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The IC-7100 offers 100W on 160m/6m, 50W on 4m/2m and 35W output on 70cm. Not only do you receive a large touch screen display, but it is also D-STAR ready and no SD card is needed.

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IC-7851

The IC-7851 is Icom's HF/6m flagship transceiver. It includes a crystal clear LO, dual scope function, high res waterfall display and much more.

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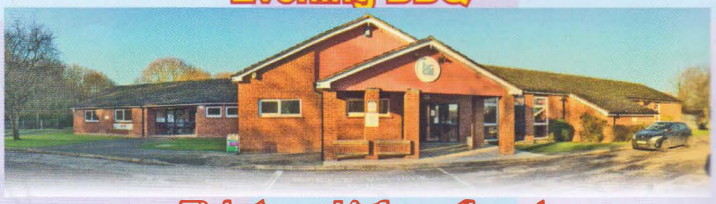

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The FT-857D is a HF - 70cm mobile transceiver and provides base station-type performance from an ultra-compact package that's ideal for mobile or external battery portable work.

FT-1XDE Transceiver

The FT-1XDE is a 2m/70cm dual band digital transceiver.

It features: built-in GPS, snapshot function, scanning, built in CTCSS/ DCS/DTMF, 1266 memory channels and smart navigation.

FTM-400XDE Transceiver

Yaesu's FTM-400XDE is a 2m/70cm dual band transceiver that includes APRS, GPS, snapshot function, automatic mode selection, 500 memory channels and a wideband receiver.

FT-60E Transceiver

The FT-60E is a dual 2m/70cm UHF band transceiver.

It is small in size, making it ideal for a brief case or car glove box.

Not only does it provide wide receiver coverage, but it has outstanding audio quality, high CTCSS/DCS flexibility and a new emergency automatic identification (EAI) feature for search-and-rescue work.

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Yaesu's FT-DX1200 is a HF/6m transceiver that provides up to 100W on SSB, CW, FM, AM. It includes a 4.3 TFT wide full colour display, a spectrum scope, an antenna tuner and it is USB capable.

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The FT-DX3000D is a HF/6m 100W transceiver, which incorporates down conversion, sharp edged crystal roofing filter technology, a 3.5" TFT screen display and compact housing.

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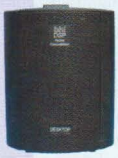

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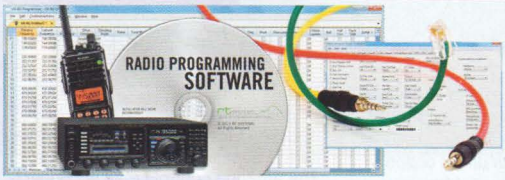

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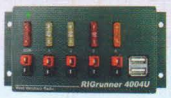

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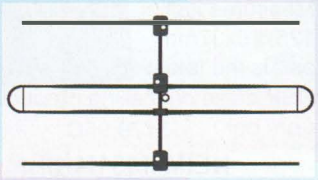
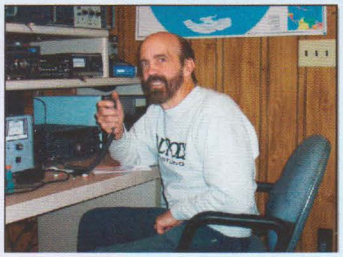
SteppIR Antenna Systems

The SteppIR 3 Element Yagi



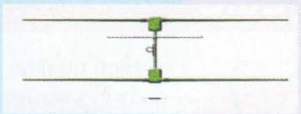
This 3 element Yagi covers all bands from 40m to 6m. On 40/30m the antenna acts as a rotary dipole.

Boom:	4.87m
Longest element:	11.9m
Weight:	23kg
Power:	3kW



Mike K7IR, came up with a great idea in 2000. He designed an antenna that has adjustable elements inside an outer casing that permits optimum and continuous tuning throughout its range. Guaranteed low VSWR wherever you operate in any band. And a neat trick is that with the press of a button you can change direction through 180 degrees without the need to turn the antnna!

The SteppIR 2 Element



This 2 element Yagi covers all bands from 20m to 6m. Fully adjustable to any frequency within the range. Also available with 40/30m driver option.

Boom:	1.44m
Longest element:	10.97m
Weight:	13.6kg
Power:	3kW

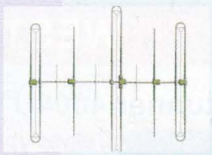
The SDA-100 Controller

Above is the SDA-100 controller. This item is supplied with each antenna. The antenna control cable is connected back to this box. This eanble you to remotely tune the antenna fro optimum VSWR and gain. It also enables 180 degree switching

The BIG IR

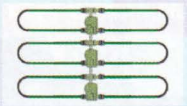
Here we have one of the best verticals that you can buy. It covers all bands from 40m to 6m and measures 10.05m long. It is self supporting in winds up to 50mph.

The Big Boys!



There are some big antennas in the range so please check our web site for the complete range.

The DB-11 Mini Yagi



Here is an interesting antenna. It has an 11ft boom and the longest element is just 19ft in length. The antenna covers all bands from 20m to 6m. Forward gain from 6.5 - 8.7dB and F/B from 15dB to 24dB.

Buying SteppIR

It has always been a wait for getting your SteppIR antenna from the USA. Things are changing and we now aim to carry stock of the more popular items. CAt the time of this advert we are still working on the prices so please check our web site.

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ID-51E Plus

Other colours available.

It is a twin band 2m/70cm, D-Star handheld transceiver with built in GPS receiver, 500 extra memory channels, dualwatch and automatic position reply (DV).

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FT-2DE

Wide receiver frequency coverage. You have the combined option of normal FM or Yaesu's digital Fusion.

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2m/70cm handheld transceiver. Includes a GPS receiver, built in mini USB port, 1000 memory channels and dual recieve on the same band

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Combined boom microphone and headset with HC-6 element which has a wide frequency

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Microphone that detunes the internal resonance of the housing giving clearer sound.

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Vertical Antenna

Ultra stable and dependable 4 bands vertical. Adjust frequency by adjusting tubing length, and even tune the traps for up to 2MHz shift

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6-BTV

Vertical Antenna

6-band antenna will easily handle full legal limit of power on SSB and CW. Built to last, uses thick walled heavy duty aluminium.

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WSDRX-1-MK3

Ultra wide-band coverage SDR receiver with full coverage reception from 100KHz/2GHz. It has independent antenna inputs for shortwave and VHF/UHF, also it has two micro USB slots for your computer and mobile phone.

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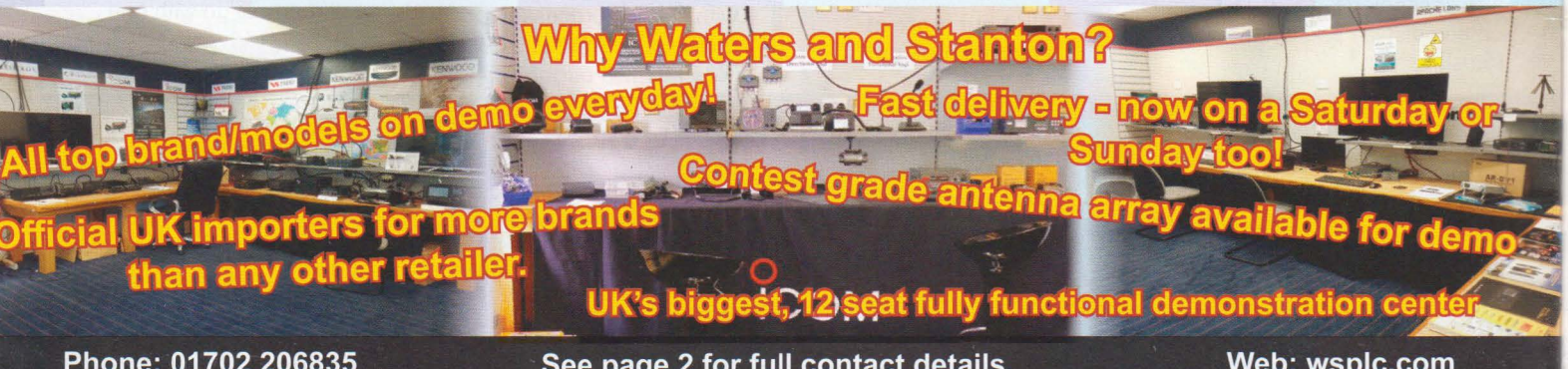

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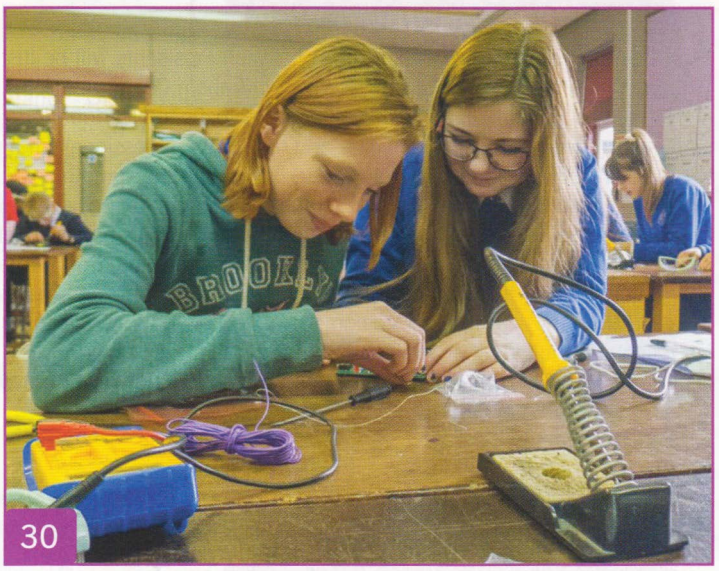

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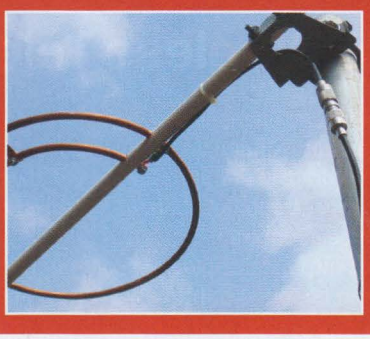

Cover image: A simple halo antenna for the 2m band. Photo: John Adams, G3ZSE.

RadCom THE RADIO SOCIETY OF GREAT BRITAIN'S MEMBERS' MAGAZINE

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RadCom is published by the Radio Society of Great Britain as its official journal and is sent free and post paid to all Members of the Society. **The June edition of *RadCom* is expected to arrive with most Members by 25 May, although this can take up to a week longer in some cases; international deliveries can take longer still.**

All material in *RadCom* is subject to editing for length, clarity, style, punctuation, grammar, legality & taste. Articles for *RadCom* are accepted on the strict understanding that they are previously unpublished and not currently on offer to any other publication. Unless otherwise indicated the RSGB has purchased all rights to published articles. No responsibility can be assumed for the return of unsolicited material.

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Technical supplement *RadCom Plus* is available to RSGB Members online at www.rsgb.org/radcom-plus
RadCom Basics for Members new to the hobby can be found at www.rsgb.org/radcom-basics/

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Change at the top

When this reaches you, the transition between Presidents will be just a few days away and the process of handing over from the retiring General Manager to his successor will be underway. Graham Coomber, GONBI, took on the role in May 2012 following a period of change for the Society.

He has brought stability, experience and focus to Headquarters and the wider Membership. As Chairman, I have worked very closely with Graham over the past three years and found his professionalism a great asset to the Society. He has worked quietly but effectively with both the HQ staff and the many volunteers, enhancing the standing of the RSGB both in the UK and globally.

Whilst managing day-to-day operations to ensure the Society breaks even each year, he has enabled the NRC to develop, brought into being the two free *RadCom* supplements and enhanced HQ's professionalism on communications and outreach to the media.

His tact and diplomacy skills have been demonstrated on numerous occasions in his dealings with Members, other related organisations and Ofcom. He has forged excellent working relationships on many fronts.

The recent high level of 'customer satisfaction' survey ratings for the various HQ functions is a testament to the work Graham has done in reshaping the way that services are delivered.

We wish Graham well in his retirement and look forward to working with his successor Steve Thomas, M1ACB.

Graham Murchie, G4FSG
RSGB Chairman

Steve Thomas, M1ACB

Although I've been a volunteer with the Society since 2008 and an active radio amateur for many more years, becoming General Manager and changing my long-term hobby into my career is something I'm very proud to be doing. I'm very much looking forward to working with the staff at RSGB HQ and the wider team of volunteers, all of whom are as dedicated to supporting our Members and also protecting and developing amateur radio as I am.

I've spent the majority of my career in the IT and telecoms industry, with many roles in management, strategy, leading international teams and projects. I've also been part of the RSGB Regional Team, supporting radio amateurs throughout East Anglia, as well as Secretary of the Regional Council and a member of other Society groups and committees. I'm sure I will need to draw on all of this experience for the exciting challenges ahead.

Although my volunteer roles with the Society have taken an increasing amount of very enjoyable time over recent years, I still find some time to enjoy a wide range of amateur radio activities including DX, contesting, holiday island activations and licence training with local clubs. I find training and supporting the recently-licensed particularly rewarding, building on my experience of working with graduates, apprentices and schools during various parts of my career.

The science of amateur radio has been an important introduction to technical careers for many people and an interesting technical hobby for many others. I've seen for myself the excitement and curiosity that amateur radio has created amongst the young people involved in the ARISS school contacts with Tim Peake, some of whom are already becoming the next generation of radio amateurs as a direct result. I will be working with the Board to review the Society's strategy, to ensure that the RSGB works effectively to increase awareness and understanding of amateur radio, wireless science and its technologies, and also to make the hobby accessible to everyone.

I look forward to meeting and talking with you in the near future.

Steve Thomas, M1ACB

Changes to Wireless Telegraphy Regulations

On 24 March, Ofcom announced changes to Wireless Telegraphy Regulations to allow them to be enforced against Radio Frequency Interference (RFI) from apparatus that is in service, which they have not been able to do until now.

Ofcom consulted on the draft in January 2015 and the RSGB and others made comprehensive replies. The announcement is backed by a Statement that goes into detail about the effect of the new Regulations and why almost all the suggestions submitted by ourselves and others have been omitted.

Ofcom's Statement is at http://stakeholders.ofcom.org.uk/consultations/undueinterference/statement/

The new Regulations can be found at http://www.legislation.gov.uk/uksi/2016/426/made

In essence, where it is established that undue interference is being caused, and the sufferer has done what they reasonably can to alleviate it, Ofcom can serve a notice on the user of offending apparatus requiring them to stop using it within 28 days. Where a safety of life service is affected, the notice can have immediate effect.

The EMC Committee will be discussing with Ofcom what the words 'undue interference' and 'has done what they reasonably can to alleviate it' mean for radio amateurs, in the context of these new regulations.

Before offending apparatus can be brought back into use, the new regulations require that it be restored to have the same level of emissions permitted under the EMC Regulations when it was placed on the market or taken into service in the European Economic Area.

While the new regulations apply to a wide range of apparatus, some that are of most concern to radio amateurs are, unfortunately, not covered. For example, the new regulations do not apply to apparatus that is covered by the present Radio and Telecommunications Terminal Equipment Regulations, although these are significantly changing in April and we will, of course, keep Members informed.

The RSGB welcomes the general purpose of the new Regulations but we have reservations about their effectiveness.

The EMC Committee will be compiling questions for Ofcom about the new Regulations, and Ofcom will be providing an article for next month's *RadCom*. Any points you wish to be considered should please be sent to emc.chairman@rsgb.org.uk as soon as possible.

DRM Wanted

A Deputy Regional Manager is required for Leicester and Rutland, District 131 Region 13 East Midlands. If you have some time to spare, are keen to develop amateur radio, are willing to work as part of a team and live locally, then the Regional Manager would like to hear from you. Jim, G0EJQ takes over the role of Region 13 Regional Manager on 23 April and can be contacted by email to rm13@rsgb.org.uk or on 0750 006 1306 or 01522 880 178.

Exam Question Writer's Seminar

The RSGB and Roger, MORBK would like to thank Martin Lynch for allowing the Question Writers seminar to take place in the Ham Radio Training Academy, situated above the ML&S showroom. The session was a great success with those taking part praising the standard of the facilities.

Amateur radio survey

The findings of the Amateur Radio Survey that was undertaken at the end of last year have now been analysed. They will inform the Board's review of the Society's strategic vision and goals. A summary will be given at the AGM and appear in the June edition of *RadCom*. A presentation of the key findings will be made available to affiliated clubs.

QSL Matters

This month at the bureau, we're allowing ourselves a very brief moment of celebration! All incoming cards go through 3 basic stages, holding, sorting and despatch, with smaller stages in between. For as long as anyone can recall, and in common with other busy IARU bureaus, the time it takes for a card to arrive at the bureau and be sent to the sub-manager has been between 3-4 months, subject to seasonal variations. A reduction in the time that cards are held before sorting means that this time is now being reduced by up to one month and will result in Members receiving their cards quicker.

Deciding what is a genuine callsign and what's not makes lots of extra work for the bureau and our experience is that the number of untraceable calls is growing. Around two thirds of all errors we find are for SSB contacts and the remainder CW (no info on data QSOs is available). Some are obvious mistakes, but others appear deliberate, suggesting a rise in piracy during the last 2-3 years. All Members can help us by ensuring logged calls are correct and by ensuring that any personal secondary calls are listed on the RSGB database.

For anyone considering computerising old log books and then paper QSLing, uploading to Logbook Of The World or Club Log is a real cost/time saving alternative. It's often a great way to get that elusive award you've been chasing. Too often we see Members sending volumes of cards for quite old contacts, only to see many returned later as uncollected, non-member, or Silent Key. A good example is G3T-V Sub Manager, Nigel, G3TXF who has begun scanning his personal collection of 500,000+ paper cards, for electronic storage (and recycling). Interestingly, he's uploaded all of his 986,043 QSOs and now has 340,507 contacts confirmed electronically.

Sub managers often report difficulties in contacting Members to advise them of cards waiting or due for recycling. If you have changed your email address in the last 12 months, please check your details on the RSGB Membership database by logging onto the website.

We are pleased to welcome Andy Hook, GM7GDE, as the new volunteer for GM4-8 Series cards. Our thanks go to Tom Wylie, GM4FDM the retiring manager and for his help, in ensuring a smooth transition. For details, see RSGB website.

Strategic review

The Board is embarking on a review of the Society's strategic vision and goals and a Member with group facilitation skills is sought to work with the Board and others during the process. Please contact the General Manager via email to gm.dept@rsgb.org.uk if you are able to assist.

New trustees

The RSGB sponsors HF DXpeditions to the rarer countries through a fund that is supported each year from proceeds of a raffle that is held at the annual RSGB Convention, as well as income from legacies and donations.

The Society wishes to put on record its thanks to Colin Thomas, G3PSM who is stepping down as a Trustee of the fund after 19 years, and to welcome two new trustees – Martin Atherton, G3ZAY and Gordon Rolland, G3USR.

Details of the fund are at http://rsgb.org/main/operating/hf-dxpedition-fund

Bid to Host YOTA 2017

The RSGB Board is delighted to announce that the RSGB has been successful with its bid to host the 2017 Youngsters on the Air gathering. It will be held in the summer of 2017 and the RSGB looks forward to working with the IARU Region 1 Youth WG Chair, Lisa, PA2LS as plans are made for this event

NI newsreaders

In the GB2RS report of the April edition of *RadCom*, it was suggested that there were no news readers in Northern Ireland or in the Isle of Man. The GB2RS Manager, G3VBA, would like to apologise for the error as there are a number of excellent news readers in Northern Ireland, some of whom have been reading the news for many years. There are, however, no news readers yet on the Isle of Man. Apologies to all those news readers in Northern Ireland, and our grateful thanks for their service to the amateur radio community. The good news is that since the erroneous report, a new news reader for Northern Ireland has come forward to join the existing team.

New RCF partnership

The Radio Communications Foundation (RCF) and the UK Electronics Skills Foundation (UKESF) have announced a partnership to promote RF engineering at universities. A competition will be open to students at UKESF partner universities who complete RF and communications-related final year projects. It will launch with the support of some UKESF company partners ahead of the next academic year, with details to be published later in the spring. See http://commsfoundation.org/projects-2/ukesf-rcf-partnership/ for more information..

Meeting with Ofcom

Representatives of the Society met with Ofcom last month. Subjects discussed included how the Society and Ofcom could work more effectively to tackle reports of EMC, implementation of the WRC-15 agreement to harmonise the spectrum allocation at 5MHz and progress with licence re-validation. Ofcom reported that, due to the commissioning of a new IT system, there would be a pause in the revocation process until later in the Spring. Further details are on the RSGB website under the 'RSGB Notices' tab.

Congratulations

To the following Members whom our records show as having reached 80 or 50 years' continuous Membership of the RSGB.

80 years

Mr J D Wightman	ZL1AH

50 years

Mr R Sykes	G3NFV
Mr R M Jones	G3NKL
Southgate ARC	G3SFG
Mr R B Heaton	G3UGX
Mr M J Peake	G3UIJ
Mr F Bilke	G3UZD
Mr J Elliott	G3WFK
Mr A Wickham	G3IAZ
Mr R C Whattam	G8ACQ
Mr S Haseldine	G8EBM
Mr M A Hall	GM8IEM
Mr B Cushing	MODJQ
Mr R Soifer	W2RS

Errata

Apologies to Geoff Darby, G7GJU whose callsign was incorrect in the April issue of *RadCom*.

Exam Group volunteers

Following the transfer of responsibility of amateur licence examinations to the RSGB the Examinations Group is looking for volunteers to join the Group. Ideally, volunteers will have a Full Licence and experience in radio communications technology in some professional, educational or employment capacity. Full details are at http://rsgb.org/main/about-us/volunteering-for-the-rsgb/exams-group/

Building the ECC

Are you an active member of a RAYNET group and interested in helping promote the role of amateur radio in emergency communications? The Emergency Communications Committee (ECC) is being enlarged to make it easier for committee members to keep in touch with the RAYNET membership in their area. There are three vacancies: the North of England, the Midlands and Northern Ireland.

Where possible Committee members will be expected to meet with the RAYNET groups in their area and attend the zonal meetings organised by RAEN. The main activity is to facilitate the unification of RAYNET however you may be asked to answer questions related to emergency communications or pass them on to someone who can answer them.

If you are interested, please contact Peter Thomson, GM1XEA, by email to ecc.chairman@rsgb.org.uk

The RSGB would like to welcome to the RSGB family the following new Members who have joined their voice to ours and are helping to keep the RSGB strong.

Mr G Ridley, 2E0DVI
Mr R Sindall, 2E0ETD
Mr S Haigh, 2E0FGM
Mr R Heslop, 2E0HES
Mr M Simonsohn, 2E0HVE
Mr T Benson, 2E0XTV
Mr M Panchal, 308038
Mr L Di Girolamo, G0LMM
Mr T Aldridge, G3PJQ
Mr A Parker, G4AXN
Mr N Davenport, G4EOX
Mr A Mcconnachie, G7RRJ
Mr I Jukes, GW1MNU
Mr D R Catleugh, GW8YDR
Mr M Minzoni, IW4DXK
Mr N Takahashi, JE8KKX
Mr J Cantor, K1ZN
Mr A Johnson, KD7VDG
Mr P Gorczycki, M0HTP
Mr N Clark, M0HZO
Mr A Kalisz, M0IGA
Mr M O'Connor, M0MKO
North West ARC, M0NWC
Mr A Leggett, M0NWK
Mr R Hathaway, M0OPR
Mr P Hanman, M0PZR
Mr A Blackmur, M1BIK
Mr R Argent, M1EGP
Mr C Hemingway, M3DKW
Mrs P Dixon, M3PKD
Mr K Furlong, M6BPB
Mr T Hill, M6EPU
Mr R Sansom, M6EYO
Mr J Poriyath, M6FVM
Mr G Wardell, M6FXH
Mr L Ulvenmoe, M6GBL
Mr E Thresher, M6GQG
Mr P Hunter, M6GQP
Mr P Collier, M6GQZ
Mr J Tranter, M6JDT
Mr M Towle, M6MHT
Mr S Iles, M6OWC
Mr J Baggott, M6PVP
Mr D Howden, M6WCZ
Mr J Unwin, M6WIX
Mr G Szabo, M6YUL
Mr K Florence, M6ZBS
Mr A Maiden, M6ZTD
Mr K Payne, MD6IUH
Mr N Prentice, MI6NTP
Mr J Welbourne, MI6RWW
Mrs A Hazel-McGown, MM6YWF
Mr W Horobin, MW3TGX
Mr L Horobin, MW3UFN
Mr J Nicholas, MW6EEJ
Mr O Hopkin, MW6ORH
Mr D Gardner, MW6ZKZ
Mr G Zenger, N2GZ
Mr L N Horne, N2NY
Mr R Blair, RS307641
Mr P Hall, RS307649
Mr M Higham, RS307668
Mr M Potts, RS307681
Mr M Dyer, RS307740
Mr K Ring, RS307741
Mr P Blagden, RS307758
Mr M Willis, RS307780
Mr A Allen, RS307828
Mr A Hutchinson, RS307830
Mr M A Norrell, RS307834
Mr M Kaczmarek, RS307835
Mr K P Taylor, RS307879
Mr M Wells, RS307891
Mr M Marshall, RS307892
Mr D Jappy, RS307896
Mr D Williams, RS307907
Mr S Robottom-Scott, RS307908
Mr R Burton, RS307918
Mr A Kirkpatrick, RS307921
Mr L Pullen, RS307950
Mr J Hill, RS307959
Mr D Wadman, RS307986
Mr R Meeking, RS308012
Mr M Golding, RS308015
Mr J Ali, RS308028
Mr J Allen, RS308040
Mr R Holland, RS308054
Mr D Takayama, SM0UDH
Mr P Rentsch, VK3FPSR
Mr P Hartwell, VK6GX
Mr C Olheiser II, W7AIT
Mr C Allen, W9CCA
Mr W Milton, WG9O

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

Mr R K Hampson, 2E0SON
Mr S H B Montgomery, 2I0SHM
Mr D A Douglas, 2M0AZC
Mr R Cotterell, 2W0RDD
Mr P Pollock, EI8JT
Mr G Gerard, F5BEG
Mr F Beesley, G0EYJ
Mr D R Moore, G0FZH
Mr N Brook, G0KIY
Mr G T Greed, G0LCQ
Mr A Goldstraw, G0PSH
Mr N W Taylor, G0RUF
Mr G Skupski, G0VMA
Mr M J Buckland, G0XAE
Mr D W Dixon, G1DCG
Mr A Adams, G1EGZ
Mr M G Halloway, G1NRF
Burton ARC, G3NFC
Mr A F Smyth, G3XNE
Dr R G Scaife, G4ALH
Mr I Bontoft, G4ELW
Mr D S Restall, G4FCU
Rev J McKae, G4ILA
Mr P J Hodgkinson, G4IPB
Mr A Tapp, G4MTQ
Mr R J Briggs, G4YJB
Mr T Hunt, G6MEW
Mr D F Brain, G7RUJ
Mr C R Blackmur, G8FHN
Mr C G Miller, G8KVO
Mr C Bonnett, G8OTE
Mr T G Main, GM4DCL
Mr P M Jones, GW4PJQ
Epsom Scouts RG, M0ESG
Mr B Chalmers, M0NBA
Mr N Q Berrie, M0NQB
Mr M Reeve, M0PTO
Mr A Snelson, M0WAV
Mr J H Green, M1JHG
Mr P J Brindle, M3PMO
Mr S L Collis, M5SLC
Mr D McCarthy, M6BYK
Mrs N J Sinclair, M6TLD
Mr P Dallas, MI0PFD
Mr J Sinclair, MI0ZSC
Mr S J Henry, MI5UTC
Mr P C Clutton, MW3GWP
Mr RLF Coomber, RS178146
Mr P Jules, RS183998
Teldan Info Systems, RS196674
Mr L Sheldon, RS302046
Mr S G Kirk, RS35594
Mr M Lindgren, SK2AT

NEW

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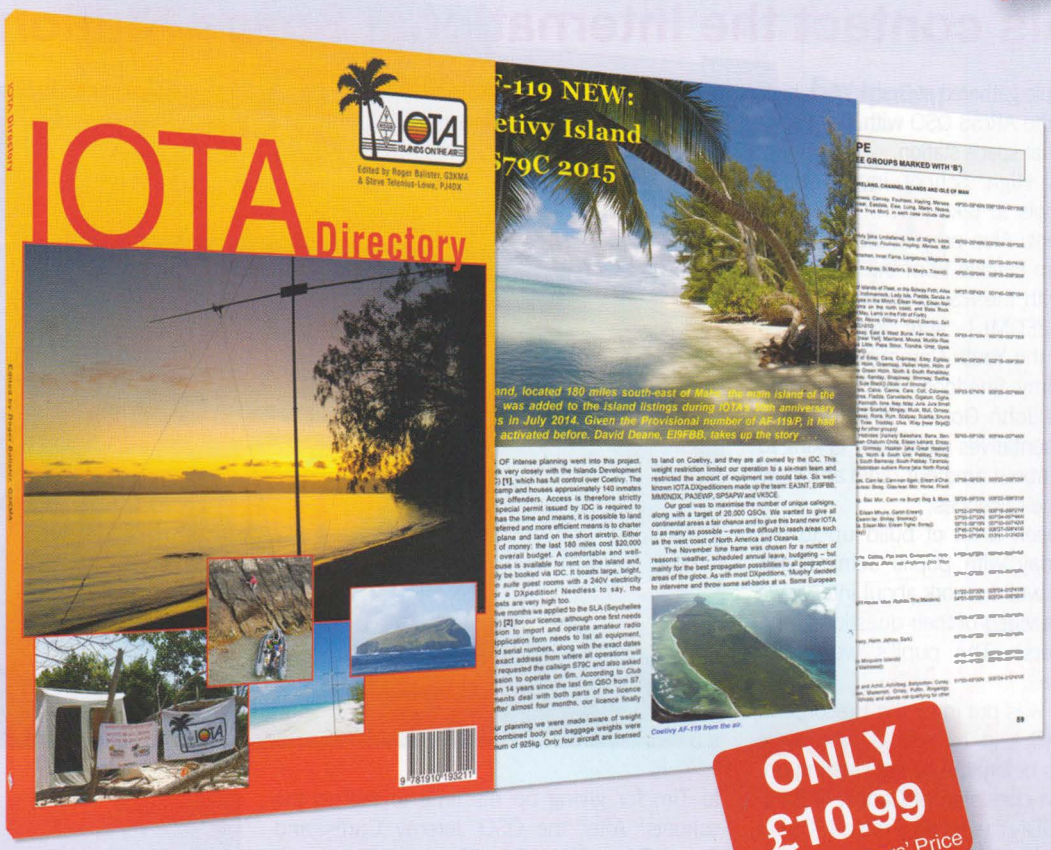


ONLY £10.99
RSGB Members' Price

IOTA Directory

17th Edition

Edited by Roger Balister, G3KMA and Steve Telenius-Lowe, PJ4DX

If you are not aware of the Islands on the Air (IOTA) award programme, this book explains this fascinating and hugely popular activity. Simply put, the book aims to provide the most comprehensive guide to the programme and much more besides.

The *IOTA Directory* contains the complete, official listing of IOTA islands but is much more than just a simple list. There is much more besides with details of the latest IOTA Honour roll, Golden List, etc. The IOTA Directory provides everything you need to participate in IOTA, from lists of islands, grouped by continent, and indexed by prefix through to application forms and masses of information and advice for island hunters, award applicants and DXpeditioners alike. Also included in the colour section there are fascinating reports of several IOTA operations from palm tree lined 'Coetivy Island' south of the Seychelles, the much cooler 'Melville Island' in the Canadian Arctic, through to the remote 'Antipodes Island Project' that took place amongst the penguins in New Zealand.

If the simple act of collecting QSLs from around the world hasn't appealed before. The multitude of islands and the fascinating IOTA programme laid out in this book will change your mind. The *IOTA Directory* is a must have if you are already involved or simply just interested.

Size 210x297mm, 128 pages ISBN: 9781 9101 9321 1
Non Members' Price: £11.99
RSGB Members' Price: £10.99

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

Schools contact the International Space Station

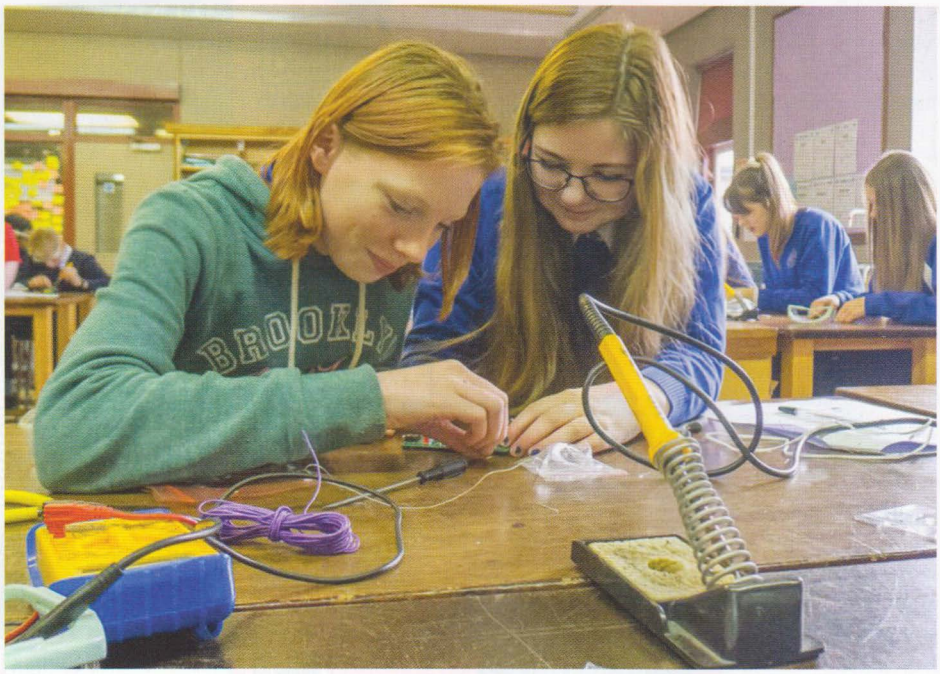
On 5 March, people gathered at Builth Wells high school to watch the ARISS QSO with Tim Peake on the international space station.

Builth Wells High School invited three other local schools to take part in the once-in-a-lifetime event. Also present were Jeremy Curtis and Susan Buckle from the UK Space Agency along with the RSGB Representatives Mike Jones, 2EOMLJ and Will Davies, 2WOWOD from the Youth Committee, Region 7 Manager Jimmy Sneddon, MWOEQL and RSGB President John Gould, G3WKL. All of the RSGB representatives were busy talking to pupils and staff about amateur radio and how they could get their licences.

There had been a lot of build up to the event on Saturday with pupils doing space themed work as well as work about interviews and had made a video of their questions (and expected answers). The pupil's work was featured on a wall.

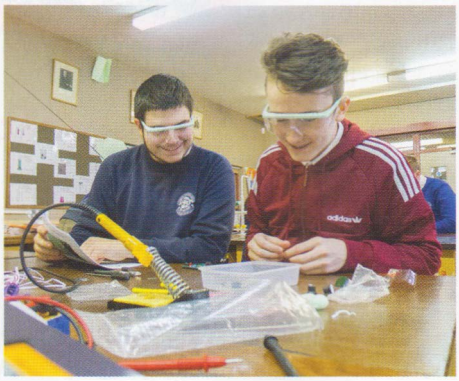
A lot of work was put in by the Brecon and Radnorshire ARC and by ARISS who were busy there hours before the contact setting up. The ARISS team consisted of Carlos, G3VHF (radio), Phil, MODNY (sound), Frank, MOAEU (graphics), Noel, G8GTZ (audio stream) Graham, G3VZV (camera), John, G7ACD (camera), Alex and, of course, Ciaran, MOXTD who was the main speaker for ARISS. The team used a lot of tracking software to find out where the ISS was and when the AOS and LOS were and used a TS-2000 with two beam antennas mounted on John, G7ACD's mast.

At the time of AOS, Becky Bowen, 2WOYLL (main operator) called, "GB1SS this is GB4PCS standing by for a scheduled contact, over". Uniquely to Powys, there was an instant reply from Tim, which hasn't happened in a UK ARISS contact before. As the pass went on, he became clearer and clearer and around 10 pupils managed to pass messages. As Tim was about to go from the horizon, Becky wrapped the contact up and said goodbye. Just before this though the crowd cheered to show their appreciation



to Tim for giving up his time to talk to the schools. After the QSO Jeremy Curtis and Susan Buckle from the UK space agency took a question and answer session which lasted 35 minutes. The audience thoroughly enjoyed themselves throughout the event especially during the climax, which of course was when the team managed to talk to Tim.

Becky who made the contact has the following words to say about the amazing experience. "On the Friday before the contact with Tim I was feeling quite confident, I didn't realise how big this event was going to be. On the morning of the contact I was feeling very nervous to be standing in front of all those people and also to be speaking to Tim Peake. It was an honour and privilege to speak to Tim and to be able to do the contact with Powys Schools. It wouldn't have been possible to do it without Adam who is the chairman of the Brecon and Radnor ARS and also the team at ARISS."



In conclusion, the event was very successful especially when we heard Tim's voice. It was truly mesmerising! I'd like to give my thanks to ARISS for all the work they did as well as Brecon and Radnor ARS.

A thoroughly enjoyable morning was had by all.

(Will Davies 2WOWOD, youth@rsgb.org.uk)

In Essex

Although there are no planned contacts with Tim Peake from Essex, that hasn't stopped local amateurs from helping schools to engage with the ISS and amateur radio. A small team from Essex Ham helped pupils, staff and parents at St Michael's School in Leigh-on-Sea, to tune in to the downlink of two ARISS contacts. Pupils have been taking part in Tim Peake's Space Seeds experiment, and the opportunity to hear him live was a perfect fit with the school's existing studies of space and the ISS.

The event received coverage for amateur radio in the local press, and St Michael's School has since made use of the RSGB Youth Video to stimulate interest in amateur radio. Pete, MOPSX from Essex Ham is a STEM Ambassador, a network of volunteers able to work with schools to help encourage a greater understanding of science, technology, engineering and maths.

NEW

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ONLY £5.99

The Rig Guide

Buy New
Second Hand
Trade-in

Edited by Steve White, G3ZVW

What should you pay for a second hand radio?

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

The Rig Guide continues to define the prices of amateur radio equipment in the UK, fully updated and covering more than ever before *The Rig Guide* is rightly one of the most popular amateur radio books around.

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

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

Knowing the worth of any piece of equipment means you can easily cover the cost of *The Rig Guide* with just one purchase or sale. Selling or Buying, you need a copy of *The Rig Guide*, don't be at a disadvantage - buy a copy today!

Size: 210x297mm, 96 pages ISBN: 9781 9101 9302 0

Price £5.99 post free (UK only)

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

RSGB SHOP

Radio Society of Great Britain www.rsgbshop.org
3 Abbey Court, Priory Business Park, Bedford, MK44 3WH. Tel: 01234 832 700 Fax: 01234 831 496

Mesh operators meeting planned

An initial meeting for all those interested in Broadband-Hamnet, a system of digital communications on the amateur microwave bands, will be held on 22 May at Crawley Amateur Radio Club, Hut 18, Tilgate Recreational Centre, Tilgate Forest, Crawley.

The organisers hope to attract attendees from across the country. There will be presentations, demonstrations and open discussions.

Please contact Ted, G4ELM, via email to BBHN.Event.2016@gmail.com to receive a copy of the agenda and to let him know if you plan to attend.

Lundy DXpedition

A DXpedition to Lundy Island (EU-120) will take place from 2 to 7 May by three members of the Virtual ARC from Kent. Mark, G0GQT, Keith, M0KJA and Nigel, G0GDA will be using the club callsign MX0VRC as /P. The island has no grid electricity and uses generated power between 6am and midnight, the units being switched off during the night to rest them and the three intrepid amateurs. Three stations will be using a variety of aerials and running SSB, data & CW on the 10 to 80m bands. QSL is by eQSL. www.qrz.com/db/mx0vrc

Cluster net is growing

The SouthWest Cluster 950 Net is currently running on Sunday evenings across GB7AA, GB7BS, GB7JB, GB7SD, GB7DR and now GB7KT joined the network recently. The DMR net is on Slot2 Talkgroup 950. GB7CW is in the final stages of establishing their new internet link, GB7MJ (Romsey) is due to join very soon and GB7ED and one other repeater are due to join the network in late Spring.

The SouthWest Cluster operates independently of the Phoenix and BrandMeister networks. As the 950 net is still experimental, a vote is currently running on the Bristol 70cm Repeater Group Facebook pages to get user feedback on the timings of the network. If you do not use Facebook, feel free to drop Mat, G7FBD an email with your suggested slot via http://gb7bs.com/index.html.

Bath University Exam Successes

Following well-received talks at the Trowbridge and City of Bristol clubs on the RF Studies carried out at Bath University, Prof Cathryn Mitchell decided to give amateur radio a try. Six of her PhD students also joined in and all have now passed the Foundation and Intermediate exams. Most of the students took part in the Bath Buildathon in January building the Kanga Acorn II SDR and others built G-QRP Club Sudden receiver kits in their home countries over the Christmas break. Cathryn and her students represent no fewer than six nations, a truly international class! Thanks to Philip, MOPHI, Lewis, G4YTN and Dan, MOTGN for helping with tuition, assessments and invigilation. Some of the new 2E0s are now continuing their studies in Bath aiming to sit the Advanced exam in July. The photo shows Cathryn (second from the left) with her team, less Sam Lo who was not around for the group photo by Steve, G0FUW, lead instructor at the Bath Radio Classes.

HamBay

HamBay is a free ads service for amateurs to sell and buy their surplus equipment. It is located at www.hambay.uk. This service is being provided by Adrian Lane, 2E0SDR.

Mills on the air

This year, Mills on the Air takes place on 14 and 15 May, with details of participating stations at www.g4cdd.net

Cambridge & District Amateur Radio Club will be running GB0CMW from Cattell's Windmill, Mill Road, Willingham CB24 5UU. The Mill has external seating and a tea room with the radio operating within the Mill, which is accessed via steps.Contact Ian, M0HTA, 0744 304 6045

Leicester Radio Society will be operating GB2WWM from Wymondham Windmill, Butt Lane, Wymondham LE14 2BU. There's a tea room serving everything from snacks to main meals plus assortment of small shops. Contact John, G0IJM, 0793912 1132.

Eight years ago Dutch amateurs took part at a Pumping-station in the Northeast of Groningen and their participation has grown every year. Last year stations from Belgium and Sweden joined in making it a truly international event. PB16MILL will operate from the De Eendracht mill at Gieterveen in the Northeastern part of Drenthe. Details at www.pd6mill.com.

Cars with masts

Twenty five used ex BBC local radio cars are being sold on behalf of the BBC by Cambridge Broadcast. These units have a professional technical installation of a pneumatic mast. The vehicles are all Peugeot based on either 806 or 807 models and ages range from 2001 to 2006. Most have technical battery fit outs with split charging from engine, and external mains inputs, with 19" equipment racks, and audio monitoring. For details see http://cambridgebroadcast.com/Vehicle/bbc-radio-car/

New Nepalise amateurs

The photo shows just some of the 45 new radio amateurs in Kathmandu, Nepal. Kathmandu now has two FM repeaters, one of which is connected to the internet, IRLP node number 5511 and W6KTM-R Echolink node number 461694. Their tutor, 9N1SP is on the left of the photo. For more information visit www.qsl.net/9n1sp

241GHz QSO

There was an error in the report last month of the first UK contact on 241GHz between G8CUB and G0FDZ. The world record is actually 114.4km in a contact between WA1ZMS and W4WWQ back in 2008. Apologies for the error. Details of various distance records of interest to the radio amateur can be found at www.ok2kkw.com/dxrecords.htm#76g

Digital survey

Leicestershire Repeater Group recently carried out a survey into users views on Digital FM.They received results from 20 people, including some non-members of the repeater group. 15 were in favour of implementing a digital voice facility with 10 favouring GB3CF (2m) and 11 already had some digital FM equipment. Of those who have digital facilities there was quite a mixture with 7 having Yaesu Fusion equipment, 5 Icom D-Star, Motorola 2 and 3 did not specify. Some had more than one variety of kit.

All respondents are thanked for their input and the many useful comments. As a result of the information the LRG Committee have decided to implement a Yaesu Fusion dual mode repeater (analogue and digital FM) on GB3CF, subject to the necessary approvals.

GB3LEU synth problems

The Leicestershire UHF Beacon, GB3LEU, was switched off on 24 February to investigate spurious emissions that were being produced by the synthesiser stage of the transmitter, which uses a design based on the LMX2541 IC. It is not known how long it will be out of service. If anyone has experience of this particular chip and has cured the problem of spurious outputs or has no problems with it, LRG would appreciate any information. Please contact Geoff Dover, G4AFJ on 01455 823344.

EMF 2016

Electromagnetic Field is a non-profit UK camping festival for those with an inquisitive mind or an interest in making things: hackers, artists, geeks, crafters, scientists and engineers held on 5 to 7 August at Loseley Park, Guildford.

A temporary town of more than a thousand like-minded people enjoying a long weekend of talks, performances, and workshops on everything from blacksmithing to biometrics, chiptunes to computer security, high altitude ballooning to lockpicking, origami to democracy and online privacy to knitting. Details and tickets can be found at www.emfcamp.org/

Kenwood UK VHF challenge

The aim of the Kenwood UK VHF Challenge is to work as many large locator squares during 2016 on 2m and 6m as possible. For example, one point for a QSO with JO01 and one point for IO91 and so on. All modes are allowed but not the use of repeaters, satellites or other relaying.

Provide a simple list of your QSOs with station worked, band, time and locator squares in either a MS Word, text or spreadsheet file to Mark Haynes, M0DXR by email to mark.haynes@uk.jvckenwood.com by 14 January 2017.

There will be a trophy and prize for the winner.

RAOTA net

Laurie, G2BUP and Fred, G6YUY were both present on a recent Radio Amateurs Old Timers Association 40m net, and they are both 100 years old! Fred turned 100 in February and Laurie in March.

RAOTA seeks to keep alive the pioneer spirit and traditions of the past in today's amateur radio by means of personal and radio contact, whilst being mindful of any special needs.

BYLARA at rallies

British Young Ladies Amateur Radio Association (BYLARA) members will be in attendance at the Village at War event in Tilford on 7 and 8 May. They look forward to welcoming members and friends.

Collins radios

The European Collins Collector Association (CCAE) is 6 years old. With 261 members all around the world, the website has news, technical articles in English, French and Italian and articles about Collins radios. See www.ccae.info There are nets on Saturdays on 7.165MHz at 11am local Paris time and on Thursdays on 14.263MHz at 3pm local time in Paris.

