air night and club raffle
11 DVD night
18 Social evening
25 GB4SDD (St David's Day), junk sale, raffle

Newport ARS
Margaret, GW4SUE, 01633 665 289
7, 14, 28 Club night
21 Tetra and DMR radio systems, Phil, GW4REX

REGION 8: NORTHERN IRELAND

RR: Philip Hosey, MI0MSO, RR8@rsgb.org.uk

Bangor & District ARS
Harry, GI4JTF, 0289 042 2762
7 Early amateur equipment, N Newell, GI3YMY

REGION 9: LONDON & THAMES VALLEY

RR: Tom O'Reilly, G0NSY, RR9@rsgb.org.uk

Aylesbury Vale RS
avrs@rakewell.com
13 Discussion evening

Burnham Beeches RC
Greg, G4EBY, ebytronics@gmail.com
3, 10, 17, 24 Club net, 10.30am, 145.500MHz
4 Club night
18 Show & Tell and Construction Award judging

Chesham & District ARS
Terry, G0VFW, 01442 831 491
6 Using the Western HF10 antenna, Jeremy, G3XZG
20 CW evening

Edgware & District RS
Mike, G4RNW, michael.stewart5@ntlworld.com
28 The RSGB in wartime, Steve, G0PQB

Milton Keynes ARS
Phil, G4FVZ, 0780 263 6998
11 Intro to FT8, Martyn, G0GMB; at NRC
25 Shack safety, Andy, M0GYK

Newbury & District ARS
Rob, G4LMW, 0797 088 5614
27 TJ2TT DXpedition DVD

Radio Society of Harrow
Linda, G7RJL, lcasey100@outlook.com
1 At a Distance, Colin, G1IGA
3, 10, 17, 24 Club net, noon, 1938kHz LSB
4, 11, 18, 25 Net 8.15pm, starting on 145.5MHz FM
15 High in the sky, Tony, G7ETW
24 Activities in club shack, 2-5pm

Shefford & District ARS
David, G8UOD, 01234 742 757
7 Construction winners' talk
14 Aircraft communication, Don, G4LOO
21 Apps for radio amateurs discussion
28 Background noise discussion

REGION 10: SOUTH & SOUTH EAST

RR: Keith Bird, G4JED, RR10@rsgb.org.uk

Brede Steam ARS
Martin, M0MJU, m0nuc.bsars@gmail.com
2, 5, 12, 14, 19, 21, 26 Operating at the shack, 9am-2pm
7, 14, 21, 28 Club net, 8.15pm, GB3ES

Bredhurst R&TS
Nicky, secretary@brats-qth.org
2 Coffee morning
7, 14 Quiz night
21, 24 Pre-rally meeting/Rainham Radio Rally
28 Rally debrief

Bromley & District ARS
Andy, G4WGZ, 01689 878 089
6, 13, 20, 27 Net, 9pm, 145.500MHz and QSY
17 Intermediate course
21 Club meeting

Cray Valley RS
Dave, G8ZZK, 0773 954 9822
7 Practical introduction to meteor scatter
21 Club night

Crystal Palace R&EC
Bob, G3OOU, 01737 552 170
1 AGM
6, 13, 20, 27 Net, 8pm, 145.525MHz ± QRM

Darenth Valley RS
Mike, G8AXA, 0788 415 7776
13 The Sun & its effects on us, Steve, M0HRY
27 Natter night & on the air

Dorking & District RS
David, M6DJB, djb.abraxas@btinternet.com
26 Slim Jim/J-Pole antennas, Tom, G4DFA

Dover ARC
Aaron, M0IER, 0771 465 4267
7 SDRplay presentation and demo

Farnborough & District RS
Mel, M0JMR, sec@farnboroughradio.org.uk
New venue: Boyce Building, Aldershot Army Museum, Queens Avenue, GU11 2LG
13 Bandwidth required for LTE and 5G
27 Life from the other side

Fort Purbrook ARC
Chris, G3WIE, g3wie@fparc.org.uk
4, 11, 18, 25 Open net, 8pm, 145.275MHz
22 Test and soldering equipment, room FP-1

Hastings E&RC
Gordon, M3YXH, 01424 431 909
3, 10, 17, 24 Net, 11am, 144.575MHz
27 AGM & 'bring your mystery thing'

Hilderstone RS
Ian, 2E0DUE, secretary@g0hrs.org
14 APRS, Paul, M5AAD
16 Thinking Day on the Air
28 Natter night

Hog's Back ARC
Ray, G4LUA, 0118 981 4174
11 Natter night and CW practice
25 Annual General Meeting

Horndean & District ARC
Stuart, G0FYX, 02392 472 846,
www.hdarc.co.uk
1 Club night
15 Sailing the Atlantic in a small boat, Russ, G4SAQ

Mid Sussex ARS
Peter, G4AKG, 01444 239 371
1, 22 Radio night/
8 Natter night
15 Dissecting the doublet antenna, John, G8JBJ

Surrey Radio Contact Club
John, G3MCX, 020 8688 3322
1, 8, 16, 24 Net, 8pm, 145.350MHz
3, 10, 17, 24 Net, 9.30am, 1905kHz
4 Millimetric Microwaves with Chris G0FDZ
7, 14, 21, 28 Net, 8pm, 70.300MHz
18 Fix-it, move-it-on, skills, advice & chat

West Kent ARS
Keith, G4JED, 01732 446 331
11 Open meeting

The March *RadCom* deadline is 23 January and for April it's 20 February; get your May news to us by 27 March.

REGION 11: SOUTH WEST & CHANNEL ISLES

RR: Martin Sables, G7NTY, RR11@rsgb.org.uk

Exeter ARS
Ivor, G6ATJ, g6atj@hotmail.co.uk
5 Net, 7.45pm, GB3EX
12, 19, 26 Net, 7.45pm, GB3EW
13 Fun night, Pete, G3ZVI & Slade, 2E0SQB
27 Data modes best operating practice, 2E0SQB & M0IHT

Exmouth ARC
Mike, G1GZG, 01395 274 172
6 AGM

Mid Somerset ARC
David, G8BFV, 01749 670 085
11 Digital modes, Dave, G3ZXX

Poldhu ARC
Keith, G0WYS, 01326 574 441
12 Early wireless operators, G3PLE

Riviera ARC
rivieraarc@gmail.com
7 SDR night
20 Natter night

Torbay ARS
Kerry, M0KRE, kerry@m0kre.net
1, 15 Club meeting
1, 8, 15, 22 Club net 3.663MHz, 9.15pm
2, 9, 16, 18, 23 Club net, 3.663MHz, 10am
4, 6, 11, 13, 20, 25, 27 Club net, 3.663MHz, 10.30am
3, 10, 17, 24 Club nets, 14.270MHz, 9.30am, 145.575MHz, 12 noon
4, 11, 18, 25 Club nets 1.982MHz, 8pm, 50.155MHz, 8.30pm
6, 13, 20, 27 Club nets 14.270MHz, 9.30am
8 Business meeting
22 AGM

South Bristol ARC
Andy, G7KNA, 0783 869 5471
7, 14 Quiz night/Technical topics
21 FT8, Steve, G0UQT
28 Open house and on air night

Weston Super Mare RS
Martin, G7UWI, g7uwip@googlemail.co.uk
4, 11, 25 Club night
18 Main meeting

REGION 12: EAST & EAST ANGLIA

RR: Peter Onion, G0DZB, RR12@rsgb.org.uk

Cambridge & District ARC
Richard, G4AWP, 0770 229 5300
8 History of microwave engineering, William, M0WJE
22 History of amateur TV + demo, Ian, G3KKD

Felixstowe & District ARS
Paul, G4YQC, pjw@btinternet.com
4 Rig clinic
18 Amateur satellites, Jason, G7OCD