JARL 90th Anniversary Award

To celebrate its 90th anniversary, JARL has several awards available for contacts between 12 June 2015 and 11 June 2016. Applications must arrive by 31 December 2016. There are awards for contacts with Japanese amateur stations with 9 different prefixes, 9 different cities or ku of Japan, 9 different Guns of Japan, 9 different prefectures of Japan or with 90 different amateur stations. Details at http://tinyurl.com/hmeg9rk

70cm net

North Bristol ARC run a 70cm net on Sundays from 1900 - 2000UTC. The net is operated in association with the Bristol 70cm Repeater Group on GB3BS (RU68). Members and non members are most welcome, as are newly licensed operators. A wide range of subjects are discussed, some not radio related at all.

radcom@rsgb.org.uk

New Products

Alinco DR-735E dual band mobile

The Alinco DR-735E is a fully featured dual band VHF/UHF mobile radio with a full colour LED display using 10 standard colours plus 6 colour memory channels to let you assign different colours for different functions. For example, you can designate one colour to the right VFO and a different colour to the left VFO or add them to memory so you can see at a glance which memory bank you are using.

The radio has fully independent keys and controls to allow true dual-band operation, it also features a removable front panel that can be remotely mounted. Full-duplex receiver enables simultaneous TX/RX within 144/440MHz bands as well as V/V and U/U receiver capability. Fully independent frequency, audio level and squelch knobs for right and left VFOs make it seem more like operating two mono band radios rather than a dual band transceiver. It is also computer programmable with free software available for download.

The radio will sell for £269.95, see www.nevadaradio.co.uk for more information.

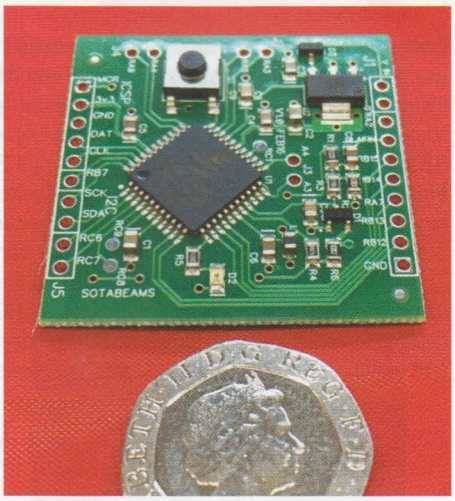
Digital audio filter modules

SOTABEAMS has introduced a range of digital audio filter modules. LASERBEAM modules can be used to make standalone audio filter units or as a high-performance add-in for existing equipment. Digital filters have near perfect characteristics; compared to analogue audio filters; they have better shape-factors, better stop-band attenuation and less tendency to 'ring'.

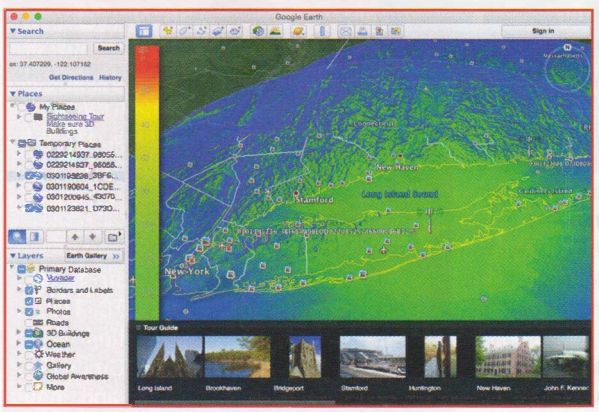
There are three different versions: General purpose, CW and SSB filter; CW/DATA, wide and narrow CW filters; SSB: wide and narrow SSB filters. All the modules have an on-board overload LED to help in using them. LASERBEAM modules with the narrow CW filter option, incorporate provision for a tuning LED to make them even more useful.

The filter modules have been optimised for battery use, drawing just 30mA and using a supply from 5 to 14 volts. As the modules are ready-built, using them is easy: just connect power, audio in and out and a 'wide-narrow' switch. SOTABEAMS even carries a handy filter integration kit.

See www.sotabeams.co.uk



RFinder includes coverage maps



The RFinder Worldwide Repeater Directory is a steadily growing worldwide repeater directory including IRLP, Echolink, AllStar, DStar, MotoTRBO and even Winlink information. There are, currently, over 175 countries in the directory. Access to the World Wide Repeater Directory is provided by any version of the RFinder smartphone apps on Android, iPhone and iPad/iPod Touch, by subscription.

Thanks to CloudRF.com, RFinder will now have coverage maps for all repeaters on earth. The resulting KMZ files are viewable in Google Earth on Windows and Mac (through web.rfinder.net and routes.rfinder.net), on Android and iOS versions of RFinder. The Windows and Mac versions allow multiple coverage maps viewable simultaneously. Visit http://subscribe.rfinder.net for full details

hupRF

Dave, G4HUP has told *RadCom* that the trading name has become hupRF. This is now a full time business and will continue to provide quality products for the experimenter and builder of RF modules. All previous products will continue to be supported, and information will be accessible via the new website at http://hupRF.com

A new product has been released at the same time – an upgrade kit for the DA1-4HL distribution amplifier to convert it to the 8 channel version – the DA1-8U. Details can be found on the website.

IC-7300 transceiver availability

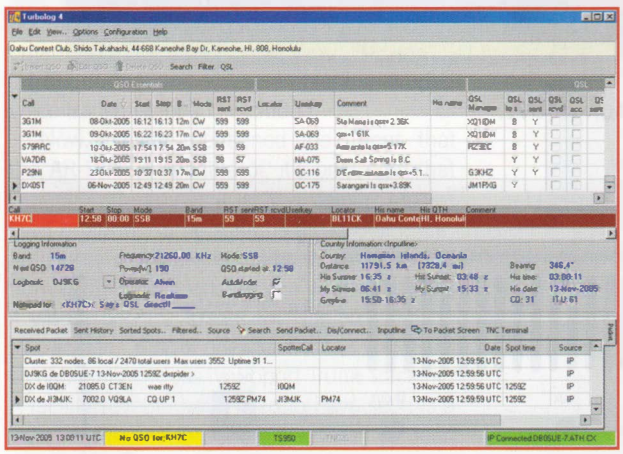
There has been huge interest across the globe about the IC-7300 HF/50/70MHz transceiver since it was shown for the first time at the Tokyo Hamfair in 2015.

Since the preliminary pre-release brochure, information has been scarce. However, Icom has released a production schedule for this model and stock should be available from authorised Icom UK amateur radio dealers during April with a suggested retail price of £1049.95 (inc VAT). A US version has been demonstrated at various dealers in the UK by Chris Ridley, G8GJC from Icom UK.

This new model has a high-performance real-time spectrum scope and employs a new RF direct sampling system. The IC-7300's real-time spectrum scope provides top-level performance in resolution, sweep speed and dynamic range. While listening to received audio, the operator can check the real-time spectrum scope and quickly move to the intended signal. The combination of the real-time spectrum scope and waterfall function improves the quality and efficiency of HF operation.

The new RF direct sampling system employed by the IC-7300 realises class leading RMDR (Reciprocal Mixing Dynamic Range) and Phase Noise characteristics. In addition, the IC-7300 has a large touch screen colour TFT LCD, convenient multi-function dial knob, automatic antenna tuner, voice recorder function and more. The IC-7300 is a revolutionary compact radio that will excite HF operators from beginners to experts.

A review by Peter Hart, G3SJX will appear in a forthcoming *RadCom*.



Turbolog4.12 now available

TurboLog4.12 is the latest of the yearly updates of the Station Management Program and is ready for immediate download from the Turbolog website at www.turbolog.de

The new features includes incoming Packet spots are tightly related to the DXCC database, which is computed right from the content of the user's logbook. The user can decide on missing countries, bands, modes or band-slots being marked in conspicuous colours of his choice. This makes it easier to spot a missing band point, which could be gained from working a particular incoming spot.

The BANDMASTER plug-in from VE3NEA has also been integrated that offers a graphical display of Packet spots on the frequency axis, individually for all bands. In the course of the interaction between TL4.12 and BANDMASTER the user can decide on spotted calls being marked in a definable colour if they were logged before. Finally a new SPLIT button was devised. Being equipped with +/- buttons allows the fastest transition from transceive into the split mode.

A full list of new features in TL4.12 can be read on the NEWS page of the Turbolog website.

New Antex Soldering Station

A new six-piece Soldering Station from Antex features a Hot Air Rework tool, two nozzles, a station, a 50 watt soldering iron that goes from room temperature to 450°C in 55 seconds and a safety stand.

This station gives the user the capability of surface mount rework, the salvaging components or heat shrink on to wires using the 700W hot air rework tool. It has a variable temperature control between 100 and 500°C and comes with two nozzles.The LED digital display indicates mains and iron power.

A 50 watt pencil-like soldering iron has a 2.3mm bit and has a temperature range of 200-450°C. It also features a close to tip sensor for fast temperature feedback and silicone heat-resistant safety cable to avoid accidental burns. Varying replacement tips and irons are available separately.

The station is priced at £249.98, see www.antex.co.uk for details.

AOR AR-DV1

Digital Voice Receiver

The AR-DV1 is a new receiver from Japanese company AOR. It is unlike anything they have produced before. AOR describe it as 'The first software defined receiver of its kind to receive and decode virtually ALL popular digital modes'. In reality it is a marriage between a Software Defined Radio (SDR), a superhet receiver and a computer, all built into a package that has a front panel the size of a standard car radio.

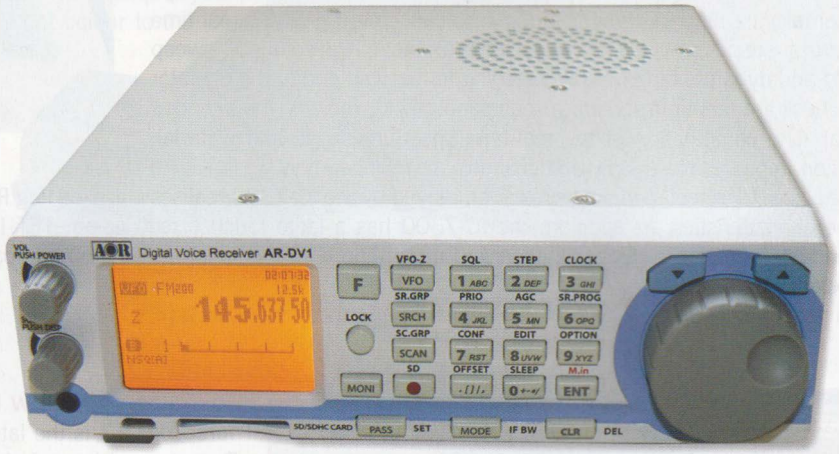


PHOTO 1: The distinctive looking AOR AR-DV1.

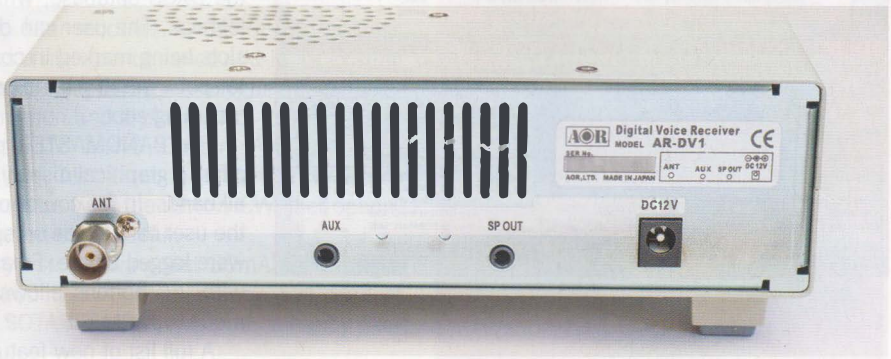


PHOTO 2: The uncluttered back panel.

The AR-DV1 arrived well packaged and protected. Along with the receiver you get a mains power supply, a 60cm telescopic antenna with a BNC plug, a 4GB SDHC memory card and a printed 68-page operating manual.

The painted steel housing of the receiver (**Photo 1**) is a distinctive two-tone off-white and beige colour, with a powdery blue trim on the front. On the unpainted steel back panel (**Photo 2**) there are sockets for 12V DC power input, antenna (BNC), and 3.5mm jacks for an extension speaker and FM discriminator output. On top there's a grille for the loudspeaker and underneath four feet. The front feet incorporate fold-out extenders that can raise the front of the receiver by 33mm. This tilts the receiver up by 10°. The sides of the AR-DV1 have threaded holes, so the receiver can be mounted to a bracket.

That just leaves us with the most interesting part of the outside – the front panel. On the left there are rotary controls that incorporate press buttons. These control on/off/volume and squelch. Beneath them is a 3.5mm jack for headphones. Next comes a multifunction monochrome LCD display (not touch screen). Beneath it is a micro USB socket for computer connection and a socket for an SD/SDHC memory card. Then comes the numeric keypad and associated keys, which are illuminated. Finally the rotary tuning control, with illuminated up and down buttons above it.

The power unit supplied with the DV1 was a plug-top linear type, with a ferrite core clipped on at the radio end of the DC lead. The power unit was equipped with a Continental European 2-pin plug and came screwed into a 13-amp adapter. The overall effect was to make the power unit protrude 89mm from the surface of a socket. At 480 grams it was also quite heavy, that meant it tended to droop. I am informed by AOR that this power unit has now been replaced by a smaller, lighter, switch mode type.

Table 1: AOR AR-DV1 specification (from AOR).

Size (mm):	178(W) x 215(D) x 50(H)
Weight:	1.5kg
Frequency range:	100kHz-1300MHz
Analogue modes:	AM, FM, Synchronous AM (Low and High), USB, LSB, CW
Digital modes:	See Table 2.
Power supply:	12V DC (nominal), 750mA
Audio power:	1W
Sensitivity:	Below 18MHz, 0.71μV typical 18-1300MHz, 0.32μV typical
Memories:	2000 (in 40 banks)

Inside

Removing the top cover reveals a single PCB (**Photo 3**), populated with surface mount components. Several modules are individually screened. But that's not the end of it, because the underside of the PCB (**Photo 4**) is also populated with components. I have only one comment to make about the quality of construction of the AR-DV1. It's *very* nice.

As regards receiver architecture, the first element is an automatic attenuator, followed

by a bank of bandpass filters and preamps. Below 18MHz the AR-DV1 works as a direct conversion Software Defined Radio, with the bulk of the work carried out by a Field Programmable Gate Array (FPGA), a Reduced Instruction Set Computer (RISC) and an AMBE chip to handle decoding of the digital voice modes. From 18MHz to 180MHz it works as a double conversion superhet, with IF frequencies at 393MHz and 31MHz. Above 180MHz it becomes a triple conversion superhet, with the first IF at 1.7GHz.

At all frequencies the demodulation uses SDR techniques, so reception of any mode is possible, see **Table 2**. The receive bandwidth can be set as required, and digital noise reduction and a notch filter are available. As you would expect, there are numerous user configurations. The colour of the backlight of the liquid crystal display can be changed, the receiver has a clock, a calendar, an alarm function, a timed digital recording function and numerous other facilities. Memories can be tagged with alphanumeric characters and organised into various banks. CTCSS and DCS are supported, and a descrambler for inverted voice transmissions is included.

Now, having mentioned the things that the AR-DV1 is capable of, it's only right that I mention the things it isn't. It doesn't resolve DAB or DRM (some stations are digital *voice*, aren't they?). Neither does it resolve the sound from digital television. On VHF FM broadcasts it would be nice to see the station ident on the screen, but it doesn't decode the RDS signal. Neither does it support Trunk Tracking. A facility I would have liked to have seen is a video output, so that the display can be seen on an external monitor. From this I conclude that the designers were given a brief to design a product capable of receiving all the common digital voice *communication* modes and that's exactly what they did.

Remote control of the AR-DV1 is via a USB link to a computer. Software is not supplied but the protocol is simple, so those with programming experience should find it easy to write their own utility. Software is available online, but currently the choice is limited.

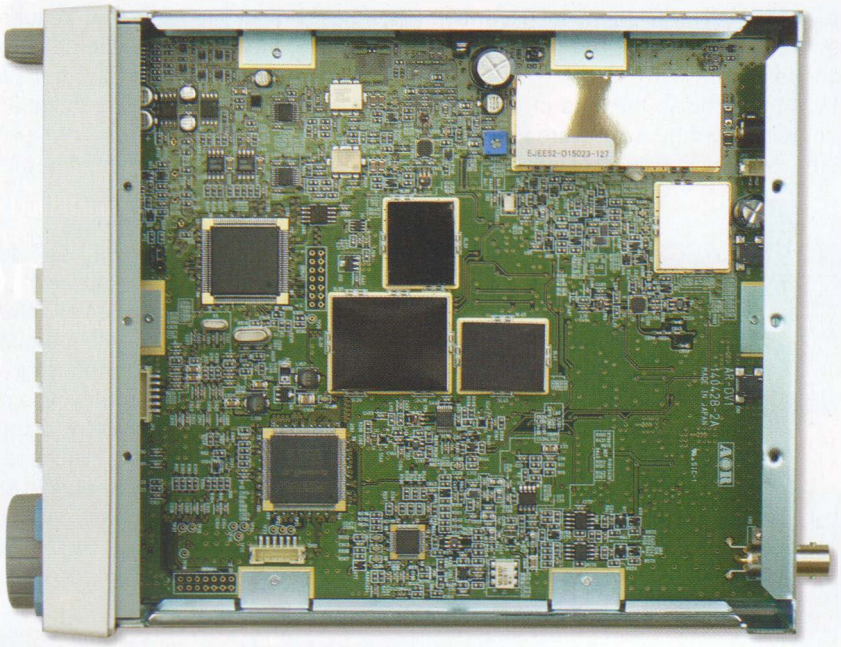


PHOTO 3: Topside of the PCB in the AOR AR-DV1.

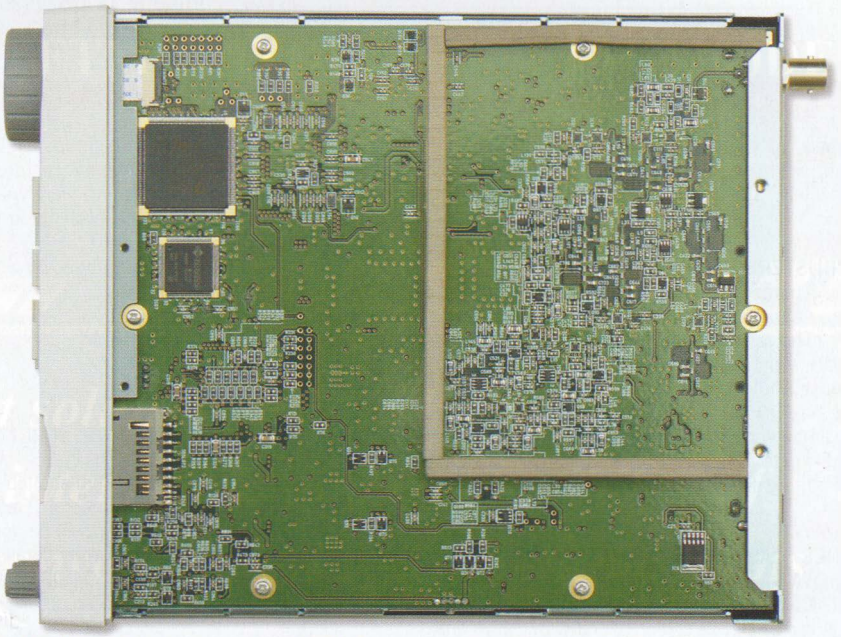


PHOTO 4: The underside of the AR-DV1 PCB.

On air performance

One of the first things I did after powering the receiver on was check the firmware revision. This is displayed at the moment of switch-on, but disappears after a few seconds. The AOR website informed me that a newer version was available. Downloading the ZIP file was straightforward, as was unzipping it and transferring the relevant file to an SD card. Having plugged the SD card into the socket the firmware updating procedure was simple and went without a hitch. The SD card is also used for audio recording and memory backup/restore.

On VHF/UHF I found the automatic digital voice mode detection worked well. The modes I was able to monitor were D-Star, DMR and Fusion. You can switch to a dedicated mode, but automatic detection invariably switched to the correct mode in an instant and the quality of the audio was fine.

On HF SSB and CW I found the sensitivity to be adequate and the readability of signals good. There are narrow and wide 'brick-wall' filters for both CW and SSB. Rotating the tuning knob (it has detents, so you can't spin it) was a chore for someone accustomed to spinning a tuning dial but, if you are accustomed to channelised operation, I'm sure you will feel at home with it. On SSB and CW there was an annoying clicking from the loudspeaker *whilst rotating the tuning knob*. Irrespective of the tuning step the clicking was the same volume, but it wasn't present at all frequencies. It wasn't noticeable at HF, but it was quite pronounced between 140MHz and 170MHz. With the antenna unplugged there was no clicking while tuning, suggesting a strong nearby station was causing the problem while the synthesiser locked onto each new frequency. This was confirmed

Steve White, G3ZVW
steve.g3zvw@gmail.com

by using the receiver some miles away, where the problem did not occur until a handheld transceiver was keyed up nearby. I think this is the kind of problem that could be fixed by a firmware upgrade, to momentarily mute the receiver while the synthesiser locks to each new frequency.

All the press buttons are tactile and need a firm press to operate, but not so hard as to make the receiver move across the desk.

The audio quality from the internal loudspeaker was disappointing. It might be a decent quality speaker with a substantial magnet, but it isn't mounted in a proper housing. The audio quality was much better when using an external loudspeaker, and if you plug in stereo headphones you will find the DV1 receives FM broadcasts in stereo.

Recording received audio to the SD card is a one-button operation. Initially I experienced problems with this, but AOR informed me that the SD card needs to be a maximum of 32GB and formatted FAT16 or FAT32. As soon as I formatted the card I was using to FAT32 it worked. Recordings are automatically named with a simple sequence number, 000, 001 etc.

DIGITAL MODE	BANDWIDTH	MODE	VARIOUS	COMPATIBLE VOCODER	AR-DV1 VOICE DECODING
D-STAR	12.5kHz			AMBE	O
ALINCO DIGITAL	12.5kHz	EJ-47 (voice mode F1E)		AMBE	O
YAESU DIGITAL	12.5kHz	V/D mode		AMBE+2	O
	12.5kHz	Voice FR mode			X
DIGITAL CR	6.25kHz		NON-ENCRYPTED	AMBE+2	O
	6.25kHz		ENCRYPTED	AMBE+2	X
NXDN	6.25kHz	REGULAR MODE	NON-ENCRYPTED	AMBE+2	O
		REGULAR MODE	DIGITAL SCRAMBLING (15 BIT)	AMBE+2	O
			ENCRYPTED		X
			TRUNKING		X
	12.5kHz				X
DPMR	6.25kHz	dPMR446		AMBE+2	O
	6.25kHz	TIER 1		AMBE+2	O
		TIER 2			X
		TIER 3			X
P25	6.25kHz & 12.5kHz	PHASE 1	NON-ENCRYPTED	IMBE	O
		PHASE 1	ENCRYPTED		X
		PHASE 2			X
DMR	12.5kHz	TIER 1	NON-ENCRYPTED	AMBE+2	O
			ENCRYPTED	AMBE+2	X
		TIER2	NON-ENCRYPTED	AMBE+2	O
			ENCRYPTED	AMBE+2	X
		TIER 3	TRUNKING	AMBE+2	X

TABLE 2: AOR AR-DV1 digital modes (from the Operating Manual).

Conclusions

The AR-DV1 is a smart, capable receiver built to the very highest standards. Depending on where you are coming from it is either (a) a digital voice receiver that also does other things, or (b) a wideband general coverage receiver that also does digital voice. I think both viewpoints have merit. Through firmware updates it should be possible to keep it up-to-date with new modes. No doubt firmware updates will also provide new facilities, improvements and bug fixes.

I would like to thank Waters and Stanton for the review sample and Frederic Collin of AOR in Japan for his co-operation. The AR-DV1 is available from W&S, priced £1199.95.

RALLIES & EVENTS

Members of the RSGB Regional Team will be present with a bookstall at the rallies this month marked with an RSGB diamond.

1 MAY

DAMBUSTERS HAMFEST

Thorpe Camp Museum, Tattershall Thorpe, near Coningsby, Lincolnshire LN4 4PE.
The venue is all on one level and doors open at 10am. Admission is £3 and includes entry into the museum. Hot food will be available in addition to the NAFFI. This is mainly an outdoor rally but some limited space is available indoors with a small charge for tables. More information by email to tony.nightingale@yahoo.co.uk

1-2 MAY

SHANES CASTLE STEAM TRACTION RALLY CASHOTA

Shanes Castle, Randalstown Rd, Antrim BT41 4NE. Including a CASHOTA station operated by Ballymena ARG. Family attractions, catering, disabled facilities, car parking, accessible by public transport. Contact Hugh Kernohan, GI0JEV, 028 2587 1481.

2 MAY

DARTMOOR RADIO CLUB RALLY

Tavistock College, Crowndale Road, Tavistock, Devon PL19 8DD.
The venue has free car parking as well as disabled facilities but please note there is no talk-in station. Doors open at 10.15/10.30am and admission is £2. There will be trade stands, a Bring & Buy and special interest groups. Catering is available on site. Contact Roger Hann, 2E0RPH on 01822 840 723, or by email to 2E0RPH@gmail.com.

8 MAY

35th LOUGH ERNE AMATEUR RADIO RALLY

SHARE Centre, Lisnaskea, Co Fermanagh, Northern Ireland BT92 0EQ
Doors open from 11.15am to 4pm with disabled visitors gaining access 15 minutes earlier. There will be trade stands, a Bring & Buy, car boot area, flea market, special interest groups, an RSGB bookstall, a licensed bar and catering. Lectures will form part of the day's activities and there will be a prize draw. Camping is available. More information from Michael Clarke, M5MTC on 0286 862 1436 or by email to mi5mtc@learc.eu. [www.learc.eu].

15 MAY

NEWTON-LE-WILLOWS ARC RALLY - CANCELLED

15 MAY

LAMFEST

Elescar Heritage Centre, Wath Road, Elsecar, Barnsley S74 8HJ
Doors open for traders at 7am and tables are free of charge. The public gain access at 10am and admission is £2. All monies raised will be donated to the Yorkshire Air Ambulance. Further details from Ian O'Donnell, M0IOD on 0191 604 0255, 0748 212 3223 or sales@hamradio-shop.co.uk.

21-22 MAY

DAYTON HAMVENTION®

Hara Arena, Dayton, Ohio, USA.
There are large car parks as well as transport to the event from various locations. The venue also has disabled facilities. Doors open at 8am. There will be trade stands and a huge flea market as well as special interest groups and an RSGB bookstall. A lecture programme will take place each day. There are multiple catering outlets and family attractions on site. US exams are available and there is a raffle. Details by email to international@hamvention.org. [www.hamvention.org].

21 MAY

ROCHDALE AND DISTRICT ARS SUMMER FLEA MARKET INDOOR SALE

St Vincent de Paul's, Caldershaw Rd, off Edenfield Rd (A680), Norden, Rochdale OL12 7QR
Doors open 11am-3pm, 10.45am for disabled visitors. Talk in with S22 on 2m (145.550MHz) and entry is £2.50 with those under 12 free. Coffee, tea, soft drinks and food available. Traders can set up from 8am. Pitches £5/pitch or £10/pitch and table. Further details from Dave, G3RIK on 01706 633 400 or by email to rally@radars.me.uk

22 MAY

BLACK COUNTRY RADIO RALLY MARK 2

Portway Lifestyle Centre, Newbury Lane, Oldbury, West Midlands B69 1HE.
The venue is 1 mile from junction 2 of the M5. Doors open at 10am and the admission is £2. A raffle will be drawn at 2pm.

22 MAY

33RD DUNSTABLE DOWNS RC ANNUAL AMATEUR RADIO CAR BOOT SALE

Stockwood Park, Luton
All the usual facilities. [www.ddrcbootsale.org].

22 MAY

BROADBAND HAMNET MEETING

A get together of BBHN Mesh Operators and those interested in this system of digital communications on the amateur microwave bands has been arranged at Tilgate Forest Rec. Centre, Hut 18, Tilgate Forest, Crawley, West Sussex RH11 9BQ. For details and an agenda contact Ted, G4ELM via BBHN. Event.2016@gmail.com.

28 MAY

26th WATERS & STANTON OPEN DAY

22 Main Rd, Hockley SS5 4QS
Doors will be open from 10am to 4pm with free refreshments for visitors. Reps from the major manufacturers will be in attendance as well as the local clubs, Chelmsford ARS, Thames ARG and Essex Repeater Group. The presentation of the Region 12 Club of the Year plaque (and bottle of bubbly) will take place during the day. There will be several talks including Nigel Booth, M0CVO on antennas and Murray Niman, on 5G Future telecoms and amateur radio. New equipment will be on display from Icom, Kenwood & Yaesu. A charity raffle with good prizes in aid of the British Wireless for the Blind Association will also be held.

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《 Improved 66 ch GPS receiver included 》

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Entering the RSGB 144/432MHz contest

Ian, 2E0IJH invited me to participate in the RSGB 144/432MHz contest with the Capel Battery Contest Group from their cliff top site at Capel le Ferne.

I arrived at the site on Friday afternoon and was shortly joined by Ian, 2E0IJH. The bright spring sunshine was rather deceiving, as the keen breeze was decidedly chilly.

The first job was to erect the trailer tent that Ian had towed onto site, this was to be for the 70cm station. After completing that we used the time whilst waiting for Trevor, G6ALJ to arrive to tow out the towers and open up the secure storage to release the other required kit. The first to be erected was one of the 2m arrays. This was a four over four – four, four-element stacked Yagis mounted on a 30 foot scaffold pole mast. The purpose of this array is to provide a broad lobed beam that would be used to work local and semi local stations.

Just as this was completed and ginned up into the air, Trevor joined us. In short order the on-site Land Rover was fired up and used to tow out two more towers, one more for 2m and the other for 70cm (and possibly 23cm). We also towed out another trailer tent, this one to house the 2m station. Trevor then had to disappear off on other duties.

One of the benefits of having an ex WW2 gun battery as an operating site is secure storage. A rather deceptive small opening reveals an underground complex that is more spacious than the average 3 bed semi. The flipside is that access is via a vertical ladder, so any required items have to be attached to a rope and hauled up by hand.

After much hauling, a short and very welcome break was taken in the onsite 'workshop' to enjoy a much-appreciated cup of coffee.

Building the stations

Ian and I then set about putting the second 2m array together. We fitted the head unit to the tower along with the stub mast, onto which we attached the two long 13-element Yagis. The mechanical fit went quite sweetly – if only the same could be said for the electrical fit, of which more later.

The 2m station. 200W into a pair of long Yagis but without a masthead preamp, not perfect but workable.

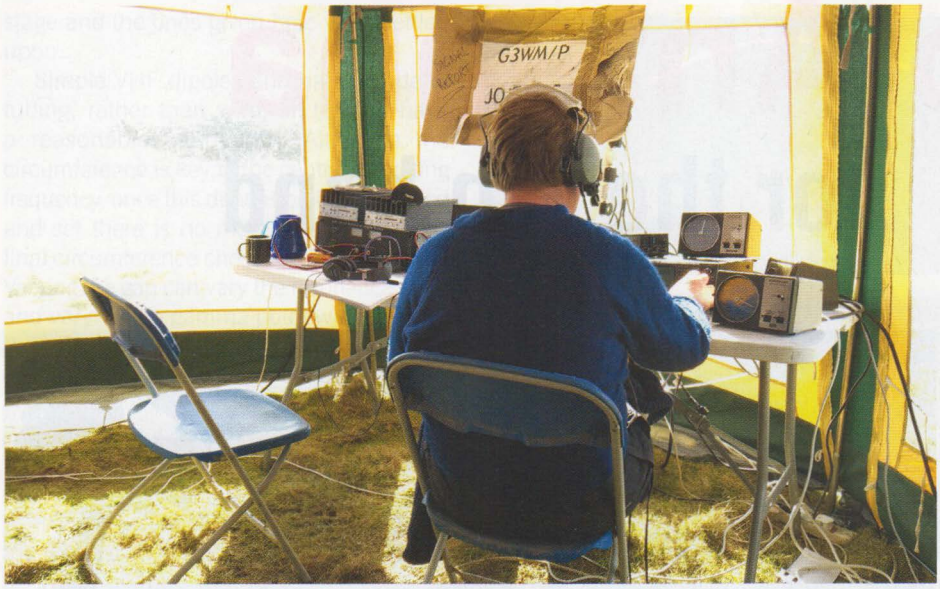
Secure storage is in an ex WW2 gun battery but access is via a vertical ladder, so items have to be attached to a rope and hauled up by hand!

As light was now fast fading, I decided to call it a day and returned home for the night. My reasoning for that was sound. A night in my warm bed after a hot meal would better prepare me for the rigours of another day in the cold followed by possibly a partial night of operating and a few hours in a sleeping bag.

After a restful night in that warm bed I was back on site for 9am the next morning. I found Ian had erected the second trailer tent single-handed and had spent a reasonable night on site. As Ian and I were about to begin we were joined by Adam, MOCVN. We then continued with the completion of the 2m station, which is where the trouble started…

Problems on 2m

The two Yagis are fed via a splitter; new after the old one was found to be faulty last VHF NFD. Ian had also rebuilt the preamp and relay unit and it had performed admirably on the test bench. The array has separate coax feeds for Tx and Rx. After getting odd VSWR readings, all connections were checked and rechecked. The relay/preamp unit was opened and checked; still no obvious fault could be found. After several feeder swaps, each time requiring the tower to be luffed over (an exercise requiring much cranking on the winch to lower it, do the job and then raise it again to test) we found we could get what appeared to be a working solution using a single feeder direct to the splitter. The



The station ran a FT-726 to a 200W solid state amplifier.

mast was then cranked up to working height about 40 feet.

It was at this point we discovered the vagaries of the ground. We had checked when we placed the tower, pulled out the stabilising legs and adjusted them to ensure the trailer mast was level. As the mast reached working height the whole shebang started to tilt, with the towing hitch end lifting up a good 8 inches. Placing my entire weight on the towing hitch just about brought it back down. Scary.

It appeared that the wind pressure blowing on the array and extended mast was sufficient to drive the rear leg down into the ground collapsing the rabbit/mole-burrowed ground. With the rear leg temporarily jacked up using a highlift jack, several short lengths of scaffold board were used to pad the foot and spread the load on the soft earth. The whole rig was again checked and reset level.

Just in time, as the contest was about to start. The 70cm station was abandoned, through lack of time and operators. So we had 200W into a pair of long Yagis but without a masthead preamp, not perfect but workable...

Distorted signals

A decision was made to 'hunt & pounce', after five minutes of not getting a response to our calls a contact was made, only to be told we had a distorted signal. Quick rechecks of the FT-726 were made, drive level, ALC setting along with the connections to the 200W solid state amplifier. A few more contacts made but again told we had a poor signal. On monitoring our output on a spare Icom set, yes we had a horrible signal.

Again we cranked down and luffed over the tower and rechecked the feeders and connections. A decision was made to run a single Yagi after we got a strange difference in received noise between the two Yagis. The mast was again raised to vertical for checking. Still we had an awful signal.

An attempt was made to fire up the reserve FT-726, but probably due to the cold temperature (it was about 3°C outside), it didn't want to play. The Icom was pressed into service, reducing our output to 100W as the amplifier couldn't be immediately configured to be run from that rig. Later, the amplifier was put back in line, raising our output to a nominal 200W.

Back on the air

However, we were back on the air and started making contacts, the received signal reports even improved when we remembered to crank the tower back up to its working height!

Slow but steady progress was made, every station we heard we managed to work, if not immediately but within a couple of calls. After a session of operating, I noted that it was now very dark outside and, as I stepped out of the operator's chair, I realised how cold I had become. I was shivering and it wasn't stopping when I moved about to get the blood flowing. I decided to again go home as I doubted I would get very comfortable in a sleeping bag that night. I bid Ian and Adam good night.

After sitting in the car with the heater on for a few minutes, I felt comfortable enough to drive home. I had just about warmed up after the 40-minute journey. Upon reflection, I probably hadn't fully recovered from a viral infection the previous week.

After a warm shower, hot meal and a good night's rest, I was again fit the next morning to return to the fray. I re-joined Adam and Ian on site and worked the rest of the contest. Again we had a slow but steady rate of contacts, finding new stations who were operating in the 6 hour section and one or two weekend operators who were checking out 2m, happily finding the band occupied with signals and who were willing to give away points to the rabid band of contesters. But the supply of workable stations gradually withered as contest came to an end at 1400UTC.

At contest end we put the kettle on and discussed our woes. We were satisfied that, despite the difficulties, we had put on a working station and had completed the contest even if not as competitive as we would have wished.

We then set about dismantling the station. First was the trailer tent for 2m, followed by the four over four then the trailer tower mounted long Yagis. It was as we started dismantling the feeders from the tower that Ian noted that one of the N type connectors had moved forward on the end of the cable, probably causing an incomplete connection with the outer (the centre pin was still soldered). We had finally found the fault. Ian found another connector possibly with the same problem. Too late now, but Ian is investigating the feeders.

Just as we had completed the dismantling and were returning items to storage the first proper precipitation of the weekend arrived – wet snow – and the breeze picked up as well. So it was a well-chilled, frozen-handed and externally dampened G0PDZ who thankfully turned on the car heater to again thaw out on the journey home.

But it was fun, hard work, but fun. Lessons learnt, experience gained and hoping that it will be warmer in May for the next 2m contest – yes I'm going back!

In the end we made 79 claimed contacts, making 30,082 claimed points, possibly placing us at 5th place in the open section. Our most distant contact was at 862km with OL4A in the Czech Republic.

It was a pity that this contest, like many weekend contests appears to being less well supported within the UK and it is sometimes hard to work the EU stations who don't beam towards the UK routinely or don't try to work G stations not realising we are also contesting.

The feeders are Westflex, giving low loss at VHF, but are fairly stiff and do not like being coiled and uncoiled. The long lengths require careful handling so as not to damage them by loose coils crimping themselves under their own weight when being managed. Ian is also investigating the crimping N types on this type of foam cored metal foil sheathed type feeders. He has already identified reports of connectors slipping just as we have found due to the foam core 'creeping' when the coax moves. It could be that new feeders are required or additional efforts are required to ensure reliable termination of this type of cable.

Ian Lowe, G0PDZ
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A Simple Halo Antenna for the 2m band

The halo is a simple, easily constructed, lightweight and compact antenna that is horizontally polarised. Many amateurs start, and continue, on 2m with FM and a 'white stick' vertical antenna. These days many HF sets also have all modes on 2m, so why not give SSB (and CW) a try with a horizontally polarised antenna?

This is a very low-cost design that has given good results. It is ideal for loft mounting, or, with some weather-proofing, mounting outside. As this antenna is virtually omni-directional, there is no need for a rotator. This could be a good afternoon's project!

A small bit of theory

The halo transmitting element is basically a half wavelength, although it looks a lot smaller in the circular 'halo' format shown in Photo 1.

A standard half wave dipole has a feed impedance of around 50Ω at the centre. If you form this dipole into a circle, the feed impedance drops. However, tapping into a point away from the centre will find a point that is about 50Ω again. A *gamma match* is used to connect at this point, which is what the 'arc' next to the element is. A single, unbalanced, gamma match is fine – the whole element is still fed with RF energy. Be aware that, as with all half-wave dipoles, there is a voltage at the two ends. The halo has its ends near to each other at the gap – avoid touching the antenna at this point (or any other) whilst transmitting, or you may get an RF burn!

Some experimental notes

There are really three main variables in a halo design: the circumference, the end gap and the gamma feed point. Various sources in books and on the web were consulted and although the halo is a well-established antenna, there is quite a variance in dimensions. Therefore these three key dimensions were all varied at the 'lash up'

PHOTO 1: The completed halo antenna. Waterproofing would be required for permanent outdoor use.

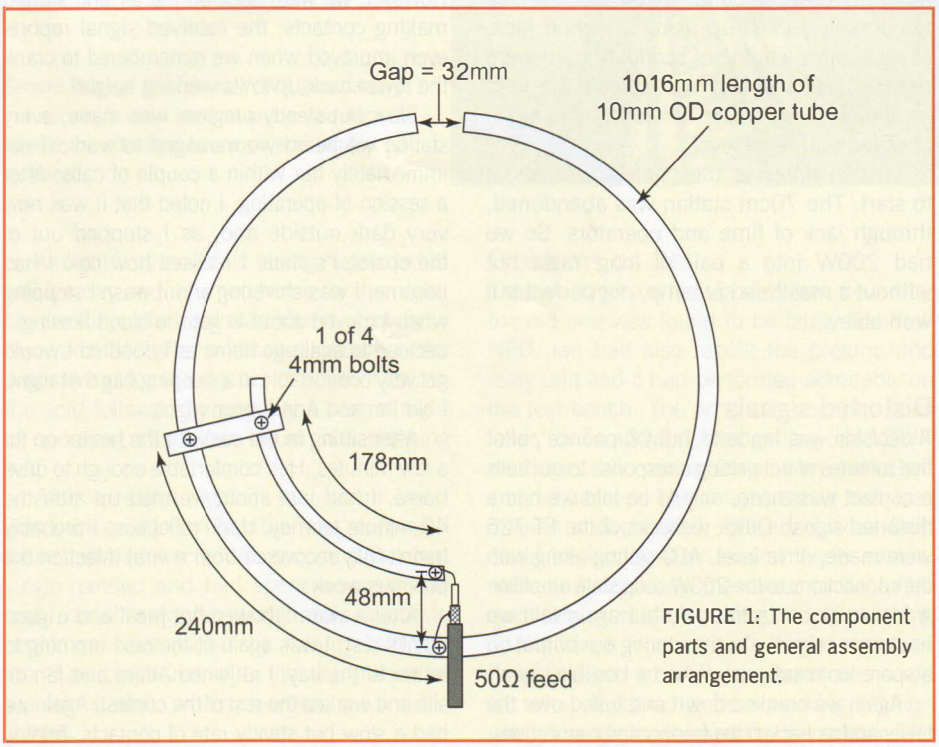

FIGURE 1: The component parts and general assembly arrangement.

stage and the ones given here were settled upon.

Simple VHF dipoles and halos made of tubing, rather than wire, all tend to have a reasonable bandwidth. Although the circumference is key to the central operating frequency, once this dimension is determined and set there is no more to consider. The final circumference chosen here works well. Varying the gap can vary the resonance a bit, and varying the gamma point will also vary the impedance match a bit. Neither are too critical in this design and the measurements given have worked well.

In some designs the gamma match is above or below the main halo element. Here it is in the same plane, which makes for simpler construction, although it can distort the theoretical radiation pattern.

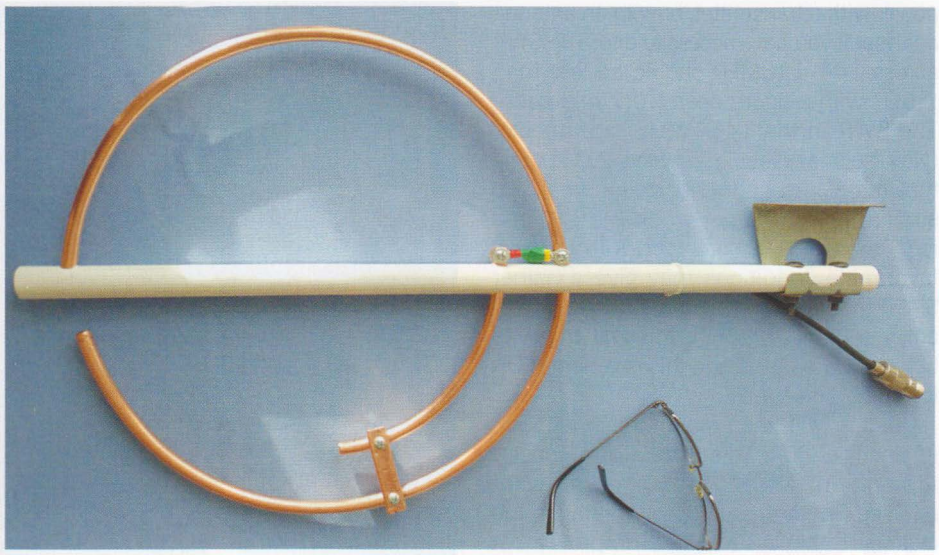

PHOTO 2: General arrangement of the halo antenna, with spectacles for scale.

Materials

The main material is copper tubing. This is not very critical, but here 10mm outside diameter microbore central heating tube has been used. It can be bought from DIY 'sheds' for around £25 for a 10m coil. This is more than you need for one 2m halo, but it leaves plenty for trying 4 and 6m designs – or perhaps a tuned loop for HF [1]. Maybe two people, or perhaps a group of club members, could share a coil?

10mm diameter copper tube of this sort is quite easy to form by hand and, as supplied, the coil is around the right diameter anyway.

Other items needed are:

- a plastic or fibreglass tube (I used a length of left-over 21.5mm diameter overflow pipe)
- some coaxial cable
- a connector (eg PL259)
- a bracket
- some nuts, bolts and washers of about M4 size (suitable types can often be found in pound shops, usually more cheaply than at DIY sheds)
- insulating tape and/or heatshrink sleeving.

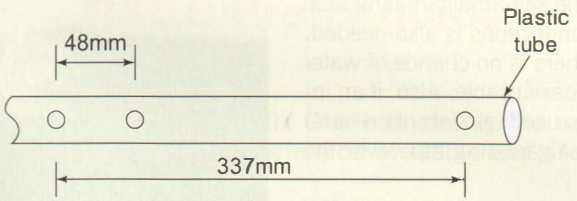

FIGURE 2: Drilling details for the support tube. Holes should be fractionally larger than 10mm.

Construction

Refer to **Figure 1** and **Photo 2** for details. Start by cutting a length of copper tube to exactly 1016mm. A small hand operated rotary pipe cutting tool is ideal and leaves a nice finish, but a hacksaw is also fine. De-burr the ends with a de-burring tool or a file and/or wire wool. Form this length into the best circle you can manage, which will be around 330mm diameter. Take time to do this. If there is a circular 'former', or some other radiused item handy, then this can be useful. Don't worry too much – it only needs to be *basically* circular. Note that you must leave a gap of about 32mm between the ends.

Drill a hole at the centre point of the element, and another one 240mm along from it. The size of the holes should match the bolts you're using.

Next, cut a 205mm length of copper tube and form this into an arc to match the circle as best you can. This will form the gamma match arc. Drill a hole close to one end, then another 178mm from the first hole, as shown. Note that this means 178mm around the tube, as shown by the dimension mark in Figure 1. Now cut a piece of copper tube 65mm long. Use either a club hammer or a strong vice to flatten the tube. It will form the shorting link. Drill 2 holes, as shown, 48mm apart. Ensure that all the metalwork has the rough edges removed.

The length of the plastic support pipe is not really critical, but around 600mm is probably about right. Drill three holes in it, as shown in **Figure 2**. These will need to be *slightly* greater than 10mm in order to give some clearance to the copper tube (but not too much). Probably the easiest – and safest – method is to drill 10mm holes and then open them out a bit with hand tools such as a round file or reamer.

Note that the end hole need only go through one side of the material (see Photo 2). Finally, drill mounting holes at the end of the plastic tube, to suit your own bracket or mounting method.

Now fit the main element into the tube. Again, take the time to do this carefully. When satisfied, fit the gamma arc and the shorting bar in place. Adjust the halo gap again to about 32mm, if necessary. Refer to Photo 2. Finally, connect the coaxial cable, as shown in **Photo 3**, noting that the inner goes to the gamma match and the braid to the longer tube. Attach the coax to the antenna with crimped and soldered eyelets. It's probably easiest to use a short length of thin coax and terminate one end of this in a suitable plug or socket, then connect the main run of coax to this connector. For 2m, a coax run up to about 30' can be done in one of the modern RG8 Mini coaxial cables, without too much loss. Some are lower loss than others – check out the specifications.

Testing and installation

Either inside or outside, position the antenna in a reasonably clear spot and measure its SWR on 2m. You can do this on low

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power with a transmitter, or with an antenna analyser if you have access to one. The SWR across 144–146MHz should be less than 1.5:1, with a figure near 1.0:1 mid-band. The SWR in the 146/7MHz experimental (NoV) segment should be below 2.0:1. Note that the SWRs quoted here are what you should be able to get when the antenna is in a fairly clear, high spot. A test in less favourable conditions may give a higher SWR. It is worth noting that an SWR of 2:1 only results in 11% of the transmitted power being reflected back and this is generally OK for any transceiver.

If all is well, then mount the antenna in its final position. This halo is light enough to hang on strings in a loft, if you want to – see **Photo 4**. Outdoor mounting in the clear will give a subsatntial improvement for all VHF antennas. For outdoor mounting you will need to waterproof it a bit. Some lacquer over the screw connections would be sensible and some self-amalgamating tape over the main connections is also needed. Make sure that there is no chance of water getting into the coaxial cable. Also, if an in-line connection is used (as described here) then use self-amalgamating tape over the connectors.

Try listening to one of the 2m beacons [2]. Compare it against an existing vertical antenna if possible. Listen around in the SSB segment – roughly 144.300MHz ±100kHz. An ideal time for a good test is one of the RSGB's Tuesday activity nights – see the Sport Radio column for details.

Performance and conclusion

Simple tests showed that although it was not truly omnidirectional, in the sense that the signal is the same at all points of the compass, the antenna did have a fairly decent response all round. The power rating, assuming that the coaxial connections to the halo are sound, should be fine up to 50W (and probably beyond this).

This design ought to be scaleable, so, for example, for a 6m design the key measurements could be scaled up by a factor of 145/51, that is multiply everything (except tube diameter) by 2.84. Note that if you build a 6m version and want it in the loft, then you'll likely need to do the final assembly *in* the loft, as the finished item probably won't go through the hatch!

References

[1] for example, 'A minimal loop for QRPp', *RadCom*, January 2016

[2] listed in the *RSGB Yearbook* or online at www.ukrepeater.net

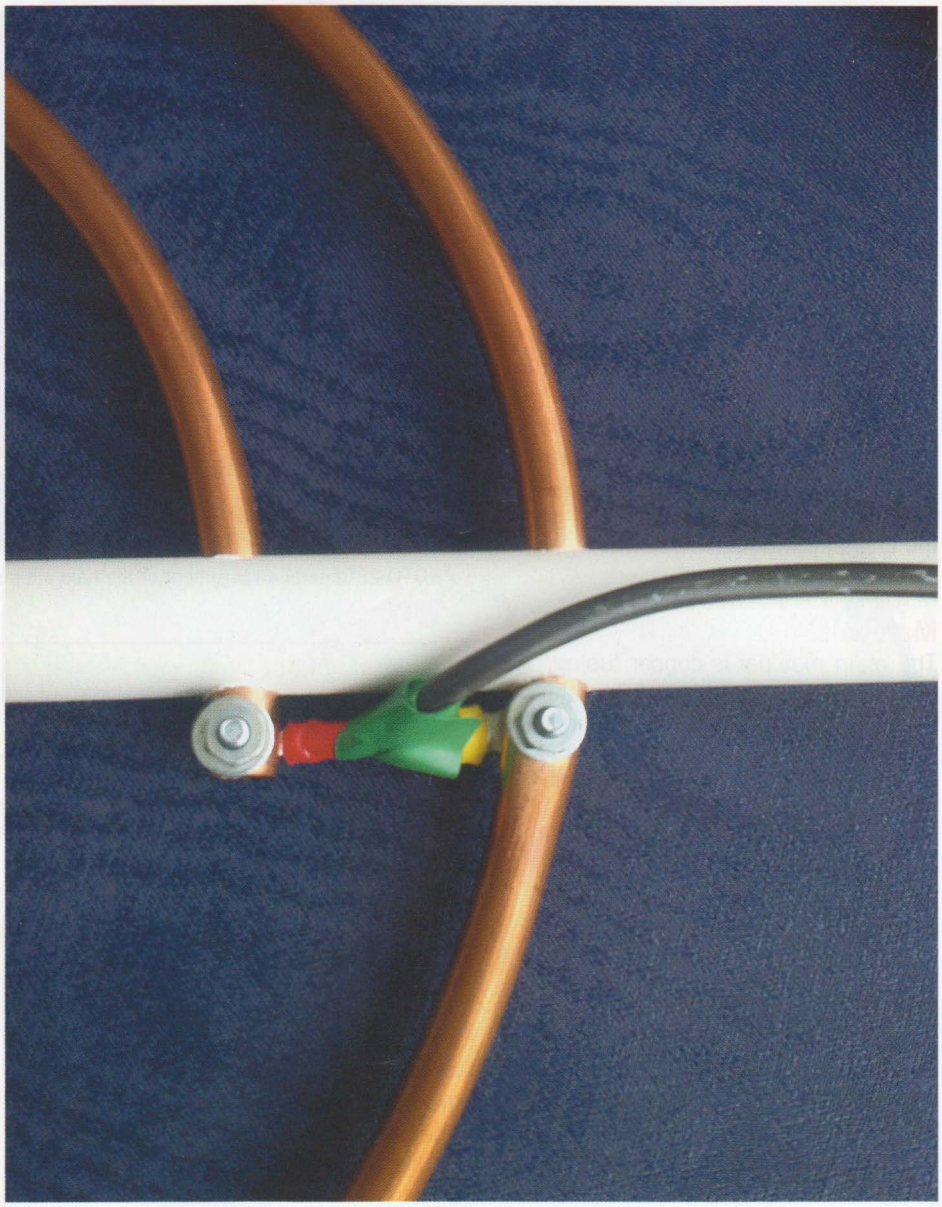
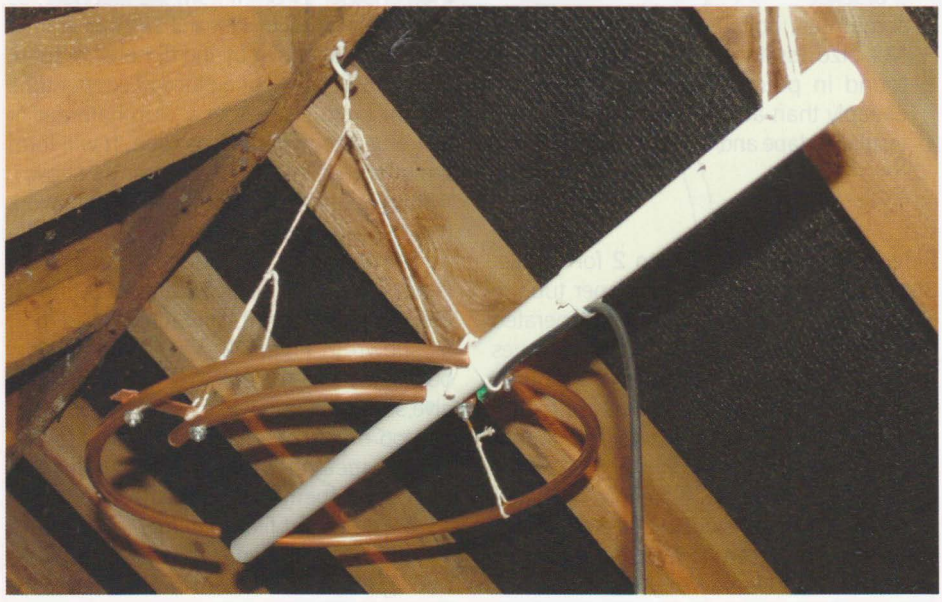


PHOTO 3: Close-up detail of the feed point arrangement.



The halo described here makes a great more-or-less omnidirectional horizontally polarised loft antenna.

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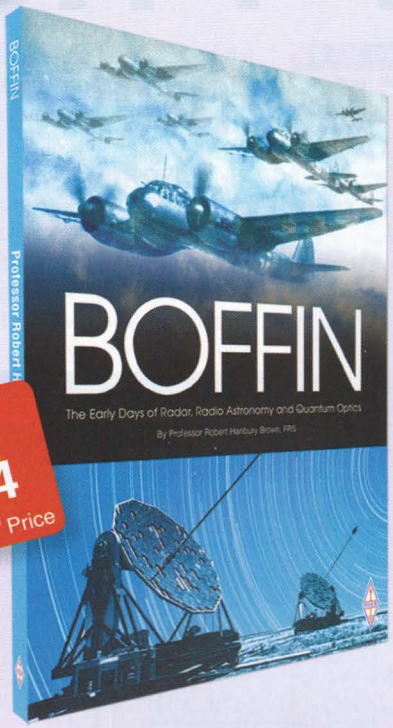

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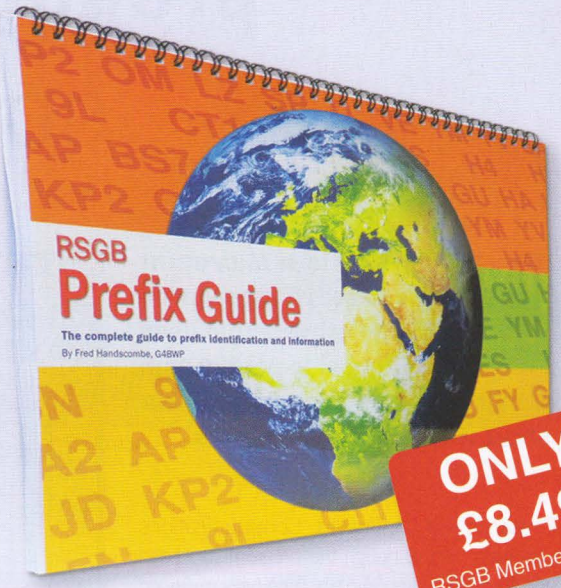

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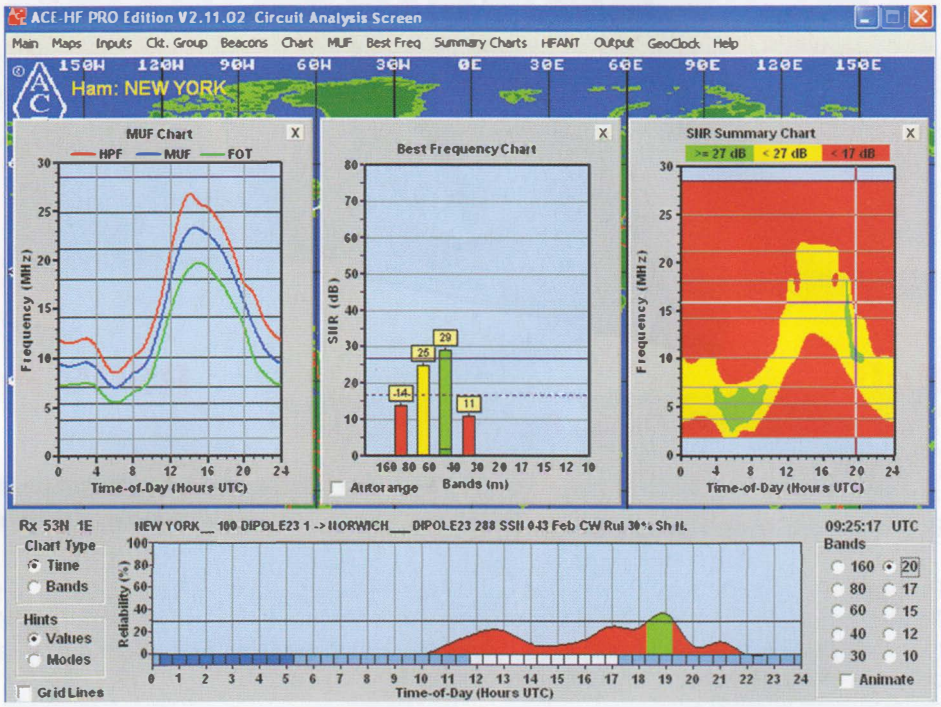
ACE-HF PRO propagation prediction software

ACE-HF PRO is a Microsoft Windows-based HF propagation prediction software that uses the *VOACAP* HF model to predict path openings or coverage on the amateur or short wave broadcast bands.

ACE stands for 'Animated Communications Effectiveness' and although the program has been around for a few years, and was originally reviewed in *RadCom* by Gwyn, G4FKH back in October 2006, it recently took on a new lease of life after it was acquired from its original owner by Oklahoma-based Long Wave Inc (LWI).

Established in 1995, LWI specialises in communications engineering and technology, especially for the US military. The company felt that *ACE-HF PRO* was a good fit with its other work and bought it from Richard (Dick) P Buckner.

Actually, there was already a connection between LWI and Dick Buckner. Dick, the software's original designer and creator, worked with Phil Miller, LWI's CEO, more than 20 years ago to create prototype *ACE* software for simulating US Navy VLF submarine communications from the Tacamo E-6 aircraft. After *ACE-VLF*, the Navy requested Dick add an HF capability. The result subsequently become the *ACE-HF* network system simulation and visualisation software, which is used as the standard HF system performance model by US government and military agencies according to LWI.



The same path with the maximum usable frequency, best frequency and signal-to-noise ratio charts overlaid.

Interest to amateurs

ACE-HF PRO is now being marketed as version 2.11 and features a number of additions and enhancements. Let's look at the main ones that might be of interest to radio amateurs.

The first is that 32 and 64-bit Windows operating systems are now supported, so it will work on all versions of Windows, up to and including Windows 10. It also has the ability to produce area coverage maps that can be displayed using Google Earth and Google Maps. If you have a Windows XP or Windows 7 PC with a 32-bit OS, you can still use the traditional *ACE-HF* area built-in lower-resolution coverage maps or Google Earth.

LWI's Bob Barth, said: "Now that *ACE-HF* is available from LWI, HF system performance analysis simulations are available at a completely new level. These new animated maps definitely benefit not only operators of large HF networks, but also ham operators."

The latest program also has the ability to get new smoothed sunspot number (SSN) values via the internet, which are recommended for *VOACAP*-based prediction programs, directly from NOAA. On the area coverage 'Make Display' screen, you can also now select 'All SSNs' for easier comparison between different smoothed sunspot numbers.

All the features introduced in the previous versions have also been retained. These include 'Antenna Central', which features 1,650 antenna models by the late L B Cebik, W4RNL.

Thirty-four new maps are also included for both the main and circuit analysis screens. Latitude and longitude readings now appear on the circuit analysis screen when the user left-clicks on the selected map. Lastly, the DXCC database has also been updated.

What can it do?

So to recap on Gwyn's original review from 2006, what can *ACE-HF* actually do?

ACE-HF uses the *VOACAP* ionospheric model to predict the reliability or quality of any point-to-point HF path on any of the HF bands. Alternatively, it can produce predicted area coverage maps from your location.

VOACAP (Voice of America Coverage Analysis Program) is a radio propagation model that uses empirical data to predict the point-to-point path loss and coverage of a given transceiver given two locations, the antennas, smoothed sunspot number, and the time/date. It was originally designed and written for the Voice of America, hence the name, and is an improved and corrected update of the earlier *IONCAP* software.

VOACAP is a free downloadable program, but its interface and output is a little clunky. An online version (*VOACAP* Online – www.voacap.com) has helped a lot, but if you want more flexibility a commercial propagation program like *ACE-HF* is an alternative.

VOACAP forms the basis of many of the propagation prediction programs on the market today and is a tried and tested model that can work well for predictions from 4-30MHz. Note that it was never initially designed to work on 80m, but in 1999 *VOACAP* was changed to include a more conservative model of night-time absorption for signals below 4MHz. However, anecdotal evidence showed that this was a little too conservative so *ACE-HF* gives you the option of invoking the original *IONCAP* absorption model setting if you wish to experiment with different computations for 3.5MHz.

The system is highly configurable in that you

can pick the antennas in use at either end of the contact, plus the mode and 'required reliability' for the path you wish to compute. You can also specify your noise level type (eg City, Rural etc), which is vital to getting the right result. Both short-path and long-path predictions can be selected.

Having input your parameters, on pressing 'Run' you are given a map showing the signal path and a graph and the probability of making the contact on the selected band for each of 24 hours. By 'right clicking' on the graph you have the choice of selecting your desired plotted parameter. These include S-units, signal to noise ratio (SNR), take-off elevation angle, reliability and many more.

If you are looking for the best time to make the contact, the reliability graph is colour coded red and green – green showing you the best time. You can also click the 'animated' button and it will flick through each of the HF bands in turn. This is a quick way of finding the optimum band and time.

You can also set up a group of paths, such as the UK to 18 different locations and the software will produce a reliability/SNR table for each of the paths, on each band, for your specified hour.

The area plots work by specifying what bands you wish to compute for, what hour, what SSN(s) you choose (the correct SSN or up to four different ones from 10 to 130) and the antenna types. The system then computes each of these paths after telling you how many there will be. For example, one sunspot number x 10 bands x one hour is 10 plots. A 10-band prediction for a whole day would be 240 plots.

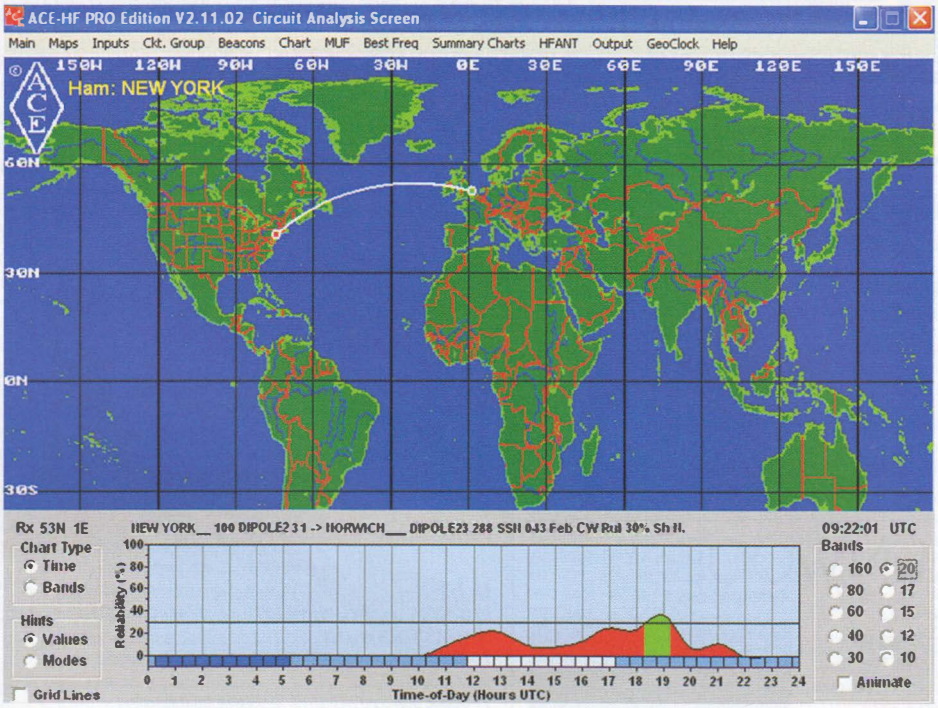
These plots can take a little time to produce, depending upon how many you select. A 12-plot (one band for 24 hours) selection took about a minute to compute, but a full 24-hour (240) plot would take more like 20-25 minutes. However, these calculations are saved and can be recalled to be plotted at any time.

Once the calculations have been completed you can opt to display them on the built-in maps (not Windows 10) or Google Earth. Note that to use Google Earth you must have it installed on your PC.

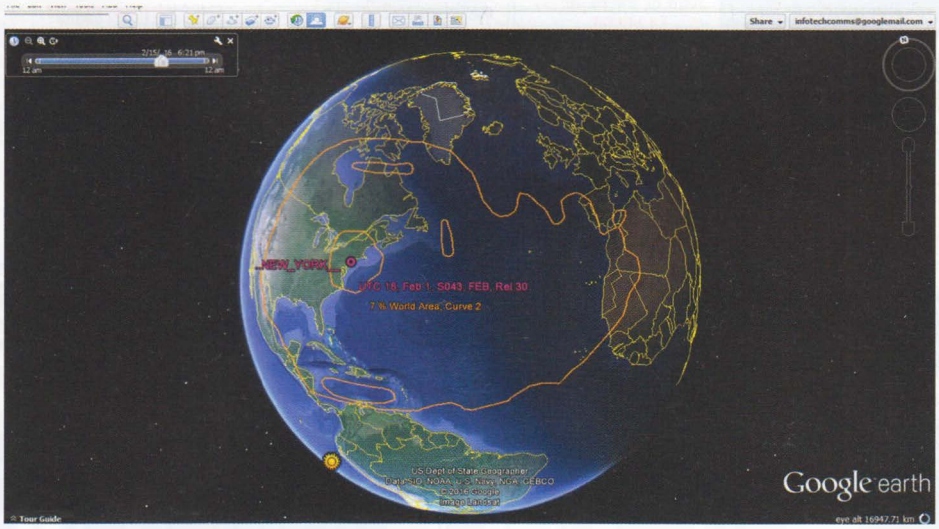
The ability to display predicted coverage paths on Google Earth is a nice touch and really brings the software up to date. It does it by producing .kml (Keyhole Markup Language) files that Google Earth can read. Please note that your computer must be able to actually *run* Google Earth for this to work. One of my older XP machines didn't have the required 3D graphics card and it refused to run Google Earth, although it was OK with the built-in maps. On a newer 64-bit OS like Windows 10 you can't use *ACE-HF PRO*'s built-in maps, only Google Earth, but it ran fine on my Windows 10 HP Stream laptop.

The software can also produce real-time predictions (reliability or signal-to-noise ratios) for all of the NCDXF beacon chain on five bands, and shows which beacon is currently transmitting. The display can also be animated to show the probability or SNR for each beacon for each hour of the day.

I've barely scratched the surface of what *ACE-HF PRO* can do. It can also produce point-to-point charts, maximum usable frequency plots, 'Best Frequency' and 'Summary' charts. Or you can switch to short wave mode and do calculations for the broadcast bands.



The main *ACE-HF PRO* screen showing propagation from London to New York on 20m over 24 hours.



ACE-HF PRO's prediction of the coverage of the 4U1UN NCDXF beacon on 14MHz overlaid on Google Earth.

Like all propagation prediction programs it pays to read the manual VERY carefully and ensure you are using the right parameters. The supplied manual is very comprehensive and well worth a read with continued reference.

Conclusion

Overall, the software can suit both casual HF users and those more deeply interested in propagation matters. It is very useful for those 'what if' predictions and for getting an idea of the best time and band for a DX contact.

ACE-HF PRO is available from Long Wave Inc. (www.longwaveinc.com) for $199.00, or $219.00 with a printed manual. Upgrades from earlier versions of *ACE-HF* are available for $99.00. The software is supplied on a CD-ROM from the US and you have to register it to get an e-mailed unlock code.

ACE-HF PRO allows for one transmit location, while *ACE-HF PRO Mobile* allows for multiple locations for both transmit and receive, but it does cost $599.00. Most radio amateurs should be fine with the cheaper *ACE-HF PRO*.

My thanks to Long Wave for supplying the review copy.

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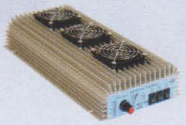

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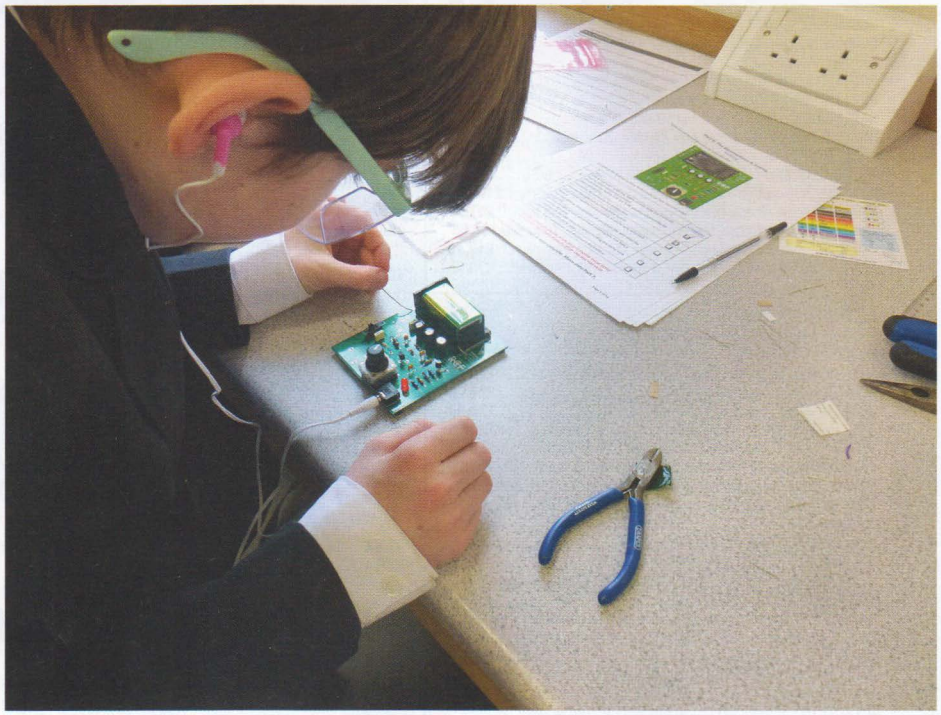
Encouraging schools during the Principia mission

Astronaut Tim Peake began his sixth-month mission on the International Space Station in December 2015, becoming the first British ESA astronaut to visit the Station. He will be involved in many experiments aboard the ISS during this time.

Research in space crosses many different subjects – the unique environment of the ISS offers a great opportunity to investigate novel materials, life in space, the human body, fluid physics, new technologies and many other things.

Working with the UK Space Agency, ARISS (Amateur Radio on the International Space Station) has developed a programme that has enabled a number of schools to speak directly to Tim Peake, during his stay. This has enabled live interaction between pupils and Tim and is one of the highlights of the Principia STEM outreach programme. During the pre-arranged school's contact, students have been able to put a number of questions directly to the astronaut using amateur radio VHF and UHF radio equipment specially installed at the school for the occasion by the assembled ARISS team.

In the lead up to the ISS school contact, events take place to promote amateur radio as well as science and engineering. Local radio clubs have been involved with activities like buildathons, special event stations and other experiments to enable the young people to make the most of the Principia mission.



Oasis Academy Brightstowe, Bristol were the third school to contact the ISS.

Several schools in Powys combined to enjoy the science-based activities and the ISS contact.

Buildathons

The RSGB, through the Radio Communications Foundation (RCF), put together an AM/160m receiver kit, the Rodway, that could be built – with supervision – in each of the schools leading up to the main event of the school contact. As there's no better way of learning about radio than by actually building something, we put together a School Information Pack that covers some history of radio, some basics about electromagnetic radiation, transmitters and receivers, electronic construction, specific kit instructions and some suggestions for research exercises and experiments to do after the build, ending with a suggestion that a Foundation course is a very good next step.

Time was tight but we turned a design idea into a working kit in a very short time and the first build took place at Sandringham School in January. Steve, GOFUW was voted 'leader' for the day and members from the Verulum Club helped out with a ratio of one helper to

three kits. School staff stayed with us to cover wider supervision duties.

In this first school, all had done some soldering before and that helped get things off to a flying start. Despite warnings in the briefing, and the instructions, a few parts were fitted the wrong way round, a few in the wrong place and there were a few solder bridges, but by the end of the day all but two of the receivers were working and they were soon sorted with a bit of fault finding – all part of the learning process. The happy smiling faces when the first signals were received were great to see and shows that a working homemade receiver still has a 'wow' factor, even in this digital age. That sentiment was captured neatly as one of the pupils photographed the analogue radio on his tablet computer's digital camera; he was proud of what he had made and wanted to show his parents.

In the course of a week, the pupils went from building a receiver, to receiving broadcast signals, then to receiving amateur signals across the classroom and finally on to witnessing the first amateur contact with a UK astronaut on board the ISS. Not a bad progression path!

I am not sure whether it was the kit building, the Special Event Station, the ISS contact or a combination, but the event has prompted more of Sandringham's pupils to have a go at the Foundation course. Let's hope it has a similar effect at the other schools that ARISS have selected, and beyond Tim Peake's mission. The RCF kindly sponsored the first two hundred Rodway kits in support of the ISS school contacts.

From the interest shown so far, building the receivers looks to be doing a good job in promoting radio and electronics in schools. It shows how building simple analogue gear is a great way to get newcomers interested in the technology. After these simple experiments, they can progress to more complex circuits and later to digitally driven projects, higher power etc. Giving youngsters greater awareness of the underlying technology, this has to be a good investment in the future of the hobby.

Royal Masonic School for Girls, Rickmansworth was the second school to speak to the ISS.

Kit development

The RSGB went to Tim Walford to obtain a suitable kit for the buildathons. He described the process by which the Rodway went from an idea to a fully working project in schools.

"Bearing in mind that our licences gives us the special privilege to experiment with the technology, and to help improve the understanding of it, the approach needs to have an 'educational element'.

"Some would argue that the current state and pace of digital technology is so advanced that any item to be built by newcomers should be 'entirely digital'. While not denying the undoubted importance of digital technology, we do live in an analogue world and the fundamentals of radio communication are also analogue. The essential processes that we use, eg amplification & filtering, need to be appreciated in analogue terms long before there can be any discussion of how they might be performed in a digital machine. Hence my belief that any introductory equipment should be analogue – it can (and certainly should be) followed up by simple digital 'gadgets' but it does need to be in that order!

"It is also clear that the complexity of most digital devices – even a simple piece of logic such as a counter, let alone a microprocessor – is not as easily understood as a simple analogue receiver.

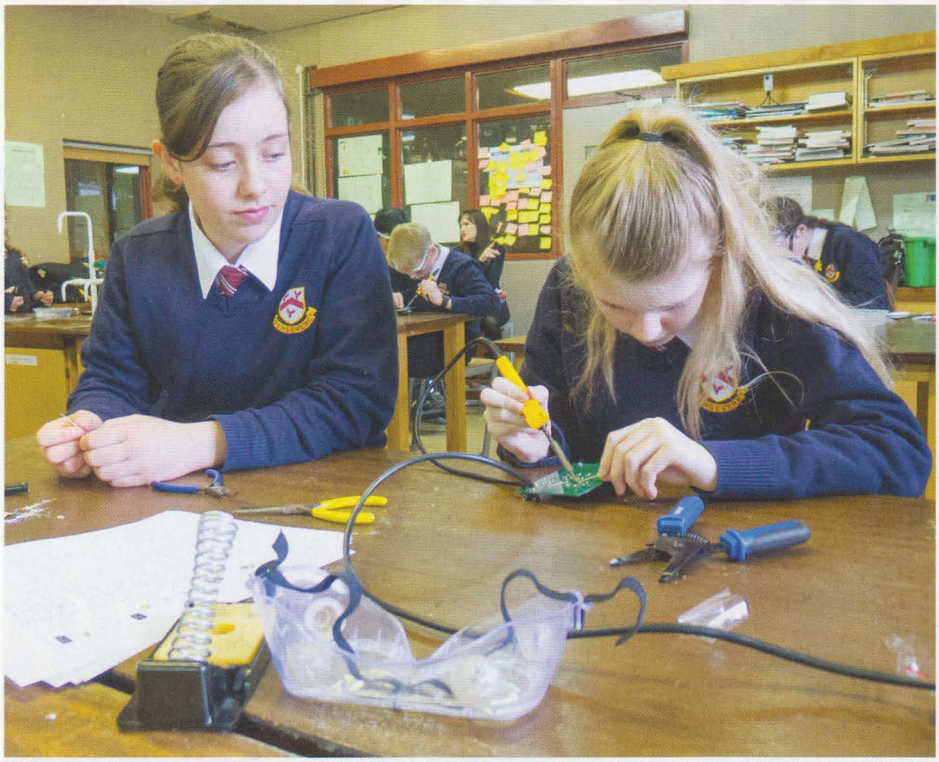
"And so I suggest that when we are encouraging new entrants into the hobby, we have to start by encouraging and stimulating their interests in these fundamental processes and analogue methods. These are quantities and processes that they can actually measure or perform experiments on easily in the school lab. It is also more natural for most of us to think initially about the technology in these analogue terms.

"Many of us who have built and used our own equipment will know the tremendous thrill and pride that comes from being able to say 'I built it'. So it is with newcomers, especially when young, who can take some 'gadget' along to their grandparents and say 'look what I did today' – this will provide a real boost to their ego that, we as the hobby's protagonists, need to actively encourage given the special conditions of our licence.

"We need to interest them in the technology and to gain an understanding of the fundamentals of radio techniques, by introducing them to what can be done with simple equipment. Their technical knowledge will be limited and this suggests we should start with some of the simpler (older) modes that were the foundations of radio communication, ie amplitude modulation for speech transmission. Luckily we do still have powerful medium wave broadcast stations that are easily received; so if we encourage a new entrant to build a MW RX, this will be an early win-win situation! Such receivers are not difficult and can be made with a few transistors and conventional resistor/capacitor/inductor parts.

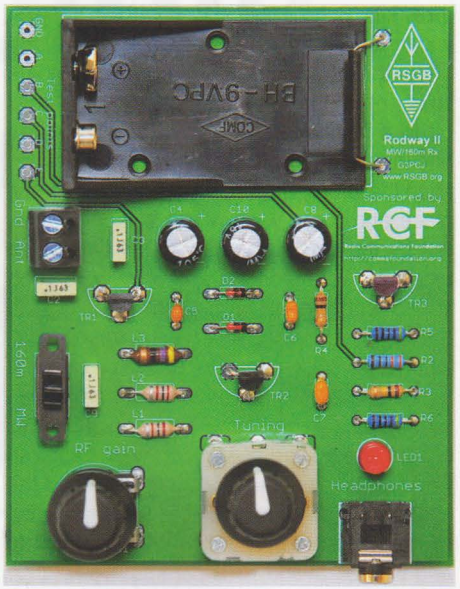
"So the design thinking for a suitable receiver means it has to be able to drive the

Tim Walford, G3PCJ and Steve Hartley, G0FUW



In Wales, different schools sent interested pupils to take part in the activities.

At Royal Masonic School for Girls, they worked in groups to complete each project.



The Rodway has proved to be a successful project.

ubiquitous lightweight 32Ω earpieces, and this dictates an audio amplifier, which can be most easily realised with one or two MOSFET active devices.

"Traditionally signal detection, or demodulation, would be done with a germanium diode but silicon ones can be used instead provided they have a little forward bias. Constructing multi-winding or tapped tuning inductors is a bit daunting – especially for the low frequency bands; but this can be overcome by adding a grounded gate broadband RF amp feeding into resonant load comprising a high value, ready wound, single winding choke type inductor (without any extra small input winding) and the tuning capacitor. A pair of small 100μH bead inductors in series will give coverage of the higher frequency end of the medium wave band when resonated with both sections of a PolyVaricon tuning capacitor. The diode detector is then lightly coupled to this tuned load so as to maintain the selectivity, which can then feed the audio amp. With a suitable switch, the inductors can then be changed to being in parallel, or another inductor of about 50μH can be switched in to cover 160m, which can be used for short range amateur radio AM contacts! A few metres of 'thrown out' aerial wire is long enough to pick up the MW broadcast stations (provided the aerial is not totally within the Faraday cage of a modern reinforced concrete building), and will also be enough for short range 160m amateur radio phone contacts within a small demonstration area.

"This simple Tuned Radio Frequency RX design, which uses only three of the same BS170 MOSFET transistors, has become known the Rodway (after a place in Somerset). It is about the simplest that can be readily built and used for the all-important initial 'wow factor' and then later for demonstrations of some amateur radio techniques.

"Because I don't have the facilities for large scale PCB manufacture, Giles Read, G1MFG at the RSGB has laid out a PCB for commercial production and, with support from the Radio Communications Foundation, this has become a product directly aimed at school pupils thanks to the excellent project manual put together by Bath Buildathon team members Dan, MOTGN and Steve, GOFUW.

"From early reports, these have been very successful in the initial schools to have a go at building their own radios."

Websearch

Sandringham School Video: http://amsat-uk.org/2016/01/06/students-in-ham-radio-buildathon/

RCF: http://commsfoundation.org/

Walford Electronics: http://www.walfords.net/

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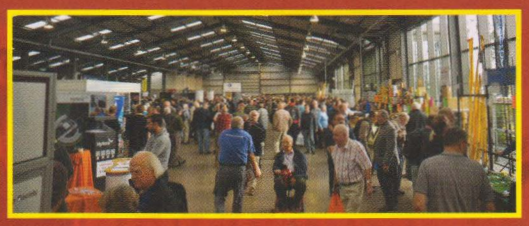

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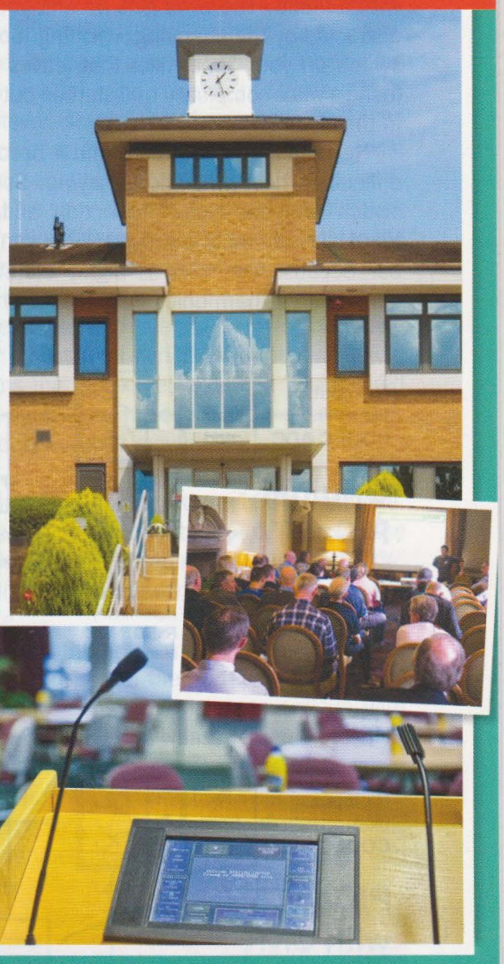

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STAR Noise Reduction

STAR Noise Reduction (SNR) is a DSP Rx development originally designed to complement the PICaSTAR HF Tx/Rx [1]. It delivers a significantly improved ability to remove multiple and simultaneous unwanted noises. A critical priority is to achieve this with minimal disturbance to the wanted signal quality in either SSB or CW mode. 'Noises' in this context include general band noise (local and propagated), multiple interfering carriers – and domestic multi-tone sources such as plasma TVs, PLT and SMPSUs. And combinations thereof.

First, a small digital analogy. Imagine you are sitting in a park having a quiet chat with a friend. The wind gets up and you are distracted by the annoying whistling. So you switch on your Tone Killer that leaves your friend's voice completely undisturbed but now in the clear.

Next it starts to rain hard and it becomes difficult to hear what he is saying. So you switch on your Noise Reduction and the readability is much improved. How can this be? Because the voice is highly correlated and is rich in harmonics whereas rain noise is completely random and uncorrelated. So it is possible to detect and exploit this difference by subtracting the noise.

Then suddenly a large crowd appears and they all start rushing around and yelling at each other. You realise it must be a weekend so both of you give up trying to have a chat and switch off. No technology can help here.

But on a more serious note, you reflect philosophically that one man's noise is another man's signal. Ah, yet another design challenge!

How did we get here?

Most of us live in an urban or suburban environment and our ability to have even a basic HF QSO is being increasingly limited by noise, both QRN (natural) and QRM (man-made), both locally sourced and ionospherically propagated. And worse, that noisy HF environment is getting noisier with every passing day. For most of us, tracking down local noises and removing them at source is a complete dream. As for remote propagated noise, I only have to point my HF beam at any major (ie noisy) city to hear if the band is open to that part of the world or not.

Pragmatically accepting that the noise exists and trying to reduce it using DSP felt like a more realistic strategy. So with some completely different software techniques I wanted to try out, in September 2011 the SNR project was conceived.

Phased implementation

This project has two distinct phases. Phase I was to design and build SNR as an integral part of the PICaSTAR. That phase is now complete. Phase II is to port that design over to a widely available and standalone add-on board to go on the audio output of any Rx. Phase I took over 4 years to complete and Phase II is just starting at the time of writing.

Figure 1 shows a block diagram of the original PICaSTAR approach to noise reduction versus current SNR. Both use the identical dedicated DSP hardware. The performance difference is profound.

For the purposes of this overview, you can substitute any classic non PC-based DSP Tx/Rx for the original PICaSTAR. For an equivalent to PICaSTAR with SNR you have to substitute something expensive, recent and typically requiring both a good PC as well as a good radio.

Why did SNR Phase I take so long?

Mostly because it took me a very long time to truly grasp and internalise the fact that everyone wants something different. I had thought the customer requirement was simple. Just remove those wretched noises!

Well, it turned out that is not always exactly what is wanted.

Firstly, some do indeed want all noise removed – but some prefer a residual comfort level. And a few don't want any meddling with the signal and its context whatsoever.

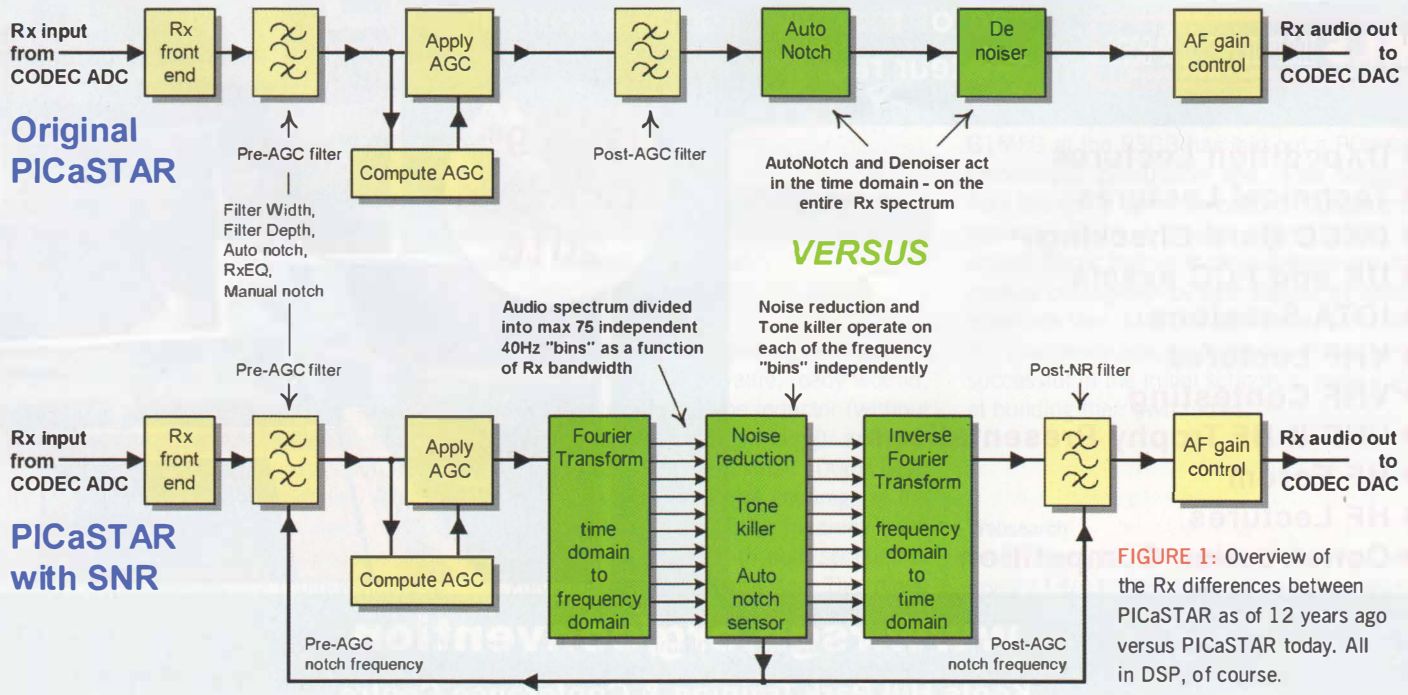

FIGURE 1: Overview of the Rx differences between PICaSTAR as of 12 years ago versus PICaSTAR today. All in DSP, of course.

For sure, nobody wanted noise removing to the extent that the wanted signal audio quality was compromised.

The second reason is that it turned out to be difficult. It was never entirely obvious which design approach was best until very late on.

Thanks to Dave, G3SUL, we ended up after much iteration using 'non-linear prediction', a technique used among other things to forecast share prices. So it must be good! See countless references on the web.

The third reason was that squeezing the SNR software into the existing processor is hard work, not just in terms of the memory it needs but, even more critically, the huge number of extra instruction cycles that have to be executed in real time.

Using the same hardware for SNR Phase I was a prerequisite. Firstly, because many have already invested in building that PICaSTAR hardware. Secondly, because one of my main amateur radio pleasures is squeezing good software into inexpensive hardware. This is pure masochism!

Setting expectations

SSB signals have a typical dynamic range of some 30dB (or 5 S-points) when they leave the Tx. Your S-meter measures – and your AGC acts on – the peak value of the strongest component in your Rx passband. So if you are receiving that signal at, let's say, S5, then there will be voice components spread over the 30dB range from S0 to S5.

If you have an S3 noise floor, it follows that there are many voice components below that floor that for most practical purposes are simply not there. And exactly *which* of those voice components are below your floor is continuously changing both as a function of the instantaneous speech spectral content and the propagation. So far – as opposed to opinions, preferences and tastes – this is mere arithmetic.

A good quality S5 signal over an S3 clean noise floor is still perfectly 100% readable. However, it could never be reasonably described as "of good quality" at the receiving end, because huge chunks of it are missing. It is best and most simply described as 'noisy' because although the ear/brain integrates over time and does a great job of filling in the gaps, it leaves an overwhelmingly net hissy sensation running continuously. Some people find this very unpleasant and they would simply prefer it if that snake noise was not there.

In this example, given the readability can't be improved over already 100% readable, can we improve the listening experience? Because over any sustained period, many if not most find it very tiring to listen to. Or, to use a simpler concept, just plain irritating.

We could easily substitute near silence during pauses in the speech. This is commonly called squelch – and if it has good attack and decay time constants then I personally think this gives some useful brief relief from that continuous hiss, even on SSB. Not everybody (and probably not most) would agree. It smacks too much of FM!

The more subtle (ie difficult) approach is to note every frequency where at any instant in time the signal exceeds the noise. And pass some larger percentage of the input at that frequency through to the output – where the percentage is a function of our confidence that we have made the right decision.

This is the essence of SNR. Note also that by 'instant in time', we are not talking seconds (ie the speed of sentences, as in squelch). Rather, we are talking milliseconds.

So there are two SNR design objectives: (1) reduction of noise on perfectly readable signals while not introducing new consequential artefacts. This is defined here as maintaining fidelity. It is easily the more difficult task. (2) Improved readability on the margin. Definitely achievable for both SSB and CW.