Harwich ARIG
Kevan, 2E0WMG, 0749 352 1049
13 RSGB VHF Propagation Studies video

Huntingdonshire ARS
David, M0VTG, secretary@hunts-hams.co.uk
13 NRC, Mervyn, G4KLE
28 Baldock, Jim, G4DKW

Norfolk ARC
Chris, G0DWV, 01603 898 308
6 DX Engineering Skype talk by Tim, K3LR
13 Informal + Morse in computer room
20 Retro technology night
27 Informal, Bright Sparks, Morse in computer room

Peterborough & District ARC
Alan, G8XLH, secretary@padarc.co.uk
1, 15 Club net, 8pm, 145.400MHz
7, 14, 21, 28 Net, 1.980MHz, 8pm
13 Surplus equipment sale
27 Refurbishing an RCO (DVD)

Thames ARG
Patrick, G8JLM, 01621 855 461
1 Deciphering strange HF signals, Gary, M0ICG
8, 22 Nets: CW, 7.30pm, 144.250MHz; GB3DA, 8pm
15 TARget Night

REGION 13: EAST MIDLANDS

RR: Jim Stevenson, G0EJQ, RR13@rsgb.org.uk

Loughborough & District ARC
Chris, G1ETZ, 01509 504 319
5 TX Factor video night
12 The other man's shack: Ian, G8SNF
19 Back to basics: capacitors / inductors
26 Practical evening

Melton Mowbray ARS
Phil, G4LWB, 01664 567 972
15 Club meeting

Nunsfield House ARG
Paul, G1SGZ, pr@nharg.org.uk
1, 8, 15, 22 Club night
4, 11, 18, 25 Shack night
7, 14, 21, 28 Club net, 8pm 145.325MHz

RAF Waddington ARC
Bob, G3VCA, 0797 116 6250
1, 8, 15, 22 Club night
4, 11, 18, 25 Club net 145.325MHz 8pm

Spalding & District ARS
Graham, G8NWC, 0775 461 9701
17 Junk sale, 9.30, Bromley Hall

Shefford & District Amateur Radio Society celebrates 70 years in style

In 1948, a group of local amateurs gathered together in Shefford, Bedfordshire to see if they could form an amateur radio club. They included several prominent callsigns of the time such as Doc, G3JKK, Bill Western, G3TDW, Walt Bigley, G2AUA and Claude Pettifar, G2DPQ. Originally they met at the Old Wharf Building by the River Flit in North Bridge Street but later moved to the village hall, where the society has remained since.

The celebration was attended by the Town Mayor of Shefford, Councillor Paul Mackin, who gave a speech praising the club's endeavours over the decades and adding one or two of his own reminiscences. Also there was RSGB General Manager Steve Thomas, M1ACB (extreme right of photo), who congratulated and saluted everyone present and, later, cut the celebratory cakes.

There have been many high-profile visitors during the existence of Shefford Radio Society. One who made a lasting impression was the late Professor Colin Pillinger, who told members of his Beagle 2 spacecraft to Mars that, unfortunately, proved unsuccessful – but not for the want of best wishes from Shefford!

What is the secret to the Society's success? Chairman Ken summed it up, saying, "We continue to invite speakers to instruct us on the widest possible aspects of our hobby and, with weekly meetings, that amounts to quite a programme! We have teams operating in the international radio contests, we run an annual construction contest, we go out on DF events on foot or by car and we have members supporting local events such as the Shuttleworth Steam Fair. Individuals play a vital role, for example Richard Porter, G3NII, who has provided kits for club construction projects including a noise canceller, an antenna analyser, an L-C bridge, a Top Band DF RX, a data-mode interface and lately a CW keyer, each time ensuring that each kit has ALL the parts. Our archivist Brian Fairy deserves particular mention too. He has preserved an amazing collection of the club's artefacts and memorabilia and has recently compiled a book containing a short history of our club through the eyes of our members and their stories."

INTERNATIONAL

The **Pafos Radio Club** Cyprus held its Christmas party in mid December, several members turned out. As is usual the Club Secretary announced the Pafos Club Amateur of the Year Award for 2018, this went to Mike, 5B4ALJ for all the work he has done in promoting digimodes in Cyprus. The Pafos Club can be found on talk group 280.

REGION 1: SCOTLAND SOUTH & WESTERN ISLES

Wigtownshire ARC has been planning to hold meetings in a more central location in Dumfries & Galloway to that of its main base in Stranraer. The two largest centres of population in the County, Stranraer and Dumfries, are 70 miles apart. The venue chosen was Gatehouse-of-fleet, roughly halfway between the two, and the first such meeting was on 6 December. Ian Macdonald, GM8AVM gave his talk on *A wee history of amateur radio* to fellow members. Members from both east and west attended. The club will be holding more meetings there during this year's session.

REGION 2: SCOTLAND NORTH & NORTHERN ISLES

Montrose Air Station Heritage Centre Radio Club would like to congratulate Leslie, MM6XMQ on passing the Intermediate exam in December.

Dundee ARC held its AGM and annual awards presentation in November. Colin, MM6KOJ won the SSB Quaich for QSOs over a period and Ian, MM0HRI was presented a shield for services to amateur radio.

REGION 3: NORTH WEST

The last December meeting of **Furness ARS** was a talk and live demo of Software Defined Radio by Chris, MOTES, accompanied by Christmas nibbles. The event saw a good turnout of club members. After the talk, members were able to 'play' with the different SDRs that had been used for the demonstration to allow them to get a hand on feel for how they work. The busy year came to an end with the annual Christmas quiz by Dave, G3VUS – a general knowledge quiz for club members and their families, held at the Farmers Arms. Dave puts a lot of effort into the quiz, ensuring there is a wide range of questions to suit everyone's tastes.

Isle of Man RS would like to congratulate all three members who took and passed recent exams. Robert and Christopher passed their Foundation and Kim progressed to his Intermediate. The recent AGM was well attended and the new list of committee members and their positions is available on the club website, https://iomars.wordpress.com.

Castle Rushen High School has an active radio club (MT0GLK) that takes part in many radio based activities as well as training members for the amateur radio exams. The latest success is Archie, who has just passed his Advanced exam and now has the call MD0OOH at only 14 years old. He is proud of the fact that he got his Foundation at 12, his Intermediate at 13 and his Advanced at 14, and that he beat both his older brother and his Dad to the Full licence. Archie is hoping to get a station at home soon, until then he will be operating the school club station not only for normal QSOs but also for contests and for special events such as GB18YOTA, which the school is hosting.

In December 2018, Stockport RS held its AGM with 40 members in attendance. The new Committee would like to thank everyone who turned up and for their donations to Walthew House. Neil, M6NAE has joined the Committee in a new role of Digital Radio Co-ordinator and Nigel, M0VNL is now Station Manager. Thanks to Phil, M0XYA for his time and expertise as Station Manager and his time on the Committee. Phil will still be assisting the Committee in a technical role.

REGION 5: WEST MIDLANDS

Cheltenham ARA held their 42nd AGM, attended by 32 members, in December. The Chair, Tony, G3YYH, reported on a successful year with many highlights including two fun Field Days, Foundation and Intermediate courses, a visit to Ben Nock's Military Wireless Museum and a good display of home-constructed equipment at the annual constructors' exhibition. The G3GWW Award for exception services to the club was awarded to Smurf, M0URF and the G3CEG Cup for notable on-the-air activities to Tony, G3SNN. The Committee for 2019 was elected: Chair, G3YYH, Secretary, G3NKS, Treasurer, G3YJE, committee members M0MVA, M0NRO, M0YNG. The club now meets at the Robin's Nest at the Cheltenham Football Club.

REGION 6: NORTH WALES

On 10 October 1918, *RMS Leinster* (the mail boat), sailing between Dun Laoghaire and Holyhead, was torpedoed just off the Irish coast, resulting in the deaths of 567 passengers and crew. This was the largest ever loss of life in the Irish Sea. The centenary of this event was commemorated in October through a number of ceremonies in and around the Dun Laoghaire area. The National Maritime Museum Radio Club, EI0NMM, is based in the National Maritime Museum in Dun Laoghaire and participated in the commemoration. Two of Dragon ARC's members – John, MW0JWP and Paul, GW1PCD were in Dun Laoghaire for the commemoration and spent much of the day in the museum. Paul used the Museum's 2m station to keep his fellow club members in Wales posted on the day's events as they also had a special event station on the air.