And the Phase I outcome? In brief, the above objectives have been achieved – for stations living with a range of noise circumstances anywhere between trivial and horrendous.

We can tune SNR for more or less aggression – where the outcome varies between the limiting extremes of truncated wanted signals with switching noise in the gaps – through to such a modest reduction in noise that it becomes essentially impossible to tell that SNR is acting at all.

Finding several solutions between those extremes that suit both different operational circumstances and different personal tastes is the objective. Crucially it would seem we all have different preferences. And certainly we have different noise environments.

The ultimate test is whether you leave SNR switched on under all operational circumstances. There are some small limitations (discussed shortly) so 'very nearly all the time' is the answer here.

Establishing design priorities

SNR is designed to deliver an improved listening experience. However because in practice 'improved' turned out to be a highly subjective value judgement, a formal set of SNR project priorities was developed to provide a tangible basis for development and some agreed criteria for objectively measuring progress.

These priorities have never changed. They apply equally to all operational scenarios (both SSB and CW) ranging from monitoring an empty albeit noisy frequency in anticipation of activity, casual conversational QSOs through to sustained contest operation and DX chasing.

In this context we need to define 'signal'. For SSB, it means the one on-tune SSB signal in an appropriate Rx bandwidth. For CW it means all the CW signals in the currently selected Rx bandwidth.

The following paragraphs discuss the SNR design priorities, seen in the light of my more enlightened understanding of 'customer needs' – yet ultimately bounded by the laws of physics. So these *are* realistically achievable objectives – and not just a mere 'wish list'.

From the operator's perspective (is there any other?) the priorities split into two distinct scenarios, with the inevitable grey area in between.

Signals that are definitely 100% readable. Top priority is absolutely minimal loss of signal fidelity. This fidelity requirement amounts to wanting the signals themselves to sound essentially unchanged with SNR on or off. We do not want to remove noise at any expense to fidelity. Also, any artefacts of the wanted signal(s) that classically should not be there ideally remain untouched. We are definitely not into using our Rx technology to 'improve' their Tx technology.

The next priority is to reduce anything and everything that is not a component of the wanted signal(s). That amounts to 'white' noise (eg band noise), coloured noises (eg man made) and persistent tones (from whatever source). A few prefer complete removal, a few absolutely none and most prefer something in between.

At the same time, SNR should not introduce any new artefacts that add significantly to the noises we are trying to remove.

The argument is that the end result will be more pleasant to listen to – and less fatiguing over a sustained period. And interestingly, it seems that for some, taste can be acquired with experience and use. So in that sense, the target is a slowly moving one.

Signals that are less than 100% readable. Here the only priority is to improve the readability of the wanted signal up to 100%. Until that is achieved, fidelity takes second place.

Limitations - yes, there are some! Absurdly bass-boosted SSB signals can end up with some of that excess bass reduced. To SNR it can look like tones. You may not consider this a limitation in practice.

Especially when operating near the MUF, you sometimes get phase distortion on

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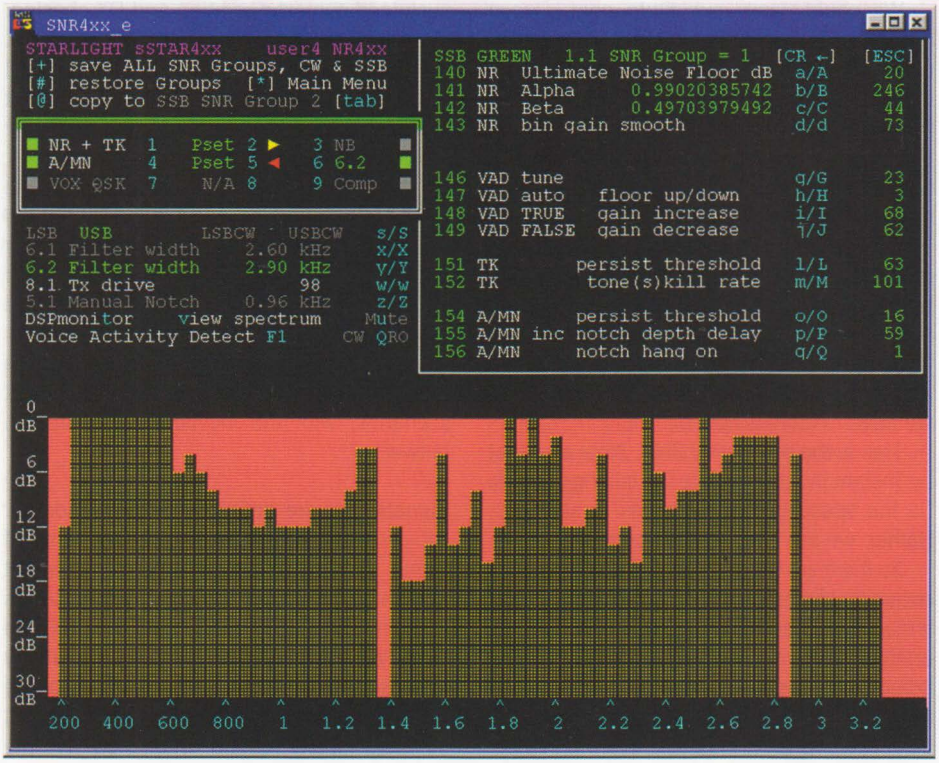

FIGURE 2: Typical SNR loader showing the tuneable SNR parameters, the STAR keypad and the resulting BSD of an SSB signal.

signals caused by different propagation path lengths on slightly different frequencies. This 'distortion' can become more apparent as you remove the background noise.

The number of SSB signals with excessive IMD products has increased noticeably over recent years – and removing masking band noise makes those IMDs even more obvious. They sound even worse.

SNR technology in brief

How do you visualise a signal? Most of us – I think – see a signal coming down the antenna lead in the *time domain*. That is, its amplitude changes with time. This as what you would see on an oscilloscope connected across your speaker terminals, namely signal amplitude up/down versus the passage of time left to right. With an analogue (ie hardware) Rx, it is the only domain we've got!

The original PICaSTAR had both noise and tone reduction in the time domain, producing better results than the obvious commercial competition. Even so, this domain significantly limits the performance in practice.

For noise reduction purposes, we classically prefer the audio in the *frequency domain*. You can visualise this as what you see on a spectrum analyser display, namely signal amplitude up/down versus frequency increasing from left to right. This domain is preferable for noise reduction purposes because it seems more intuitive (at least it does to me) to differentially change the Rx gain to remove noise at different frequencies rather than at different times. Fortunately most of the mobile phone industry agrees, so I must be right. *[The mobile phone industry also gives us four-hour batteries, so I question your choice of friends – Ed].*

In the frequency domain, these small individual bands of frequency are known as bins. Their amplitudes change with the passage of time and crucially, we can control the gain of each such bin independently.

But it is horrendously expensive, in processing terms. Getting the signal into the frequency domain and then afterwards, back to the time domain is a pure overhead. It costs a fortune in valuable processing resources and as such, this overhead achieves absolutely nothing. The virtue of the approach lies entirely in the cunning things you can do while you are in the frequency domain.

Ways and means

The classic means of getting from the time domain to the frequency domain is to use a Fast Fourier Transform (FFT). And after we have processed the bins, we get their contents back to the time domain using an Inverse FFT. (This latter step is so you can listen to signals with your ears. If you merely want to watch signals with your eyes, you don't need this Inverse step.)

You may have met this approach on a PC. Most audio packages have this capability and it is great for, say, cleaning up (removing noise from) old recordings. The distinguishing feature of this and similar applications is that they do not operate in real time. If you can easily spare several minutes to wait for the result, fine. If passing the audio through the process several times improves it further, great. But if you are trying to conduct any meaningful QSO, such delays are totally unacceptable.

If the delay (latency) is not too bad, one possible workaround is to not provide VOX and QSK operation – or to make them so slow that nobody would use them. There are plenty of examples of this approach on simplistic SDRs. Completely unacceptable.

You can always get there by throwing more money at the problem by buying ever faster hardware. As a matter of principle, I don't see any great joy in just throwing money at any hobby. I would rather invest my time and derive pleasure by taking on the challenge. Further, with PICaSTAR, hundreds of people had faith and long ago committed to their base hardware platform – and I am also not into 'churning the market'.

The scale of the problem

With PICaSTAR DSP Rx processing, successive samples of the signal arrive every 20.83μs – so that is how long we have to process each and every one of them. Nyquist must be obeyed!

A lot of that processing occurs at audio and is implemented in five code blocks that are run in turn at a 9.6kHz rate. To give you some sense of scale, each such block has enough time to process, say, two good quality audio filters – which is about six *hundred* instructions.

Irrespective of the exact variant you choose, the FFT and its inverse each require several *thousand* instructions. For example, a 1024 points radix-4 FFT optimised for run time straight out of the Analog Devices code library requires 37,016 instructions – and the Inverse FFT, same again. Without debating the detail, you can see we are several orders of magnitude away from even contemplating this approach.

Chugging away in the background for the purposes of producing a spectrum display, this is not a problem. In the real-time live QSO signal path, it's a complete non-starter.

The so-called 'fast' Fourier Transform may be *way* faster than its predecessors but is nothing like fast enough for us.

The nature of the solution

This project only got started at all because I chanced on a paper on the web **[2]**. The first page of this paper describes the benefits of the approach succinctly – and it was just made for this job. This approach was used to get started but later **[3]** was found, which describes a form of Sliding Discrete Fourier Transform (SDFT).

This turned out to be even better in practice.

One significant advantage over the conventional FFT is that you only need to compute the bins you are actually using. So in the narrower bandwidths associated with more difficult situations, the processing load drops and can be re-allocated.

The SDFT plus the Inverse SDFT needs 26 instructions + 7 instructions per bin. For the worst case bandwidth of 3kHz using 75 bins each 40Hz wide, this comes to a mere 551 instructions. That's more like it!

There is another important limit. The inherent latency of any Fourier transform is a function of bin width. 40Hz bins are as narrow as you would want, since with anything much narrower, that increased latency would make Rx/Tx transition delays unacceptable in the real world.

With commercial radios these critical numbers tend to be a well-kept commercial secret. I am not aware of any other truly *amateur* radio transceiver that uses this approach.

But don't try this at home using C++. Of necessity this was all hand-carved in AD Assembler from solid gold bricks. It took months to eventually get it down to those 551 max instructions.

Reducing the noise

Crudely, we decide if a given bin contains more signal than noise. And then switch it on or off accordingly. But switching bins between fully on and fully off is not desirable, since the noise generated by that switching action would generate more internal noise (in the form of switching sidebands) than the external noises we are trying to reduce.

So, in general, we try to change the gain of each bin as a function of our confidence that – at decision time – the bin contains more signal than noise. Often that is not too difficult. But with low SNR signals, when we are on the very edge of deciding if a bin is more signal than noise, confidence in that decision is – by definition – only 50%. Getting more of those decisions right when on the extreme margin is the essence of improved readability. See **[4]**.

SNR features

SNR has three completely new subsystems.

Noise Reduction (NR). This improves the signal to noise ratio of wanted signals versus typical band noise. It can also be tuned to reduce some coloured noises (eg DRM). NR has been explicitly designed for minimal disturbance to the wanted signal if that signal is more than about 3 S-points over your noise floor.

NR reduces noise differentially across the frequencies in the passband. In addition it has a detector that is explicitly looking for an on-tune voice in SSB mode and for keyed tone(s) anywhere in the passband in CW mode. When it finds them, the signal or noise decision is instantaneously biased further towards 'signal'. For speech this detector is universally known in the trade as a Voice Activity Detector (VAD). For CW, I have called it a Morse Activity Detector (MAD).

STAR SNR is in contrast to the original STAR Denoiser that, like all others based on the Wiener filter I have ever heard, often leave you listening to audio apparently coming out of a large drain-pipe.

Tone Killer (TK). TK reduces all persistent tones. These vary from truly persistent single or multiple carriers through to tonal interference from (for example) PLT and plasma TVs – where persistence at a given frequency is harder to establish. You get to pre-tune persistence so that SNR will distinguish between slow and wanted CW versus the persistent and unwanted tuner-uppers.

The improvement is dramatic. With minimal loss of fidelity to wanted signals, TK can be tuned for sensitivity to the point where it will reduce tones that you may not even be able to hear (ie you did not realise they were there until after they were removed). This is in contrast with the original time domain AutoNotch, which could usually handle only one tone – and also because that included a keyed tone, it could not be used in CW mode.

Auto/Manual notch (A/MN). A/MN builds an auto-frequency and auto-depth notch on the instantaneously strongest interfering carrier. This notch is particularly effective since it reduces the tone before it gets to the AGC detector. See Figure 1. So the AGC gain on the wanted signal is not reduced by an interfering carrier, even if that carrier is stronger than the wanted signal and would normally dominate the AGC. This holds true up to the point where the carrier strength exceeds the maximum notch depth of 65dB, ie at about S9 + 10dB.

Alternatively, this notch may be switched on and manually tuned in frequency. This approach is particularly useful for a non-continuous but constant frequency interfering tone.

In practice you will see the S-meter read say S9 on a strong interfering carrier – and you won't even hear any weak wanted signal. When you switch on A/MN you will see the S-meter drop to the point where any wanted signal is now controlling the AGC. And if there is no wanted signal present, the S-meter will drop all the way to your noise floor.

It should be noted that no add-on standalone processor (including SNR Phase II) can ever achieve this, since the unwanted carrier has depressed the Rx gain in the parent Rx by AGC action. The damage to the wanted signal has already been done.

Tuning SNR

For context, let's have a brief glance at what this looks like. We have a PC-based application illustrated in **Figure 2**. All the user control keys are shown in a cyan (light blue) font.

On the left are all the non-SNR controls needed to define the circumstances under which you are pre-tuning SNR. This includes a replica of the actual PICaSTAR keypad.

On the right are the tuneable SNR parameters, numbered 140-156 for reference purposes only. They are used to pre-tune NR, TK and A/MN capabilities for your tastes, for your personal noise environment(s) and for different operational circumstances.

There are nine such SNR Groups per mode to cater for a wide range of different circumstances. Each Group comprises a set of 13 SNR parameters and, once tuned, you allocate one of these Groups to each of your 3 most common circumstances. Classically these are good, medium and poor conditions.

Then, for operational use on PICaSTAR (ie no PC), you switch (with one keystroke) between these three. Occasionally you might select one of the other six from a top-level menu. For example, if you are afflicted by a specific nasty noise (eg plasma TV, PLT etc), the general idea is to pre-tune at least one SNR Group specifically to handle its idiosyncrasies – and then select the appropriate SNR Group when trouble strikes.

Although most people don't need anything like this much versatility, none the less you wouldn't ever want to be tuning all (or indeed any) of this in the heat of battle. Hence the term 'pre-tune'.

At the bottom of the window is the Bin Spectrum Display (BSD), which shows the instantaneous insertion loss in dB of all the currently active bins, ie those in the current Rx Filter width. They swing between full scale, full gain and the floor level you have set with parameter 140, Ultimate Noise Floor.

However, bins that are being notched by TK are fully attenuated irrespective of your Ultimate Noise Floor setting. See as an illustration the two TK notches on carriers at approximately 1.4kHz and 2.8kHz.

A/MN has no impact on the BSD because it notches out the strongest tone early in the Rx chain. However, it follows that A/MN must have already removed a stronger third tone in the Rx passband as illustrated – or otherwise A/MN (not TK) would have already taken out the stronger of the two remaining tones.

In CW mode, you will see an auto-width and auto-frequency mini-filter build around each CW signal in the Rx passband.

Watching the BSD while tuning your SNR parameters is the best way to optimise them. Since we have long since internalised what a

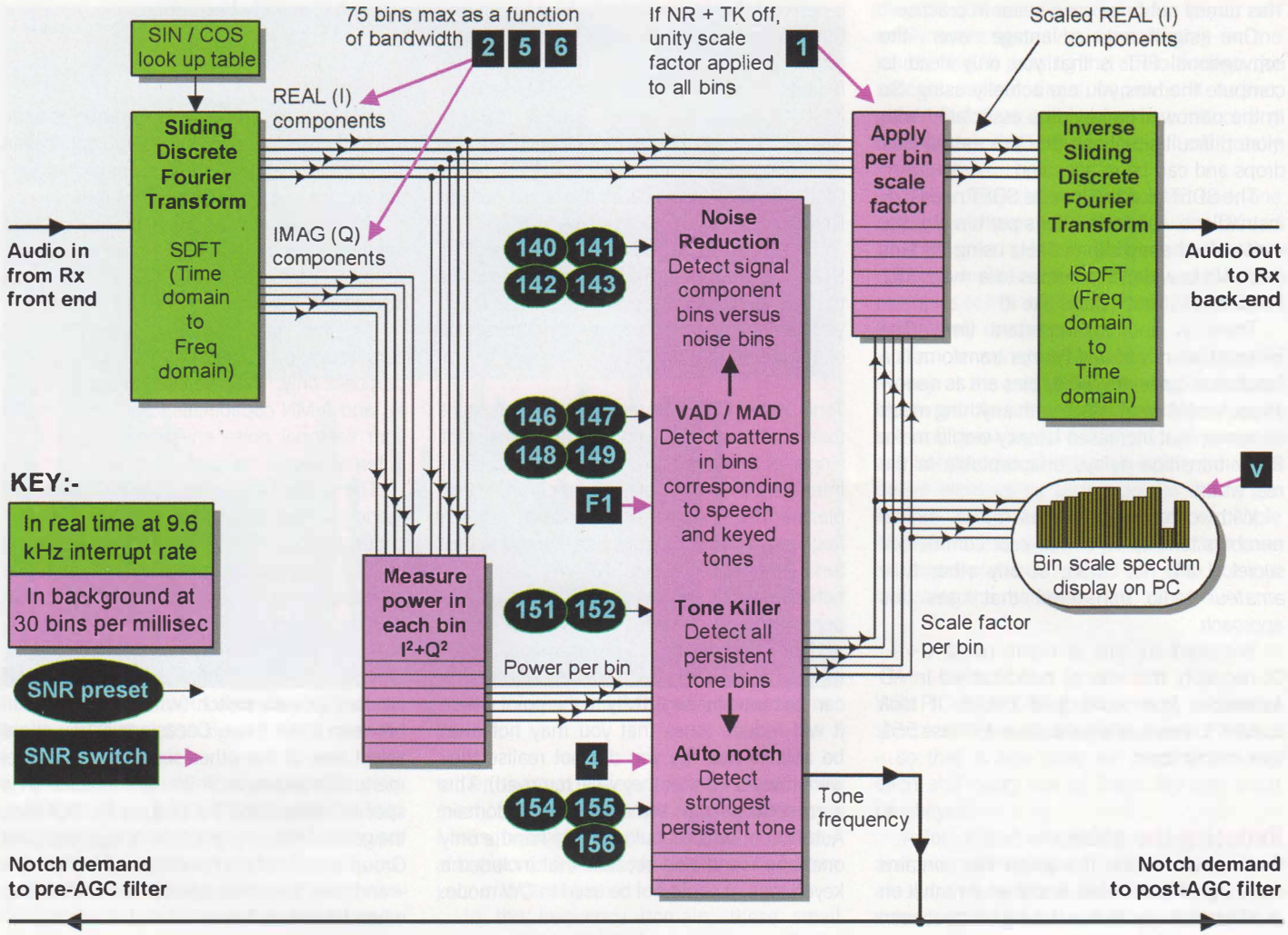

FIGURE 3: More SNR implementation detail, showing where the pre-tuned NR, TK and A/MN parameter settings apply.

good signal sounds like, the starting point for SNR optimisation is to tune in good quality signals with already good SNR – and also internalise what that looks like.

Please note carefully that the BSD shows the spectrum of instantaneous gains at the different bin frequencies, ie *this is SNR's response to the signal + noise*. It is not a classic spectrum display of the signal + noise *per se*.

Figure 3 shows a bit more detail of SNR and where those user preset controls apply.

Figure 4 shows a typical BSD in CW mode at the moment of key down. This example is in a 1.4kHz bandwidth at a CW Pitch frequency of 600Hz. This signal was 3 'S'-points over my Ultimate Noise Floor, which is set at 22dB down. Note the two keying side-bands, which result in the characteristic keying hardness. You would lose these in a narrow CW filter.

One extreme SNR consequence

Over the last decade, my MDS on 15m has come in repeatably at -131dBm in a 3kHz bandwidth. In fact, the actual numbers don't matter for the purposes of this discussion. What really matters is that when I connect my antenna (as opposed to a dummy load), then on any HF band I can hear some incremental band noise that exceeds my Rx internal noise. Even on an apparently closed band.

When I switch on NR, that band noise goes down (ie the AF output drops by many dB) and what I can now hear is occasional tones (at various tuning rates) as I tune across the band. These are doubtless DDS LO spurii that normally lurk completely unheard below the Rx internal noise floor. When I switch on TK, all those tones completely vanish as well.

What is happening here is that SNR first removes the band noise, and then goes on to also reduce the Rx internally generated wide-band noise floor – and *then* it goes on to remove any internal spurious tones.

So with SNR on, I end up being able to hear signals that are further below my Rx noise floor (as conventionally defined) than with SNR off. The Rx MDS has been effectively improved and I can now measure -136dBm in that same 3kHz bandwidth. Nearly one S-point improvement. And to measure this I have to inject a keyed carrier – or otherwise SNR maliciously removes the measurement tone as well!

Note that you can't achieve the same result simply by having a quieter Rx front end. You have to also reduce the band noise.

Tone Killer and A/M Notch detail

This further detail describes the interaction between TK and A/MN to provide more context.

In fact it is TK that calculates the frequencies of all the required notches and it applies post-AGC notches to all persistent tones. It also works out which is the single instantaneously strongest tone – and passes its frequency over to A/MN. A/MN then builds the pre-AGC notch at an ever increasing depth. So TK is left to remove any post-AGC residual tone that is greater than [tone level + AGC gain – notch depth (dB)]. This rapidly subtends zero as the A/M notch builds – hence the non-appearance of a notch on the Bin Spectrum Display. And of course, you hear no tone.

The point is quickly reached where the offending tone is so notched out that TK

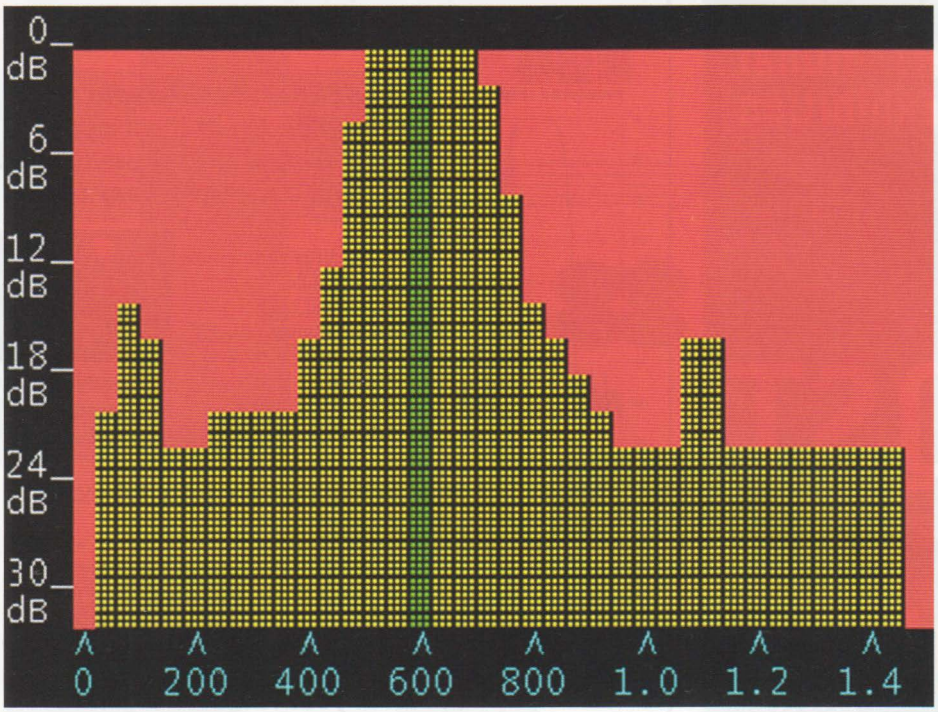

FIGURE 4: Typical CW BSD display on a modest signal.

no longer even sees it – or some other tone becomes stronger, eg a speech component. And so the A/MN notch depth starts decreasing until the cycle starts again. This is a classic servo loop and it caters for QSB on the carrier (including switching off) – and QSY of the carrier – and/or some other carrier becoming instantaneously dominant.

A/MN is designed to be left switched on under most circumstances. If you wait for a big tone to appear before switching on A/MN, AGC action will have already reduced the Rx gain at all frequencies and it will take much longer for A/MN to recover the AGC (and therefore the wanted signal). The end result will be the same, but noticeably slower to get there.

There is an LED that flashes on while the A/M notch is being built. Often you will see these brief flashes when you can hear no interfering tone. That is not because there is no tone. It is because A/MN has done its job perfectly and completely transparently.

There are some more difficult situations:

- If there is more than one persistent tone in the passband then A/MN will swap between the two strongest tone frequencies. It will devote more time to notching the strongest tone. If for example, one tone is weak and the other strong, A/MN will only occasionally switch to the weaker tone. This switch occurs after A/MN has acted on the stronger tone to the point where the weak tone becomes the stronger. Almost immediately after switching to that other tone, the situation is reversed. But the notch still has to be re-built on a different frequency. There is a tuneable preset amplitude threshold that minimises the impact of this effect.
- There will always be more A/MN activity in the presence of both signals and tones than with only one of them. Even if an interfering tone amplitude is in fact constant, its apparent amplitude will vary as the wanted signal moves the AGC point. This can lead to a lot of A/MN activity as the notch depth tracks the changing tone amplitude.
- If you get two (or more) CW signals of similar amplitude on exactly the same frequency, the 'gaps' will tend to be filled in and the net result will sound more like a continuous tone both to you and to A/MN. So it is more likely to react.
- If a wanted SSB signal has a particularly mono-tonous voice then you may notice occasional small A/MN activity. If you pre-tune A/MN so this never happens, you may feel it is a bit slow to react when a real tone comes along.
- In general in CW mode, you tune for a CW tone to be deemed persistent if it lasts longer than a dash at your slowest wanted CW speed. But the slower you set this minimum CW speed then the longer A/MN has to wait to see if every dash is ever going to stop. Thus the A/MN response time to a tone that eventually turns out to be a persistent carrier is necessarily increased. A similar argument applies to reasonable speed CW which is excessively weighed down by unconventionally long dashes.
- CW contest reports (ie 5NN) commonly sent differentially at huge WPM will often appear to A/MN as a continuous tone. But, in general, the A/MN reaction time to this data burst will still let most of it get through. Enough always gets through so that you are left in no doubt what happened. But you might be left briefly wondering if you got 4NN or 5NN. I suspect it was 5NN.

Audio recordings - but also a word of caution

There are some recordings on the web [5] that illustrate the impact of SNR. On various sites you will also find recordings made using other products. Please note that some of these recordings are simply of some noise only – both before and then after noise removal. But there is no wanted signal. This illustrates a profound lack of understanding of the issue. It is only the wanted signal to unwanted noise ratio that matters ie S:NR. So with no wanted signal present to compare with, such 'results' are completely and inherently meaningless.

You can always reduce any noise simply by turning down the AF Gain. Or for truly spectacular results, just switch off your Rx.

Which you will recall is where – chatting in the park – we STARted.

Acknowledgments

This project could never have happened without active and enthusiastic contributions. Some in the form of theoretical insight, some for operational insight, some for tuning, testing and stressing. But all for demonstrating the extraordinary range of personal tastes and preferences out there. My particular thanks to Harold, W4ZCB; Dave, G3SUL; Peter, OE6ZH; Paul, G4WJH; Jörg, DL8JW; Ray, G4TZR; Paul, G3ZCU; Gary, K5AMH; Bob, 5B4AGN; Duncan, G4ELJ; Vasil, LZ1QB; Brian, VE7JKZ; Alessandro, IK6FWJ; Laci, HA9KLA; Lajos, HA5CDQ; Ryan, KK6DZB; Jonathan, GW2HFR; John, G3GIH; Tony, G4CIZ ... and to Fran for her insightful proof-reading.

Websearch

[1] PICaSTAR: A Software Transmitter And Receiver by G3XJP. First published in *RadCom* starting August 2002. Also in *RSGB Radio Communication Handbook* 8th Edition. Latest details are at https://uk.groups.yahoo.com/neo/groups/picaproject/info

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[5] Some sample recordings and other information can be found at https://uk.groups.yahoo.com/neo/groups/SNR_group/info

W-8681-SOLAR Weather Station

The new weather station from Watson includes many new features that will make it an extremely useful addition to any shack.

As well as the usual range of temperature, wind speed/direction, humidistat and rain gauges, this new weather station adds light (kLux) and UV level measurement as well as providing solar power for the remote transmitter.

Construction

The weather station is supplied disassembled but construction is very simple and a screwdriver and pair of pliers is all you'll need. In addition to the plastic arms that carry the sensors, the weather station includes a couple of short metal poles that slot together to form a short mast that can be mounted on a more substantial post using large jubilee clips (supplied).

Mounting the sensors onto the plastic arm was very easy as there were locating pegs and screws for each item that made for a very positive fit. As you can see from the photos, the wind speed and direction indicators are mounted in the clear at the top of the assembly with the rain gauge and light sensor/humidistat on separate sensors just below. For the review, I positioned the bar supporting the wind sensors East to West so I could mount the solar cell and light meter on the South side and put the rain gauge opposite on the North side. All the sensors were pre-wired – all I had to do was plug the sensors into the appropriate sockets. The final task is to fit the two rechargeable AA cells (supplied) in the transmitter and strap the sensor to the mast. With the outside unit complete, I turned my attention to the base unit. Not much to do here other than insert three AA-cells (not supplied). As soon as the base unit is powered-up it starts to search for the outside unit and in my case that was found very quickly and readings were very soon being displayed. The entire process from opening the box to completion took little more than half an hour.

Base Unit

As you can see from the photograph, the base unit has a very detailed display with most of the measurements available at a glance. Each of the sensors can be set with high/low alarms to give you warning of particular weather condition that could be useful to spot that illusive VHF lift. If you want to keep records of the changing weather situation, you can use the supplied EasyweatherPlus Software to download and analyse the data on your PC. The weather station uses a standard USB connection to the PC link and both cable, software and printed manual are supplied – makes a nice change!

Summary

The weather station has been working very well for me and having a solar powered remote transmitter is a great idea and avoids the problems of having to access the remote unit to change batteries. The measurements from the sensors are updated every 48 or 60 seconds so the display is always up-to-date.

Thanks to Waters & Stanton for the loan of the review model.

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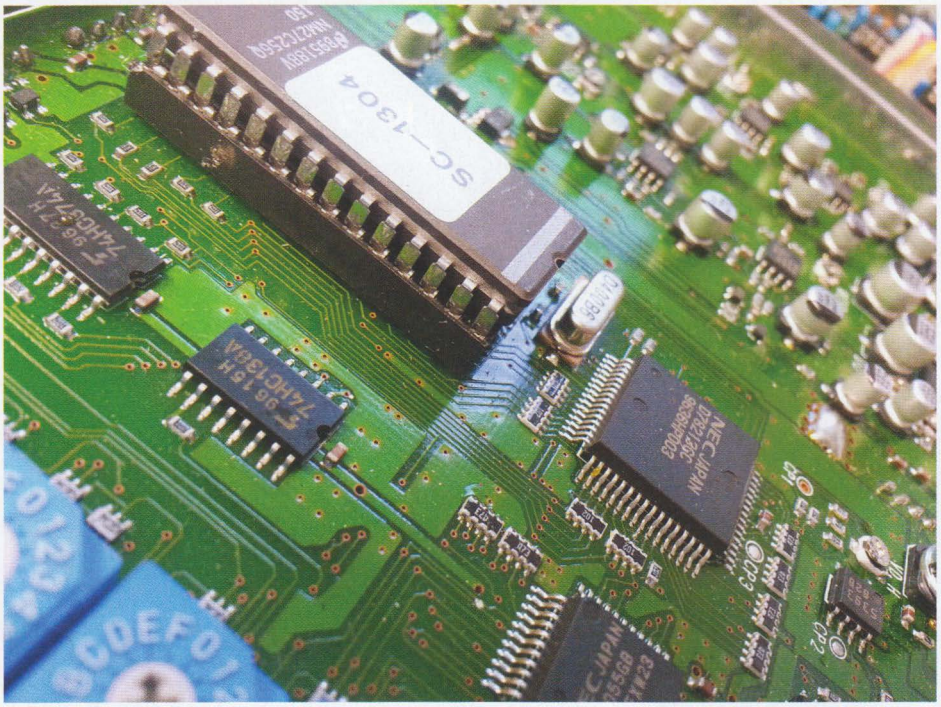
Using authentication in amateur radio

Repeaters and beacons need to be reliably controlled as part of the conditions of their licence. Good repeater sites rarely coincide with amateur's homes and are often difficult to access. An RF control link is an obvious solution – but this raises the spectre of malicious meddling with control functions. Cryptography has a solution that allows a control message to be sent reliably *and unencrypted* (so it is legal to send via amateur radio), which will also detect any attempt to imitate or repeat the message [1].

The two essential ingredients in the process are *cryptographically secure hash functions* and *multi-way handshakes*.



Part of a repeater's control logic (photo by Dave Williams, G8PUO, RILGES repeater group).

Secure hash functions

A simple analogy for a hash function is that of cooking a stew, reducing it, and then liquidising it into a soup. The aroma and taste from a spoonful tell you what the constituents are but without giving a precise description of the ingredients. The addition of a spice to the stew modifies the flavour depending on the spice used.

A hash function is used to compress data of any size down to data of a fixed size. The values generated are referred to as hashes.

At this point you may well ask 'what on earth uses a function that behaves like an electronic black hole?' The answer is *cryptography*, and for this we have to blame the beer served in the Eagle in Cambridge [2]. About 1967, Roger Needham and Michael Guy were discussing the dangers of storing passwords on the multi-access Titan computer they were helping to build. Over a pint of inspiration they realised that you could store the *hashes* of the passwords instead of the passwords themselves. When someone logged on, the hash of their password was calculated and compared with the list. So if a naughty person copied the passwords file, they couldn't impersonate another user because they didn't have the password. Since then, hashes have become – along with block and stream ciphers, cryptographic primitives – one of the main building blocks of cryptographic protocols.

A good secure hash function has the following properties:

- It is virtually impossible to calculate a message from its hash
- It is virtually impossible to change a message without changing the hash
- It is virtually impossible to find two different messages with the same hash
- A 1-bit change in the input affects each hash bit with a probability of exactly 0.5.

Secure hash functions – also known as one-way functions [3, 4] – have uses such as digital signatures, message authentication codes, and other forms of authentication. They can also be used to detect duplicate data, uniquely identify files, and as checksums to detect data corruption.

The essential feature of hash functions is that you can calculate the hash of any stream of bits or bytes and get a unique digital fingerprint of that item. If you include your own secret key as part of that input, you'll get a different fingerprint that is unique to that item *and your key*.

Hence two people who share a secret key can communicate with an extreme degree of certainty that their messages have not been subject to modification or interference, by simply appending a secure hash to the message – *but without hiding the message*. A keyed hash system called the Message Authenticator Algorithm was developed by Donald Davies and David Clayden of NPL in 1983 and became part of the ISO 8731-2 Banking standard.

Here, we are assuming the hash-based message authentication code (HMAC) method of combining a key and data, using the SHA-1 algorithm [5]. SHA-1 outputs a 160-bit (20 byte) hash.

Handshaking, or 'who am I talking to?'

If you've ever been on either end of a misdialled phone call you will realise how difficult it can be to identify who you are

talking to. We all use certain clues that make us trust that we know who is on the other end of the line. Tone of voice, accent, subject matter, time of day all contribute to that trust.

You may go as far as to ask the other end about some shared private information to confirm their identity. However, assuming you've been overheard, that secret must be considered to be in the public domain and cannot be used again.

Context is important too – as the conversation continues, the context will change and form a subtle backbone to the whole dialogue.

Challenge-response handshaking [6] is a method of generating trust between two parties prior to them conducting business. When there are hackers who want to subvert the process, special measures have to be taken to ensure that a high level of trust is maintained throughout the dialogue. For simplicity, each packet has the same four field format and its integrity is guaranteed by making the fourth field the keyed hash of the first three fields.

Initially, each party must challenge the other so that the response is only known to the challenger. This method uses a shared secret key along with a hash function.

Consider the example where Alice needs to tell Bob to do a task and report back on the results. Initially, Alice challenges Bob by sending a number that is used once only (known as a 'nonce' – see later) and Bob replies with the keyed secure hash of the nonce and also a nonce of his own. In this case accurate timestamps can be used as nonces.

In the data packet shown in **Figure 1** we've added a message, a digest (see later) and all three are processed to produce the Keyed Hash value for that packet.

Figure 2 shows Bob's reply, which is both a response to Alice's challenge and also a challenge to Alice. After Alice has verified Bob's response by checking the has his correct and the digest matches what she previously sent, Alice can trust Bob.

Only when Alice's second message to Bob has been verified by Bob can Bob trust Alice. He can then confidently act on the other contents of that message – which can be information, a request or a command etc.

If the first message to Bob was a replay attack (recording of a previous packet), the attack would fail because the new Timestamp 2 and hence the new Keyed Hash 2 would be different and so the attacker would not be able to create a valid message 3 packet without the secret key.

From now on, the back and forth dialogue can be taken as trustworthy as long as the messages contain fresh material (nonces) each time and are verified by keyed secure hashes. **Figure 4** shows a response to message 3.

	Field 1	Field 2	Field 3	Field 4
Alice → Bob	Timestamp 1	Message 1	Digest 1 (KH(T1))	Keyed hash 1

FIGURE 1: Format of a simple initial message from Alice to Bob.

	Field 1	Field 2	Field 3	Field 4
Bob → Alice	Timestamp 2	Message 2	Digest 2 (KH1)	Keyed hash 2

FIGURE 2: Bob's response to Figure 1.

	Field 1	Field 2	Field 3	Field 4
Alice → Bob	Timestamp 3	Message 3	Digest 3 (KH2)	Keyed hash 3

FIGURE 3: Alice's reply to Bob, establishing trust both ways.

	Field 1	Field 2	Field 3	Field 4
Bob → Alice	Timestamp 4	Message 4	Digest 4 (KH3)	Keyed hash 4

FIGURE 4: Bob replying to Alice.

The chain of digests or context in these messages confirms the sequence of the messages. When each message is sent, the sender notes what digest they expect to see in the next reply. The timestamps introduce freshness at every stage so that no packet is ever repeated, meaning that the keyed hash has to be recalculated for every packet.

The digest is a smaller version (64-bit) of its hash input. In this case the suggestion is a simple accumulator, where every input byte is added into the accumulator and the accumulator is rotated by 8 bits after each addition. Initialising the first digest field with the hash of the initial timestamp enhances the uniqueness of the chain of digests.

Nonces / timestamps

Nonces are numbers that are used once only. In cryptographic protocols they are often used as a way of distinguishing one transaction from another. In the present suggested protocol a timestamp will suffice, assuming that the time is of such accuracy that the timestamps of successive transmissions will always be different (eg a resolution of say 1 millisecond where the transmissions may take several milliseconds).

Key security

Keys, like all secrets, only remain secret for a certain length of time. In WW II, the US cipher machine the M-209 was designed for a key life of 24 hours. This meant that it was assumed that the enemy was able to deduce the key after a day and that all previous traffic was open to view.

Ofcom's latest guidance (October 2015) on encryption is in the context of RAYNET activities and insists that keys must be written in logbooks. It must be assumed that as soon as the logbooks are able to be seen, all the transmissions become public knowledge. All parties involved must understand this and tailor their messages accordingly. Also, this raises privacy issues where medical records are involved and those involved should consider extra logbooks that can be kept under lock and key.

Because the method of authentication described here does not hide the message, those rules do not and must not apply. The authentication keys *must* be kept safely locked away.

Keys should be long, preferably in excess of 64 bytes. This is especially important where the key is an ASCII string as there are fewer than 96 printable characters in each byte. It's not important that you remember the key, so a jumble of random words and numbers from a newspaper is ideal.

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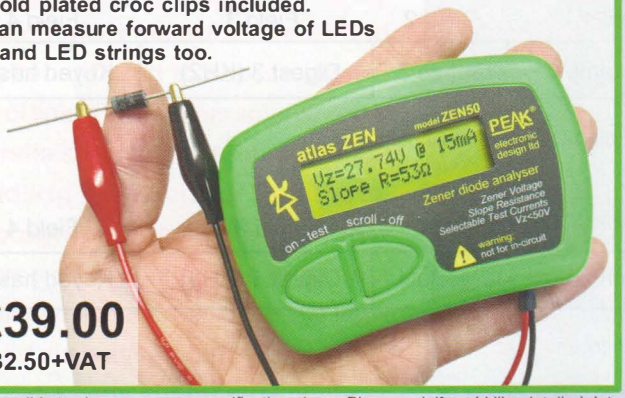

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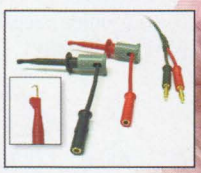

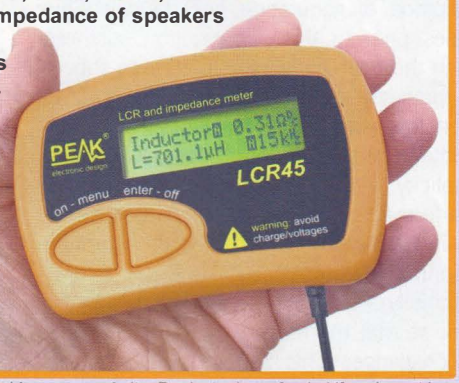

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Multi-Station Use

When more than two entities are involved, the message should include identifiers (eg callsigns) showing who is transmitting and who is receiving. Both identities should be checked for correctness before the message sequence can continue. This can then be logged (electronically) by both parties. With repeaters and beacons, a Keeper and up to four other licenced, named operators are allowed to switch the unit on and off. An unlicensed person may turn the system off but is not allowed to turn it back on. This can be accomplished by assigning different levels of access to each person. Logs are also important as indicators that the system is or has been under attack.

Implementation

Who or what is Alice and who or what is Bob? So far, the assumption is that both are programs running on different computers and that they share a secret key. Even simple computers such as the Raspberry Pi have operating systems and can run multiple copies of a program simultaneously. If Alice and Bob start talking to each other at the same time then two copies of the programs will talk to each other independently. This condition has been the basis for a 'reflection attack' [7], which should to be avoided.

To avoid this schizophrenic situation, only one version of the program must run in simplex mode at either end of the link. It is further suggested that dedicated single chip microprocessors without operating systems are designated as Alice and Bob. The program should be designed to run in either Master (initiator) or Slave mode and if errors or abnormal behaviours are detected, it should return to a quiescent state.

There should be a timeout check for each reply packet so that if a 'man in the middle' decides to add a large delay in relaying the packets (eg time taken to process an attack) this can be detected and flagged up. Also, a *minimum* turn around delay should be specified, to allow transceivers to change mode.

It's best to follow Christopher Strachey's dictum: 'It is impossible to foresee the consequences of being clever, so you try to avoid it wherever you can.'

Conclusion

An Authentication Protocol has been outlined that should protect Repeater and Beacon control links from malicious interference – and in a manner that does not break the rules or the spirit of amateur radio. This scheme also has the advantage of zero running costs when compared with systems that use mobile phone (SMS or DTMF) links.

Acknowledgements

Bruce Christianson, Alex Shafarenko, MOSFR (University of Hertfordshire), Mark Lomas (Capgemini), Anthony Hodge, G4UPY, Andy Holden, M6GND, David Jardine, GOFDV, Tom Pitcher, M60NX, Barry Pollard-Wilkins, G8DXU (Southdown ARS), Peter Hutchison, G4URT and Alastair Turner, G4RUL (Eastbourne R&EC) have all generously contributed their time and expertise to this article. However, yours truly must take full responsibility.

Websearch

[1] https://en.wikipedia.org/wiki/Replay_attack
[2] https://en.wikipedia.org/wiki/The_Eagle,_Cambridge
[3] https://en.wikipedia.org/wiki/One-way_function
[4] https://en.wikipedia.org/wiki/Cryptographic_hash_function
[5] https://en.wikipedia.org/wiki/Hash-based_message_authentication_code
[6] https://en.wikipedia.org/wiki/Challenge-response_authentication
[7] https://en.wikipedia.org/wiki/Reflection_attack

CQ Worldwide
WPX CW

The Worked All Prefix CW Contest takes place at the end of May each year and Ken Randall, G3RFH describes his recent entries.

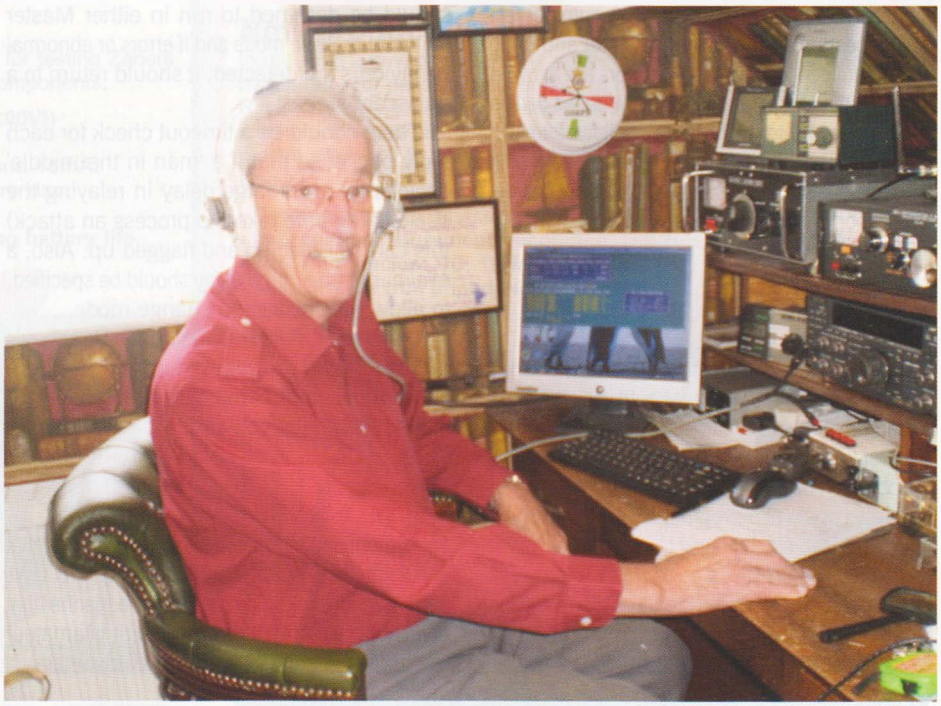

PHOTO 1: G3RFH keeping himself young and his brain active by contesting.

"I took part in this contest in 2013 as a single band entrant, choosing 10m so as to give me some time in bed when the band was closed! However, I made a score of 51,275 points from 230 QSOs and 175 prefixes. Not bad from a band that's often written off as dead. My equipment was my old Kenwood TS-870, with 100 watts to a Sirio 827 vertical, the base of which was only 15ft above ground.

"In 2014 I decided to really get my feet wet and put in an all-band entry. Although the contest is on for 48 hours, I decided I would try to get some sleep and as it turned out I managed this, operating for a total of 32 hours 30 minutes.

"In 2015 I opened my account at 0515 on the Saturday by trying 40m, but there didn't seem to be a lot of activity so, after only four QSOs, I shifted to 20m, where I found the band packed with signals. Later, on trying 15m, I found that packed as well. Conditions seemed good, despite the gloomy predictions. All day it was mostly 20m and 15m, with the occasional bursts on 10m. In the early evening 15m and 20m both opened up to the Far East, where I worked five stations in China. I'd never worked China before, though I had heard a couple some times but couldn't get through the pile-ups. Now, in a contest, it was a lot easier – and nothing gives me greater satisfaction than to be picked out of a crowd and hear my callsign coming back from a rare DX station. Other notable countries worked were East Malaysia, Laos, Vietnam, the Seychelles and Japan. As the evening wore on I shifted down to 80m and 160m. 80m was very noisy. Although there were plenty of stations on, I thought it would have been busier. 160m was very quiet and only a few contacts were made before I decided to retire, just after midnight. Altogether it was a very satisfying day, with 507 contacts.

"The next morning I had intended to rise at 0600 but overslept to just before 0800, so I missed the early sunrise period. After a few contacts on 40m it was back to 20m and 15m again, but I noticed there seemed to be a lot more activity on both bands. During the afternoon, South American stations were coming through; mainly Brazil and Colombia, but a French Guiana station was also worked. North American stations seemed to be coming through at all times day and night, including the West coast, but there were only a few VEs (not like during BERU, when I was swamped by Canadians). Getting on towards midnight and the end of the contest I was well into 800+ contacts and wondering if I could reach 900. I managed to make QSO number 899 at 23:59:40, to complete my log. My claimed score was 758,520 points from 504 prefixes. The band breakdown was 160m (11 contacts) 80m (48) 40m (115) 20m (478) 15m (208) 10m (39).

"I thoroughly enjoyed the contest, though it was very tiring. It was exhilarating when I reflected on the DX stations I had worked. For 2016 I might revert to a single band entry, but you never know! My equipment was my 11 year old Kenwood TS-870 (100W) to a shortened doublet at 30ft in the centre, a GAP Eagle vertical bolted on the side of my shed and a homebrew helical vertical for 160m (15ft at the base). I used SD for logging and a homebrew Logikeyer (now 35 years old) and Magpad magnetic paddles made by Tom Withers. My ears do the receiving!

"There were the usual few running high power into poor antennas – they were putting out extremely strong signals, yet couldn't hear anybody – and the usual few using high power and producing key clicks either side of their signal. One Eastern European station I heard sounded like a band-saw, over 10kHz wide! Plus, of course, the high speed computer generated Morse. Some of these I listened to six or more times, but I still couldn't copy their callsigns, so I just ignored them. There were plenty of others wanting contacts who were using 'proper' CW. It was interesting to listen to some of these high speed merchants, the number of times they were asked to repeat the number. If they only slowed down a fraction they would have avoided the need for all that, but a lot of them are using computers to read the incoming Morse (if the signal is good enough)."

So, how did Ken fare in last year's WPX CW? Out of seventeen entrants from England in the all-band low power category he came a very creditable second, to Andy, G4PIQ (who was operating as M7Q). I'll leave the final words of this feature to Ken, who says about contesting; "I reckon it keeps my mind active and myself young! A good weapon against dementia."

Steve White, G3ZVW
steve.g3zvw@gmail.com

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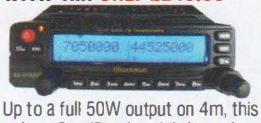

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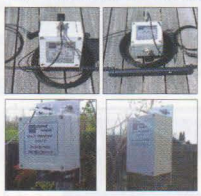

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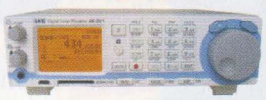

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MOCVO crystal oscillator kit

This crystal oscillator kit is part of a range of kits from M0CVO that can be used alone or to assist in an Intermediate amateur radio licence training program.

Assembly

As you can see from **Photo 1**, the kit is supplied with all the component parts along with a small printed circuit board (PCB). In addition to the hardware, there were 3 pages of A4 size instructions that included the PCB layout and a photograph of the finished kit. I was surprised that there was no circuit diagram in the assembly notes as I think it would aid the learning process – MOCVO has said it will appear from now on.

Assembly of the kit was straightforward and the step-by-step instructions were very clear. The assembly followed the usual practice of mounting the resistors and capacitors first. The convention of assembling resistors and capacitors first comes from the premise that passive components are cheaper and generally more robust so can tolerate more heat and mechanical stress. If you are planning to use the kit as part of a project, rather than a learning exercise, it would be advisable to drill a couple of mounting holes in the PCB before you start assembly.

Assembly continued by installing the wire-ended crystal and the 2N3904 NPN transistor. The final steps were to solder the PP3 battery connector, Molex output connector and the polyvaricon variable capacitor. I've shown a photo of the completed kit in **Photo 2**.

Circuit design

I traced out the circuit diagram of the oscillator and have shown this in **Figure 1**. Those of you familiar with home construction will recognise this as a classic Colpitts design but with a polyvaricon variable capacitor in series with the ground leg of the crystal. This latter feature enables the oscillator to be 'pulled' a bit from its nominal frequency, thus producing a Variable Crystal Oscillator (VXO). This technique is useful because the crystal accurately defines the centre frequency of the oscillator, whilst the series variable capacitor enables a tuning range of a few kHz either side of this frequency.

The Colpitts design was originally developed by American engineer Edwin H Colpitts back in 1918 and is one of a number of standard oscillator designs that have stood the test of time. The key feature of a Colpitts oscillator is the use of a capacitive tap to supply the feedback signal for the oscillator. The design employed in the MOCVO kit is a standard

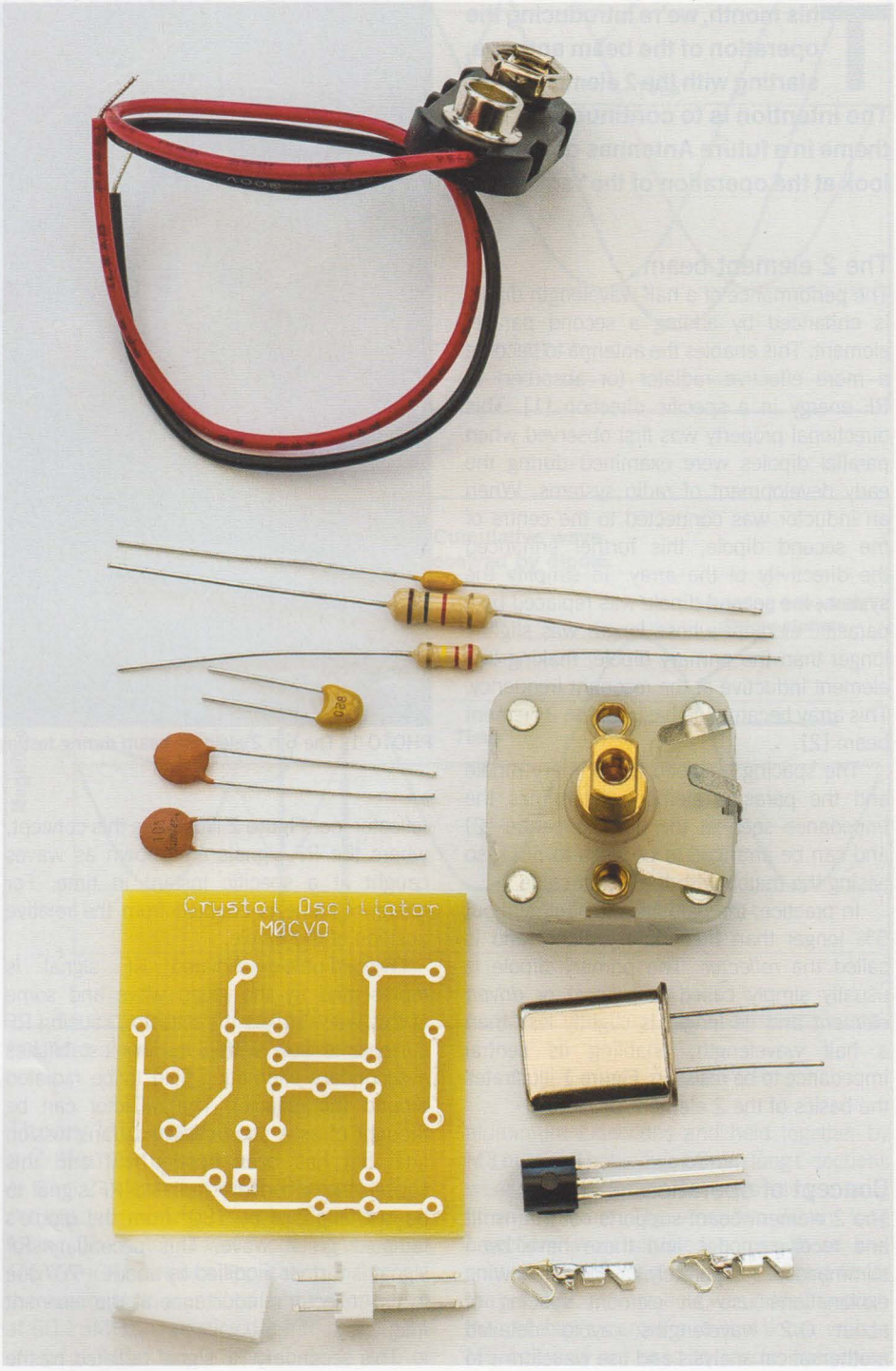

PHOTO 1: MOCVO oscillator kit parts.

Continued on page 70

Mike Richards, G4WNC
mike@photobyte.org

Antennas

This month, we're introducing the operation of the beam antenna, starting with the 2 element array. The intention is to continue with this theme in a future Antennas column to look at the operation of the Yagi beam.

PHOTO 1: The 6m 2 element beam during testing.

The 2 element beam

The performance of a half wavelength dipole is enhanced by adding a second parallel element. This enables the antenna to become a more effective radiator (or absorber) of RF energy in a specific direction [1]. This directional property was first observed when parallel dipoles were examined during the early development of radio systems. When an inductor was connected to the centre of the second dipole, this further enhanced the directivity of the array. To simplify the system, the second dipole was replaced by a parasitic element whose length was slightly longer than the primary dipole, making this element inductive at the resonant frequency. This array became the basis for the 2 element beam [2].

The spacing between the primary dipole and the parasitic element determines the impedance seen at the dipole's centre [2] and can be arranged to be close to 50Ω, so easing the match with the feeder cable.

In practice, the parasitic element is about 5% longer than the primary dipole and is called the *reflector*. The primary dipole is usually simply called the *dipole* or *driven element* and its length is slightly less than a half wavelength, enabling its central impedance to be resistive. **Figure 1** illustrates the basics of the 2 element beam.

Concept of operation

The 2 element beam supports both transmit and receive modes and these have been summarised separately. The following explanations use an element spacing of about 0.2 wavelengths, avoid detailed mathematical analysis and use waveforms to examine operational concepts.

Transmit mode: Applying a resonant RF signal to the dipole's centre causes RF currents to flow and an alternating electromagnetic field is established around the dipole. This is the *Near-Field*, whose influence does not extend far from the dipole. However, the reflector is located within the dipole's Near-Field and so RF currents are induced in the reflector too. **Figure 2** illustrates this concept, where the RF signals are shown as waves caught at a specific instant in time. For reference, time is counted from the relative position of the dipole.

The dipole's radiated RF signal is represented by the green wave and some of this wave strikes the reflector, causing RF currents to flow within it. This establishes a secondary alternating field to be radiated around the reflector. The reflector can be thought of as a short-circuited transmission line that has been opened out and this causes the secondary radiated RF signal to be out of phase by 180° from the dipole's radiated green wave. This secondary RF signal is further modified by about +70° due to the reflector's inductance at the resonant frequency.

This secondary RF signal radiated by the reflector is illustrated as the purple wave in Figure 2 and this combines with the green wave, establishing the blue cumulative wave shown.

Referring to the waves to the right of the dipole, the blue cumulative wave has a larger magnitude than the green wave radiated by the dipole. To the left of the dipole, the secondary purple and primary green waves are more out-of-phase and blue cumulative wave's magnitude is lower compared to the green wave. Consequently, the RF signal to the right of the dipole is greater than that to the left and the 2 element beam presents a gain in the RF signal to the right of the dipole.

It is the blue cumulative wave that creates the RF signal that is radiated forward of the 2 element beam that establishes the RF power bearing signal radiated as the *Far-Field*.

Receive mode: Referring to **Figure 3**, Element 1 represents the reflector and Element 2 the dipole that is facing a distant transmitter. The green wave now represents an incoming RF signal travelling towards the 2 element beam from the distant transmitter.

The incoming green wave strikes the dipole inducing RF currents within it, however these are extremely small (usually a few microamps). Therefore, the *Near-Field* generated by these small RF currents is negligible and can be disregarded. Not all the incoming green wave's power is induced into the dipole and the wave continues to travel past the dipole towards the reflector. When it encounters the reflector, the green wave induces RF currents into it. This causes the reflector to radiate a secondary

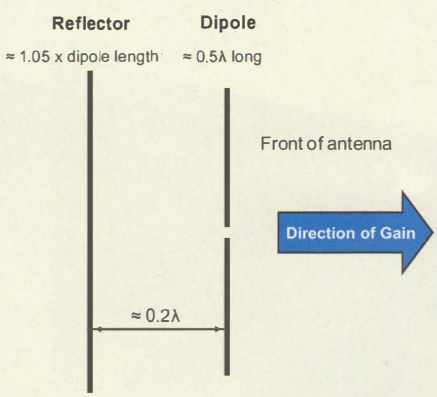

FIGURE 1: 2 element beam concept.

RF signal, shown as the purple wave, that is phase shifted by 180° and further modified by the reflector's inductance by about +70°.

Part of this purple wave travels towards and encounters the dipole, inducing additional RF currents into it. The vector addition of the RF currents now flowing in the dipole results in the blue cumulative wave in Figure 3. This wave's magnitude is larger than the RF signal induced by the incoming green wave in the dipole and the 2 element beam yields a gain as a receiving antenna in the direction of the distant transmitter.

Turning the antenna around, now has Element 1 as the reflector and Element 2 as the dipole. The reflector first encounters the incoming green wave from the distant transmitter and RF currents are induced into it. These cause the reflector to radiate the purple wave that is again phase shifted by 180° and further modified by the reflector's inductance by about +70°. The purple wave radiated by the reflector travels towards and encounters the dipole inducing RF currents into it.

Not all the incoming green wave's power is induced into the reflector and it continues to travel past the reflector towards the dipole. When the green wave encounters the dipole, it induces RF currents into it. However, this time the vector addition of the RF currents flowing in the dipole result in the magnitude of the blue cumulative wave being much lower compared to the incoming green wave. Consequently, the 2 element beam exhibits a *loss* as a receiving antenna in the direction of the distant station.

Therefore, when receiving, the 2 element beam is directional because it yields an RF signal gain when the dipole faces the distant transmitter but exhibits a loss when the antenna is turned around.

For the beam array to work, it relies on the RF signals travelling past the elements. Therefore, this form of aerial is termed a *travelling-wave* antenna.

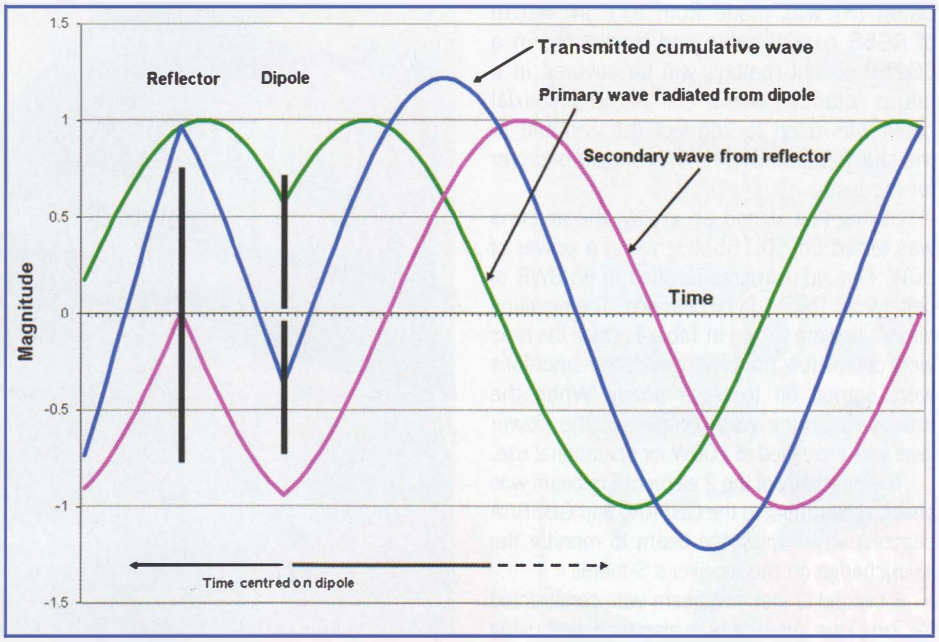

FIGURE 2: 2 element beam in transmit mode.

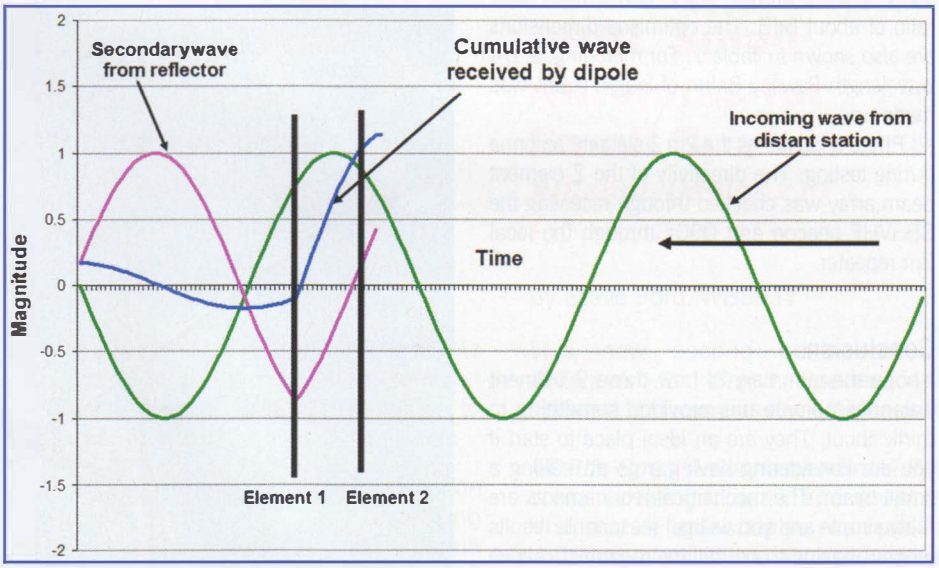

FIGURE 3: 2 element beam in receive mode.

Theory into practice: a 2 element beam

A 6m 2 element beam (**Photo 1**) was constructed using surplus aluminium tubing. The antenna was modelled using the *MANNA-GAL* antenna application to forecast the antenna's dimensions and performance at 50.15MHz. It predicted a free-space gain of about 4dBd and a front-to-back ratio of around 9dB.

Using the predicted dimensions, a prototype 2 element beam was assembled and clamped to a 4.5m extendable mast for testing. A commercial dipole centre was used for the dipole (as described in the February Antennas column).

To hold the reflector in place on the square boom, a clamp was made from four aluminium L-sections and held together by M3 nuts and bolts. Two 60mm long L-sections were spaced 25mm apart, providing a snug fit on the boom. The other two 90mm long L-sections were situated across these and spaced 12mm apart, allowing a snug fit for the reflector. A 6mm hole was drilled through the reflector's centre and the boom with a M6 bolt and nut used to secure everything in place. **Photo 2** illustrates the clamp arrangement.

For matching, a 1/4 wavelength Pawsey

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Balun [3] was made from a 1.5m length of RG58 coaxial cable and terminated in a SO259 socket (baluns will be covered in a future column). About 8m of 50Ω coaxial cable was used to connect the antenna to the shack-based SWR meter and transceiver for the tests.

Having first signed on in CW, the antenna was tested on 50.155MHz using a power of 10W. Fine adjustments resulted in an SWR of better than 1.05:1 to be obtained. The resulting dimensions are shown in **Table 1**. Once the tests were completed, the transceiver's transmissions were signed off to close down. When the antenna's tuning was completed, the power level was increased to 100W for operational use.

The directivity of the 2 element 6m beam was checked by tuning to the GB3RAL and GB3BAA beacons and turning the beam to monitor the level change on the receiver's S-meter.

A second 2 element beam was constructed for 2m. This antenna was also modelled using *MANNA-GAL* to predict the dimensions and its performance at 145MHz. This gave a free-space gain of around 4dBd and a front-back ratio of about 5dB. The optimised dimensions are also shown in Table 1. For matching, a 1/4 wavelength Pawsey Balun of length 0.5m was made up.

Photo 3 illustrates the 2m 2 element antenna during testing. The directivity of the 2 element beam array was checked through receiving the GB3VHF beacon and QSOs through the local 2m repeater.

Conclusion

I hope the summary of how these 2 element antennas operate has provided something to think about. They are an ideal place to start if you are considering having a go at making a small beam. The mechanical requirements are fairly simple and you will get reasonable results without having to be millimetre-perfect. Above all, have fun experimenting.

Websearch

[1] *Radio Systems TECIII*, D C Green, Section 5 Antennas, pages 84 – 85; Pitman, 1979

[2] *Antennas, 2nd Edition,* J D Kraus, Section 11.9 Arrays with Parasitic Elements, pages 476 – 481; McGraw-Hill Book Company, 1988

[3] *Radio Communication Handbook 12th edition,* edited by Mike Dennison, G3XDV and Mike Browne, G3DIH, Section 14, Practical VHF/UHF Antennas, Peter Swallow, G8EZE, Figure 16.44, Page 16.20, Mike Parkin, G0JMI; RSGB, 2014

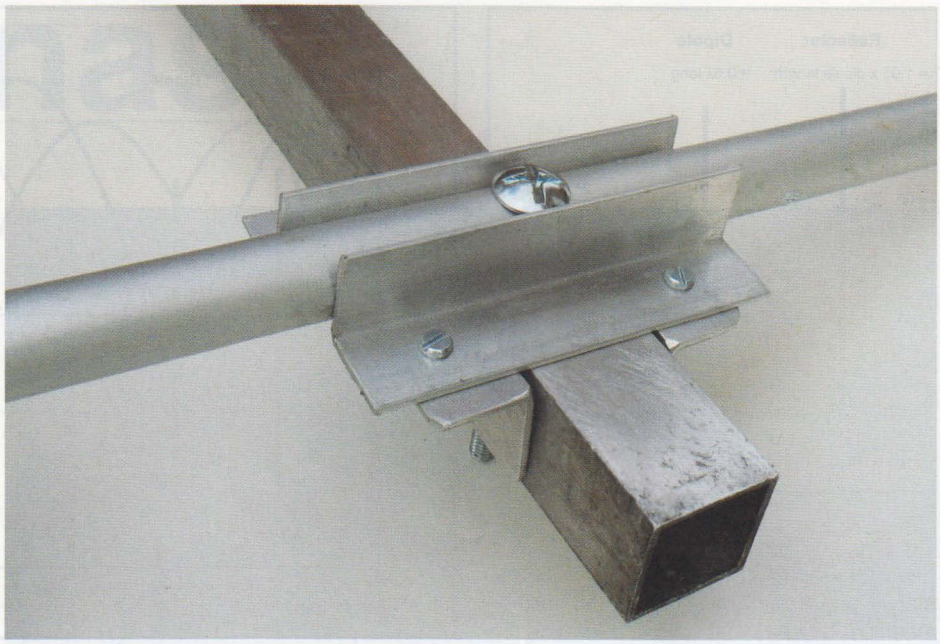

PHOTO 2: Reflector homebrew 6m reflector clamp.

PHOTO 3: The 2m 2 element beam during testing.

TABLE 1: 2 element beam antenna component dimensions.

Band	Reflector total	Dipole (per leg)	Element diameter	Element spacing	Boom dimensions
6m	2.95m	1.325m	12mm	1.12m	25mmx25mm
2m	1.06m	0.45m	12mm	0.48m	25mm diameter

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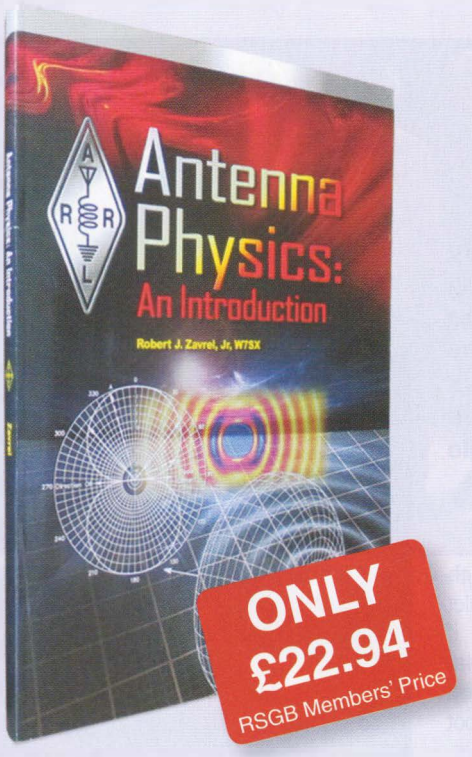

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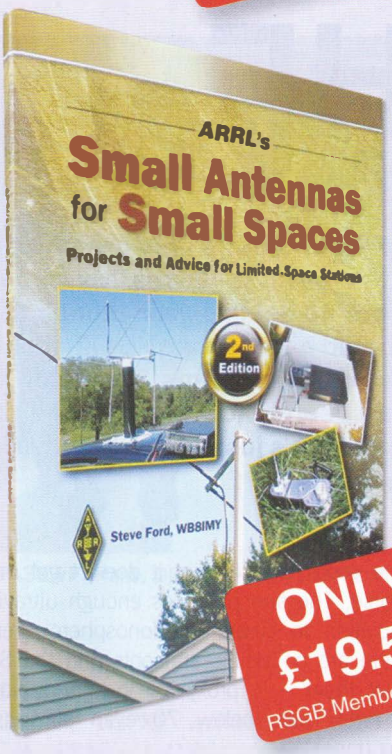

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HF

Conditions now are probably about as good as they are going to get this year, though there should be an autumn peak after the summer doldrums. The solar flux has been below 90 for some time and there's just one sunspot visible as I write.

The good news is that it doesn't get much worse. The sun produces enough ultraviolet radiation to create the ionosphere even if there are no visible sunspots and the Solar Flux Index – a proxy for the UV radiation – rarely dips below 70 even at sunspot minimum.

The DXpeditions to Heard Island (VK0EK) and Juan de Nova (FT4JA) will have been active until a few days ago and, as expected, signal strengths from FT4 were much better than from VK0. Nevertheless, UK stations managed VK0 QSOs on every band from 10-160m. On 30m and down the QSOs were all between 1700 and 2300. On 17m and up they were between 0600 and 1300 – with 10m peaking sharply around 1100. Surprisingly few QSOs were made on 20m – almost all around breakfast time. At times propagation seemed to peter out just south of the UK as Italian and Spanish stations were reporting strong signals that were inaudible here. The picture was slightly different with the FT4 where rather more UK stations made QSOs, again on all bands from 10-160. The LF QSOs were slightly later than with VK0 and the HF QSOs were distributed more evenly across the daylight hours. 20m QSOs were more numerous and mostly being made in the early evening.

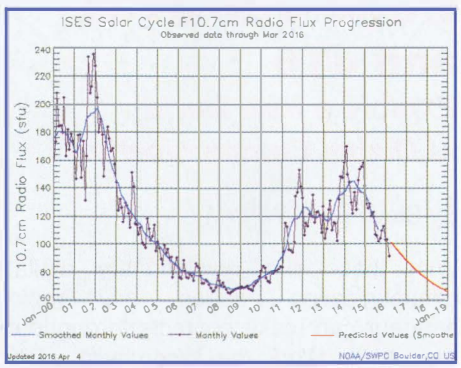
The TX7EU team, which included Tom, GM4FDM, made around 32,000 QSOs from the Marquesas Islands with UK stations getting through on 40-15m. A quick look at Club Log didn't show any UK QSOs on 12 or 10 and the team weren't QRV on 160 or 80.

The ARRL contest in early March was an opportunity to assess propagation to the west coast and it was quite good. GW4BLE, GOTSM, MOURX and others worked into California, Arizona, Nevada, Colorado and Utah on 15 and or 10 metres. Alaska and Hawaii (non-counters for us in this event) were heard on 15 but not on 10m. Ray, W2RS, in Arizona was using QRP to a vertical and worked 10 UK stations on 10m on the Sunday.

Nuku Hiva QTH of TX7EU with hexbeam in front.

ARRL DXCC

The short P5 operation by 3Z9DX in December was approved for credit, which must bode well for the anticipated longer visit later this year. If you need this one then keep your fingers crossed. And, in a surprise move, the ARRL deleted Kingman Reef from the DXCC list – not because it is disappearing under the waves (which it is) but because it is no longer administered separately from its neighbour, Palmyra. This administrative change actually happened around 15 years ago when the US Navy relinquished control but DXCC action has only just been taken. I suspect IOTA will follow suit and declare that Kingman will become part of the Palmyra group but we have to QRX for an announcement on this.



Solar Flux Curve – Tnx NOAA-SWPC.

DXpeditions

Felipe, CE5WQO and Dima, RA9USU plan to be active from San Felix off the coast of Chile some time between July and September for up to 3 weeks. San Felix is likely to be about the 7th most wanted DXCC entity after the FT4 and VK0 have finished. The last significant DXpedition was in 2002.

Svein, LA9JKA will be active as JX9JKA in his spare time from Jan Mayen (EU-022) starting in mid-April for six months. He plans to focus on 160, 80, 40 and 30 metres.

A very large number of Russian RT73 callsigns are expected to take part in 'The Inventors of Telecommunications', which is a scientific-educational radio marathon held from 16 March to 16 June. Each callsign represents a historical figure in the area of telecommunications or electronics. Reports so far include RT73AM (Antonio Meucci), RT73AP (Aleksandr Popov), RT73CS (Carl August von Steinheil), RT73CW (Charles Wheatstone), RT73EA (Edwin Armstrong), RT73EL (Emil Lenz) and RT73LL (Leonid Labutin). A website is under construction at rt73.net.

Harry, JG7PSJ will be active as JD1BMH from Ogasawara (AS-031) from 27 April to 6 May. He will be QRV on 40-10m CW, SSB and RTTY.

IOTA

A team from Croatia and Germany (9A2MF, 9A2NA, 9A6AA, DC5WW, DD0NM, DH6TJ, DK2RO, DL8AW and DL9NBJ) will be active as 9A8DXG from the Palagruza Islands (EU-090) from 28 May to 4 June. They will operate CW, SSB and digital modes on the

HF bands.

Jim, MM0BQI will be active as MM0BQI/p from Tanera Mor (EU-092) from 29 July to 5 August. He will participate in the IOTA Contest as GM1J.

Jean-Pierre, VA2SG will be active as XM2IOTA from Iles-de-la-Madeleine (NA-038) from 27 July to 2 August. He will operate SSB, CW, RTTY and PSK31 on 20 to 10m, as well as on the low bands, mostly during his late afternoon and evening hours.

A group of five amateur radio operators will be QRV from Fort Jefferson, Dry Tortugas Island (NA-079) using a special call K4T from 6-8 May. They will be operating with two 50 watt stations on CW and SSB on 80 through 6m.

TX7EU team arriving at Nuku Hiva airport. L-R Ronald, PA3EWP, Hans, DL6JGN, Tom, GM4FDM and Ernoe, DK2AMM.

Correspondence

Peter, G4XEX found conditions were up and down in March – but mostly down. He found: on 15m – XV9NPS, P29LL, ZL/ZS9HI/MM, FY5KE, HS1JZT, 8P5A and ZP5WBM; on 17m – 3XY1T, 8R1/K9KK, 5J0P (San Andres – an all time new one (ATNO)), KG4BP, FK8IK, and HI8CCZ; on 20m – BG9HKP, 3B9FR, PJ4/K2NG, ET7L, V85AVE, HS0ZHC, DU1JM and 4S7B. He also heard a lot of JA and South American stations.

Peter, G3HQT thought March was a rather noisy month (or alternatively that his receiver was wearing out). He found: on 12m – 5V7D; 15m – 3C7A; 17m – 5J0P; 20m – 4W/N1YC, XU7TZG, DU3LA, E44YL; 30m – FH/F2DX, 4S7RTG, E21EJC; 40m – ET7L, C5GCJ.

Fred, G3SVK was busy in the Commonwealth Contest and other events but like many at the end of the month was still waiting for the pile-ups for FT4 and VK0 to die down. He found: on 12m – 5V7D; 15m – P400FA; 17m – Caribbean stations inc. 5J0P, 5X1XA, 3B9FR, VR2EH, 3DA0CC, DU3LA, E44YL and 3XY1T; 20m – Caribbean, VK8AN, HL3X0K, 5V7D, BG9HKP, 9M2ZAL, YB16SUN, DU3LA, HS6ZBQ, XU7TZG, VK9CK and EP2LSH; 30m – XP3A, EY8MM, E21EJC; 40m – large numbers of Caribbean stations, VKs and ZLs, HS0ZEE, JI2RMC, 4S7GWG, ZL/ZS9HI/MM, LU1ZI (South Shetland), AT1HQ (India), ET7L, 4S7BBG, JT1C0, FY5HB.

Tom, G4IDL worked: on 10m – PJ4/K2NG, 5X1XA, 3C7A (an ATNO); 12m – 4S7BBG, 5J0P, ZP5K0, 3DA0IJ, ZD7BG; 15m – 3XY1T, VU2MUD, 9J2B0, FH/F2DX, Caribbean; 17m – PZ5W, 3XY1T, TX7EU, VK9CK, 5J0P, E44YL; 20m – VK/ZL, 9M2PUL, 9M6XR0, ET7L, JT1C0 & the Caribbean; 30m – 0Y1CT; 40m – HS6ZBQ, 5J0P, VK3XU, V44KAI, J34G, VP9/G3VYI, ZF2CA, J79XF, ZP6CW, S01WS, YS3/DL5YWM and ZL3XDJ.

Gordon, G3PXT worked: on 15m – PY2VA, FR1GV, LU1XU, JA2ATE, LU1DA, ZS6UB, CX5ABM, ZS6H0N, 7X3WPL, LU3EBT; on 17m – JA5BDZ, VK4FNQ, HS0ZBS; on 20m – HZ1TL, YF1D0, PU2N0L, HS7IKS, T6MH, BD7IPT; on 40m – 4L4C, 9K20D,VK2RI, 7X5KBS, S0IA, HK1F, UP2L, YB6HBI, A71AE and UP0L.

The path to the north-west through the auroral zone is always an interesting one and David, G3YYD reports working T32SB in early March on 15m as late as 2047. The T32 had an auroral note and there was a geomagnetic disturbance under way. Michael, M0GXM was listening out for Alaska around 1800UTC during March and managed QSOs on 20 and 17m.

Kevin, ZB2GI says he is active on HF-SSB and datamodes. He has a TS-570 running 10W into a magnetic loop mounted on the balcony of his apartment and also operates portable.

TABLE 1: 2016 Worked DXCC Entities (ranked by All). Showing Top 3 from RSGB Members table in Club Log plus submitted scores and Club Log scores of recent correspondents where available).

Call	CW	SSB	Data	All
M0NKR	93	193	61	228
G4PTJ	159	102		228
G5LP	216	22	153	222
G1X0W		204		204
G0RPM	73	39	106	170
G4IDL	168			168
GI4DOH	142	21	39	148
G3SVK	145			145
G4XEX	46	80	75	129
G3HQT	104		41	119
G3PXT	36	75	104	110
CT7AGZ	107		2	107
G4CCZ	77	38	28	94

TABLE 2: Forthcoming DXpeditions.

Until 24 April	8R1A
Until 28 April	A25UK
Until 29 April	9M0S
20-25 April	RT92KA (AS-092)
23 April – 2 May	VK9NU
24 – 30 April	GS0NWM
27 April – 6 May	JD1BMH
28 April – 1 May	A91HI
8 – 15 May	E44QX
22 – 29 May	GS3PYE Arran
14 – 18 Aug	UE23RRC (AS-142)
17 – 28 Aug	TX2AH (OC-063)
19 – 29 Aug	CY9 – St Paul Island
3 Sept – 25 Nov	VP6AH (OC-044)
11 – 19 Sept	TO5FP St Pierre/Miquelon
25 Sept – 25 Oct	H40GC and H44GC
27 Oct – 10 Nov	ZL7 by 6Gs

Malaysia Class B

Class B operators in Malaysia use the 9W prefix and are now permitted to use 7.0 – 7.2MHz, with a maximum power of 50W PEP in addition to their existing allocations on 28MHz and higher bands. I'm not sure we will hear them very often.

Finally

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

Martin Atherton, G3ZAY
g3zay@btinternet.com

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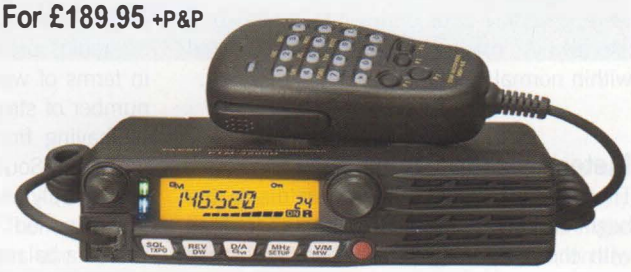

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VHF/UHF

Ten days of continuing high pressure systems over the UK produced little in terms of DX.

March didn't really provide much in the way of openings or activity except over the weekend of 19/20 March while the REF French 2m contest was taking place. Some good contacts were made with ducting down to south western France (JN03 etc) from the western side of the UK and Isle of Man with very strong signals. Meteor scatter conditions were generally poor during the month but, like always, many contacts were completed within normal MS range of 1100-1500km.

Meteor season begins

The good news for many operators is the beginning of the MS season occurs in April with the Lyrids Meteor Shower that peaks around the late and early hours of 21/21 April. This shower is generally a slow developer with a gradual rise and fall of reflection rates that can start as early as 16 April, tailing off by the 26th. The shower is created by the debris of comet Thatcher, which takes 415 years to orbit the sun. The radiant of the shower – the area where the meteors look to be emerging – is the constellation of Lyra.

Hot on the heels of the Lyrids, the Eta Aquarids rise on 19 April falling by 28 May with a peak around 6/7 May. Clearly in the rising period there could be some overlap with the April Lyrids. The dust/debris from the famous Halley's Comet is responsible for this shower with a second encounter during the year as the Earth passes through its debris again in October with the Orionids shower so named as the radiant is visible in the constellation of Orion.

Multi band station

Apologies for the departure from the normal format but a couple of months ago I pictured my multi band VHF/UHF antenna system in these pages. Thanks for all the comments (good and bad) by email and even, yes, an actual letter in an envelope through the post! Thanks John. There were requests regarding how to establish and maintain such a station with some hints and ideas how to keep it all on the air. This month I will cover the antenna and mast/tower arrangements – followed next month by the shack end and the multiband switching required as all the activity for 6, 4, 2, 70 and 23cm is run off just one rig – the FT-897D.

In the scale of VHF/UHF arrays, this is small fry but it is probably a good example of how to get a reasonable performance multi band station established in a semi urban area.

First, we need to look at the antennas and the mechanical construction. The 'tower' is only a scaffold pole structure as a Versatower type arrangement is impossible at this QTH. (Other tower manufacturers are available!). Fortunately, my QTH has a good open aspect at 125 metres ASL – which, although great for radio, presents considerable difficulties in terms of weather and the ever-increasing number of strong winter storms we seem to be having from November to March. The prevailing South/South West/Westerly winds can be truly awesome in their power.

The period 2015/16 has been particularly bad so a balance needs to be struck – there's no point having a system that is clearly too big to stay up during winter – as it will stay on the ground most of the time. So consider a Winter/Summer antenna maintenance and change schedule, which can include antenna change, cable check, guy wire check and general lubrication and painting. For contests I know many stations who change antennas each week to suit each event – again this is great if the tower is able to be wound over and easy to access. However, my interests above contesting are particularly in weak signal DX work on 6, 4, 2, 70 and 23cm and would make this arrangement impossible as the antennas need to be up all the time to take advantage of openings on different bands. The VHF DX season also forces one's hand – starting on the low bands ie 6 and 4m where Sporadic-E propagation is prevalent from April to August and as described earlier, the meteor scatter season starts in earnest.

For 25+ years the Yaesu G600RC has served me well – only ever one strip down when most of the ball bearings fused together. This is definitely not a pleasurable experience. When the bell housing is removed you get completely covered in black oily grease that doesn't come off for ages either from clothing or skin. You must wear PPE here. Personal Protective Equipment is vital – remember it's only a rotator! – barrier cream, nitrile gloves and eye protection. There are many rotators on the market – go for the best your budget will stand and remember multi antennas require a lot of torque and strength in the braking system. The wind will blow the antennas round east or west and the braking system must be able to handle this – the more antennas the more the twist. The head unit/rotator cage has also been up there for many years – a fully galvanised steel battleship job from TennaMast of Scotland [1]. This was worth every penny and also has a Yaesu GS065 thrust bearing at the top that supports the stub mast. Without the rotator cage you are limited to the height of the stub mast due to the bending moment and shear forces at work. Imagine the pressure on the rotator casing with the wind blowing sideways onto the antennas. A rotator cage is a must for more than one antenna with anything like the correct spacing. Whichever setup you chose you need to consider guy wires for good stability even in light breezes. Always check the weather forecasts and make sure you keep the antennas beaming into the prevailing breeze – this over a long term will pay dividends. Use a streamer if you can off the back this is a really cheap and effective wind indicator.

Remember, however you are going to lift the whole system, strength and lightness is key. A piece of steel scaffold pole would probably be too heavy – so try and find an aluminium/dural tube. If you ever see one of these rare beasts its worth getting one just to keep for a rainy day. Try scaffolding yards as they may have one or two lying around – they are not used for structural scaffolding much these days. The weak point of any installation like this is the area around the stub mast and the thrust bearing. Basically the higher you go with the stub mast to cram more antennas on, the more the strain on this point when windy. Here it is essential to try and manufacture a double sleeve to go over the stub mast and inside the thrust bearing. This will give extra strength in this area.

The big decision is which antennas / bands are you likely to be active on. Obviously there will be a favourite. In my case 2m is a must have, followed closely in 2nd place by 70cm. Thankfully, there is plenty of sound information on this matter. Ian White, GM3SEK has written an excellent article that is available on his website that describes Capture Area extremely well [2]. However, it maybe that you decide to just cram on what you can and hope for the best.That's fine and is what I have done to be honest but you will notice strange things occurring. With poorly spaced antennas, the manufacturer's direction plots, gain figures etc could well be disrupted. Most of these designs are created

New rotator cage with dual pole entry. Picture courtesy of TennaMast.

in free space anyway, but you could notice that the beam pattern and gain figures are different with closer proximity to other antennas. This needs proper thought and research however it may be case of "well, I want to get on 5 bands so I'll just chance my arm". In many cases this will work but just be aware of the pitfalls of poor stacking of antennas. Obviously more antennas equal more weight and a not insignificant factor is the feeder cable, which needs adding in to your calculations.

Unless you are into moonbounce and considering the plague of man-made electro smog that seems to be prevalent these days, if you want to make life easier, try and feed all the antennas directly down to the shack with the finest cable you can. Whilst mast head preamplifier systems are highly worthy, the complexity can outweigh their usefulness. There are many good cables around at varying prices. I use Andrew Heliax on all bands, type LDF5-50 for 23cm and separate runs of LDF4-50 for 70cm, 2m and from the 6/4m dual band antenna. This cable is available new but sometimes comes up on auction sites and again is worth having in stock. Even when using this high grade commercial telecoms cable there will be losses, but for terrestrial operation in most cases this is balanced against the 'faff factor' of keeping mast head preamps and all the switching etc that is involvedin full working order. As this type of cable is quite rigid – you will need some flexible coax to go around the rotator from the antenna feed point. There different manufacturers and prices so look for the best cable your budget will stand and look closely at the attenuation figures reference frequency and the connectors required.

Next Time

I hope to bring all this and the shack (business end) of the system together. The overriding factor in all this is safety. Plan ahead and whatever you decide on, make safety of yourself, others and property the main consideration.

70cm beacon update

Some information from Geoff, G3TQF who is beacon keeper at GB3LEU IO92IQ (432.490MHz) advising that the beacon was switched off on 24 February at approximately 1220UTC. The beacon transmitter will remain off the air whilst some frequency stability problems are resolved. GB3LEU has been a tremendous success, being in the middle of the UK, so hopefully it will be back on the air soon. Thanks again Geoff and to all beacon keepers for the hard work and dedication required to keeping these beacons on the air. You really miss them when they are not there! The replacement for the ON0VRT 70cm beacon that was lost a few years ago due to mast ownership changes came back on the air in the second half of last year with a new callsign ON0VHF in locator JO20HP. On the same site as the 2m beacon and on is original frequency of 432.450 the good conditions on 19/20 made it agood signal strength around the UK and Ireland. Spotted in G, GD and by Mark, EI3KD (IO51) at a superb distance of 905km.

2m activity sessions

Lyn, GW8JLY is looking to promote 2m sessions to try and generate more SSB activity. On the VHF/UHF Yahoo group site he has teamed up with a number of operators spread throughout the country to coordinate activity periods. The initial idea was to try and make sure there are day and night time sessions to try and cover all bases regarding time frame and operators availability. The first session was on 28 March and, in the first hour, stations heard or worked from here were GM4PPT (IO75), GW8JLY, 2E0NEY (IO81), G3SMT, M0BUL, G0GXT (IO82), G8HGN, G3YDY (JO01), GD8EXI (IO74), GM4JJJ (IO76), but unfortunately I couldn't quite copy Lawrence, GJ3RAX. Going forward, the schedule will be Monday and Friday evenings between 8 and 10pm and Wednesday mornings 10am and 12 noon. If there is a good spread of activity even if you are vertically polarised please listen out on 144.300MHz ± 50kHz – you should hear some good strength signals. Also please remember that 70cm sessions are also still going well on Wednesday nights from 7 to 9pm.

Conclusion

Hopefully next month we wil have some good DX in our logs so please send all your reports as soon as possible. Next month there will also be some very interesting information about Web SDR on VHF/UHF.