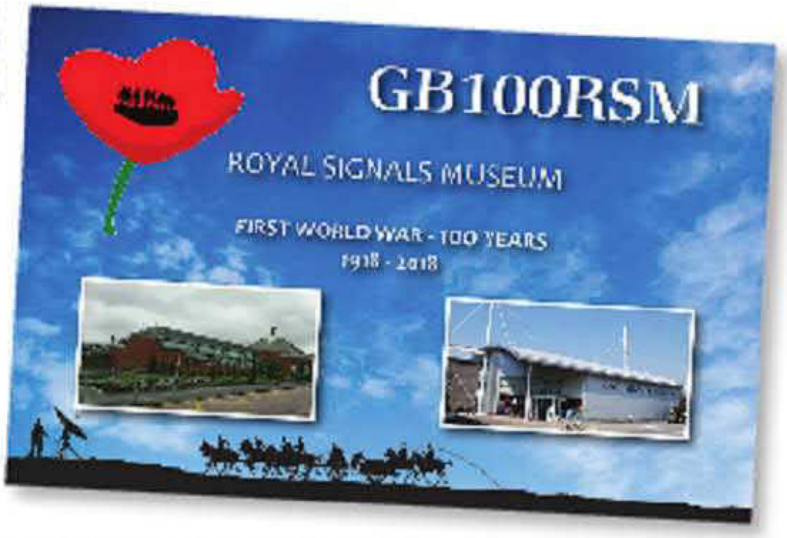
REGION 8: NORTHERN IRELAND

In February, the **Bangor & District ARS** meeting will incorporate a talk by Norman, GI3YMY on the early radio amateurs. Crystal sets and home-made TRF radios will be on display, followed by a selection of Second World War military surplus radios.

REGION 10: SOUTH & SOUTH EAST

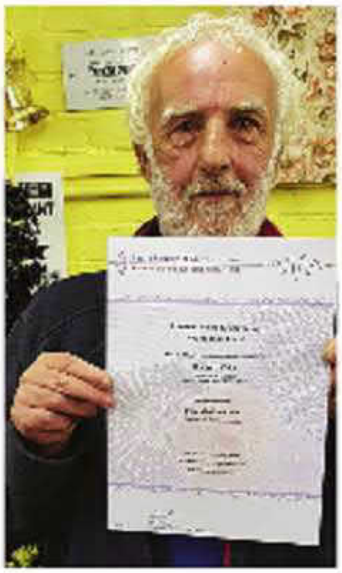
Farnborough & District RS have moving their meeting venue to Aldershot Army Museum, just off Queens Avenue, Aldershot, Hants GU11 2LG. Meetings start at 7.30pm on the 2nd & 4th Wednesday. See www.farnboroughradio.org.uk

Marsham ARS meets monthly, although the day can vary month to month, at The Club House, Wood Field, Fairlight. Contact sec.m0vft@gmail.com for more information.



GB100RSM was set up at Hillview School in Bournemouth as part of the two day visit by The Royal Signal Museum team on 6 and 7 November. Hillview School is a primary school with some 650 pupils aged 5 to 11 years old. The callsign reflected the 100 year anniversary of the end of World War 1 and was part of the week's Remembrance Activities at the school. The aerials were a 40 and 20m inverted vee on a mast on top of the school hall and the rig was a TS-570, kindly loaned and operated by Ian, G3YUZ. Unfortunately the noise level of S7/S8 meant only really strong S9 signals could be heard and contacted so our apologies to all those stations that we simply could not hear in the noise. It also meant that skeds with stations in Ypres, Tyne Cott and the Somme could not be completed, much to our disappointment. Overall we managed 74 contacts in 20 countries; best DX was Russia and Malta but all the schoolchildren were able to listen and take the mic during these QSOs. Four activities were designed for the children to be 'hands on and military communication phones/handheld radios could be used while hearing about the history from Heliographs on the North West Frontier in 1897 to modern military systems. The Morse instruction and semaphore activities were very popular with all age groups and the secret codes and ciphers also created a lot of interest.

BBC Radio Solent attended and interviewed Adam Forty, the Museum assistant director, Gemma Roots, School History Lead, and a 6 year old pupil Amelia Perks. The school children are now eagerly awaiting the QSL cards from our contacts to display against a map of Europe .



REGION 11: SOUTH WEST & CHANNEL ISLES

Cambridge & District ARC entered the RSGB DX Contest on Sunday 7 October using the club's FT-2000, a DX Commander fan vertical and 140 foot doublet. G4AWP, G0LRD and G8CRB managed to activate GX2XV for the best part of 18 hours, making 110 QSOs.

The main September meeting of **Peterborough & District ARC** was a talk by club member, Derek G3KHZ, on his DXpedition to Bangladesh last year. The station was set on two rare islands, Bhala Island, IOTA reference AS-140 and St Martins Island, AS-127 respectively. Derek was accompanied by SM6CVX, G4EDG, DL6KWA. Local amateurs S21ED and S21TV helped with officialdom and local arrangements as well as taking part in the DXpedition. The two islands had not been activated for many years and the callsigns used were S21ZDC, S21ED and S21TV. Derek said the DXpedition was a huge success and he is grateful to all those involved. Details of the equipment used and contacts made can be found at http/s21iota.weebly.com/ Derek's next DXpedition will be to Papua New Guinea in 2019.

To help budding radio amateurs in East and West Dorset, **Sidmouth ARS** will be holding training courses at Foundation and Intermediate Level in 2019. Amateurs requiring help with Advanced level are also invited to contact them. Every encouragement and assistance will be given and total beginners are very welcome. For further details or to register interest visit www.sidmouthars.org.uk

At the November monthly meeting of **Torbay ARS**, Tony, G6GLP presented a talk on how to get prepared for contesting, with many aspects that even some of the more experienced operators found noteworthy. Topics included the set up of the shack; such as clearing a work desk and room for the operator and logger if one. The check out of rigs, antennas and tuners for the bands and most import check the rules for things such as times, band plan, exchange and should there be other contests running what they may require if you get called. Then was the inevitable discussion on logging programs and preferences. Kerry, M0KRE described and demonstrated a piece of very clever DF equipment that can be made for under £5 all in. It took the form of a couple of PIN diodes alternately switched on and off to feed phase shifted RF to a receiver. This would produce a null when the two antenna were at 90° to the source and if in line would produce a tone. Two readings would be required from different locations to get a cross mark on a map. Many thanks to all the club members involved for a very informative evening.

REGION 12: EAST & EAST ANGLIA

November was a busy month for **Peterborough & District ARC**, with two meetings plus a Foundation exam for 6 candidates, all of whom passed. Congratulations to them. Tony, G0IAG, gave a report on the many Special Events that PADARC that had taken place during 2018. He said the events had been very successful and the club had gained members and great publicity as a result. To round off 2018 PADARC members operated GB900PC until the end of the year from their home QTHs within the Peterborough district. This has been authorised by Offcom to coincide with the continuing celebrations of the 900th anniversary of Peterborough Cathedral. At time of writing over 800 contacts have been made on voice, PSK 31 and CW. The annual Christmas party saw table magic by John Learoyd. John, a local magician and member of the Magic Circle, baffled all with his tricks and sleight of hand. A really nice Christmas Party.

Members of the Norfolk ARC contest team with the Horace Freeman Trophy for winning the general category of the RSGB 80m Club Championship again in 2018. The club has more than 100 members, a history dating back to the 1950s and has an active calendar of talks, events, special event stations and courses. Its activities include putting on special event radio stations to celebrate events such as Marconi's birthday and Railways on the Air, plus Bright Sparks events for youngsters who are interested in electronics.

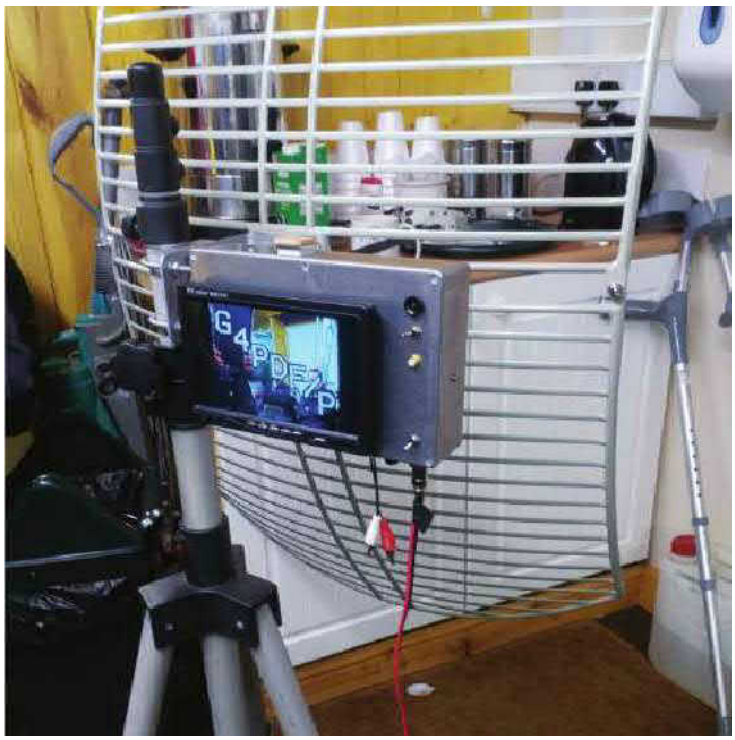
Braintree & District ARS held their annual surplus equipment sale. Items generously brought along by members together with some SK effects, included bundles of cables and packages of components, an oscilloscope, a range of power supplies, loudspeakers, soldering irons, microphones, an antenna, various items of test equipment and a substantial winch. Dave, G0DEC worked his way up and down the tables describing the goods and Melvin, G0EMK acted as auctioneer. Those items not sold during the evening will be taken to the Canvey rally.

Next deadlines

March edition: 24 January
April edition: 21 February
Full list: tinyurl.com/RC-2019-deadlines

REGION 13: EAST MIDLANDS

The winning entry in this year's **Lincoln SWC** construction contest for the Joe Rose Memorial Trophy was the portable 5GHz ATV transceiver made by Bob, G4PDF. The equipment was all installed in a box that was mounted to the back of the dish, then fixed to a tripod. The transceiver included a screen overlay showing his callsign and also converted a received GPS signal into a locator that is also displayed.



For Sale

FIBREGLASS TUBE
High strength tube, square box, rod, and other sections stocked in 6m lengths, can be cut. Engineered Compositions, Chester. Tel: 01244 676000 e. info@engineered-composites.co.uk www.engineered-composites.co.uk

SINOTEL UK - AUTHORISED UK
importers for Xiegu, TYT & Baofeng. HF & mobile transceivers, handhelds, accessories, antennas and more. www.sinotel.co.uk, 01926-460203, sales@sinotel.co.uk

CTCSS ENCODER AND DECODER KITS, DTMF Kits and Modules, PIC Microcontroller Development Kits. www.cstech.co.uk

CHECK OUT OUR WEBSITE
for lots of new and exciting items! Windows 10 ready CAT and programming cables, latest version SDR USB sticks, replacement microphones, cables and PTTs for studio microphones, linear switching cables and much more. technofix.uk or www.technofix.co.uk

DX COMMANDER MULTIBAND VERTICALS
Best price / performance of any commercial HF vertical. See www.m0mcx.co.uk and check out DX Commander on YouTube. qrz@m0mcx.co.uk

Equipment

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

RADIO REPAIRS BY M0NKL
Icom, Yaesu, Kenwood etc, plus linear amplifiers, please contact Nick on 07770 397668 or email np262@yahoo.com

Wanted

VINTAGE RADIO & VALVES WANTED national cash settlement for silent key, shack clearouts 07552 678725, vintageradio@btinternet.com

Aerials

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For quality HF Wire antennas, BALUNs, UNUNs, VHF/UHF base or mobile antennas, all made in England, for QRP to QRO. Also available accessories and kits for home builders. At a price to suit your pocket. www.m0cvoantennas.com

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G4TPH MAGLOOPS BACK IN PRODUCTION.
Remote tune and manual tune models for 40m through 10m. Details at www.g4tph.com

QUAD BAND COLINEARS.
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NEW ANYTONE ATD868UV 2/70 DMR + ANALOGUE handheld radio, 4000 channels,built in GPS, Multiple DMR ID's , inc charger, program lead, handbook etc£139.95, QYT KT8900D 2/70 25/20w mobile only £79.95 ea, Mirfield Electronics 07825549430 www.mirfield-electronics.co.uk

HAMTENNA UK
Manufacturers of Antennas, Baluns, Ununs and suppliers of antenna wire and accessories. Checkout www.Hamtenna.co.uk

COMMERCIAL BALUNS
Professionally made commercial baluns and matching transformers, multicore Mil spec, resin potted, IP68, custom made by Geoff Brown G4ICD. www.rfcomms.co.uk or www.rfcomms.uk

PRO ANTENNAS
Happy New Year from Pro Antennas. Why not get the new year off to a good start with a new, compact HF antenna. Visit www.proantennas.co.uk for details.

Miscellaneous

ALL UK STATIONS – CALL IN ON OUR 'M1CRA' CHRISTIAN NETS!
WACRAL welcomes all amateurs & listeners to our Sunday morning 'GOOD NEWS' nets, now at 0730-0830 on 3.747 MHz +/- QRM and, again, at 14.00-15.00 on 7.147 MHz. Or, do join us on Wednesdays 07.30 3.747 MHz +/- QRM, 10.00 on 7.147 MHz (if no contact established after 5 mins QSY to 3.747 MHz and 21.30 on 3.751 MHz, for nationwide Christian fellowship and relaxed chat. All UK Local times. See www.wacral.org for more net info and WACRAL details or just call Ian G4OPP on 01622 746650 or g4opp@wacral.org

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Payment to: RSGB, 3 Abbey Court, Priory Business Park, Bedford, MK44 3WH

Advertising. All display and classified advertising enquiries (except Members' Ads, which go to memads@rsgb.org.uk) should be sent to: Chris Danby, G0DWV, Danby Advertising, Fir Trees, Hall Rd, Hainford, Norwich, Norfolk NR10 3LX
Tel/Fax 01603 898 678
e-mail adsales@rsgb.org.uk

Business Cards

Advertisers Index

FREE MEMBERS' ADS

Members may email a Members' Ad of up to 40 words to memads@rsgb.org.uk. **You must include** your name, callsign, phone number, email address and location (these details are not counted in the 40 word limit). Optionally, attach your own photo of the item (*at least* 800 x 600 pixels, in good focus and well lit). DO NOT just download a photo off the internet. Maximum of 1 ad per Member per month; other terms & conditions also apply (see tinyurl.com/MemAdsInfo). We no longer accept ads by post or phone.

FOR SALE

70MHz TRANSCEIVERS Two Wouxun KG-699E handheld transceivers, manuals and charger. Mint condition, £120. Yaesu FT-290R with microphone, good condition, £80. MFJ201 dipmeter, boxed, mint condition £80. GW Instek GOS652G 50MHz dual trace scope, mint condition £90. All include uninsured delivery. Ian, G3YUZ, 01202 767 001, i.c.wilson@open.ac.uk (Bournemouth, Dorset).