Websearch

[1] www.tennamast.com/masts/about

[2] www.ifwtech.co.uk/g3sek/stacking/stacking2.htm#1

Richard Staples, G4HGI
g4hgi@live.com

GHz Bands

More new GHz activity

I was really pleased to work Steve, G4HTZ (JO01JN) on 10GHz recently, over a very obstructed 88km path. Since then Steve's worked G4DDK, ON4CDU at 276km, G4LDR at 178km and ON7FLY at 178km, all on SSB and from just a few metres above sea level. Steve runs a GPS-locked DB6NT MK3 transverter, a DL2AM 11W PA and a Zone 2 Sky dish with a GW4DGU feedhorn. Such a good system makes 10GHz very effective over this sort of range, even under 'flat band' conditions because the EIRP involved means that the propagation mode is troposcatter [1]. Sky dishes have upwards of 25dB gain on 10GHz, giving 3kW ERP for 10W in.

George, M1GEO and friends G7UVW and M0UKD are now QRV on 1296MHz with an FT-817 and a SG lab transverter. They had a first try in the March UKAC, /P from Ingrebourne Hill, Raynham, JO01cm. It was a 'minimalist' operation, with none of the luxuries experienced by more established groups. They tweeted from @georgesmartuk that the main problem, besides the cold, was the very high noise level experienced when beaming over cities. This is sadly an increasing problem, even on the GHz bands. They are building a 45W PA and looking for a quieter /P location to improve things.

March *Dubus* EME CW Contest

I had my first experience of a 23cm *Dubus* EME CW event in March and it was great fun! There was plenty of activity and G3LTF with his 'super station' 400W and a 6m dish worked 74 CW stations over the weekend! Here, running a more modest 120W to a 1.9m dish, I worked 19 stations on CW and two on JT. My 23cm Initials were HB9CW, SP7DCS, OK1CA, SP6JLW, OK1KIR, ES5PC, OZ4MM, F5SE/P on CW plus G4DDK and ZS6JON on JT65c. The slow libration QSB [2] was very different from what I've experienced on 13cm, with the fade rate being just right to take out Morse characters! The high activity made me think that the demise of EME CW that some go on about may be down to the problem even the terrestrial microwave bands suffer from, namely lack of people bothering to come on and transmit. Instead, they just check the internet, see no activity and don't switch the rigs on!

PHOTO 1: A break found in the centre conductor of a piece of Superflex coax by Mike, GOMJW.

Just how flexible *are* those flexible cables?

I've run stories before about coaxial cable failure and there seems to be a constant issue with cables failing round rotators. Mike, GOMJW recently tweeted from @TheRealMike **Photo 1** of a piece of Andrew Superflex feeder from his satellite tracking antennas. The copper plated aluminium centre had snapped clean after a couple of years' operation. I found a similar problem on an apparently static Flexform SMA lead to my 10GHz PA recently. I shifted it a little when I disconnected the transverter to do some level adjustments and the outer split (**Photo 2**). This caused RF feedback and my PA to produce power without drive. I think the bottom line is that all these 'flexible' cables *are* flexible in that they can do small static bend radii, but in a position of continuous movement, only a stranded and braided cable will last a long time. I use FSJ2-50 on both my rotatable masts, and I expect to have to change them out every 5 years or so. Clearly with a satellite antenna like Mike's, with daily horizon to horizon tracking, this period is much shorter, so beware – and monitor the SWR on a regular basis.

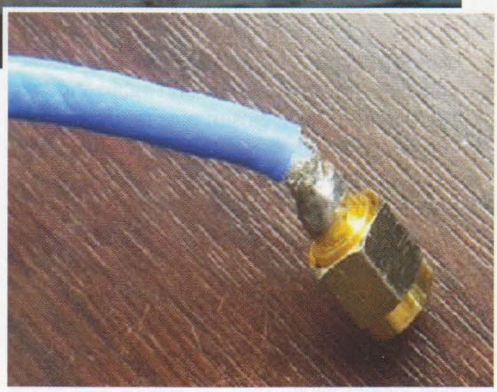

PHOTO 2: Coax braid parting company from an SMA plug.

Finally

Summer is coming so please try and get on the GHz bands outside the Tuesday UKACs. As well as the RSGB and UKuG events [3] there are the French *Journées d'activité hyper* microwave activity weekends, on 23/24 April, 28/29 May, 18/19 June, 30/31 July, 20/21 August, 24/25 September and 29/30 October. These are a good time to get on the GHz bands. There is also regular UK Monday evening GHz activity, so call on 144.175MHz and look on the ON4KST internet chat for active stations. Most of all, *call CQ*: as G3PHO noted recently, "a thousand receivers make no noise".

Please keep reports and technical snippets coming in to me by email and other channels.

Websearch

[1] www.mike-willis.com/Tutorial/troposcatter.htm
[2] www.dxmaps.com/emelibration.html
[3] www.microwavers.org/files/contests-2016.pdf

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Design Notes

More on DC power protection

After reading the March edition where we looked at reverse power protection, Tony Wallbank, G4CIZ sent in this:

"I use a P-channel MOSFET in my homebrew rig where previously I'd have used a mechanical relay with diode in series with the coil. Modern MOSFETs are very good low resistance switches and easy to use, for example switching between internal and external 12V supplies to a rig. They also work well in an over-voltage trip circuit to turn off the supply quickly. Better than the crude thyristor across the power rails we used in the past, relying on the fuse blowing quickly to remove the supply.

"It was while looking at this kind of application that I came across small ICs known variously as Efuses, Hot Swap Controllers or Power Controllers. They are essentially MOSFET drivers to simplify power supply switching. Some of them have over-voltage protection built in, a good example being the Linear Technologies LTC4635 [1]. With a couple of external MOSFETs (cheaper N channel ones in this case) and a few resistors it gives over-voltage and reverse polarity protection. The output current can be more or less what you like by choosing the right MOSFETs, and all in an 8 pin SOT package; not too small for me to see and it costs less that £3 from Farnell.

"The use of these controllers was brought home when my car GPS died due to receiving 12V from a failed switch-mode car adapter. I built a simple protector for the new one using a TPS25921 [2]. This is even cheaper, has the MOSFET power switch built in and adds over current protection, settable up to 1.6A. It is easy to calculate resistor values to use at 12V or 5V.

"The cheapest one I have found is a dedicated 5V protector from OnSemi, the NCP361 [3]. It has a built in P-channel MOSFET, up to 500mA current capability and doesn't need any resistors. It is intended to protect USB outlets but could be very useful for us to protect that expensive microcontroller IC, DSP chip or whatever.

"There are plenty of others, and they seem to be making their appearance in consumer devices such as phones to protect against the wrong AC adapter being inserted and abuse that happens in the real world. The ones I have picked out above are all in packages usable by a hobbyist without too much difficulty. I have used the first two devices above, and have the NCP361 soldered down ready to try out. The ready availability of SO to DIP adapter boards means these devices (and many others) can be used without needing to etch boards."

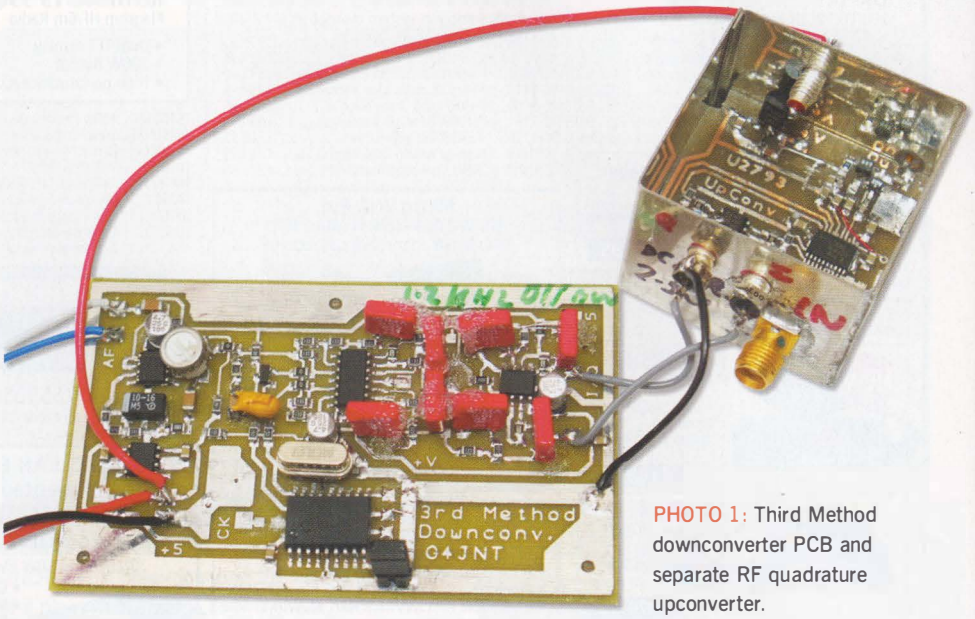


PHOTO 1: Third Method downconverter PCB and separate RF quadrature upconverter.

Third Method SSB

The 'Third', or *Weaver*, method of SSB generation is rarely seen now, at least in analogue form. It is a way of generating SSB that makes use only of low pass filters. There is no need for an audio phase shift network, or sharp sided crystal filters. Its main advantage is that imperfections and poor sideband suppression do not generate out of band signals. To see how it works, we first need to step back and consider the Phasing method (the *'second' method*, presumably). A conventional phasing exciter has an audio phase shift network generating 0° and 90° versions of the audio. These are applied to a pair of mixers, whose local oscillator forms the (suppressed) carrier for the final SSB output. The LO input is also supplied as a 0° / 90° shifted pair. By summing the output from the two mixers, one sideband is suppressed with the other enhanced. The process falls out of the trig identity SIN(A).COS(B) + COS(A).SIN(B) = SIN(A + B), where A is the RF carrier and B the voice band signal. SIN and COS reflect the 0° and 90° degree terms as COS(B) = SIN(B + 90°).

The glib statement, *"0° and 90° versions of the audio"* hides a multitude of problems. How do we generate two audio streams whose outputs are exactly 90° apart over the complete 300 – 3000Hz range for SSB voice, and also keep them closely matched in

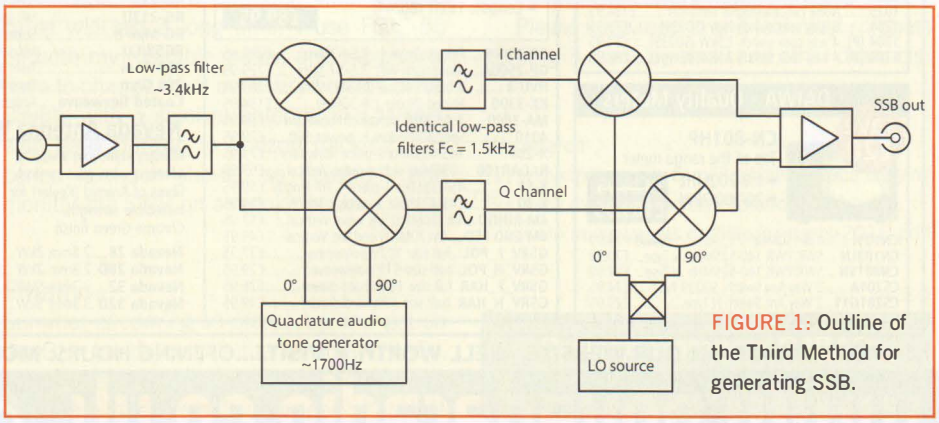


FIGURE 1: Outline of the Third Method for generating SSB.

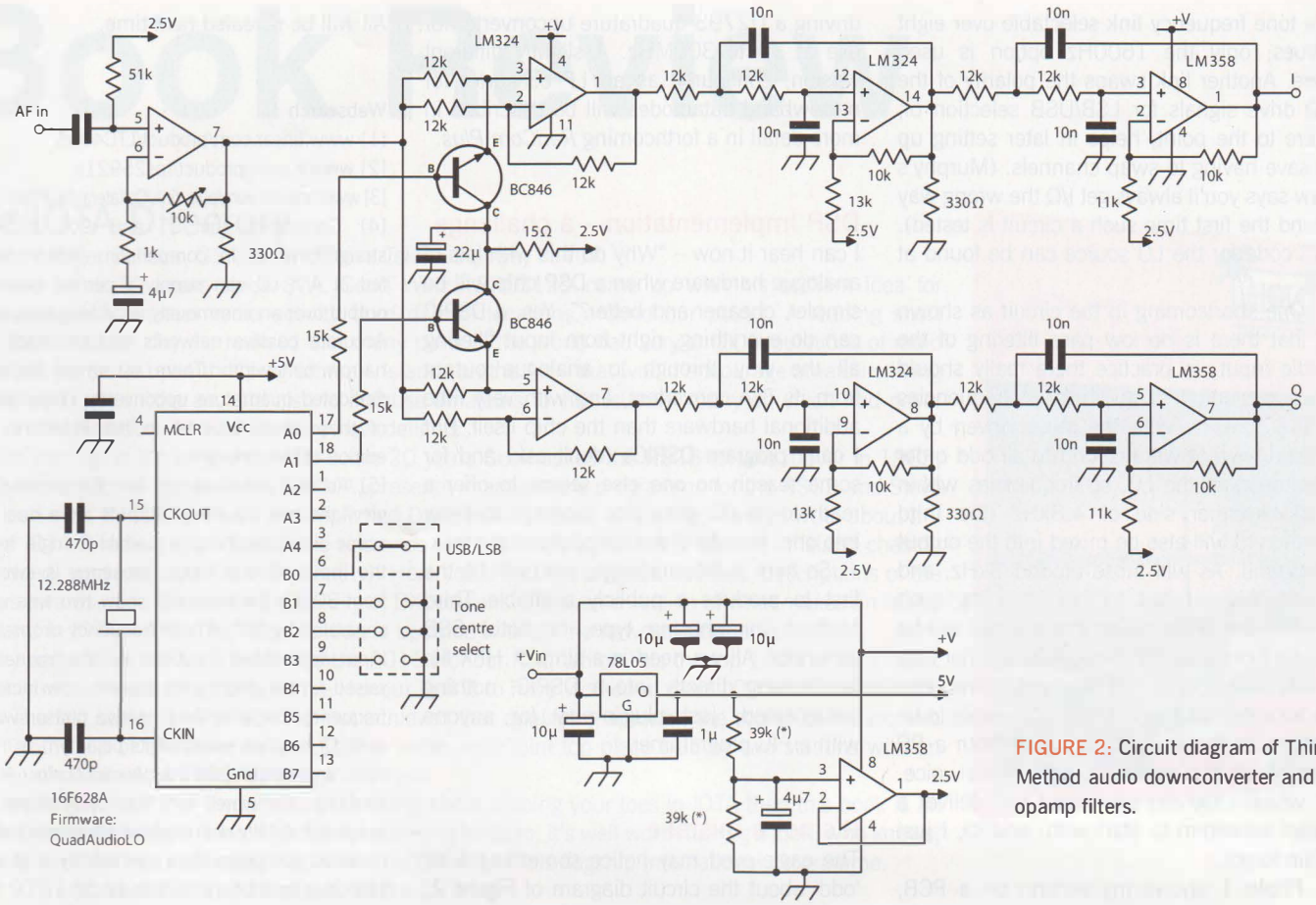


FIGURE 2: Circuit diagram of Third Method audio downconverter and opamp filters.

amplitude? Over the years several techniques have been developed such as the polyphase network and chains of opamp all-pass filters. While the resulting SSB drivers may work adequately, they need a lot of setting up and the output of the phasing networks is only ever an approximation [4].

This error in phase and amplitude gives a problem: if the two A or B terms in the equation are not identical, imperfect sideband cancellation will result, ie some SIN (A – B) or COS (A – B) terms will appear. The sideband suppression achieved for most practical circuitry is rarely better than 30 to 40dB – and that is after tweaking. Carrier leakage is determined only by the mixer suppression, and, again, is rarely better than 40dB at peak signal amplitude.

The Third Method uses an alternative technique to process the baseband voice signal, illustrated in the block diagram of **Figure 1**. The audio is fed in parallel to two mixers where it is mixed with 0° and 90° inputs from a first LO at a tone frequency *in the middle of the passband*. For voice signals this will be typically around 1600 to 1700Hz. The outputs of the mixers are then passed through two identical low pass filters with a cutoff around 1300 to 1500Hz to give I and Q channels.

The result is that the audio is now wrapped around onto itself. Assume an LO of 1600Hz. Audio at 300Hz appears at 1600 – 300 = 1300Hz; a 2900Hz signal also appears there since 2900 – 1600 = 1300Hz, while an input of 1600Hz, in the middle of the passband, gives DC at the mixer output. This folding-over may appear at first sight to have destroyed the input voice signal, but by considering the two quadrature streams together, they can be reconstructed later [5]. In fact, simply applying these 'folded over' streams to a quadrature RF upconverter does the job immediately, with the full SSB signal reconstructed **either side** of the RF carrier.

There are several points to note. To reconstruct properly, the frequency response from the first mixer output to the second mixer must extend down to DC – otherwise you get a hole in the audio spectrum either side of the first LO. For pure voice, this may not even be a big problem if the gap is only a few tens of Hz wide. More importantly, the results of poor sideband suppression and carrier leakage now fall on top of the wanted signal, that is, in the same RF passband. -30dB opposite sideband or carrier suppression would normally be considered a bit anti-social if it falls a few kHz away from where it should, and at LF might even be out of band and illegal! But here it falls on top of the wanted signal, where -30dB of inverted voice, at the same syllabic rate, on the same frequency, should be virtually unnoticed. Carrier leakage appears as an audio tone at 1600Hz and may be heard during gaps in the speech, but is far from annoying and fades out once voice modulation reappears.

A practical Third Method downconverter module

Figure 2 shows the circuit diagram of a complete first stage third method downconverter. The speech waveform passes first through a buffer stage whose primary function is to provide a low impedance drive to the quadrature audio mixers. These consist of an opamp switched between +1 and -1 gain by the bipolar transistors. The outputs pass into two identical channels of fourth order low pass filtering. With the values shown, cutoff is 1.3kHz at the -3dB point. A 1600Hz LO means voice band signals of 300 to 2.9kHz are downconverted.

The quadrature base drive to the two gain-switching transistors comes from a PIC microcontroller programmed to deliver a quadrature square wave. The firmware was designed for another application with

Andy Talbot, G4JNT
ac.talbot@btinternet.com

the tone frequency link selectable over eight values; only the 1600Hz option is used here. Another link swaps the polarity of the I/Q drive signals for LSB/USB selection or, more to the point, helps in later setting up to save having to swap channels. (Murphy's Law says you'll always get I/Q the wrong way round the first time such a circuit is tested). PIC code for the LO source can be found at [6].

One shortcoming in the circuit as shown is that there is no low pass filtering of the audio input. In practice there really should be some cutoff of audio input frequencies above 3.5kHz. With the mixer driven by a square wave it will respond to all odd order harmonics of the LO, so frequencies within 1.3kHz either side of 4.8kHz (the third harmonic) will also be mixed into the output passband. As will those around 8kHz, and so on. My excuses for not including such filtering are: a) for voice this module will be driven from a separate VOGAD amplifier (see Design Notes April 2013) so any filtering can be included on that; b) it is more likely to be used with the soundcard output from a PC generating data modes than it will real voice. In which case the soundcard will deliver a clean waveform to start with; and c), I just plain forgot.

Photo 1 shows my version on a PCB, driving a U2793 quadrature upconverter for use at 30 to 300MHz. A slightly different version, configured as an LF converter for narrowband datamodes will be described in more detail in a forthcoming *RadCom Plus*.

DSP Implementation – a challenge

I can hear it now – "Why do this with lots of analogue hardware when a DSP chip will be simpler, cheaper and better?". Yes, a DSPIC can do everything, right from input filtering all the way through to analogue output from its D/A converters, and with very little additional hardware than the chip itself. But I can't program DSPICs (don't ask) and for some reason no one else seems to offer a ready-to-go I/Q generator program to blow into one, in spite of the simplicity of the task.

So here is the challenge: who will be the first to produce a publicly available Third Method (or phasing type, or both) SSB generator. All we need is a simple .HEX file for blowing directly into a DSPIC; nothing complicated, just plug-n-play for anyone with a PIC programmer.

It's not a mistake

The eagle-eyed may notice something a bit 'odd' about the circuit diagram of **Figure 2**. All will be revealed next time.

Websearch

[1] www.linear.com/product/LTC4365
[2] www.ti.com/product/tps25921a
[3] www.onsemi.com/pub_link/Collateral/NCP361-D.PDF
[4] Generating the 0° and 90° at RF is straightforward, in comparison. Digital dividers fed at 4 * LO can supply a perfect quadrature output over an enormously wide frequency range. Accurate passive networks can be made for a narrow bandwidth. There are whole families of dedicated quadrature upconverter chips. Several of these were covered in the February 2012 edition of this column.
[5] An instructive way to see the process is to view the two I/Q mixer outputs on a dual trace scope while applying a variable single tone to the input. As the input frequency is swept up from 300Hz the trace will show two sine waves, separated by 90°, whose frequency drops as the input approaches 1600Hz. As the frequency is raised further, the traces show a now-increasing frequency, but with their relative phase swapped over. Or has one swapped its polarity?
[6] www.g4jnt.com/QuadAudioLO.zip – this contains firmware for the quadrature tone generator. A fully documented assembler listing is included so constructors can modify it at will to use other tone or crystal frequencies

MOCVO crystal oscillator kit – continued from page 55

emitter follower (or common collector) amplifier with the capacitive tap formed by C2 and C3 and R1 supplying the base bias voltage. R2, set at 1k, provides a relatively low output impedance (approximately 150Ω) for driving any following stages.

Kit testing

The kit instructions recommend testing with a receiver set to USB and tuned to the nominal frequency of the crystal. As the review model was for 40m it was supplied with a 7.030MHz crystal, which is, conveniently, the QRP CW calling frequency. After powering up with a 9V PP3 battery, I tuned to the 7.030MHz crystal frequency and swung the capacitor until I heard a tone. I was then able to track the capacitor tuning range by following the tone to its LF and HF limits and tuning the receiver until the tone frequency decreased to close to zero (zero-beat). This produced a measured tuning range of 7.0285MHz to 7.0313MHz, which was a total span of 2.8kHz. This was a very useful tuning range and fine for its intended use as the oscillator in a simple QRP CW transmitter.

I also took the opportunity to take a closer look at the output waveform, which was roughly sinusoidal at 7.03MHz but the output is also rich in harmonics. Examination with a spectrum analyser revealed the following useful harmonics: 14.06MHz (-10dB), 21.09MHz (-17dB) and 28.12MHz (-26dB). Whilst these harmonics are useful for accessing other bands, you will need some good filtering to tame these when using the oscillator as the basis of a 7.03MHz CW QRP transmitter.

Summary

The MOCVO oscillator kit is a useful and simple to build project that would indeed be useful as part of an Intermediate licence training programme.The kit costs £7.00 and is available direct from MOCVO Antennas (www.mOcvoantennas.com). Versions are currently available for 7.03MHz and 14.06MHz. My thanks to MOCVO Antennas for supplying the review kit.

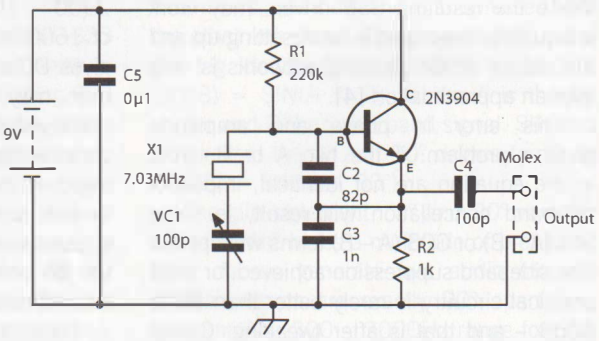
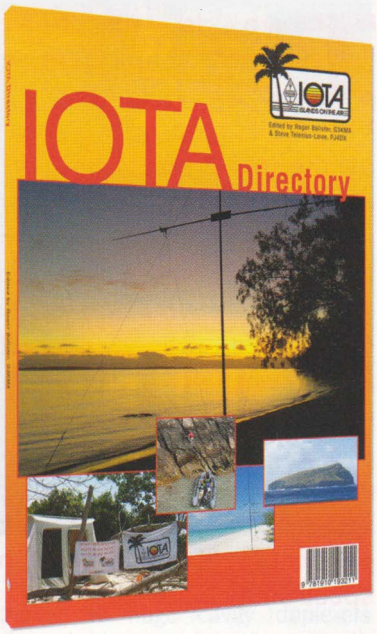


FIGURE 1: MOCVO oscillator circuit diagram.

PHOTO 2: The completed MOCVO oscillator kit.

Book Review

The IOTA Directory



Edited by Roger Balister, G3KMA and Steve Telenius-Lowe, PJ4DX

It is now some 52 years since SWL Geoff Watts, BRS3129 came up with his brilliant idea for encouraging HF amateur radio activity from diverse locations around our planet. A leading short wave listener of his day, he realised that many parts of the world had very small populations of radio amateurs. He came up with a programme – Islands on the Air – that would encourage amateurs living on islands to get on the air, and also to enthuse amateurs to visit islands, many of which had never been on the air before and hence were new delights.

After managing the programme for some 20 years Geoff asked the RSGB to take it over in 1985. This book's editor, Roger Balister, G3KMA, presently manages the programme for the RSGB and Steve Telenius-Lowe, PJ4DX is a very accomplished DXer, making them very well-placed to write about it.

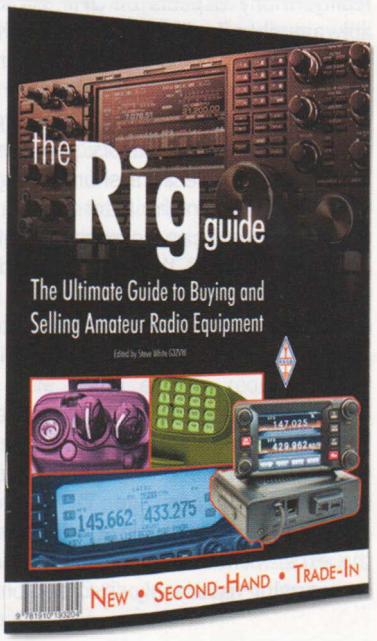
The IOTA Directory is an invaluable reference work for anyone with any interest in island chasing (or, indeed, working any kind of rare entity). Here you'll find the programme rules, descriptions of the various awards, discussions on the validity of DXpeditions and even a section of what *makes* an island an island in IOTA terms. This latest edition is updated with all the newest information.

Very early on in the book you'll find the 2016 Honour Roll, which lists the top 1400 or so scorers. The only requirement for getting on the Honour Roll is to have worked at least 100 islands within the rules. The last seven on the list have just achieved that qualifying amount; the scores of the top two dozen at the top of the table are all 1100 or more, with joint top place held by two stations with an almost-unimaginable 1115 islands to their credit.

There is no doubt that if you're even thinking about dipping your toes in IOTA then this book is an essential must-have read. Even if you're not planning to do so, it's well worth having a look: who knows, you may even find yourself caught up in the excitement of this flagship international programme.

ISBN 9781 9101 9321 1, 128 pages, 210 x 297mm
Non-Members' Price £11.99, Members' Price £10.19

The Rig Guide



Edited by Steve White, G3ZVW

Subtitled 'The Ultimate Guide To Buying and Selling Amateur Radio Equipment', this book contains an exhaustive list of amateur radio equipment – transceivers, receivers, linear amplifiers and accessories such as DSP equipment. You'll find details of nearly 400 different pieces of equipment from around two dozen brand names including relative newcomers such as Baofeng, TYT, Quansheng and Intek.

The information is presented in an easy to use tabular format. Each entry starts with the name and brief description, such as "Icom IC-3230H 2m/70cm FM mobile transceiver. 30 memories. Scanning functions. Dual receive. Optional CTCSS, DCS and voice synthesiser." Then there is a clear 'recognition' photograph, followed by a brief set of specs covering things like output power and frequency range.

The final column is perhaps the one most people are interested in: the price guide. This is divided into three: the new price, secondhand guide and trade-in value. These are 'real world' prices. The new price is the 'street price' at which the item sold (often quite a bit lower than the list price). The secondhand price is what you're likely to pay *from a dealer*, which may be a bit more than you'd expect on sites such as ebay. Dealers tend only to sell secondhand gear that they've checked is in good working order (it may even come with a guarantee); most auctions have no such assurance. Finally, there's a trade-in price, which is what you could expect to get if you offered the equipment to a dealer *for cash*. You may well be able to negotiate a better deal than that if you're buying something new (or bigger) but bear in mind that the dealer has to make a profit and factor in the cost of any warranty.

Tucked away at the back of the book is an alphabetical list of *RadCom* equipment reviews since January 1990. This valuable but easily-overlooked section is extremely useful if you're considering buying something secondhand: it points you to the reviews done *at the time the equipment was new* and gives you the opportunity to see an unbiased report on what the equipment is capable of. As an example, the final section of the book is Peter Hart's review of the Elecraft K3S HF & 50MHz transceiver, which gives a pretty good idea of the sort of coverage of most *RadCom* HF transceiver reviews. (Other reviews, for example 2m/70cm handhelds, are usually considerably less detailed but still contain valuable insights).

Overall, if you're considering buying or selling any amateur radio equipment, this book provides an invaluable source of information. It is also instructive to keep a copy beside you when browsing through Members' Ads in *RadCom* – you'd be surprised what bargains turn up there from time to time.

ISBN 9781 9101 9320 4, 96 pages, 210 x 297mm
Price £5.99 inc P&P (UK only)

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Homebrew

There is no universally accepted agreement defining the exact limits of the HF, VHF, UHF, and microwave parts of the radio spectrum. In most amateur radio literature, HF extends to 30MHz, VHF covers the 6m, 4m and 2m bands (50-146MHz), 70cm (432MHz) is usually classified as UHF; 23cm (1296MHz) and above are classified as the microwave bands. Some spectrum charts have sub-categories that are defined in terms such as super, ultra, extremely high or low depending in which end of the spectrum you are looking at.

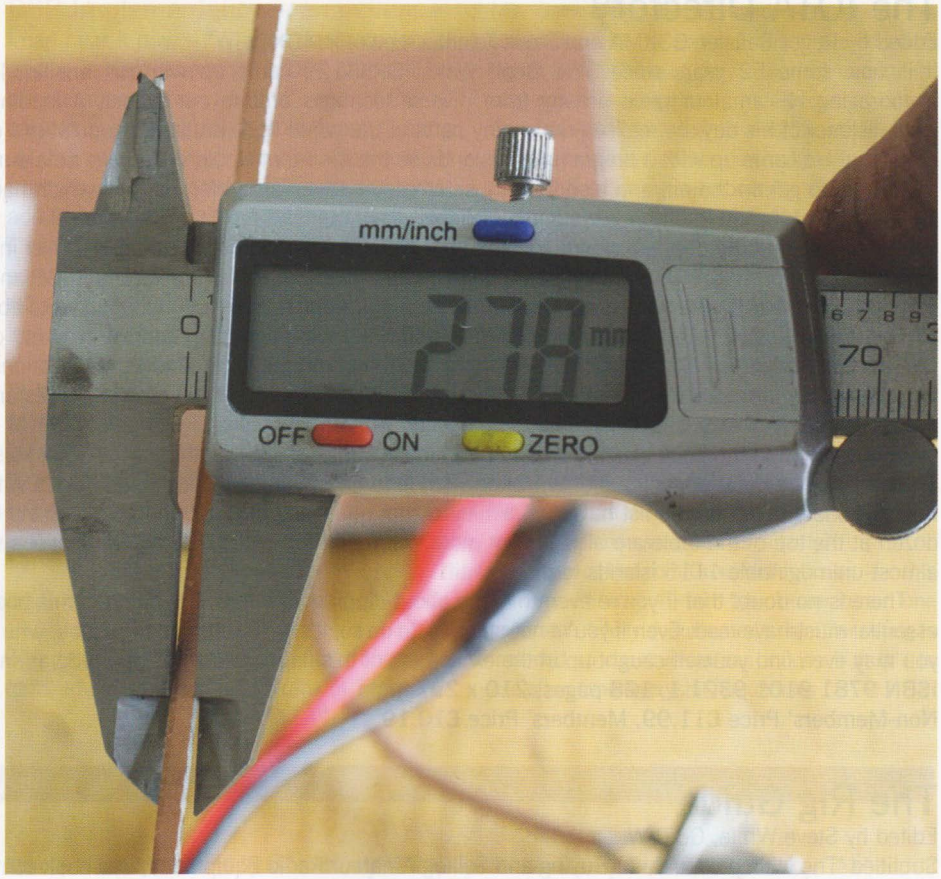

PHOTO 1: Measuring home-made stripline. The target width is 2.77mm and this sample is more than close enough.

UHF and microwave construction is often seen as a 'black art', something beyond the scope of the average home constructor. In reality, many aspects of UHF construction are arguably less difficult than their HF equivalent. Component values can often be established using a simple ruler or measuring tape rather than messing about with hand-wound inductors. UHF inductors may be as simple as a short, straight wire or hollow tube. In the latter case, a simple threaded screw can be used as a trimmer capacitor. Where the circuit is built on PCB, it is possible to make many of the key components like filters, matching networks or divider/combiner circuits entirely from PCB traces.

Some of the pioneers of radio like Hertz, Bose, Marconi and others were using frequencies in the VHF to microwave region well over 100 years ago. The use of such short wavelengths made it much easier for the experimenter to reflect and focus radio waves using reasonably sized equipment.

Lumped vs distributed

As mentioned last month, the difference between low frequency and RF electronics lies mainly in the nature of the reactive components. At UHF and above, these reactive components are often formed as sections of transmission line (TL). Although we sometimes like to make a clear distinction between lumped and TL components, any practical device will always have some element of both types. The lumped element model behaves just like the ideal components found in most simulation software. A typical model for a lumped component is for an infinitely small device that always has the required properties without any stray, unwanted or unexpected values. Lumped capacitors, inductors, resistors and other devices are always consistent regardless of frequency. In the real world, all devices will have stray reactances. Connecting leads on capacitors will have a small amount of inductance. This may be insignificant at lower frequencies, but, at UHF, it may be greater than or equal to the capacitive reactance. At some frequency, the device will be series resonant; above this frequency, your capacitor will present an inductive reactance. Similarly, coils have inter-turn capacitance that will make them self-resonant, usually at some frequency above their normal working range. In

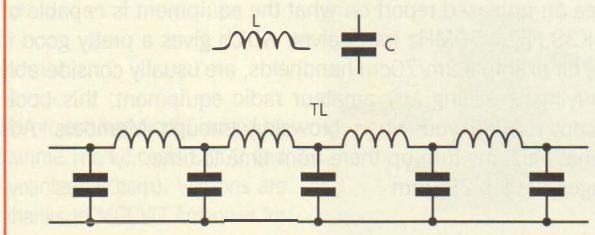

FIGURE 1: Standard component symbols for inductors (L), capacitors (C) and a simplified equivalent of a transmission line (TL) (see text).

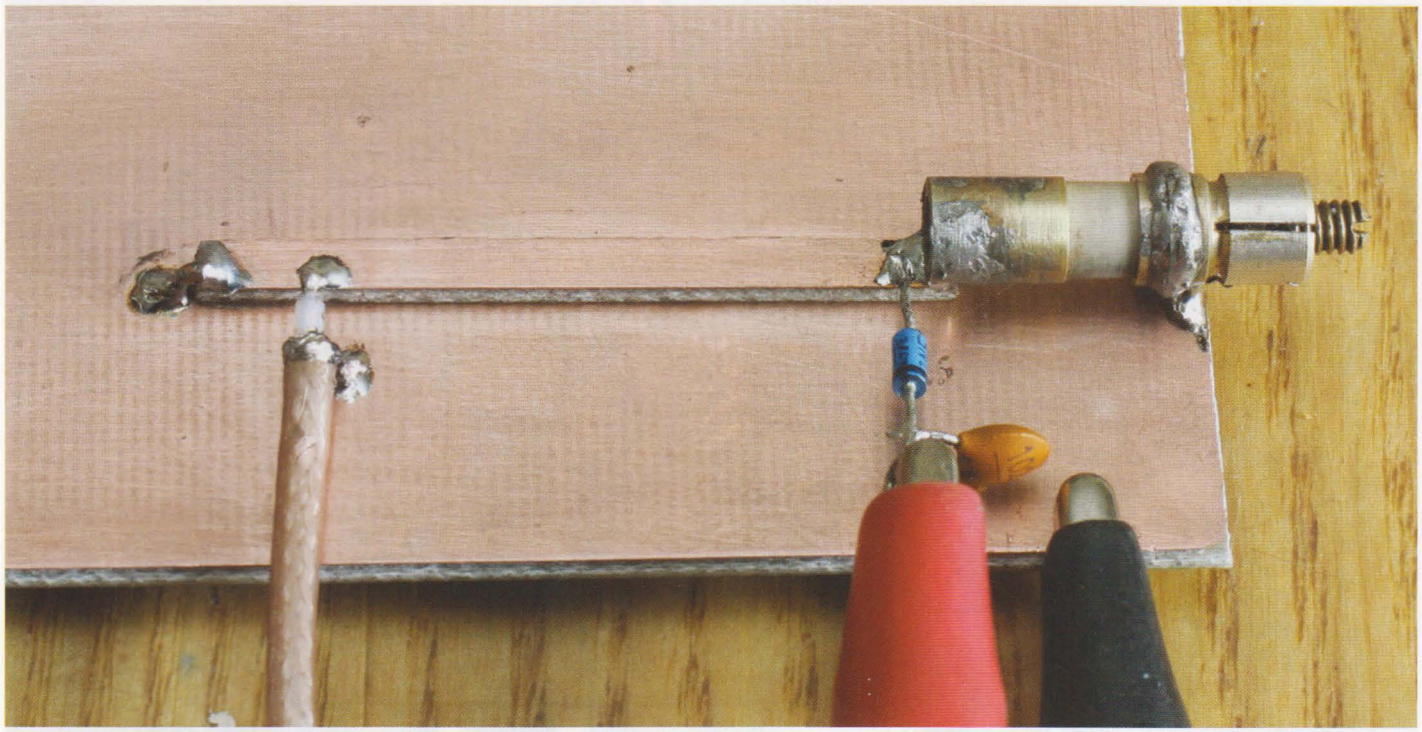

PHOTO 2: General arrangement for testing my home-made stripline.

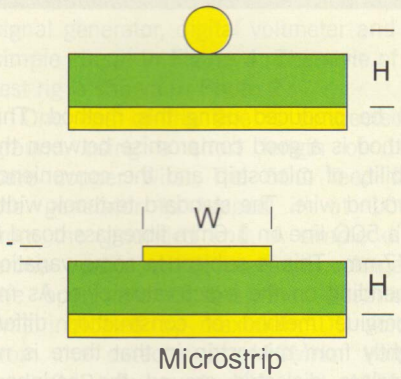

FIGURE 2: Transmission lines above ground on a PCB: top, a round wire; bottom, a stripline track.

practice, components may be considered lumped if their size is very small compared to the wavelength of the signals in the circuit. Surface-mount chip capacitors are a good example of an almost perfect lumped component.

Transmission line components have distributed values. The most common examples are coaxial line, stripline and parallel wire transmission lines. Each type of line has a given amount of capacitance, inductance and resistance per unit length. **Figure 1** shows the standard symbols for L and C and a simplified model of an unbalanced transmission line (TL). A more accurate model would include losses in conductor resistance and dielectric loss.

Transmission lines are commonly used as resonators in filters or impedance matching networks. At frequencies where the line length is much less than a quarter wavelength and line loss is negligible, an open circuit line will show capacitance and a line terminated in a short circuit will present an inductance.

There are many different types of transmission line available. For aerial feedline, flexible coaxial cable is ubiquitous. Solid and semi-solid lines offer lower losses and greater power handling. Open wire line is widely used by radio amateurs. Resonators based on transmission lines are used in various types of filter. Open or short circuit coax stubs can cure RFI problems at little or no cost. TL resonators are used in many applications ranging from tiny PCB micro-stripline to huge cavity duplexers used as filters in amateur repeaters.

It is relatively easy to design transmission lines with an air dielectric. Such lines have a high velocity factor (VF), usually well above 0.9. This means that the electrical length of the line is quite close to the free-space wavelength (300/f). For lines with an insulating material other than air, there will be a significant difference between the physical size and the free-space wavelength. Typical coax cables have a VF somewhere in the range 0.6-0.85. PCB microstrip will have similar values for VF.

Figure 2 shows two common types of PCB stripline. The first is a round wire on the 'top' side of the PCB with a continuous ground plane on the other. One big advantage of this style of construction is that there is no etching required. The second example is a standard micro-stripline that uses a PCB track as the conductor. Characteristic impedance is easily calculated provided that the physical dimensions of the board and the relative permittivity (ε) of the dielectric (insulator) is known. **Figure 3** shows design information [1] for both types.

Printed microstrip is ideal for mass production or when you are building from a published design. Non-printed methods like the round wire mentioned above are more

Microstrip $Z_0 = \frac{87}{\sqrt{\varepsilon_r + 1.41}} \cdot \ln \frac{5.98\,H}{0.8\,W + T}$

Wire above substrate $Z_0 = \frac{60}{\sqrt{\varepsilon_r}} \cdot \ln \frac{4\,H}{D}$

FIGURE 3: Design equations for the transmission lines shown in Figure 2.

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hbradio@eircom.net

PHOTO 3: The completed 144-576MHz quadrupler.

flexible for fine tuning prototype circuits. In many cases, it will be possible to make changes and adjustments to the circuit using nothing more than a standard pair of side cutters. My favoured type of stripline construction uses pre-cut strips of single-sided PCB that are glued to a copper ground plane. Any desired width or impedance can be produced using this method. This method is a good compromise between the stability of microstrip and the convenience of round wire. The standard textbook width for a 50Ω line on 1.6mm fibreglass board is 2.77mm. This is subject to some variation depending on the exact value of ε. As my superglue method of construction differs slightly from microstrip in that there is no fibreglass dielectric around the periphery of the line, the line impedance may be slightly different from the calculated value. In practice, the results are near enough for most purposes.

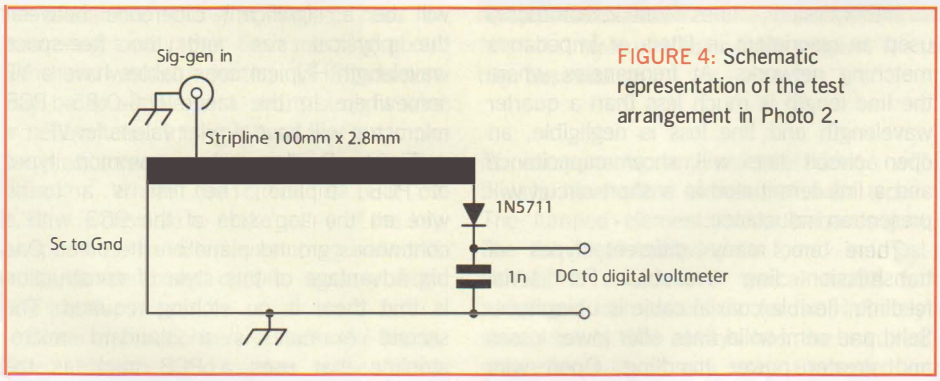


FIGURE 4: Schematic representation of the test arrangement in Photo 2.

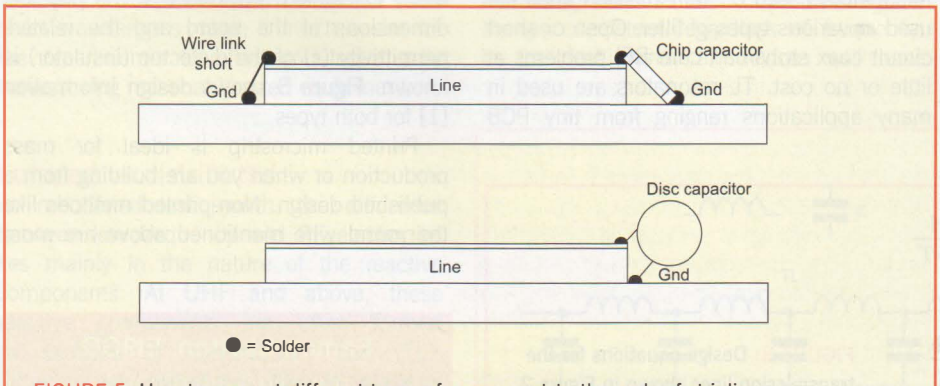


FIGURE 5: How to connect different types of component to the ends of striplines.

I keep a small stock of pre-cut 50Ω line ready for my next UHF project. It isn't that easy to cut PCB with extreme accuracy using a hand hacksaw. I aim for a track width of 2.8mm. As the width of the cut is almost 1mm, I add ~0.5mm and mark the board with a sharp pencil at 3.2-3.3mm. Apart from the time spent cutting, the cost is negligible, so I usually cut more than I am likely to need and then hand pick the straightest and most accurate cuts for more critical applications – see **Photo 1**. The lines are glued to the copper ground plane using the cheapest superglue available. Premium brand glue is too hard to remove when changes or adjustments are required.

I don't have much test equipment for frequencies above UHF. To test the properties of my current PCB stock, I glued a 100mm length of line to some scrap

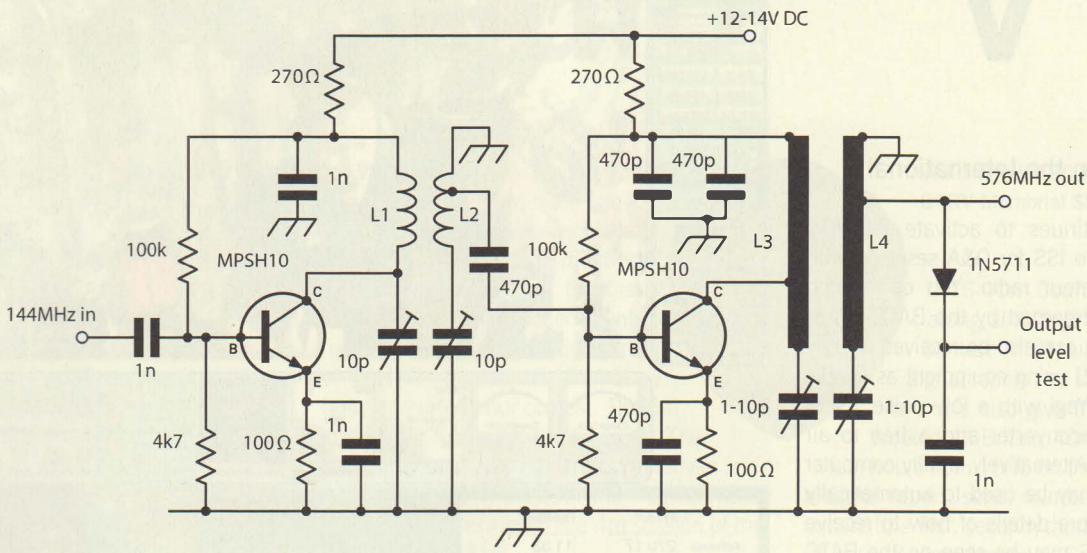


FIGURE 6: Two frequency doublers configured for x4 multiplication. * The 1N5711 and 1n capacitor are optional, used to provide a convenient DC indication of the output level.

PCB laminate. The line was tested using a signal generator, digital voltmeter and the simple circuit in Figure 4. The style of the test rig is shown in **Photo 2**.