ALINCO DX-SR9E TRANSCEIVER, 18 months old, standby base rig & hardly used. Excellent condition, all boxes, instructions. With 5MHz band & ERW7 program lead included – about £60 extra on new price. Collection or carriage at cost. £380. John, G0JYL, 0797 417 9546, jaj.bartram@btinternet.com (Westbury, Wiltshire)

AS NEW, HARDLY USED PL155 15V 5A current limit PSU. Cost me new £300. Asking £100 incl. leads and manual. Not switch mode but heavy-duty transformer. Reason, downsizing. G3ASE. 01480 463 129, bobg3ase@gmail.com (near Cambridge).

DENTRON CLIPPERTON L linear amplifier. Mint condx. 1200W, DX100 mint, good valves in both no marks on either. Codar AT5 plus PSU and leads. Mint. Icom 7100 RX plus remote-control full factory spec. Sensible offers on all. G3WRT, SMS 0754 916 0011 (Ipswich).

ICOM IC-7100 for sale £750 ono. Covers HF, 6m, 4m, 2m and 70cm. All mode including D-Star. All original packaging, manual and HM-151 multifunction microphone. Excellent, as new, condition. Head unit with screen protector shown. Scott, GM4CLQ, 0791 922 0174, gm4clq@gmail.com (Larkhall, Scotland).

ICOM IC-756 Pro 2 and Diamond GSV3000 power supply, hand mic, pwr. lead, unmarked and boxed, £550. Buyer to collect please. Ken, G3XSJ 01179 683 003 g3xsj@btinternet.com (Bristol).

MFJ259C new, boxed, £270, carriage included. M0CVO 4:1 high power balun, unused, £25, post included. Pair Spectrum Communications 40m traps, £40, post included. Pair Spectrum 80m traps £40, post included. Yaesu FC-902 ATU, excellent condition, boxed, manual, £180, carriage included. John, G4YDM, 07903 336 038, g4ydmone@gmail.com (Washington, Tyne & Wear)

PORTISHEAD RADIO on the line classic Marconi Rx CR150/3 2Mc/s to 60Mc/s double superhehet xtl filters S-meter original in correct plinth cabinet as used by GKA c/w AM type 3 power supply. GWO, £220. M0BGA, clive.r1155@gmail.com.

SAMLEX SEC1225G power supply, 23A at 230V, virtually unused £80. Heil Pro-Set K2 headset & mic, also virtually unused, £75. p&p extra at cost or collect. Chris, M0PSK, 01568 610186, chrism0psk@gmail.com (Leominster).

SK SALE obo late Jim Finch, G1NZQ of Hednesford. Various rigs ham and CB, including associated equipment, and two sets of antenna masts. For lists, contact Alan via m0iqx@btinternet.com .

US NAVY GENERAL RADIO CO Wavemeter Type 758-A 55-400 megacycles in beautiful condition. A lovely instrument - check it out on the net. £25 post free to UK. David Bennett, G0WQQ, dandrbennett@btinternet.com (Princes Risborough).

YAESU FT-3200D VHF 2m mobile transceiver FM/C4FM Fusion 144 to 146MHz. In excellent working order had very little use boxed as new with mic & manuals. Mobile mount not used + DC lead, 65/30/5 watts £129. Doug, G8KOM 01628 822 453, satmobile@hotmail.com (Reading, Berks).

YAESU FT-897 good condition, boxed, £500. LGD. ATU for 897, £75. FC30 ATU for 897, £100. Collection or carriage at cost. Paul, G1DXQ, 0791 984 6277 (Norwich).

WANTED

ANYONE WITH KNOWLEDGE or possession of 1930s German microscopes, especially Hensoldt Metami microscopes, please contact Joe, M6XEW, 01252 712 431, Wasilewski.joe@outlook.com (Farnham, Surrey)

COMMAND SET transmitter for 80m, type BC-696-A, T-19/ARC-5 or CBY-52208. A rack with connector and a suitable power supply as well would be ideal but not essential. Contact John, M0BIC, 0779 249 7854. jbrock1154@yahoo.co.uk (Lincolnshire).

DENCO MAXI-Q IF transformers. IFT6/1.6MHz and IFT11/465kHz. Needed for valve Rx project. Can arrange carriage. Frank Martin, G7GQP, 0795 555 0591, frankm@btinternet.com, (Washington, Tyne & Wear).

GELOSO VFO 4/104 with plastic dial, also high impedance microphone. Brendan EI4BB, ei4bb@yahoo.ie, 00 353 87 2508651 (Dublin).

HAMTRONICS WEATHER satellite receiver R303-137 or R139, working or not working, kit or assembled. Ray Collins, M1FJL, 01749 870 517, ray@collins05.plus.com (Wells, Somerset).

HEATHKIT HP23A Working condition preferred but non working considered. Part wanted is the Transformer. David Seabrook, G4LJG 0759 734 2975, david1.seabrook@ntlworld.com (Rushden, Northamptonshire).

KW2000B, good cosmetically, requiring TLC acceptable. Can collect reasonable distance or will pay carriage. brian.tibbert1942@hotmail.com (Ilkeston, Derbyshire).

LDG M-7600 meter - the one that matches the Icom IC-7600. David, G5HY, 07912 619 001 david@g5hy.com (nr Ringwood, Hants)

NATURAL RADIO ELF extreme low frequency 3Hz-20kHz experimenter in "whistlers and 'sferics" for telephone and email guidance with thanks. Dave, G7GZC, 0798 488 1430, g7gzc@hotmail.co.uk (Twickenham).

SILENT KEY CLEAROUT or just not wanted - please don't throw them away. I collect QSL cards for historic interest and research Any date but prior to 1970 preferred. Can collect or arrange collection. Tony, G4UZN, AQuest1263@btinternet.com (Leeds)

SPE EXPERT 1K-FA amplifier. Stan Hunt. G1VUK 01580 881968 dreamer1605@icloud.com (Robertsbridge, East Sussex).

RALLIES & EVENTS

Members of the RSGB Regional Team will be present at the rallies this month marked with an RSGB diamond.

If *your* rally or event is not listed here,
PLEASE SEND US FULL INFORMATION
by email to radcom@rsgb.org.uk

3 FEBRUARY
SEARS 35th CANVEY RADIO & ELECTONICS RALLY

Cornelius Vermuyden School, Dinant Avenue, Canvey Island, Essex SS8 9QS.

A new venue for 2019 and doors open at 10am, disabled visitors can come in from 9.45am. There is free car parking and easy level ground floor access to 2 large halls. Admission cost is £3. Tea, coffee and soft drinks will be available, as well as bacon butties. There will be radio, computing and electronics traders and special interest groups. More details from the rally co-ordinator on tony@tonystreet.net

8-10 FEBRUARY
73rd ORLANDO HamCation®

Central Florida Fairgrounds and Expo Park, 4603 West Colonial Drive, Orlando, Florida 32808, USA Over 150 commercial vendors, more than 200 swap table vendors and the largest tailgate area in the southeastern US, will show and sell amateur radios, parts, computer hardware and software and other interesting electronic items for a growing group of radio enthusiasts. Over thirty forums held at the Lakeside Pavilion will present a diverse range of topics including digital amateur radio, new software developments, youth and amateur radio. K1AA will be the operating as a special

SPECIAL EVENT STATIONS

No special event information had been received from Ofcom at the time this page was sent to press (7 January), but if any does arrive, we will publish it on the RSGB website *RadCom* pages.

The RSGB will do its best to publicise your special event and its callsign, but you must help us to help you. On the back of Ofcom's Special Event Station NoV application form there is a Data Protection section. Unless you specifically tick the Yes box, Ofcom cannot tell RSGB about your event, which means it won't appear here, on GB2RS, or on the RSGB website. (If you don't tick either box, it's automatically assumed to be 'no'). So please tick Yes!

Please also send advance publicity information about your special event to radcom@rsgb.org.uk so we can feature it in Club Calendar, the News pages and/or other parts of *RadCom*, the Newsletter and on the RSGB website.

event station and talk-in station. HamCation® is the second largest ham shows in the United States and third largest in the world after Tokyo and Hamvention with over 22,300 visitors last year. www.hamcation.com

10 FEBRUARY

HARWELL RADIO AND ELECTRONICS RALLY

Didcot Leisure Centre, Mereland Road, Didcot, Oxon, OX11 8AY (3 miles from Milton Interchange on A34)

Doors open 10am to 3pm - admittance £3 (under 12s free). Free car parking. Disabled parking and facilities. Traders, Special Interest Groups and RSGB Bookstand. Refreshments available all day. Talk in on 145.550MHz, using G3PIA. Details from Ann, G8NVI by email to rally@g3pia.net [www.g3pia.net/radio-electronics-rally].

17 FEBRUARY

RADIOACTIVE RALLY

Nantwich Civic Hall, Cheshire, CW5 5DG.

The venue has free car parking and the doors open at 10.30am. There will be a Bring & Buy, as well as traders and RSGB book stall. A single raffle ticket is included with the entrance programme with additional tickets available. Catering is provided on site. Contact Stuart Jackson on 0788 073 2534.

24 FEBRUARY

RAINHAM RADIO RALLY

The Victory Academy, Magpie Hall Road, Chatham, Kent, ME4 5JB

Doors open 10am to 4pm, £2.50 adult entry, free entry for kids. Local and national traders, BRATS Kitchen, BRATS Interactive Zone for kids, BRATS junk, talk-in station on 145.550MHz using GB4RRR.

24 FEBRUARY

RED ROSE RALLY

St Josephs Hall, Chapel Street, Leigh WN7 2PQ

Doors open 11am. Details on the internet at www.wmrc.co.uk

3 Mar – **Exeter Radio & Electronics Rally**
16 Mar – **Laugharne Rally**
17 Mar – **34th Wythall Radio Club Hamfest**
24 Mar – **Hamzilla Radio Fest & Electronics Fair - hosted by Dover Amateur Radio Club**
24 Mar – **Callington Radio Rally**
31 Mar – **BATC Regional Convention**
7 Apr – **Cambridge Repeater Group Rally**
14 Apr – **West London Radio & Electronics Show** (Kempton Rally)
28 Apr – **NARSA - Northern Amateur Radio Societies Association Exhibition** (Blackpool Rally)
6 May – (New Venue)
Dartmoor Radio Rally
9 Jun – **Junction 28 Radio Rally**
9 Jun – **East Suffolk Wireless Revival** (Ipswich Radio Rally)
15 Jun – **Rochdale & District ARS Summer Rally**
16 Jun – **16th West of England Radio Rally**
21-23 Jun – **HAM RADIO Friedrichshafen**
22 Jun – **Bangor & District ARS Rally**
23 Jun – **Newbury Radio Rally & Boot Sale**
14 Jul – **Cornish Radio Amateur Club Rally**
14 Jul – **McMichael Radio Rally & Boot Sale**
28 Jul – **Wiltshire Radio Rally & Electronics Fair**
9 Aug – **26th Cockenzie & Port Seton Mini Rally**
11 Aug – **Flight Refuelling ARS Hamfest**
22 Sep – **Weston-Super-Mare Radio Rally**
27-28 Sep – **National Hamfest**
6 Oct – **46th Welsh Radio Rally**
11-13 Oct – **RSGB Convention**
13 Oct – **Hornsea Amateur Radio Rally**
16 Nov – **Rochdale & District ARS Winter Rally**

NOW IS THE TIME TO TELL US ABOUT YOUR NEXT RALLY – email details to radcom@rsgb.org.uk TODAY

SILENT KEYS

We regret to record the passing of the following Members.

Name, callsign	Date
Mr J B Coyne, 5B4AIZ / G4ODV	12/2018
Mr K J Rodden, G0ASI	12/12/2018
Mr D B Delanoy, G3FOQ	16/12/2016
Mr M Smith, G3TRV	05/12/2018
Mr T P Holroyd, G3YHD	27/11/2018
Mr O L Cross, G4DFI	29/11/2018
Mr G Platts, G4XOF	12/2018
Mr L Palmer, G6FKW	9/2018
Mr M E Baxter, G8DHU	11/2018
Mr B Bourne, G8EIK	19/11/2018
Mr M J J Jones, GD4WBY	7/2018
Mr G Steward, K3ND	7/2018
Mr M Jones, M0VLN	24/12/2018
Mr R J Ingate, M3CAM	10/2018
Mr H Broadhurst, M6HBE	04/12/2018

The *RadCom* editorial team apologises to David Jackson, G4HYY, his late brother G3ZMX and also to G4JYY, for errors made in recent Silent Keys listings in *RadCom*. We are pleased to report that G4HYY and G4JYY are alive and well, despite being reported to the contrary, although G3ZMX is indeed a Silent Key. We are very sorry for any distress caused.

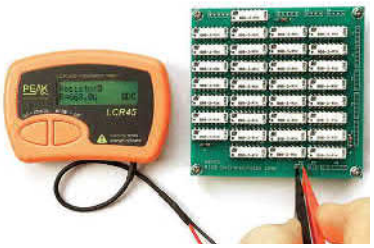
To notify us that a Member has passed away, please email details to sales@rsgb.org.uk or phone 01234 832 700, option 1. This will ensure that their Membership will be ended properly and that they appear in the Silent Keys list. We need to know the name, callsign and date of death.

Ofcom must also be informed, on 0300 123 1000 (calls charged at same rate as normal 01 or 02 numbers). From outside UK call +44 207 981 3131. We are not permitted to pass on SK details on your behalf.

RESULTS OF DECEMBER'S RESISTOR POLYHEDRA CONTEST

We are glad that a series of strong entries were made, despite the fact that we managed to omit the closing date (7 January) from the version of the competition printed in the December 2018 *RadCom*!

Many novel and inventive approaches were used by different entrants, which was really nice to see. Gordon Brindle, M6NFQ went to considerable lengths in his entry, making a bespoke PCB with 32 resistor packs that implemented all twelve puzzles simultaneously (see photo, right).



It's always hard to work out whose answers were 'best' but, on the basis of the criteria in the competition, a selection has been made by the originator of the contest, Dr Mark Foreman, G7LSZ. He writes:

In third place was David Owen, GM1OXB. He wrote his own custom, iterative software to calculate the resistances. Sadly, of the 43 resistances, his software made eight bad predictions.

In joint second place are Brian Heywood, ZL1IE and Alan Pickup, G3XLF. Both made very good entries. Their efforts are strongest intellectually as they used symmetry rules, the star / delta transformations to calculate many of the resistances, but both had to resort to building physical models for some of the challenges. Brian used a vast number of 1k resistors and a breadboard. Regrettably, Brian's measurement for the C60 puzzle was 3.4% too high, placing him outside the 2% limit criterion. All his other calculations or estimates were within 2%. Alan sadly got the resistances for the birdcage 2.8% too high, netting him the same number of right answers as Brian.

In first place was Robin Brown, G8OKE. His approach was to use commercial software (*LTSpice*) to calculate the resistors. As according to the rules G8OKE is the winner he has been awarded a £25 RSGB book token. But the joint second-placed entries were so good we have taken the exceptional step of awarding them each a £10 RSGB book token as a consolation prize.

Congratulations and thanks to all who took part, and particular thanks to Dr Mark R StJ Foreman, G7LSZ/SA6BID for setting the puzzles and adjudicating the winners. Prizes are on their way.