One end of the line is connected to ground using a short length of 1mm bare copper wire. The 50Ω feed from the generator is tapped in at 10mm from the grounded end. A simple diode probe was used to measure voltage at the open end of the line. Resonance was indicated by maximum DC voltage from the detector at 410MHz. Voltage was 3dB down at 400 and 415MHz indicating a loaded Q of 27 in this circuit. Lines of this type typically have VF of around 0.6. This test shows VF of 0.55, although the ~1pF capacitance of the diode probably accounts for the difference. Based on LF measurements, short circuit L is around 30nH and open circuit C is around 8.8pF. Zo=sqrt(L/C) = $\sqrt{((30 \times 10^{-9}) \div (8.8 \times 10^{-12}))}$ = 58.3Ω, although this may not be exact because it is quite difficult to make direct measurements of such small values.

Figure 5 shows how to connect components or ground links to this type of line. Surface-mount chip capacitors are recommended for use at UHF and above. It may be possible to use disc capacitors provided that leads are trimmed close to zero length. For decoupling, A parallel pair of identical capacitors can be used. Stiff wire around 1mm diameter is ideal for ground connections. For wider lines, a strip of copper foil may give better performance.

A 144-576MHz frequency multiplier

Figure 6 shows a pair of frequency doublers. Both are based on transistors in the common-emitter configuration. The first stage uses conventional LC resonators at 288MHz. The second stage uses tuned striplines at 576MHz.

Construction

L1 and L2 are each air-cored 4 turns 1mm copper wound on a 6mm former. Turn spacing is more than the wire diameter for a coil length of around 10mm.

The output tap on L2 is 0.8T from the grounded end. The trimmer capacitors should be tunable down to a minimum value of 1-2pF. I had intended to use a BFR91 or similar UHF/microwave transistor in the second stage. Just for fun, I used another MPSH10 in the prototype. With a specified fT of min 650MHz, this is probably not an ideal choice, but it has performed well in this circuit.

L3 and L4 are 40mm lengths of glued stripline (as described earlier). The top of L3 is decoupled by a parallel pair of 470pF disc capacitors. The transistor collector is tapped in at 13mm from the open end. L4 is grounded at the top and output is taken at 8mm from the grounded end. Line spacing is 1.8mm. The trimmers must be capable of tuning down to about 1-3pF. 10pF piston trimmers are ideal. Miniature ceramic types are acceptable once they meet the capacitance requirement.

Tuning

I have installed an optional diode probe at the output. This is useful for indicating output voltage while tuning the circuit. As with any VHF/UHF multiplier chain, it is important to tune for the correct harmonic and ensure the output is clean and stable. 576MHz is just beyond the range of my spectrum analyser, so I used my frequency counter to monitor the dominant output frequency. Current is easily monitored by measuring voltage drop across the 100Ω emitter resistors.

I used the 144MHz oscillator from last month as the signal source. Once the 144MHz drive is applied and the first stage is drawing a few mA, tune the 288MHz trimmers for maximum current in the second stage. You should find resonance close to the minimum capacitance end of the trimmer range. At resonance, you will find there is a small drop in emitter current on the tuned stage, ie a dip in current in the stage you are tuning and a peak in the following stage. When 144MHz drive is swiftly killed (eg by shorting the crystal with a screwdriver), output should fall to zero immediately.

After tuning, I got 1Vpp at 576MHz. The assembled unit is shown in **Photo 3**. This unit will be used as part of the local oscillator for a 1296 - 144MHz receive converter.

That's all for this month.

Reference

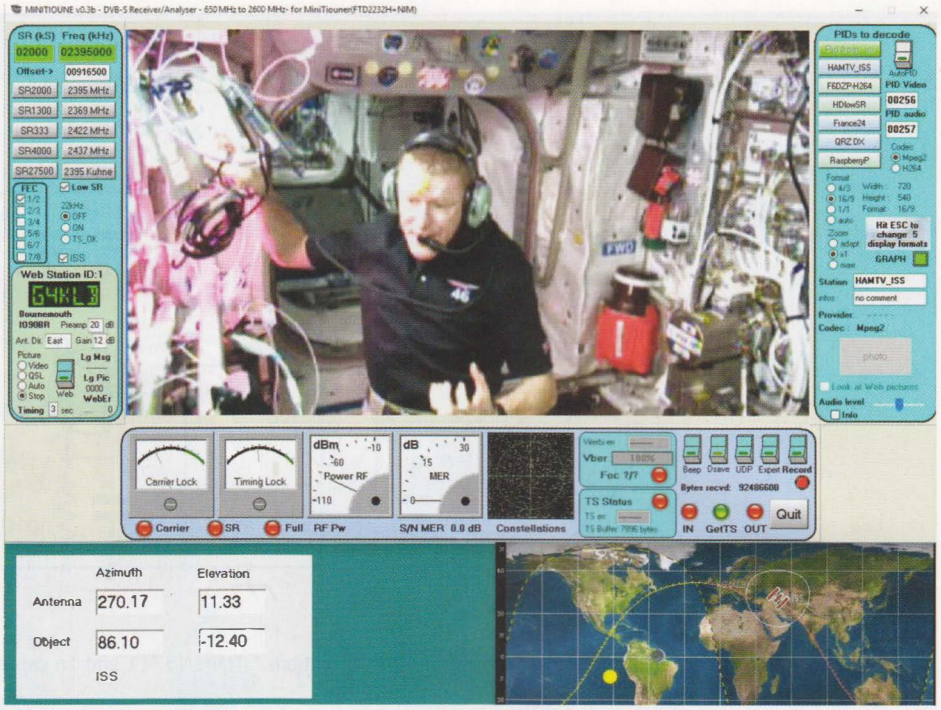
[1] MT-094 *Microstrip and Stripline Design*, Analog Devices, 2009

ATV

Amateur TV on the International Space Station

Tim Peake continues to activate the ATV transmitter on the ISS for Q&A sessions with schools via amateur radio. You can watch these sessions streamed by the BATC [1] or the transmissions can also be received directly when in range [2] using equipment as simple as a hand held Yagi with a low noise 13cm to L band downconverter and a free to air satellite receiver. Alternatively, a fully computer controlled dish may be used to automatically track the ISS. More details of how to receive ATV from the ISS may be seen on the BATC Forum [3].

The next planned contact for Tim Peake will be with Ashfield Primary School pupils in Yorkshire, planned between May 3 and 6 (dates are only finalised very close to the event). This will be organised by staff member Michael Ross, M6FFK, through his links with Otley Amateur Radio Society (OARS), supported by BBC One Show scientist – and Otley resident – Dr Marty Jopson. This will probably also be streamed by the BATC.



Tim Peake transmitting fast scan digital ATV from the ISS, as received by G4KLB using a dish antenna at home.

Geosynchronous satellite

Further to our report last May, the Yje Es'hail 2 satellite, from The Qatar Satellite Company that will have an ATV repeater on board is still on schedule for launch in the autumn. This will be 13cm input and 3cm out. Because it will be geo-synchronous, at 26°E, dish pointing will be much easier. Watch this space for more information later in the year.

TV repeater news

GB3GG, near Grimsby in NE England will be losing its site in September. It is on top of a school that is being demolished. Unfortunately they have not been able to find a new site for the repeater.

GB3IV, at RNAS Collingwood near Portsmouth is off the air. It may be re-built on this site or may move to a better location at a higher site. Details will be announced when known. The Keeper is Howard, G3NZL.

Several repeaters now also have narrow band digital inputs with transport streams as low as 300kS/sec on various bands – including the new 146MHz band. This can be very useful when testing reduced bandwidth transmissions when no-one is about. See the repeater streaming sites [4] or the individual repeater websites for further details.

Most clubs and repeaters have an activity night. Please make sure your activity night is shown on your repeater streaming page: this will encourage activity on the evening.

GB2RS ATV newsreader retiring

Roy, G8CKN transmits the GB2RS news at 9.30am every Sunday on several FM voice channels and also on ATV via the GB3HV repeater near Farnham in Surrey. Broadcasts are streamed live at [4] and previous recordings are also available – click on News Desk on the left and then select GB2RS News. Roy started broadcasting the news on 2m FM 37 years ago, adding 70 and 23cm TV in 1995. His internet streaming service started 15 years ago: well done Roy, quite an achievement! Mike, G8LES has acted as a backup provider when Roy is not available.

After all this time Roy is looking for one or more amateurs to take over these transmissions. If you are interested in helping out then please contact the GB2RS News Manager, Ken Hatton, G3VBA, via email to gb2rs.manager@rsgb.org.uk. Roy can offer assistance to set up, and some equipment may also be available.

Broadcast equipment exhibitions

Several exhibitions each year show the latest very expensive professional broadcast television cameras and equipment. The main two are NAB in Las Vegas in the spring and autumn's IBC in Amsterdam. More recently there have been two smaller exhibitions in the UK: BVE, in London Dockland in the early spring and Manchester in the autumn [5]. If you are interested in the latest broadcast products then they are well worth a visit, especially as admission is free for those who pre-register online.

BATC Convention

This year the BATC Convention will be at the RAF Museum Cosford, NW of Birmingham, on 24-25 September [6]. This will include lectures, members' equipment demonstrations, BATC Shop, surplus equipment sale, trade stands, the club meeting as well as the annual dinner. The BATC is always looking for more helpers: if you would like to join the BATC committee and help with the running of the club then please talk to a committee member.

Websearch

[1] http://principia.ariss.org/live/
[2] ISS location: www.n2yo.com/space-station/
[3] www.batc.org.uk/forum/
[4] www.batc.tv
[5] www.bveexpo.com
[6] www.batc.org.uk

Forthcoming rallies with an ATV stand

22 May: Dunstable Downs
21 May: Norden, Rochdale
4-5 June: SERF, Eastbourne
19 June: Newbury
26 June: West of England Rally

Dave Mann, G8ADM
g8adm@gb3bh.com

Sport Radio

HF-wise May is a straightforward month, but on VHF it's the year's busiest.

On HF it's the 80m Club Championships all the way this month – SSB on the 2nd (Bank Holiday Monday), datamodes on the 11th and CW on the 19th. May marks the half way point the series and, as I write, Norfolk ARC has a comfortable lead in the General category. Will they finally be able to win the G5RV Memorial Trophy this year?

On VHF we start with the 2m UKAC on the 3rd. On the first weekend of the month there are three overlapping events. The 432MHz-248GHz Trophy starts at 1400 on the 7th and runs for 24 hours. Starting at the same start time, but running for eight hours, the 432MHz Trophy and 10GHz Trophy contests are ideal if you are not equipped for all UHF/microwave bands. The 70cm UKAC is on the 10th. The 70MHz CW Contest is on the morning of the 15th and the first of this year's VHF CW Championship events. Then it's back to the UKACs, with 23cm on the 17th. The 144MHz May Contest runs for 24 hours over the weekend of 21st-22nd. This contest is part of the VHF Championship series with 6- and 24-hour sections for Single-Op Fixed and Single-op Open stations, plus an Open section for multi-op stations. On the 22nd, the first the 144MHz Backpacker events runs for four hours, the first three of them overlapping the final three hours of the 24-hour contest. The 6m and SHF UKACs are on the 26th. The third session of the 70MHz Cumulatives is on the afternoon of the 29th and the final RSGB VHF event of the month is a 4m session of the UKACs on the 31st.

Starting on the 7th, the UK Six Metre Group's Marathon is a contest without fixed operating times. The object is to work as many Locator squares as possible across three months of the Sporadic-E season. The Italian National Society ARI International DX Contest runs for 24 hours from midday on the 7th. There are sections for Single-op CW, SSB, RTTY, mixed, and Multi-single. Italians send a signal report and a 2-letter Province code (there are 110 to collect), while non-Italians send a signal report plus serial number. Check the rules for scoring. The UKuG Low Band Contest is on the 8th. It coincides with the RSGB events taking place the same weekend. Also on the 8th, the IRTS 40m Counties Contest runs along similar lines to their 80m contest in January. Exchange a signal report and serial number (EIs and GIs also give their county). The Worked All Britain 40m Phone runs for four hours from 1000 on the 15th. Exchange a signal report, serial number and your WAB square (the first, second, third and sixth figures of your 8-digit National Grid square). The big international contest is the CQWW WPX CW that takes place for the 48-hours of the weekend 28-29th. If geomagnetic conditions are quiet the CW segments of all the HF contesting bands will be packed, but if they are disturbed activity on the upper bands will be limited. Finally, the first in this year's series of five 5.7/10GHz Contests organised by the UK Microwave Group takes place on the 29th.

Will Norfolk ARC finally win the G5RV Memorial Shield this year?

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steve.g3zvw@gmail.com

RSGB HF Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
May 2	80m Club Championships	1900-2030	SSB	3.5	RS + SN
May 11	80m Club Championships	1900-2030	Data	3.5	RST + SN
May 19	80m Club Championships	1900-2030	CW	3.5	RST + SN

RSGB VHF Events

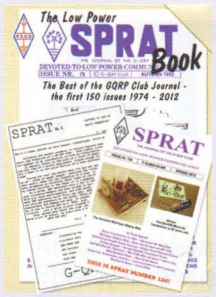
Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange
May 3	144MHz UKAC	1900-2130	All	144	RS(T) + SN + Locator
May 7-8	432MHz-248GHz Trophy	1400-1400	All	432-248	RS(T) + SN + Locator
May 7	432MHz Trophy +	1400-2200	All	432	RS(T) + SN + Locator
May 7	10GHz Trophy	1400-2200	All	10G	RS(T) + SN + Locator
May 10	432MHz UKAC	1900-2130	All	432	RS(T) + SN + Locator
May 15	70MHz CW §	0900-1200	CW	70	RST + SN + Locator + Postcode
May 17	1.3GHz UKAC	1900-2130	All	1.3	RS(T) + SN + Locator
May 21-22	144MHz May Contest +	1400-1400	All	144	RS(T) + SN + Locator + Postcode
May 22	144MHz Backpackers #1	1100-1500	All	144	RS(T) + SN + Locator
May 24	50MHz UKAC	1900-2130	All	50	RS(T) + SN + Locator
May 24	SHF UKAC ~	1900-2230	All	2.3-10G	RS(T) + SN + Locator
May 29	70MHz Cumulative #3	1400-1600	All	70	RS(T) + SN + Locator
May 31	70MHz UKAC	1900-2230	All	2.3-10G	RS(T) + SN + Locator

Best of the Rest Events

Date	Event	Times (UTC)	Mode(s)	Band(s)	Exchange (info)
May 7 - Aug 7	UKSMG Summer Marathon	All	All	50	4-character Locator
May 7-8	ARI International DX	1200-1200	CW, Phone, RTTY	1.8-28	RS(T) + SN (I's give Province code)
May 8	UKuG Low Band	0800-1400	All	1.3-3.4G	RS(T) + SN + Locator
May 8	IRTS 40m Counties	1200-1500	SSB/CW	7	RS(T) + SN (EIs & GIs also send County)
May 15	WAB 40m Phone	1000-1400	SSB	7	RS + SN + WAB area
May 28-29	CQWW WPX CW	0000-2359	CW	1.8-28	RST + SN
May 29	UKuG	0600-1800	All	5.7-10G	RS(T) + SN + Locator

+ VHF Championship event § VHF CW Championship event ~ Different bands at different times. Visit www.rsgbcc.org for more information.

Operating, DX, QRP &



Low Power - Spratbook

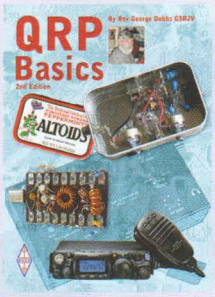
The best of the GQRP Journal - the first 150 issues 1974 - 2012

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 1974. Its journal, SPRAT is recognised as one of the world's leading QRP publications.

The Low Power Spratbook covers transmitters, receivers, transceivers, antennas, ATUs, Morse keys and keyers, and a section for those circuits that do not fall happily into any particular part.

The Low Power Spratbook will appeal to the dedicated QRP enthusiast through to all those who have never tried QRP construction work before.

320 pages, 174x240mm,
ISBN: 9781 9050 8686 3
Non Members' Price £14.99
RSGB Members' Price £12.74



QRP Basics

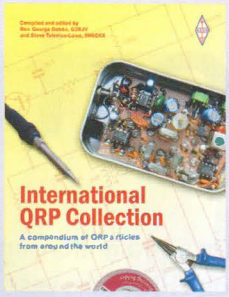
By Rev George Dobbs, G3RJV

This new second edition of *QRP Basics* has been thoroughly updated, providing the ideal guide to low power amateur radio. If you want a new challenge, or have just wanted to try QRP, then *QRP Basics* will help.

QRP Basics starts with the 'Why' - what makes so many so enthusiastic about QRP - and then concentrates on the 'How'. Good, solid advice includes choosing commercial QRP equipment, simple antennas and operating tips. Much of the book deals with the art of home-construction, providing practical advice on workshop techniques, and choosing and using components.

Already a QRP operator, or new to this part of amateur radio, *QRP Basics* is everything you need to get started.

Size 174x240mm 208 pages
ISBN: 9781 9050 8684 9
Non Members' Price £14.99
RSGB Members' Price £12.74



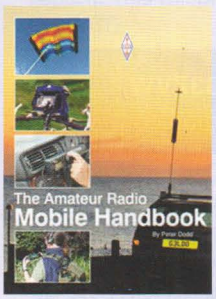
International QRP Collection

Compiled and edited by Rev. George Dobbs, G3RJV and Steve Telenius-Lowe, 9M6DXX

QRP is practiced by many radio amateurs across the globe. Much is published by these QRP enthusiasts detailing great designs, best practice and much more. The authors of the *International QRP Collection* have scoured the world for the best of these and compiled them for you, into this great scrapbook.

The *International QRP Collection* contains articles from well known amateur radio magazines such as *RadCom, QST, Sprat, Break In*, as well as some original material. By far the largest section is that devoted to construction. This will please most QRP enthusiasts, who are also keen equipment builders. To complement this, there are also sections on modifications to QRP equipment, reviews of commercial equipment, QRP theory, and articles on QRP operating.

Size 210x274mm, 176pages
ISBN: 9781 9050 8655 9
Non Members' Price £12.99
RSGB Members' Price £11.04



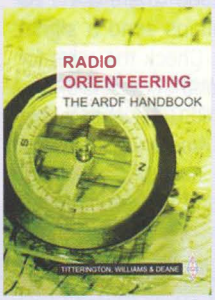
Amateur Radio Mobile Handbook

2nd Edition
By Peter Dodd, G3LDO

The fascination of taking a radio away from home and making contact with stations is an enduring one in amateur radio circles. Written by acknowledged mobile expert Peter Dodd, G3LDO *Amateur Radio Mobile Handbook* is for those who regularly "go mobile".

Mobile operation can offer a great escape from EMC problems or restricted home operation and provides the challenge of the quest for that really good operating location. This book is designed to cover all these aspects of this popular part of the hobby. From the basics of amateur radio mobile, installing radio equipment and antennas in a vehicle, maritime mobile, bicycle mobile to pedestrian mobile is all covered here.

Size 240x174mm, 128 pages
ISBN: 9781 9050 8671 9
Non Members' Price £11.99
RSGB Members' Price £10.19



Radio Orienteering - The ARDF Handbook

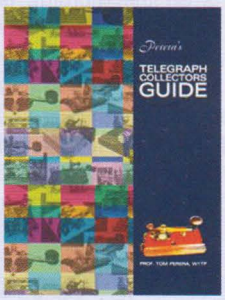
By Bob Titterington G3ORY, David Williams, M3WDD and David Deane, G3ZOI

Amateur Radio Direction Finding (ARDF) is an outdoor pursuit which combines orienteering with the amateur radio skill of direction finding. Competitors use their skills to locate hidden transmitters within a given time limit.

Radio Orienteering - the ARDF Handbook is packed with information, you'll find everything from 'top 10 tips to improve performance' to 'organising an ARDF event'. Beginning with the fascinating history of ARDF the book provides a general overview of the sport.

This book is an excellent and rounded reference work, highly readable, well-illustrated and is ideal for investigating the sport.

Paperback, Size 175x240mm 112 pages
ISBN 9781-9050- 8626-9
Non Members' Price £9.99
RSGB Members' Price £8.49



Perera's Telegraph Collectors Guide

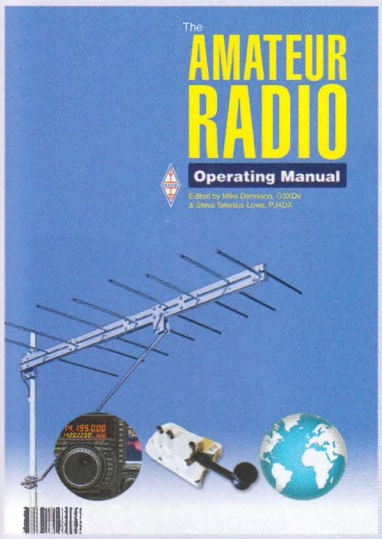
By Prof. Tom Perera, W1TP

This is the third edition of the famous *Perera's Telegraph Collectors Guide.* Written by the leading expert on Telegraph Keys this book provides the reader with the comprehensive guide to telegraph keys. There is a historical background of telegraph keys and details of the types of keys available from the earliest 1830 varieties through to the present day. Morse code keys, spark & wireless keys, military keys from around the world and radio keys are all covered. There is also a wide range of material covering practice sets, semi-automatic keys (or "Bugs"), electronic keyers, paddles, home-made keys and even novelty items. There are even tips on restoring telegraph keys.

This guide is ideal companion for anyone with an interest in telegraph keys and is a fascinating reference work on telegraph and Morse keys since their very inception

Non Members' Price £9.99
RSGB Members' Price £8.49

Morse books



RSGB Amateur Radio Operating Manual

8th Edition

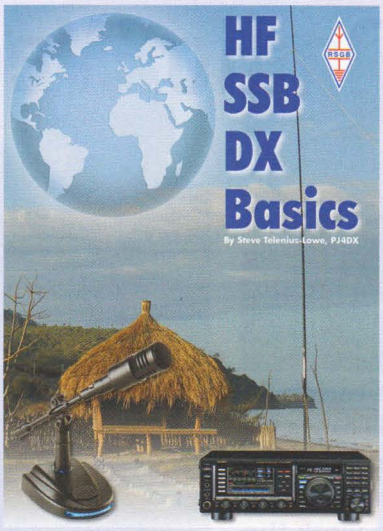
By Mike Dennison, G3XDV and Steve Telenius-Lowe, PJ4DX

Amateur radio is a fast-moving hobby and every year sees numerous changes. Since the first edition of the *RSGB Amateur Radio Operating Manual*, it has provided the best practical guide to the hobby as it is today and this edition is no exception.

The 8th edition of the *RSGB Amateur Radio Operating Manual* is written and edited by those already skilled in their field so that, no matter what the activity, you can not only learn the basics but also the techniques that lead to success. Operating is an essential part of amateur radio. We all learn early on how to communicate with our fellow amateurs. However, to get the best out of our hobby, skills must be learned. And no matter how skilled you are in your particular field, there is much to learn when embarking on another activity. Techniques for operating on all bands from 136kHz to 24GHz, and all modes from CW to ATV, are included.

This edition of the *RSGB Amateur Radio Operating Manual* has been completely revised and updated. Anyone who wants to enjoy amateur radio operating to the full, will find the *RSGB Amateur Radio Operating Manual* remains a mine of useful and practical information.

Size 210x297mm, 240 pages,
ISBN: 9781 9101 9313 6
Non Members' Price: £16.99
RSGB Members' Price: £14.44



HF SSB DX Basics

By Steve Telenius-Lowe, PJ4DX

Contacting far flung parts of the world (DX) on the High Frequencies (HF) on single sideband (SSB) is one of the enduring fascinations of amateur radio. HF SSB DX Basics provides a practical guide to making the most of this endlessly fascinating area of operation.

Many are put off by the challenges of DX operation but well known author and DXer Steve Telenius-Lowe dispels the myths about huge antennas and high power in an easy to understand way. From what HF SSB is and what DX is all about, you are led through to the opportunities they provide and much more. There is a practical guide to which antennas make good choices in your location, choosing your transceiver, the microphones used and even what the myriad of buttons on a modern transceiver do. There is a guide to the HF bands you can operate, their propagation characteristics and what to expect from them. Steve also provides practical advice on how to avoid pitfalls when operating on the bands and much more including handling pile-ups, split working, QRP operation, QSLs and even being DX yourself.

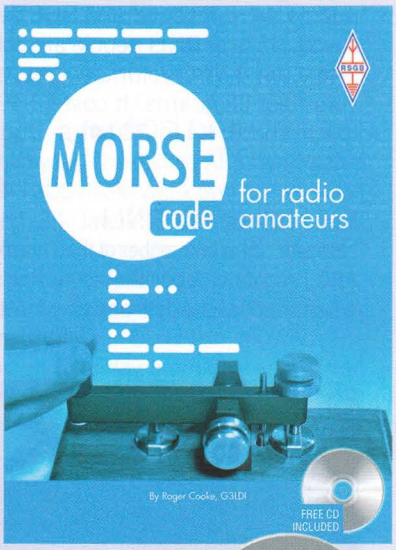
HF SSB DX Basics is for anyone interested in operating in this hugely satisfying area of amateur radio by providing advice and practical steps to get you started and much more.

Size: 174 x 240mm, 96 pages
ISBN: 9781 9101 9315 0
Non Members' Price: £8.99
RSGB Members' Price: £7.64

Morse Code for Radio Amateurs

12th Edition

By Roger Cooke, G3LDI



This newly expanded and updated 12th edition of *Morse Code for Radio Amateurs* is simply the 'book' for everyone who wants to learn all about Morse code. Written by Morse code enthusiast Roger Cooke, G3LDI this edition is a third bigger than its predecessor and contains a history of Morse code and what it means to Radio Amateurs. There is advice that explains Morse code keys and how to choose your own. There is information of how to start learning the code, increasing your speed and guides to the software included that teaches you the code. The book also provides guides to the abbreviations, prosigns and Q codes, helpful lists of resources available to those setting out learning the code and much more.

FREE CD
One of the outstanding features of this book is the special dual mode CD that is included. This provides more than an hour of audio recordings of Morse code at 5, 10, 15, and 21 words per minute. It doesn't however stop there as the CD also has a special computer readable section that contains a whole host of Morse software that teaches Morse, Morse Contesting and much more.

Morse Code for Radio Amateurs provides everything you need to get started in Morse code apart from perhaps the Key itself. This remains the 'book' for anyone wanting to add Morse code to their skills.

Size 210x297mm, 64pages, ISBN: 9781 9101 9319 8, **Non Members' £8.99, RSGB Members' Price £7.64**

SOS Radio Week

SOS Radio Week is an annual event that sees amateur radio operators throughout the UK and Ireland support RNLI stations through special event stations. Stations operate from a variety of locations, many with direct links to the RNLI. Contact with those registered stations can lead to an award. Chaser stations are those that work the registered stations during the event.

Chelmsford ARS operated GXOMWT from Marconi Sailing Club.

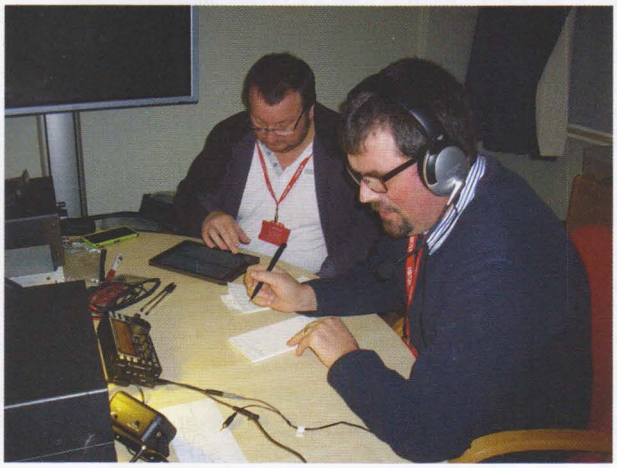
The RNLI has saved over 140,000 lives since it was set up in 1824. SOS rescue boats and drivers act as a much needed safety net in case of an emergency – our seas would be much less safe without them!

Interesting facts about the RNLI include that it provides a 24 hour search and rescue service to 100 nautical miles out from the coast of the UK and Republic of Ireland. There are 237 operational lifeboat stations and 349 lifeboats at those stations. 19,000 miles of coastline are covered by the RNLI's lifeboats.

On average, 24 people are rescued a day and there are an average of 23 lifeboat launches daily. In 2014 alone, 8,727 people were rescued and 368 lives were saved. 95% of RNLI people are volunteers. There are 4,700 volunteer crew and 150 volunteer lifeguards. It cost £149 million to run the RNLI in 2014.

Supporting the RNLI

Last year, John, a member of the Thurrock Acorns ARC, had to call out the Lyme Regis lifeboat when a colleague felt unwell and it became obvious that, without their help, the situation could become life threatening. The lifeboat duly arrived and there was a happy ending.



Dave Beck, 2EODTC and Mark Chanter, MOWMB from Plymouth Radio Club operating from the RNLI South Regional Office in Saltash.

However, the story did not stop there. When John heard that on the last Friday in January there is an RNLI SOS day, he was keen to get the radio club involved. From the club's standpoint, we wished to join other amateur radio stations on the air to raise the profile of the RNLI and hopefully at the same time raise some funds for them. All the TAARC members were keen to support such a good cause and so John applied for a special event callsign GB1TYC (Thurrock Yacht Club). We were very lucky as the Grays Yacht Club agreed to sponsor us by allowing us to use their club house on the day. Although the day proved a challenge as it was very windy and erecting the antennas took some time, the amateur radio stations were soon on the air. From the moment the stations started transmitting we were in contact with amateur radio stations located in Germany, Sweden, Russia, Italy, Spain, Portugal, Holland and the UK. The day was a huge success and we had many people visit during the day.

Thurrock Acorns ARC. From left to right, Rotarian Nicholas Wilkinson, Natalie Adams (volunteer crew from RNLI), Captain Geoff Holland Port of Tilbury, Lt. Cmdr Robert James RNR, Jason Carol (volunteer crew from RNLI) with members of the TAARC in the background.

Leading up to the event TAARC contacted some local organisations to elicit sponsorship. We were hoping to raise a £100 and were delighted with the response. Organisations that endorsed our thoughts that the RNLI was an organisation worth supporting included the *TS Dragon* (Sea Cadets), Lions Club of Grays Thurrock, Rotary Club of Stanford and Corringham, Port of Tilbury, Thurrock Yacht Club and members of TAARC. We managed to raise the sum of £630, far past our target.

During the afternoon we welcomed members of the RNLI who arrived on the local lifeboat. The vessel came from the Gravesend Station that covers the Thurrock shores as well as Kent as part of its daily training excercise.

The photo shows cheques being passed over to the RNLI. **Nick, G4HCK**

Ethan being guided by Ian Lowe as Hilderstone RC support SOS Radio Week.

Hilderstone RC operate as GB1MLS

Hilderstone Radio Club enjoyed a tremendously successful operation at Margate Lifeboat station using the callsign GB1MLS. Over the week nearly 500 contacts were made all over the UK and Europe, including 18 countries. The aim was to raise funds and awareness of the volunteer work of the RNLI's rescue service. One contact was with a person who had in fact owed his life to the RNLI. Other lifeboat stations exchanged greetings with the Margate crew.

The cooperation between Hilderstone RC and the Margate Lifeboat station has prospered to the extent that three inactive amateur licence holders amongst the lifeboat crew have now rekindled their interest in the hobby and one more crew member obtained his Foundation licence. This has resulted in five licence holders on the crew, as the station recruited club member Ian Lowe to become a Deputy Launching Authority.

One of the contacts was with some pupils from Wellesley House school who are training for their Foundation licence in preparation for their amateur radio contact with Tim Peake later this month. Their young voices cut through the airwaves making contact with amateurs at far flung corners of the UK.

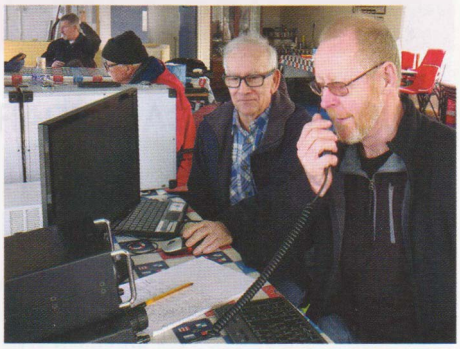
John Hislop

GB5PHL in Plymouth

Members of the Plymouth Radio Club also set up a special event station GB5PHL in support of Plymouth Lifeboats. They operated from the RNLI South Regional Office in Saltash, Cornwall to raise awareness of the RNLI's important work and to encourage support for RNLI fundraising activities. It is fascinating place where they service all RNLI equipment (including a huge radio and communications workshop) as well as provide admin support and training for most of Southern England. The arrangements for the Plymouth's role for this event were made by Stephen, MOCCA.

The station used an Elecraft KX3 to an Expert 1k FA linear and 400W out to an end fed half wave on 40m. Well over 100 contacts were made, many of them from Europe and Scandinavia.

Robert Goodall, 2E0ITN



Oliver Prin, MOWAG and Steve Webb, G4GHO on the air on HF when Chelmsford ARS operated GXOMWT.

GB2SLB, a multi club operation

On 23 and 24 January, to support the RNLI during SOS Radio Week, members of Wearside Electronic ARS, Houghton-le-Spring ARC, Durham ARC and Bishop Auckland ARC attended the life guard station at Marine Walk, Sunderland using the callsign GB2SLB.

A good day was had with a lot of HF contacts and monies raised donated to the life guard station.

Ian, G7MFN

CARS active for SOS Radio Week

For the third year, Chelmsford ARS participated in the RNLI SOS Radio Week over the weekend of 23 and 24 January. Members operated GXOMWT on HF and 2m from the Marconi Sailing Club by the River Blackwater in Essex.

The event was coordinated by Christopher Chapman, G0IPU and Oliver Prin, MOWAG. The setting up on Saturday morning was assisted by relatively mild weather, there was even had some sunshine! Operating was from around 10am through to 4pm Saturday with an earlier finish on the Sunday to allow for clearing up.

In addition to a good cause, the idea was also to encourage new members and those who had not previously participated in such an event to come along and have a go on the air.

Trevor, M5AKA

Pictured left to right are George, M5GHT, Ray, Tom, MOHYE, Ian, G7ESY and Tom, 2E0HLC who helped operate GB2SLB. Photo courtesy Ian, G7MFN.

Elaine Richards, G4LFM
elaine.richards@rsgb.org.uk

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, Graham, G0NBI, 01234 832 700, 29 Oct, On the Air. We normally acknowledge all submissions within 3 working days: if you don't hear from us, please phone. We don't normally print 'closed', 'TBA' or 'every Tuesday'-type entries. The deadline for the June edition is 28 April and for the July issue it's 26 May. For GB2RS, the deadline is 10am on the Thursday of the week of broadcast.

CLUB EVENTS CALENDAR

INTERNATIONAL

Pafos Radio Club, Cyprus,
Richard, 5B4AJG, 00 357 97 857 891,
5b4ajg@gmail.com www.cyhams.org

International federation of Railway Radio Amateurs (FIRAC) www.firac.org.uk

NATIONAL

Amateur Radio Caravan and Camping Club
membership@arcc.org.uk, www.arcc.org.uk
Net every Tuesday and Thursday 3.770MHz at 8pm. Rallies this month: Stoke Bruerne & Oxon

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

British Amateur Radio Teledata Group
bartg@bartg.org.uk, www.bartg.org.uk
Membership open to those interested in datacoms. Contests and awards organised.

British Railways Amateur Radio Society
mOzaa@brars.info, www.brars.info
2016 is Golden Jubilee. Membership open to those interested in amateur radio and railways.

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

Radio Amateur Old Timers' Association
MemSec@RAOTA.org, www.RAOTA.org
Membership is open to anyone active in amateur radio. Nets on Wed 3.763 at 1000, 1.963 at 2100, Thurs 7.163 at 1100, 3.763 at 1930 and Sun 3.763MHz at 1000.

Travelling Wave Contest Group
secretary@twcg.org.uk, www.twcg.org.uk
Friendly contest group for those who want to be involved with contesting, but who don't have a local club or whose club isn't active in contesting, from anywhere in the UK.

REGION 1: SCOTLAND SOUTH & WESTERN ISLES

Regional Manager: Marcus Hazel-Mcgown, MM0ZIF, RM1@rsgb.org.uk

Cockenzie & Port Seton ARC
Bob, GM4UYZ, 01875 811 723
5 Normal club night
7-13 On-air activity day
19 Radio check night, John, MM0JXI

Livingston and District ARS
Cathie, 2M0DIB, 01506 433 846
2, 16, 21 Operating and training evening
9 Presentation and talk
20-21 Special event weekend

Lothians RS
Mike, MM0MLB, secretary@lothiansradiosociety.com
10, 24 Club night, Braid Hills Hotel

Stirling & District ARS
Myles, MM0MYL, 07890 477 516
4, 11, 18, 25 Operating, presentations & training, 7pm
7, 14, 21, 28 Construction, projects & training, 10.30am

Wigtownshire ARC
Ellis, GM0HPK, ellis@gaston.freeserve.co.uk
4, 11, 25 Club night
17 SOTA and QRP, Neil, 2M0NCM

REGION 2: SCOTLAND NORTH & NORTHERN ISLES

Regional Manager: Denny Morrison, GM1BAN, RM2@rsgb.org.uk

Aberdeen ARS
Fred, GM3ALZ, 01975 651 365
4 Junk sale
11 A multiband dipole, Stewart, GM4AFF
18 Construction project for 70 years of AARS
25 Construction & on the air

Glenrothes & DRC
Tam, MM0TGB, 0775 3526 498
3 Leven, construction, training, operating
10 PSK31 on a budget
17 What are you doing on radio?
24 Forward planning for Field Days

REGION 3: NORTH WEST

Regional Manager: Kath Wilson, M1CNY, RM3@rsgb.org.uk

Chester & DRS
Bruce, MOCVP, 01244 343 825
29 Bring Out Your Dead!
29 Committee meeting
29 Grand surplus sale
29 Project evening

South Cheshire ARS
Alan, 2E0DDK, 01782 510 856
4, 18 On the air
11 Club and shack night
25 Ham Radio Deluxe, Alan, 2E0DDK

South Manchester R&CC
Ron, G3SVW, 01619 693 999
4 Introduction to electrical horology, G3SMT
11 Develop the new shack
25 Technical Q&A session
29 Technical forum

Stockport RS
Heather, M6HNS, 07506 904 422
2, 16 Society night
6, 7, 15, 22, 29 Intermediate course
11 Club net
23 Skills night

Thornton Cleveleys ARS
John, G4FRK, 01253 862 810
1 Practical / on the air
8 Trawler WTO
22 Clock maintenance, G3WBB
29 Transmission lines, G8KBH

REGION 4: NORTH EAST

Regional Manager: RM4@rsgb.org.uk

Denby Dale RC
Darran, G0BWB, 0797 442 3227,
3 Making traps for a W3DZZ
10, 24 On the air
17 Guess the mystery object

Hambleton ARS
Tony, G3MAE, 01609 881 530
10 Operating night
24 Introduction to oscilloscopes, Tony, G8FLV

Sheffield & District Wireless Society
Krystyna, 2E0KSH, 07884 065 375
3 Video night, The workings of Radio and TV
10, 24 Social night
17 Sheffield life hackers, Andy Kirby

Sheffield ARC
David, G6DCT, littlewood20@btinternet.com
1, 15, 29 Club night
8 Shack night, operating MORCU
22 D-Star & DMR+ repeater system, Steve M1ERS

REGION 5: WEST MIDLANDS

Regional Manager: Martyn Vincent, G3UKV RM5@rsgb.org.uk

Cheltenham ARA
Derek, G3NKS, 01242 241 099
16 Lunch, book with G3YJE
18 Surplus equipment sale

Gloucester AR&ES
Anne, 2E1GKY, 01242 699 595 daytime,
1 HRO restoration, Steve, G4HFT
3, 10, 17, 24 Club net, 7.30pm, 145.500 then ±145.550MHz
4, 11, 18, 25 Net, 7.30pm, 145.550MHz then QSY
8, 22, 29 Informal evening and general operating
15 On the air from home (club closed)

Hereford ARS
Rod, MOJLA, 01432 356 079
5 Amateur radio for vehicle club members

Midland ARS
Norman, G8BHE, 0780 807 8003
3 Open meeting, shack on the air & training classes
10 Committee meeting & training classes
14 Harwell Radio and Electronics Rally
17 Planning meeting, rallies, social events & training classes
24 General meeting, ragchew & training classes

Mid-Warwickshire ARS
Don, G4CYG, 01926 424 465
9 DVD afternoon
23 Net, 145.275MHz

Nuneaton & District ARC
Neil, 2E0NEI, info@ndarc.co.uk
2, 9, 23 UKAC
4, 11, 18, 25 Net, 145.475MHz, 9.30pm
5 Pint & chat evening
19 Sausage & bacon butty night

Salop ARS
salopamateurradio@gmail.com
3, 10, 17, 24 CW net, 4.30pm, 144.070MHz; net, 8.30pm, GB3LH
4 Natter night / committee meeting
11 Shack night with G3SRT on the air
18 Calibration night
25 Natter night

South Birmingham RS
Gemma, M6GKG, gemmagordon.m6gkg@gmail.com
1, 15 Work in the shack
2, 9, 16, 23 Shack coffee morning, 11am, visitors welcome
4, 11, 18, 25 Training classes, Dave, G8OWL
5, 12 Sorting stock for rally sales
8 Committee meeting
19, 26, 29 Sorting equipment for Wythall rally

Stratford upon Avon & DRS
Clive, GOCHO, 01608 664 488
8 Operating principles of the IOT, high power, high efficiency transmitting valves, Harri, G1EIX
22 Smith Charts demystified, Giles, G0NXA & Harri, G1EIX

Sutton Coldfield ARS
Robert Bird, spirit.guide@hotmail.co.uk
1, 15, 29 Open net, 145.250MHz, 7.30pm
8, 22 Club meeting
9 Open net, 70.475MHz FM, 7.30pm
23 DMR open net, GB7FW slot/local2, 7.30pm

Telford & DARS
John, MOJZH, 0782 473 7716
3 Committee meeting and GX3ZME OTA HF
10 Under a Fiver competition
17 Bowls evening with LWVH Bowls Club
24 Winter projects

Wythall Radio Club
Chris, GOEYO, 0771 041 2819
1, 10 80m Club Championships
2 Morse class + free 'n' easy/UKAC
5, 12, 19, 26 Nibbles Night in the Shack
7 Club net, 145.225MHz or GB3WL, 9am; RSGB 432MHz AFS contest
9 Morse class + committee meeting
14, 21, 28 Club Net, 145.225MHz or GB3WL
16 Morse class + the CAIRO interface scheme, Dr Pete Best, G8CQH
23 Morse Class + Hamfest preparation
29 Curry night at the Monsoon

REGION 6: NORTH WALES

Regional Manager: Ceri Lloyd Jones, 2W0LJC
RM6@rsgb.org.uk (after 23 April 2016)

Dragon ARC
Stewart, GWOETF, 07833 620 733
1 HF DXing, 2W0CYM
15 Propellants for cordite, MW0SEC

REGION 7: SOUTH WALES

Regional Manager: Jimmy Sneddon, MW0EQL
RM7@rsgb.org.uk

Aberystwyth & DARS
Ray, GW7AGG, 01970 611 853
11 Build your own mag loop antenna, Simon, GW4NVN
25 Net on 145.500 then 145.550MHz

REGION 8: NORTHERN IRELAND

Regional Manager: Philip Hosey, MI0MSO
RM8@rsgb.org.uk

Mid Ulster ARC
Dave, muarc.secretary@yahoo.co.uk
14 Youth members describe RSGB DXpedition trip
16 Shack attack

Next deadline is 28 April

REGION 9: LONDON & THAMES VALLEY

Regional Manager: Tom O'Reilly, G0NSY
RM9@rsgb.org.uk (after 23 April 2016)

Burnham Beeches RC
Dave, G4XDU, 01628 625 720
1 Why CW? Greg, G4EBY
15 What comes in the workshop, Steve, G0TAN

Harwell ARS
Malcolm, G8NRP, 01235 524 844,
11 Construction contest

Reading & DARC
Pete, G8FRC, 01189 695 697
11 Group for Earth Observation and live reception of weather satellite images, Francis, G7CND and David, G1MAL
25 100 years of Reading weather, Roger Brugge, University of Reading

Shefford & District ARS
Paul, G1GSN, 0787 668 5827
4 Test your rig, Bryan, M0BIK
11 2016 Construction Contest winner
18 Heritage Railways in the UK, Richard Crane
25 Royal Signals, pt 2, David, G8UOD

Southgate ARC
Mr K Mendum, G8RPA, g8rpa@arrl.net
10 The curve tracer, Mike, M0NOE

REGION 10: SOUTH & SOUTH EAST

Regional Manager: Michael Senior, G4EFO
RM10@rsgb.org.uk

Basingstoke ARC
Peter, GOKQA, 01256 414 454
15 VHF radar, propagation and the ISS, Bob, M0KER

Bromley & DARS
Andy, G4WGZ, 01689 878 089
14, 28 Intermediate course
16 Operating award schemes

Coulsdon ATS
Mike, M1CCF, 020 8654 2582
8 DXpedition to St Kilda

Crawley ARC
John, G3VLH, 01342 714 402
24 The Birth of BBC Satellite Outside Broadcasting, Malcolm, G3NZP

Cray Valley RS
Richard, G7GLW, 0783 171 5797
18 Software defined radio, Richard, G8CDD

Darenth Valley RS
Mike, G8AXA, 01689 856 935
10 Radio on the air/social
24 Audio evening

Dorking & DRS
David, M6DJB, djb.abraxas@btinternet.com
23 Build a portable 2-ele 20m beam, pt 2, Tom, G4DFA, Colin, M0GXV

Echelford ARS
John, G4GSC, 01784 451 898
11 The Role of Wireless Amateurs in WW 1, Dr Elizabeth Bruton
24 TX Factor, Stuart, M0SAR

Fort Purbrook ARC
Graham, MOCYX, 0785 040 0108
26 Presentation on Clansman radio

Hastings E&RC
Gordon, 01424 431 909
24 AGM followed by bring your mystery thing

Hilderstone R&EC
Ian, M6WFI, hilderstoneclub@gmail.com
11 Natter night
20-21 TDOTA with Margate Brownies
25 Talk

Horndean & DARC
Stuart, GOFYX, 02392 472 846
4 Natter night/social evening
18 National Coastwatch Institution, Peter Buckley

Horsham ARC
Alistair, G3ZBU, 0785 526 8666
4 Big bombs, Wing Commander John Bell DFC MBE
21 Fox hunt
25 Social, Queens Head, Barnes Green

Itchen Valley ARC
Quintin, M1ENU, 023 8078 7799
12 Members forum
26 Mechanical typesetting, an engineering marvel, Quintin, M1ENU

Southdown ARS
Andy, M6GND, 01323 486 924
1 Super regenerative receivers
1, 8 Net 9.50am 145.275 FM, 10.00am 7.035 CW
3 Net 8.30am 145.275 FM, 9.50am 145.275 FM, 10.00am 7.035 CW, Hailsham Shack CW 10.30am-12.30pm various bands & Cafe meet 12.30pm
6, 13, 20, 27 BHRS, 12.30pm, 144.300MHz SSB, 145.500MHz FM, 51.600MHz FM
10, 17 Net 8.30am 145.275MHz FM, 9.50am 145.275MHz FM, 10am 7.035 CW, cafe meet 12.30pm
15, 22, 24, 29 Net 8.30am 145.275MHz FM, 9.50am 145.275MHz FM, 10am 7.035 CW, cafe meet 12.30pm, BHRS 2.30pm 144.300MHz SSB, 145.500MHz FM, 51.600FM

Surrey Radio Contact Club
John, G8IYS, 020 8657 0454
1 Propagation, Mike, G0JMI
4, 11, 18, 25 Net, 70.300MHz, 8pm
5, 12, 19, 26 Net, 145.350MHz, 8pm
7, 14, 21, 28 Net, 1905kHz, 9.30am
15 Chat & fix-it, John, G8MNY

Worthing & DARC
Al, MOOAL, information@wadarc.org.uk
1, 8, 15, 22, 29 2m net, 7.30pm
3 On the air evening
4, 11, 18, 25 40m net, 11am
7 Sunday breakfast, 9am
7, 14, 21, 28 80m net, 7.30am
10 Discussion evening
17 Presentation on Sussex 4x4 Response (MOSSX) by Dave, G4OTV
24 Club evening

REGION 11: SOUTH WEST & CHANNEL ISLES

Regional Manager: Pam Helliwell, G7SME
RM11@rsgb.org.uk

Bristol RSGB Group
Robin, G3TKF, robin@g3tkf.co.uk
29 Recent developments in digital ATV, Shaun, G8VPG

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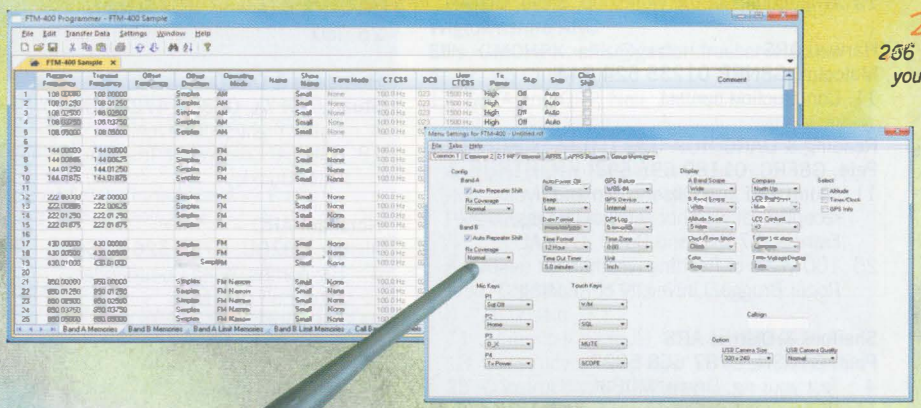

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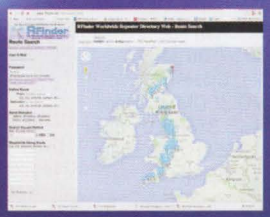

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Callington ARS
John, G4PBN, 01822 835 834
3 Monthly club meeting

Cornish RAC
Steve, G7VOH, 01209 844 939
3 Committee meeting
4 Main meeting
18 Club evening

Exeter ARS
Nick, MONRJ, 01363 775 756
2 GB3EX net, 7.45pm
8 VHF/UHF propagation, Nick, MONRJ
9 GB3EW net, 7.45pm
16, 23 Net, 145.575MHz, 7.45pm
22 Early religious broadcasting, Matt, MOSBI

Mid-Somerset ARC
David, G8BFV, 01749 670 085
9 Latest TX Factor video

Plymouth Radio Club
David, 2EODTC, d.beck123@btinternet.com
9 AGM, 7pm

South Bristol ARC
Andrew, G7KNA, 0783 869 5471
4 Air Ambulance, Mark, 2E0FKV
11 Summits on the Air, Martin, 2E0EUW
18 DVD night
25 Open house and on air night

Torbay ARS
Dave, G6FSP, g6fsp@tars.org.uk
5, 19 Club night
12 Club night with business meeting
26 AGM

Weston Super Mare RS
Paul, G3SDH, g3sdh@btinternet.com
1, 8, 22, 29 Natter night
15 Autumn rally planning

Yeovil ARC
Rodney, MORGE, 01935 825 791
4 Mini talks
11 A rotary converter, G7LNJ
18 Morse practice, G3MYM
25 On the air and committee meeting

REGION 12: EAST & EAST ANGLIA

Regional Manager: RM12@rsgb.org.uk

Braintree & DARS
John, M5AJB, 01787 460 947
1 Astronomy, Mike, G8DJO
15 Construction evening

Cambridge & DARC
David, MOZEB, 01353 778 093
12 Surplus sale
26 Foundation shack evening + TX Factor 5

Chelmsford ARS
secretary@g0mwt.org.uk
2 Satellites, Steve, MOSHQ
15 Skills night at Danbury Village Hall

Colchester Radio Amateurs
Stefan, MOXLB, 0777 161 6676
25 CW practice; what, how & why of QSLing

Norfolk ARC
Chris, GODWV, 01603 898 678
3 Fibre optics, Sonny, 2E0SYW
10 Informal
17 To the moon and back, Sam, G4DDK
24 Informal / Bright Sparks

Norfolk Coast ARS
Steve, G3PND, info@norfolkcoastamateurs.co.uk
4 Constructing baluns
11 Phased vertical antennas
18 Satellite operation
25 Planning 2016 events

South Essex ARS
Terry, G1FBW, 0798 607 0040
7 Canvey Radio and Electronics Rally

Thurrock Acorns ARC
Gordon, 2E0ELI, acorns@taarc.co.uk
16 Con-fused-d? Steve, G4HXK

REGION 13: EAST MIDLANDS

Regional Manager: Jim Stevenson, G0EJQ
RM13@rsgb.org.uk (after 23 April 2016)

Lincoln Short-Wave Club
Pam, G4STO, 01427 788 356
2, 9, 16, 23 UKCC
4 Club net via GB3LM, 8pm
6 Saturday surgery + G5FZ on the air
10 The Sun's effects on propagation, Peter, MOEJL
11, 18, 25 Club net, 145.325MHz, 8pm
13, 27 Shack activities + G6COL on the air
15 Committee meeting
17 Formal meeting
20 Shack activities + G5FZ on the air
24 Visit to Lincoln Astronomical Society

Loughborough & DARC
Chris, G1ETZ, 01509 504 319
2 Video night
9 Club net
16 Open forum – QRP
23 Practical evening

Melton Mowbray ARS
Brian, MOYBX, 0777 265 9622
9 Software for hardware

RAF Waddington ARC
Bob, G3VCA, 0797 116 6250
1, 8, 15, 22, 29 Club net, 145.325MHz, 8pm

EVENTS ROUNDUP

REGION 1: SCOTLAND SOUTH & WESTERN ISLES

Mid-Lanark ARS meets every Friday at 6.30pm in Newarthill Community Education Centre, High Street, Newarthill. The new web address is www.mlars.club and all are welcome from people looking to start out in amateur radio to all levels of licence holders.