RadCom

HF F-Layer Propagation Predictions for February 2019

Compiled by Gwyn Williams, G4FKH

	3.5MHz	7.0MHz	10.1MHz	14.0MHz	18.1MHz	21.0MHz	24.9MHz	28.0MHz
Time	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220	000011111220
(UTC)	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020	246802468020
*** Europe								
Moscow	998.....7999	54764446776 6	..4655564...	...6666 4....	...3664 2....	...2332.....	....111.....	.....1.....
*** Asia								
Yakutsk	5.......6666	........5...	...3........	.....	.....	.....	.....	.....
Tokyo	.....	.......5....	.......3....	.....	.....	.....	.....	.....
Singapore	.....	.......55...	......44....	......3.....	.....	.....	.....	.....
Hyderabad	6.....	5.......555.	.......4....	......3.....	......2.....	.....	.....	.....
Tel Aviv	885.....6888	7773...47777	..65433563..	..2554 45....	...3533.....	...12.....	.....	.....
*** Oceania								
Wellington	.....	....55554...	....5554....	....333.....	.....	.....	.....	.....
Well (ZL) (LP)	.....	.....	.....	.....	.....	.....	.....	.....
Perth	.....	.......5544.	......453...	......33....	.....	.....	.....	.....
Sydney	.....	......554...	......44....	.....23.....	.....	.....	.....	.....
Melbourne (LP)	.....	.....	....4.......	....3.......	.....	.....	.....	.....
Honolulu	.....	.....	.....	.....	.....	.....	.....	.....
Honolulu (LP)	.....	.....	.....	.....	.....	.....	.....	.....
Samoa	.....	.....	.....44.....	.....3.....	.....	.....	.....	.....
*** Africa								
Mauritius	.....	4.........4	.......4....	.......3....	.....	.....	.....	.....
Johannesburg	.5.....	45.......555	........44..	........3...	.......2....	.....	.....	.....
Ibadan	777......777	7675....5777	4.354...5644	...543.45...	...34334....	....3222....	.....	.....
Nairobi	66.....	655.....5666	..3.....55..	...3...32...	...2.222....	.....	.....	.....
Canary Isles	9998.....899	88775...5888	6636644567 54	22.2555565..	....22.262..	........3...	........1...	.....
*** S. America								
Buenos Aires	...5.....	45.5.....	...4.....	.....	.....	.....	.....	.....
Rio de Janeiro	...5.....	55.5.....	...3.....	.....	.....	.....	.....	.....
Lima	.....	.....	.....	.....	.....	.....	.....	.....
Caracas	6666.....	55.54.....5	....4.....	.....3.....	.....32.....	.....	.....	.....
*** N. America								
Guatemala	.....	...4.....	.....	.....	.....	.....	.....	.....
New Orleans	66.....	...5.....	.....	.....2.....	.....	.....	.....	.....
Washington D.C	77775.....7	4...54...45.	.....4.334..	.....2333...	.....2.....	.....	.....	.....
Quebec	7776.....56	....4....4..	......333...	......33....	.....	.....	.....	.....
Anchorage	.55.....	.....	.....	.....	.....	.....	.....	.....
Vancouver	.555.....	.....	.....	.....	.....	.....	.....	.....
San Francisco	.....	...4.....	.....	.....	.....	.....	.....	.....
San Fran (LP)	.....	.....	.....	.....2.....	.....2.....	.....	.....	.....

Key: The figures represent approximate S-meter readings, whilst the colours represent expected circuit reliability. **Black** equals low to very low probability, **Blue** equals good probability and **Red** equals a strong probability. No signal is expected when a '.' is shown. The RSGB Propagation Studies Committee provides propagation predictions on the internet at www.rsgb.org.uk/propagation/index.php. An input power of 100W and a dipole aerial has been used in the preparation of these predictions; therefore a better equipped station should expect better results. The predicted smoothed sunspot numbers for February, March & April are respectively (SIDC classical method – Waldmeier's standard) 2, 2 & 1 and (combined method) 4, 5 & 7. The provisional mean sunspot number for December was 3.1. The daily maximum / minimum numbers were 20 on 6 December and 0 on 1-4, 9 & 10, 12 & 13 and 16-31 December.

VDSL INTERERENCE

Pete, 2E0EYM

Further to G4GHB. I too have problems. I have something that 'jams out' 2m, 6m, 17m, 20m and my air band receiver. This happens every evening around just before 7pm. It could be for less than a minute, 10 mins or half an hour – sometimes longer.

On HF, 20m and 17m, the noise level rises from around 10dB to 40dB. So no chance of hearing a QSO or, if in a QSO, you lose it.

On 2m, the meter on my Yaesu FT-897 is normally resting at zero. When the noise starts it suddenly goes to S9. I have been in QSO and I can't hear anything, but they can hear me. So it's not noise just like someone holding a mic open.

As a new Foundation holder I wasn't aware that I had a problem, until a mate came round and said "that's wrong".

So logged it for a month. I contacted the RSGB and got some info, and was contacted by EMC committee member. Because he was 30 minutes from me, I would text to say the interference was there but it would be gone before he could get to me.

I'm now a 2E0 and have still got these problems 18 months on. I built a 3-element Yagi for my hand held. When the interference happened, I used the antenna and did a 360° sweep. It was between 90 and 170° from me. So that's a start. I'm partially disabled, so it's difficult to get about and it's too cold at present to get out, so the hunt will have to continue in the New Year.

Bill, G4GHB

Shortly before my letter appeared in the January *RadCom*, in fact only two weeks before, I tried a magnetic loop for receiving. Not wanting to spend a lot of money on something that may not have worked I built one. I now receive on this and transmit on my dipoles.

The doom and gloom I was experiencing has gone and by rotating the loop for minimum noise and located as far as possible away from the noise source I am able to receive signals quite well now whereas on the dipoles it was impossible, even strong signals swamped by noise. An indoor wire was still noisy. I had a horrible QSO on CW on 7MHz one day into Sweden, just constant noise with my dipole, not an easy contact. I'd had three QSOs in eleven months and almost giving up radio.

What a difference! I can even hear stuff on 10.1MHz now that I gave up on in 2012 due to immense QRM, still some noise but stations readable. It has re-opened 60m to 17m again for me, the higher bands were not a problem. Now maybe try a loop for 160 and 80m?

It has saved my hobby!

I would really encourage anybody having similar problems to try a mag loop.

GRATEFUL THANKS

Grant Cratchley, G4ILI

I would like to record my grateful thanks to Graham Boor and his National Hamfest team, together with Sam Taylor-Nobbs of Icom UK, for the most splendid raffle prize of an Icom 7300 together with a host of station accessories, presented to me at the September Hamfest. Billed as a Station-In-A-Box (and it was), I could not believe my luck! It made an enjoyable weekend in September even better and came as a very pleasant surprise. I can report that the IC-7300 is now in regular use and will remain in the G4ILI shack for quite some time to come.

GETTING YOUNG PEOPLE INVOLVED

Details withheld

Yesterday, I finally got the opportunity to spend some time presenting and demonstrating amateur radio to a group of year 13 students from my local grammar school. These are very bright people who will be taking their A levels next year and chosen because they are studying maths and physics.

I was warned beforehand by the head of physics that they might appear disinterested and not to expect too much in the way of questions and engagement. Background planning for this day was considerable, with numerous emails and a site visit made to establish a suitable location for the antenna and a suitable classroom.

On the day I was able to demonstrate a 20m voice SSB contact to Lithuania, a PSK31 contact to Spain and a local 80m contact, which I am sure was NVIS to a prearranged operator (about 9 miles away over hilly terrain with buildings between us).

Prior to, and during these contacts, I explained my background, my first experiments aged 10 in the early 70s, what amateur radio is about, licensing conditions, amateurs in science and academia, and why radio is an important enabling technology. I also spent time going over VHF and HF propagation and explained meteor scatter, tropo scatter, EME, satellite and NVIS propagation. In amongst this I also explained why HF radio is still very important in a world of satellites and internet connectivity. I also told them it was mature and reliable technology, but some things still weren't fully understood (I mentioned Sporadic-E here). I also showed them the WSPRLite transmitter and explained that with just 200mW it had reached Antarctica! In between all this I used some video clips to reinforce EME and satellite concepts in amateur radio.

Out of 20 people about three bothered to ask questions and seemed interested. Some seemed genuinely apathetic and looked like they didn't want to be there (and probably didn't), some talked to each other or played cards or looked at phones. To be fair on them, this happened whilst I was tuning around trying to find some English speaking traffic on 20m.

So what did I conclude from this day? I came away with the very strong impression that radio as a technology – and an enabling technology at that – was of almost zero interest to them. Because it's mature and reliable it simply doesn't appear on anyone's radar any more. It also seemed to me that the sense of amazement I felt at the age of 9 and 10, when I read books at school and used scrap parts to build a radio receiver (and a very crude spark transmitter) are now lost on youngsters.

If I am right, and we are truly living in an age where the latest 'App' on an iPhone is considered 'hi-tech', when inquisitiveness, and the desire to tinker with electronic components doesn't enter a child's head, then I fear for the future of engineering, at least in the UK.

It might just be possible that one or two students will remember the day in a positive light, and might conceivably take the Foundation exam. Who knows? For the rest of them though it was probably an 'old man' (I'm only 56) talking about something that was boring, pointless, and irrelevant in their lives.

I am trying to stay optimistic about the day, but to be quite honest if I'd known just how tough it was going to be, I'd probably not have gone ahead with it.

Up to this point when people have voiced their opinion that 'amateur radio is dying' I questioned these remarks. Dying? How could something this amazing be dying? Yesterday was an eye opener though, and now I'm afraid to say I think it is. The days when people were fascinated that you could talk to the other side of the world are long gone.

The question of 'how do we get more young people into amateur radio?' is a good one. At least I tried.

I have ownership of the RSGB strategic objective of Growth; Youth involvement forms a large part of the objectives that I published in October 2018 RadCom. *We are re-structuring the RSGB's Youth team to give them more freedom to support specific projects and I hope this will lead to more creativity from the team in the future. We recently held an 'Introduction to Amateur Radio' course at the RSGB's National Radio Centre (NRC) at Bletchley Park in conjunction with the hosting of GB18YOTA and a number of young people were given an insight into our hobby during this event.*

Starting in 2019, efforts to attract youth into the hobby will be focused on attendance at Maker Fayres, EMF Camps and Scouting events throughout the year. We will also continue to actively participate in YOTA events.

Mark Jones, G0MGX
Board Member

Please do not feel disheartened by this experience, every little counts. Whilst the young people you met may not be interested

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today, the information you gave them and the passion you have shown may stay with them for years to come, when they might eventually decide to give our hobby a go.

The diversity within amateur radio means that there is something for everyone, no matter what their age. It is my role as the newly appointed Youth Champion to support the RSGB Youth Team to develop a way of inspiring and motivating a new generation of amateurs.

Sara McGarvey, 2I0SSW
RSGB Youth Champion

THE NEW ONLINE EXAM

Mark, M0IEO
Training Manager, Thames Amateur Radio Group (TARG)

I was intrigued to read the article on p48 of the January issue of *RadCom* about the new Online exam. At Thames Amateur Radio Group (TARG), based on Canvey Island, the Committee shared some of the trepidation expressed in your article. However, we reasoned that an electronic malfunction was no less likely than paper copies of the exam getting lost in the post so we made the decision to go online for our December Advanced exam.

There were four out of four passes and jubilation at the instant results that meant candidates could apply for their new callsign while those who took the paper exam elsewhere a week earlier were still waiting for their results. There was also praise from our candidates for our style of a compressed weekend revision course that concentrates the mind into exam-mode at the critical moment rather than a lengthy succession of evening classes. At TARG we provide candidates with a substantial lunch (this time it was chilli con carne) to help with the physical as well as mental challenges of the exam. We feel there is a place for paper exams, as TARG also has a reputation for helping candidates who struggle with learning, but our experience of the online exam is a big thumb up.

We are pleased to hear that the candidates at TARG had a good experience with the online amateur radio examinations. We have heard of similar reports of good experiences of the online examination system from other clubs. However, a few clubs, particularly in areas where internet connectivity is poor, have experienced technical difficulties which we are working with the exam provider to resolve. We urge any club that is still nervous about changing to online examinations to contact RSGB HQ and arrange for a trial to be held alongside a forthcoming examination session.

Tony Kent, G8PBH
Examination Standards Committee Chair

CONTEST ADVICE NEEDED

Ted Martin, M6UYF

As I am new to amateur radio, I decided to try my first contest on 29 November. My Morse is fairly good (former Radio Officer) and so I went for the CW Contest, but what a surprise.

Sitting with my straight key all I could hear was automated Morse at around 30wpm sent from a keyboard. A more experienced contester later explained that only an idiot would use a straight key and that the technique was to use a top range transceiver (eg IC-7610) linked to a laptop running N1MM or similar logger. Then the whole contest was controlled by the software: pressing memory buttons; all responses are 599 no matter what; numbers sent and logged automatically; and with a software linked reverse beacon display showing who was sending and their callsign. Then all you had to do was click on the callsign with your mouse, press a couple of pre-recorded memories and the software and keyboard did the rest. In fact, you didn't even need to be able to read Morse... "how many amateurs do you think are proficient at reading machine Morse at 30wpm?" was his final incredulous question at my naivety.

It was later put to me that working a CW contest with a straight key was similar to Usain Bolt entering a one mile race against Lewis Hamilton in a F1 car.

I have always found machine Morse (including paddles) is much harder to take than good quality straight key Morse. There's usually a penalty of between 4 and 5wpm to allow for the characterless robotic nature of equal length dots and dashes and exact spaces. With a straight key we send words, and just as we speak at different speeds and with difference inflections depending on the words we are using, we send with an individual voice (or hand). You could always tell who was on the key at Lands End Radio. With machine Morse we just send letters. And that's why the professional Morse exam required blocks of letters to be taken at 16 wpm and 'clear' at 20 wpm. It's why Portishead sent the pre-recorded weather forecast (on paper tape) at 16 wpm – machine and paddle Morse is just harder to take by ear. But of course if it is being received by a computer then machine Morse is much easier for the automated systems to take. And a computer doesn't care about the speed.

So back to my dilemma. Much as I would like to participate in an RSGB CW Contest it seems that they are the preserve of computer controlled SDR radios operated by contestants who don't even need to read Morse. They just need to be good at setting up the hardware and software and using a mouse to select the appropriate response. It's not a level playing field at all.

My question is, are there any RSGB contests limited to straight key only where computer controlled radios are not allowed? Loggers are fine but not if they control the radio. And no memory buttons should be used otherwise any "Run" operators are back to sending machine generated Morse again.

If the answer is No then it means that RSGB Contests are just for SDR radios run by computers and the only skill is plugging a few boxes together and getting the software to work – the skills of any 10 year old. So why do we need a licence just to plug boxes and use a mouse?

A surprise indeed! Many of us are nostalgic for straight keys and computer-free radio but our hobby has to engage with innovations in technology whilst maintaining a backwards glance to ensure that we protect all that is special about it.

The UK is blessed with many world-class CW operators for whom reading contest exchanges at 30WPM is quite pedestrian – and they are not using computers to decode the callsigns or exchange data. They have taken part in RSGB and International Contests and honed their skills over decades. Of course they are now using computers to send most of the CW. We also have some great young contesters who are learning really fast.

RSGB encourages newcomers who might need help reading CW or want to operate at a slower speed; some contests have slow-speed categories or slow-speed frequency allocations.

Plus, from 2019 we are having separate sections in more of our HF contests for operators who do not use any assistance to find other stations.

As for Lewis Hamilton, it's a great hobby, where we can compete directly with the best in the world and aspire to emulate them.

Nick Totterdell, G4FAL
Chair, HF Contest Committee

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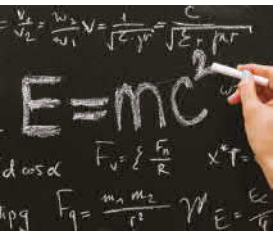

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