REGION 3: NORTH WEST

North West ARC, based at the Brooklyn Hotel, Green Lane, Bolton BL3 2EF meets every Wednesday at 7pm in the upstairs function room. Equipment is available for members to use and the club is a registered exam centre. For more details see www.nwarc.org.uk

Furness ARS held a Question and Answers session where members asked questions to the floor, with the membership fielding the answers as a group to encourage discussion and lively exchanges. Questions ranged from antenna and rotator supports to suggestions for the best option for an HF antenna is a very small garden and with unfriendly neighbours. Other topics included grey line propagation, exam questions and VFOs. It was an entertaining and lively evening.

Chester & DRS is taking part in an interclub quiz against Wirral & DRS at Irby Cricket Club on 27 April at 8pm.

Castle Rushen High School is a secondary school located in Castletown, Isle of Man. For some years now the students have benefited from an active radio club. This year a further three students, all from Year 7 (11 or 12 years old), gained passes in their Foundation exams. They are now looking forward to getting on air and are particularly keen to try a few contests. To get them started they have been lent dual band handhelds by local amateurs. CRHS radio club can often be heard on air (call MTOGLK) during its meetings on Monday afternoons and Thursday lunch times. If you hear the station give them a call. From left to right are Kai, MD6IUH, Thomas, MD6TIS and Archie, MD6SNV.

REGION 4: NORTH EAST

Bishop Auckland RAC is a local club for radio amateurs and prospective radio amateurs alike with a mixed and varied membership. Meeting on Thursdays at the Stanley Crook Village Hall, everyone is welcome. The club has a fully operational shack and there is a separate area where members can be involved in radio construction, reading or just chatting. Training is provided by Tim, MOACV and Bob, GOOCB.

Denby Dale ARS held a construction evening building traps. Most members used kits purchased from Sotabeams to make 7MHz traps to use as the basis for a W3DZZ antenna. These were easily constructed and tested with the included instruction, and some are already in regular use. The second meeting of the month was a guess the object event. Various electronic components from modern SMD to more elderly spark gap emitters were displayed. A particularly interesting selection of valves was one of the highlights.

Oliver, M6EUB, a member of the RSGB Youth Committee, attended Stockton & DARG with DRM Ian, G7MFN and gave a talk on the role of the Youth Committee.

Members of **Houghton-le-Spring ARC** attended the South Shields Voluntary Life Brigade's 150 year anniversary using the callsign GB0VLB from the watch tower. Participants included George, M5GHT, Ken, M6ELL, Ernie, M5ERN, Tom (Chairman of the museum), Tom, M0HYE and Scott, M0MCN. A good day was had with plenty of HF contacts.

REGION 5: WEST MIDLANDS

When RSGB General Manager Graham, G0NBI visited Telford & DARS, he presented a number of awards. This included a special award to Mike, G3JKX. Over the years, Mike has tutored over 350 students to various levels of licence and his long-suffering wife, Barbara, has welcomed countless students into their home, with a cuppa and a kind remark or two. An active amateur, Mike has always encouraged, helped and advised fellow amateurs and listeners in all matters amateur radio. He was the Hon Sec of TDARS for nearly 20 years before retiring in 2014. He took part in two DXpeditions to the Falklands, the most recent appeared in *RadCom* in April 2015. Details of the club programme can be found on their website at www.tdars.org.uk/

Midland ARS is celebrating some recent exam successes. Terry and Stephen recently passed their Foundation exams thanks to chief examiner Ron, M0WSN and tutor Steve, M0SSV respectively.

REGION 7: SOUTH WALES

Risca & DARS is celebrating the 40th member to join the club since it started 5 years ago. Richard Hall was closely followed by the 41st new member, Chris Doody. Richard is shown here with club chairman Clive, GW6JPC, and other members.

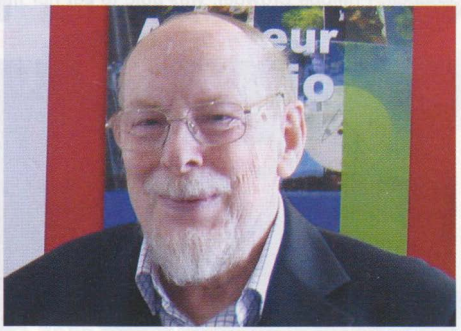
REGION 8: NORTHERN IRELAND

In May, Bangor & DARS will have a talk on PSK31 data mode by Dr Harry Squance, GI4JTF. Due to the upcoming election they have a change of venue to Hamilton House, Hamilton Road, Bangor for this meeting on 5 May. The club had 15 happy Foundation and 1 Intermediate licensee, along with instructors, at the recent course. Thanks to Myles, GI0VTS for the photo.

REGION 9: LONDON & THAMES VALLEY

Twenty four 1st Deddington Scouts, with two Leaders, undertook the Scouts Electronics badge run by the members of Banbury ARS. The course was run over two evenings, the first being basic theory, recognition of components and use of a multimeter and the second was construction of electronic kits. Thanks to Frank, M0BJN, Geoff, M0GUF, John, M1CNJ, Daniel, 2E0CZN, Scott, M6SKH, Paul, G1BZM, Ron, G8DCX and Tom, M0TTH.

Edgware & DARS would like to congratulate the club's most recent Foundation success, Yu Law. He is awaiting his callsign but was able to conduct his first QSO at an On The Air meeting. Thanks to G4RNW for the photo.



At Verulam ARC's AGM, the club Chairman David, G4HHJ, announced that the club was granting John Welsh, G0NVZ (right), honorary membership in recognition of the outstanding service he has given over very many years. John has made a major contribution by writing articles for the club's monthly newsletters explaining, in simple terms, the complexity of a wide range of subjects. Many of the articles have also appeared in *RadCom*. John also received the Chairman's Deserving Member award.

REGION 10: SOUTH & SOUTH EAST

Every year **Hilderstone Radio Club** puts on a special amateur radio station as part of the SOS Radio Week at the Margate Lifeboat Station. London Array kindly sponsored the club and the photo shows their Public Relations Manager, Gail Lewin, presenting the £200 cheque to club member Ian Lowe, who is also the Deputy Launching Manager at Margate Lifeboat Station. The club continues to support Wellesley House school in preparation for their amateur radio contact with Tim Peake on the International Space Station. The pupils listened to Tim live using handheld radios as he replied to the questions from Norwich school. They can't wait for their turn!

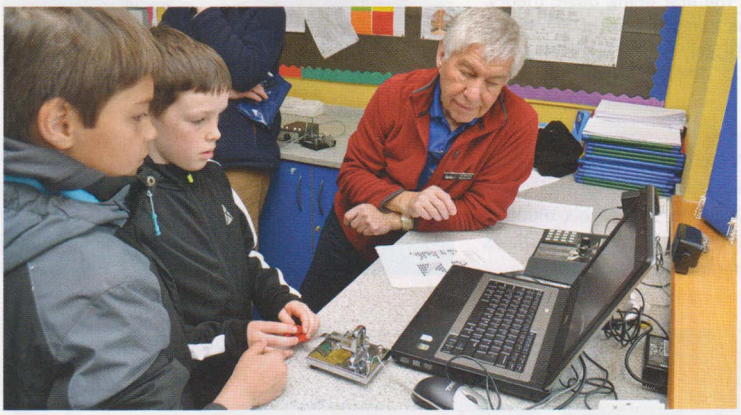
REGION 11: SOUTH WEST & CHANNEL ISLES

Mike, M1DPB gave Thornbury & South Gloucestershire ARC a very interesting and fascinating insight into radio restoration and the steps he takes in re-commissioning equipment after many years on a shelf (or worse, in a bin!). At another meeting, Peter, G4OST gave a very enlightening and honest reflection of his experiences of forecasting and some very useful links to explore regarding forecast software. Links and slides from the talk can be found at www.tsgarc.uk and search lecture notes section.

REGION 12: EAST & EAST ANGLIA

The March meeting of the **South Essex ARS** had two guest speakers: Roland, M0BDB, Chairman and Country Controller for Essex RAYNET, and Steve, M1ACB, RSGB Region 12 Manager. Roland's talk highlighted the world of RAYNET organisations across the UK, as well as some of the achievements of the Essex RAYNET team. Steve gave an overview of the RSGB's activities, an update on recent developments and a summary of his experiences of being at the first Tim Peake ISS contact in St Albans. Steve was joined by the two DRMs for Essex, Keith, G3WRO and Vic, G6BHE. The photo shows the RSGB team: Keith, G3WRO, Steve, M1ACB and Vic, G3BHE.

In support of Romford's YMCA, members of Essex Ham were active using GB4TSE to raise awareness of the homeless. Sleep Easy 2016 saw supporters designing their own cardboard boxes to sleep in, followed by a night in the freezing cold. The event raised over £4,500. Several YMCA supporters sent greetings messages to explain what was behind the event and deputy Mayor of Havering Borough Council, Philippa Crowder, was able to get her first taste of amateur radio.



Norfolk ARC ran two displays for National Science Week. The first was at a science fair at CNS School in Norwich, where NARC meets every Wednesday. As well as a demonstration HF station using G4ARN, youngsters were able to try their hand at sending Morse code, decoding SSTV signals and seeing how radio waves can illuminate incandescent and fluorescent light bulbs without wires. Contact was also made with Norwich's twin City of Koblenz in Germany on 40m and with NARC's second science week display two miles away at Norwich Cathedral via 70cm. The Cathedral display included Morse and audio waveforms demonstrations, plus radio reception on a crystal set and a medium wave and Top Band receivers. The team were also able to listen into the 40m Koblenz contact, despite the cathedral's six-foot thick walls.

Peterborough & DARC held a Buildathon building a crystal set with a difference – it had a valve, diode and opamp: a 4 band Poldhu radio kit from Poldhuradiokits.co.uk

Thurrock Acorns ARC organised another successful Essex 2m Activity Day. These events are designed to encourage more on-air activity across the county. Club members operated FM, SSB, SSTV and CW stations making over 40 contacts during the 4-hour event.

Harlow & DARS enjoyed a talk from Essex RAYNET given by Roland, M0BDB and Paul, M0LOM. At the end of the talk the club made a donation to towards RAYNET's activities.

At the end of April, **Chelmsford ARS** celebrates its 80th anniversary. The inaugural meeting in 1936 was organised by Laurie, G6LB who ran a Gents Outfitters in the High Street. He placed an announcement in the District 14 (Eastern) Section of the RSGB *T&R Bulletin* and the first meeting was held at the home of Louis Varney, G5RV, with 11 amateurs attending from the immediate area along with a further 15 from the Southend-on-Sea Group. Since those early days the club has gone from strength to strength and these days has a membership well over 100.

Braintree & DARS started the month off with the annual Rig Clinic. Once again, Dave, G0DEC brought along his test gear so that members could have their radios checked. Tests and adjustments were made to alignment, deviation and power. RSGB DRM, Keith, G3WRO came to the meeting and introduced himself.

Following the election of the officers at **Thurrock Acorns ARC's** AGM, the focus of the evening moved to a short presentation given by the DRM, Keith Haynes. Keith discussed the changes that have occurred in amateur radio including the arrival of space exploration and the impact that has had on the amateur radio community. He also explained how his role at the RSGB is designed to support the radio clubs in Essex.

Chelmsford ARS was at Sandford Mill supporting their British Science Weekend event. Despite the weather, stations were set up outside as well as in the 2MT Writtle Marconi Hut. Andrew, G0IBN, Oliver, M0WAG and Carl, G3PEM set up the HF station. An issue with high SWR was tracked down to a broken feeder line outside and quickly rectified. Andy, G7TKK demonstrated a PC and RTL-SDR dongle for tracking aircraft by receiving their ADS-B signals. 2m FM performed well with contacts out to Norfolk being the furthest.

Norfolk Coast ARS has continued with its popular format of Teach-in – Eduardo, M0KEK and Peter, G4NTN introduced the members to the Weak Signal Propagation system WSPR and gave a very effective demonstration. Members have continued with various other projects including the restoration of the club's HRO receiver and the construction of baluns & chokes and the construction and testing of earth current meters.

Congratulations to Roy, M6GKZ, Rob, M6DQI, Danglis, M6URA, Martynas, M6KVS, Tim, M6KYS and Nick, M6ZBP, all of whom (indicatively) passed the Intermediate exam with **Loughton & Epping Forest ARS**. The course was led by John, G8DZH assisted by Derek, M0XDC and Ron, G6LTT. Dave, G3ZXF kept the tea and coffee flowing and provided exam invigilation. The club was recently entertained by an interesting lecture entitled Introduction to the Raspberry Pi by Peter, G0DZB, who has had to change this lecture countless times to keep up with the release of new Pi models! Peter donated a number of Pi related items to the club raffle, including a Pi Zero.

REGION 13: EAST MIDLANDS

Adam, M6OLT passed his Foundation exam, becoming the first successful candidate to sit an examination held by **South Kesteven ARS**. Foundation and Intermediate training courses and examinations at all levels are planned for the near future. SKARS held several construction workshop evenings for its members including those who wish to progress to their Intermediate licence. Several young members attended along with cadets from the Grantham 47F ATC. Alan, G0BXU put together a kit for a practice Morse oscillator. The simple kit was constructed on stripboard and was designed to be fitted inside an inexpensive extension speaker and powered by a 9V battery with a push button and socket for an external Morse key. When the kits are complete SKARS will hopefully begin a Morse training course.

A talk was given by Steve Turner on the use of radio telemetry within falconry to the members of **RAF Waddington ARC**. The club would like to thank him for his time and the effort put into the presentation.

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Barnsley's HAM Radio Rally

Sunday 15th May 2016

In aid of YORKSHIRE AIR AMBULANCE

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Doors Open 10:00am - 4:30pm

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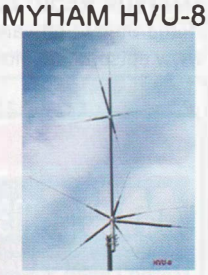

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RadCom

HF F-Layer Propagation Predictions for May 2016

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	6.....66	6.....66	66.....666	236555555642	.13333334321	..222222221.	..11111111..	.....1...
*** Asia								
Yakutsk	.....	211..1.11122	322112222233	...22222..1.	.....	.....	.....	.....
Tokyo	.....	.....23..	.....234..	.....122231.	.....111.2..	.....	.....	.....
Singapore	.....33.	.....454.	35532	234311	.....1221..	.....11...	.....	.....
Hyderabad	44	2.....3555	3.....4554	33431	.....12....	.....	.....	.....
Tel Aviv	64.....66	662.....3666	65521.235665	.35433445541	..22222353..	....1..121..	.....	.....
*** Oceania								
Wellington	.....	.....	.....11....	...1111.....	.....	.....	.....	.....
Well (ZL) (LP)	.....2..	353.....532	444.....453	333.....243	1.1.....32	21	.....	.....
Perth	.....22.	3432	13323	.....11.1	.....	.....	.....	.....
Sydney	.....2..	.....44..	.....244..	.....12221.	.....	.....	.....	.....
Melbourne (LP)	.....	.23.....	1332.....	1121.....2	1	.....	.....	.....
Honolulu	.....	.....	..11.....	...11.....	.....	.....	.....	.....
Honolulu (LP)	.....	.....	.....	.....1...	.....21..	.....21..	.....11..	.....
W. Samoa	.....	.....	.....	...1111.....	....111.....	.....	.....	.....
*** Africa								
Mauritius	3.....33	3.....4554	1.....4432	.....3321.	.....121...	.....1....	.....	.....
Johanesburg	33.....33	33.....3444	.1.....4432	.....232..	..1....22...	...1..12....	.....1....	.....
Ibadan	553.....55	6652.....566	55532...4565	215432235554	..254334553.	...21122541.	.....22..	.....
Nairobi	44.....44	55.....455	452.....3555	.13....24552	..1122.3443.	....33..221.	.....1.....	.....
Canary Isles	66.....66	776.....77	666.....677	436644455666	213655556653	1.2433346632	..1222223321	...11111221.
*** S. America								
Buenos Aires	33.....	554.....35	434.....45	212.....343	331	.....21.	.....1..	.....
Rio de Janeiro	44.....4	553.....355	443.....555	22.....554	....1...2432	.....232.	.....12..	.....1..
Lima	33.....	444.....34	3332.....44	..12.....32	.....12.	.....	.....	.....
Caracas	.....	5542.....5	4343.....34	...12.....42	....1....21.	.....	.....	.....
*** N. America								
Guatemala	.....	444.....3	3332.....3	...1.....22	.....1.	.....	.....	.....
New Orleans	.3.....	444.....	212.....2	.....1.	.....	.....	.....	.....
Washington	454.....	55532.....3	532121111124	12122232	.....11.	.....	.....	.....
Quebec	453.....	4542.....13	221.1..11123	1112231	.....	.....	.....	.....
Anchorage	.....	.....	..1.....	.....	.....	.....	.....	.....
Vancouver	.....	..2.....	..2.....	.....	.....	.....	.....	.....
San Francisco	.....	233.....	2231.....1	.....	.....	.....	.....	.....
San Fran (LP)	.....	.....	.....	.....	.....1....	.....11...	.....	.....

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 May, June & July 2016 are respectively (SIDC classical method – Waldmeier's standard) 47, 44 & 41 and (combined method) 59, 57 & 56. The provisional mean sunspot number for March was 54.9. The daily maximum / minimum numbers were 111 on 4 March and 16 on 31 March.

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ARRL HANDBOOK, 68th edition (1991) and 71st edition (1994); either one free on collection. David Rollo, david.rollo673@btinternet.com (Glasgow).

BUDDIPOLE W3BP inc TRSB (2009), 6m Yagi kit, 4 long whips, c/poise wire adaptor & wire, mast guying kit, VGC, £450. Yaesu FT-897D with internal PSU, TXCO, Collins 500Hz, LDG AT-897 auto ATU £650 (2011). Palstar BT1500A tuner, £500 (2014). Colin, M0XED, 01227 904 492 (Canterbury).

CUSHCRAFT A3S triband beam, boxed to go, £100. MFJ-259C HF/VHF analyser in box, VGC, £125. Daiwa NS-660P SWR / PWR meter, £30. Ivor, G4YIT, 01733 840 268 (March, Cambs).

CUSHCRAFT MA5B MINI BEAM 20 / 17 / 15 / 12 / 10m antenna new still in original packing £350 ONO plus post and packing or inspect and collect. Reason for sale: antenna too large for QTH. James, G0GFY, 0208 689 5149 (Croydon).

DRAKE TR7, PS7, SP75, RV7, MS7, L75, extender boards. All GWO, some user / technical manuals. £1350 ONO. Yaesu FL-7000 HF amplifier, uprated and GWO, £1300 ONO. Yaesu FL-2100Z, serviced, new valves fitted, £500 ONO. Brian Brown, GW0PUP, 02920 832 253, gw0pup@aol.com (Caerphilly, S Wales).

EDDYSTONE EA12 amateur band radio. In excellent condition, working very well, very well cared for. No mods, extremely clean. Buyer to collect, try, pay and sadly take away. £385 (no offers). Robert, G4IHT, 01285 841 203, robert@riddington.me.uk (Tetbury).

EDDYSTONE COMMUNICATION RECEIVER model EC10 mk 2, £45, collect or plus £7 p&p. Alex, G4PZX, 0797 985 5243 (Fingringhoe).

ELECRAFT KX3, £950, as new, with hand mic, roofing filters, ATU and Peli case. ELECRAFT K2, £575, with hand mic, SSB, ATU, noise blanker, audio filter and Peli case. YAESU FT-817ND, £350. Contact me for full details and pictures. Alan Tapster, M0MME, 0785 486 6433, atapster@btinternet.com (Stockton-on-Tees).

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ICOM IC-7400 HF, VHF transceiver. Icom OPC-639 EMC filter power cable. Icom SP-20 desktop microphone. All mint condition. Owned from new. £600 + £25 postage. Peter, 2M0PJA, 07534 574 273, peter.arkless@oracle.com (West Lothian).

ICOM IC-910X multi-band multi-mode base station transceiver. 23cm module fitted. Perfect condition, little used, no marks or scratches, comes with mic and power lead (with Icom filter), CiV serial cable and original box. £1025 ono plus carriage. Stewart, GM4AFF, 01674 850 330, stewart@gm4aff.net (near Montrose, Scotland).

ICOM ICF-7100, used only a couple of times for CW. Mic never used, boxed in new condition. Includes SD card with all repeaters on it. £650 included insured postage. Colyn, GD4EIP, 0762 441 3036 (Isle of Man).

KENWOOD TS-950 for sale on behalf of Leicester Radio Society. All filters and DSP. Alex, G8FCQ, alexcom22@btopenworld.com (Leicestershire).

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KENWOOD TS-570DG, excellent condition, new o/p transistors, boxed, 3 manuals (3 languages), power lead and mic, £500 ONO. Palstar PSU, £60. Buyer collects. Tony, G1RFI, 7 Kempsey Close, Woodrow South, Reddich B98 7TL.

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R1155, appears original unmodified, £130. HRO R106 US Army Sig Corps C/W 5 coils, £80. Command TX, £70. AVO CT sig gen, £30. BC221, £20. Racal RA17, £90. Collection FR rally? M0BGA, rcry100@yahoo.com (Cornwall)

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RANGER-811 800W HF amplifier, purchased from Linear Amp UK. Also, a spare set of boxed new 572B's are included in this sale. Excellent working condition £600 (cash), no offers please. Will deliver within thirty miles if required. Barry Spencer, G0BDE, 0777 201 5622, next15@ntlworld.com (Leicester).

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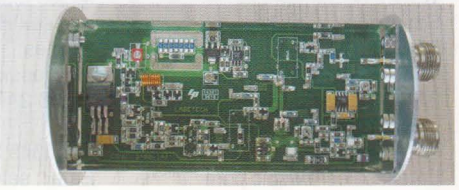


SCANNER: REALISTIC PRO 2006. 25MHz-520MHz, 760MHz-1300MHz. Internal mains PSU. 12V socket. Manual. Full working order, but case scruffy, £45 ono. Top Band (160m) mobile transceiver, 10W output, c/w microphone. G4ENA kit, built 1990, £45 ono. Buyer collects or post extra. Brian, GW0GHF, 02920 703 429, b.wlliams538@gmail.com (Cardiff).

SILENT KEY SALE. Icom IC-7000, 25–1000MHz multimode receiver (Google it for full specs), £350. Uniden hand held scanner, open to offers. Buyers to collect. Anthony Skaife, G4XIV, 01904 330 502 (answerphone) (York).

TRIO TR-751E all mode transceiver, boxed. Memories not working but otherwise in good working order. FREE to person who will collect. Reg Appleby, G3INU, g3inu14@gmail.com (Stevenage).

TRIO TS-130S transceiver 80–10m. One owner and in very nice condition. Additional narrow SSB filter installed. £180 plus carriage, or collect. G4CMU, 01306 631 115 (Newdigate, Surrey).

WOUXON KVG 2/70 mobile, never used, £150. Yaesu FT-290, working, in VGC, £50. PYE PFX on 70cm x 2, £15. PYE PFX on 2m, £15. P&P by agreement. G8SSL, 0797 666 4632 (Nottingham).

YAESU FP-707 power supply, £70. FC-707 ATU with handbook, £75.Vintage TR7200 & VFO30G, £50. Keith, G4GZS, 07859 917 317, keith4gzs@hotmail.co.uk (Rugby).

YAESU FT-920 with all internal accessories. Matching SP8 speaker, MD-100ABX desk mic. Boxed, manuals. VGC. Offers. Bill, G7AKJ, 01395 568 503 (Budleigh Salterton, Devon).

YAESU FT-950 100W HF-6m, great DSP radio, internal ATU, excellent condition, Yaesu MD-1 desk mic, power lead, manual, original box, bargain £695 (+carriage). Yaesu FP-1030A PSU to suit, GWO, boxed, manual, £110 (+carriage). Both for £800 inc mainland UK carriage. Giles, G1MFG, 01234 832 714 (office hrs), giles.read@rsgb.org.uk (Bedford).

ZX 20+2 beam for 20m. Bought new, made many VK stations, good condition, sell for £199 ono. MOCVS, 01629 823 025 (Derbyshire).

WANTED

80m MAGNETIC LOOP antenna with good SWR at 3.500 for CW work. Fred Lupton, GOMDR, 01727 822 193, fred.lupton@clara.co.uk (Herts).

EDDYSTONE 880 MK 1, Siemens E311, WS18, also rectifier valves 5U4G, U52 53KU 52KU CV575 CV1071. Steve, M6WAA, 0755 267 8725, vintageradio@btinternet.com (Warrington).

HAMEG HM8028 spectrum analyser adapter & HM8038 tracking generator. Steve, G4HXY, 01375 643 206, stevesimmons@talktalk.net (Essex).

HEATHKIT SB-200 PARTS. Rel-Pwr-Sens switch and knob. The meter cover or the whole meter (working or not). Also any mod kits (soft start, soft switch, PSU etc complete / incomplete / working or not). Please email what you have. David, G1TPA, 0780 854 9421, david.mercer@bluebottle.com (Gatwick, Sussex).

HF SLUG FOR BIRD THRU-LINE watt meter. 80-10m, 100W min. Dave McAlpine, GI4SFX, 07505 760 334 davemccalpine35@googlemail.com (Belfast, NI).

ICOM IC-7100. Everyone now buys the 7300! I am prepared to pay fair price for a second hand 7100. Andy, G3PKW, andy3pkw@gmail.com (Liverpool).

JONES STRAIGHT KEY. Pump not paddle. Also Vibroplex pump key. Colin Turner, G3VTT, g3vtt@aol.com (Rainham, Kent).

MODULATION TRANSFORMER for KW Valiant/ Vanguard or Woden UM1. Two 6L6 tubes plus two B8G bases, two B9A bases. Mitsubishi M57733. Gordon McCallum, GM3UCI, 01555 770 914 (Carluke).

YAESU FT-902DM. Please! Can someone help me find a Yaesu FT-902DM, must include WARC and be in excellent condition and from a smoke free home? Any help is much appreciated. Clive, G4OPO, 0117 949 620, clive@firstresponse.org.uk (Bristol).

YAESU YF-112A AND YAESU YF-112C. Also TCXO-4. Refurbishing Yaesu FT-840 and require filters and oscillator. Richard, G8ITB, 01689 602 948, g8itb@yahoo.co.uk (Bromley).

RALLIES & EVENTS APPEAR ON PAGE 18

SPECIAL EVENT STATIONS

These callsigns are valid for use from the date given, but the period of operation may vary from 1 - 28 days before or after the event date. Operating details are provided in an abbreviated form as follows: T = 160m; L = 80 or 40m; H = HF bands (30 - 10m); V = 6 and/or 4m; 2 = 2m; 7 = 70cm; S = satellite and P = packet. Details published here were kindly provided by Ofcom on 21/03/2016.

Date	Callsign	Phonetics	Location	Bands	Keeper
01/05/2016	GB8OMB	Old Mill Bagington	Coventry	LHV27	G8GMU
	GB2EM	Golf Bravo Two Echo Mike	Surrey	TLHV27	G4OQZ
02/05/2016	GB4APS	Ashfield Primary School	West Yorkshire	27	MOXTD
06/05/2016	GB0SWX	Stone Cross Windmill	Pevensey, E Sussex	TLHV2	G1FBH
07/05/2016	GB1WW	One Whiskey Whiskey	Wiltshire	L27	G1OQV
	GB2WBM	West Blatchington Mill	East Sussex	BN37LE	G4PAP
09/05/2016	GB4OSM	Ottery St Mary	Devon	27	MOXTD
10/05/2016	GB2BCW	Bravo Charlie Whisky	Millisle, Co Down	LH2	GI4JTF
	GB2PW	Polegate Windmill	Polegate	TLHV27	G3DQY
11/05/2016	GB5GSM	Gunton Saw Mill	Norfolk	TLH27	GOAJJ
12/05/2016	GB5HW	Heage Windmill	Derby	LH27	G6KUI
13/05/2016	GB8WW	Willesborough Windmill	Kent	LHV27	MOWYE
	GB0SBM	Saltford Brass Mill	Saltford	LH2	G7KNA
	GB2DWM	Golf Bravo Two Duloe Windmill	Cambs	TLHV27	G1KWF
	GB1MAC	Merseyside Air Cadets	Liverpool	LH27	MONVJ
	GB2AWM	Alderford Water Mill	Essex	LH27	GOEMK
14/05/2016	GB0LMW	Llanyravon Mill Wales	Torfaen	TLHV27	MOYAC
	GB2WM	White Mill	Sandwich, Kent	TLHV27	GOPDZ
	GB2UW	Upminster Windmill	Upminster	LH2	MOTAZ
	GB0CHW	Chailey Heritage Windmill	North Chailey	TLH27	G6DGK
	GB2MBB	National Mills on th Air W'end	Aberdeenshire	LHV	G3ALZ
	GB4MW	Mountnessing Windmill	Brentwood	LH2	M1GEO
	GB2WPM	Wrawby Post Mill	North Lincs	TLHV27	MOAEP
	GB6GGM	GelliGroes Mill	Blackwood	LH	MOMWZ
	GB2WMS	Water Mill Shepshed	Shepshed	L27	G1ETZ
	GB2CW	Chesterton Windmill	Warwickshire	LH2	G1EIX
	GB0BWM	Golf Bravo Zero Brill Wind Mill	Brill	LHV2	GOVFW
21/05/2016	GB2SOE	Solent Operations Executive	Waterlooville	T LHV27	M1CCF
22/05/2016	GB0DSD	Daventry Scout District	Daventry	LHV27	MOMBB
23/05/2016	GB5MTB	Beaches on the Air	Mabelthorpe	LHV2	MOVSP
25/05/2016	GB2RB	Robert Burns	Ayshire	LH	GM3OZB
28/05/2016	GB1HA	Headcorn Aerodrome	Kent	TLHV27	GOUXG
29/05/2016	GB1JC	Jack Cornwell	Carms	LH	GW7VJK

SILENT KEYS

We regret to record the passing of the following Members:

Mr E A Matthews, G3FZW	23/03/2016
Mr A J Gould, G3JKY	25/02/2016
Mr C D Harrington, G3LUL	02/2016
Mr K P Jillings, G3OIT	23/03/2016
Mr I Macey, G3RVD	13/02/2016
Mr G S Thomas, G3SWO	17/01/2016
Mr J R Hey, G3TDZ	08/03/2016
Mr R McNair, G3UBZ	22/03/2016
Mr K R Cass, G3WVO	02/03/2016
Mr D J Mackinder, G4DWP	10/03/2016
Mr W Hopley, G4ETA	24/01/2016
Mr R Young, G4GWC	02/03/2016
Dr A H E Williams, G4WWA	19/02/2016
Mr R A White, G6XCY	21/03/2016
Mr K Ireson, G7CGW	
Mr P W Milton, G8FRC	2016
Mr J W Richards, GW8GAB	09/2015
Mr C G Hampson, G8RXA	27/03/2016
Mr K C Abbott, G8SJC	02/03/2016
Mr S G Perry, G0BFG	01/2016
Mr D E Dawson, G0CIW	04/02/2016
Mr P Pero, I1HJP	26/12/2015
Mr B E Armstrong, M0DJO	07/03/2016
Mr D E Jones, MW0NCO	10/2015
Mr H Morgan-Jones, M1NTO	19/03/2016
Mr R C Dale, RS195056	11/2015
Mr A E T Nye, RS34612	04/02/2016
Mr R V Booth, W7VPV	
Mr M E Townley, ZC4MT	11/03/2016
Mr W Bevins, 2E0BZF	03/03/2016

...AND IT'S GOODBYE FROM HIM.

Graham Coomber, G0NBI, RSGB General Manager

I have been touched by the many kind words and good wishes that people have sent me for my retirement, and hope that you will forgive me for "pulling rank" one last time and taking up valuable space in The Last Word. I have enjoyed my four years at the RSGB immensely and have been privileged to meet so many Members, if only through the medium of email. Thank you one and all. I was particularly pleased to receive a note from Keith Haynes, G3WRO, DRM 123 enclosing a photo of one of the very first SWL cards that I sent to him at the tender age of 15, just as I started out in the hobby. Multiple moves of house (and countries) during my lifetime means that I have lost most of my early records although, of course, I never forgot my very first 'callsign'. Little could I have known where my curiosity about amateur radio would take me. 73, and hope to work you sometime.

ACCESSIBLE DATA MODE

Bob Houlston, G4PVB

I feel I'm not clever enough to have a smartphone... and I'm much happier without it! Consequently, I thought datamodes were beyond me until I experienced PSK31 with *DIGIPAN*. Thank you to Norman, G8ATO of Verulam ARC nets for technical advice.

AM I A DINOSAUR?

Jim Edgar, GM4FVM

I think that Ivor, MM0IEL misses a point when outlining the issues he has with 'radio via the internet' (*RadCom* April 2016).

Whilst he and I might not find this a challenging aspect of our activity, amateur radio has always offered a way of training radio professionals for the future. This pool of amateurs with up to date skills has provided qualified employees to the electronics industry over the years and has been crucial at times of war.

As so much commercial radio traffic is now handled via internet connections, we cannot train our future talent without offering comparable networks in our hobby. Whilst Ivor and I might feel that we have little to learn from IP Radio, digital voice gateways, and so forth, those who aspire to careers in radio must be able to find similar environments in amateur radio.

To be counted as a dinosaur requires a higher qualification than simply not being interested in certain aspects of the modern amateur world.

Many of us avoid certain area of the hobby. What marks out a fully certified dinosaur is someone who shows a lack of toleration for others who have different interests. I personally feel that those who inhabit all sorts of nooks and crannies of the radio amateur world are as entitled to pursue their version of self education as I am. If my interest is not theirs then they are free to continue, so long as I can expect similar courtesy in return.

We do not need to be involved with (or even understand) every aspect of the hobby, but I feel we should be tolerant when others are learning a lot from it.

We have received several letters on this subject, the rest are on the RSGB website in the RadCom *section (click on the Publications tab).*

SAGHOTA – FACT OR FICTION

Brian, M0YBX

During May 2015 I activated GB0VED from my allotment shed and have since operated from the site on 20W or less and sometimes up to 100W. Other operators who knew me would ask if I was at home or in the shed, with one asking, when I would be operating Worked All Allotments. During March 2016, I was activating the British Scientist Award from my shed and Alan, G7HZZ sent me an email showing a shed with a headline of 'Latest Sheds For Hams'. The result of all this frivolity was to actually activate SAGHOTA on the 1st of April 2016. Is this a spoof or is it serious? Well, already amateurs from all over the world are signing up to activate SAGHOTA days from their sheds and gardens etc. I for one will certainly be having SAGHOTA days this year and look forward to having a QSO with as many contacts as possible. The tranquillity and fun at my allotment shed when other hams visit, is great. Try a SAGHOTA day yourself, you might enjoy it. Info at https://sites.google.com/site/phoenixaradiouk/home

THE REMOTE REVOLUTION

Sam Turner, G4UQB

This debate has been going on for some time now. However, EI5DI is right, remote operations via telephone lines over the internet can hardly be described as amateur radio if we take it to its ultimate conclusion where one would not even require an antenna to complete such a contact. 'Amateur Radio' not – internet chatroom is.

A good example is what happened to me. I spent a couple of days making a new multiband dipole for the 10, 15 and 20 bands. I then enthusiastically called CQ to see what my blood, sweat and tears would bring in. After several 'local' European contacts bringing favourable 59 reports, I suddenly got a K4XXX in Tennessee! We had a good ragchew and, would you believe, exchanged 59 reports each way. I glanced at my 100 watt transceiver and then out to the garden at the dipole – wow, made it!

Then the bombshell. "Ok Sam, thanks for bringing me in, actually I am operating remote via OEXXX, 73 over there...". So, it was just another 'local' European contact after all.

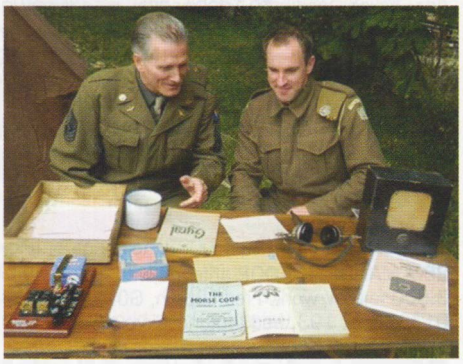
Brian, G3ZUM cannot be right where he describes such contacts as another facet of this wonderful hobby, as I felt cheated and wondered at this telephone contact via the internet and the worthless 59 reports.

VOLUNTARY INTERCEPTOR

Jonathan, 2E0HUR

My name is Jonathan, I'm the one on the right in the photo. I re-enact the Homeguard in WW2 with the Northamptonshire Living History Group. I portray myself as a voluntary interceptor with my display. At various 1940s events, I demonstrate to the public the role that voluntary interceptors played. I use my FT-817, hidden away, to receive CW and the public find it amazing that Morse code can still be heard. I also let the children have a go at CW using the Morse trainer key, which they find fascinating.

To make my display more authentic I am looking to replace the FT-817 with an All World Two receiver that was used by many voluntary interceptors at the time. Could anyone help? jonny.jefferies@yahoo.co.uk



PHOTOS OF THE INSIDES OF RIGS

Michael, G8MOB

There was a time when I could not envisage anyone not wanting to open up his newly acquired rig and take a careful look inside to judge the quality of construction.

However, that changed some years ago after I attended an inaugural meeting of a new local club. In a spirit of helpfulness I

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offered to give them lectures on a variety of topics I thought would be interesting to fellow amateurs, including my Racal, Plessey and Siemens receivers, receiver measurements, the oscilloscope, spectrum analysers, frequency standards and electronic warfare. I was met with a blank stare. They had never seen an RA17, spectrum analyser or a rubidium standard, which was understandable at the time, but what floored me was that they had no interest whatsoever in such matters, and as ex-CBers all they wanted to do was to play with their radios.

I asked did they open up the covers and look inside? Oh no – they had no interest in the internals. (What has happened to the concept of self-training?).

I asked what did they do when their kit malfunctioned. "We take it back to the dealer" was the reply. After speaking to other amateurs, the consensus was that this was fast becoming the norm in our fraternity, excluding the specialist groups who enjoy building and / or repairing their gear and who devote much time in sharing their archives and experiences with the like minded. I wonder how many readers have performed any of Peter Hart's standard measurements on their own gear?

GOOD CO-OPERATION

Andy Choraffa D.phys, G3PKW

It was very heartening to know that RSGB has met with Ofcom. As we know Ofcom and the staff, handle amateur radio licencing and have been faced with staff cuts in recent times. Despite their difficulties they continue to administer their duties very eloquently.

We, in the Society, can be of utmost help to maintain such a service. The matter of dealing with spectrum use and EMC problems etc is to our benefit, therefore I hope this co-operation is strengthened, and regular reports of progress given.

I have always felt that radio amateurs appreciate and always act responsibly with spectrum resource. I am sure that 'we' can help our administrators to uphold good standards.

SOLAR PANELS

Donald Scott, GW4OWQ

I, like many others, have considered the idea of getting photo-voltaic solar panels fitted at my house but have put it off because, in my case, the roof slates are not in brilliant condition and I didn't want to risk further problems. I am now getting to the stage where I may need to have the roof replaced before long anyway so may as well get both jobs sorted at the same time. But I, of course, also have 'radio' related concerns, transmissions on HF (especially 160m) could get into the inverter box and upset it and the more usual concern that 'hash' from the inverter would wreck HF reception! The solution to both problems is the same and, on the face of it at least, don't seem too onerous! Mount the inverter in a stout metal box that should stop direct radiation. The solar panels are essentially DC so can be 'filtered to death' at the point they enter the inverter box so should not act as aerials. Likewise the 'mains' output from the box needs only to pass 50Hz so can again be violently filtered. Though I suppose if it was quite that simple, mains operated 12V switch mode power supplies should be as 'silent as the grave'! That said it should be possible to design a 'quiet' installation, but searching around on the internet, RFI doesn't seem to be a concern for any of the suppliers/installers. Are no radio amateurs involved in the design of any of the systems? Do others have any positive experience of doing this? don.scott@dial.pipex.com

6m BEAM ARTICLE

Alan Dodson, G3MGU

May I complement *RadCom* and D Murray, MORFY on the excellent article 6m 3-Ele Beam, *RadCom* April 2016. The method used to assemble is similar to that used in frame tents, I wished I had used it years ago. My work used to take me to radar sites all over the country, often for a week or more at a time. Not wishing to sit in a bar all evening, I built Lorin Knight's 'A Transceiver For The HF Bands' from the June 1984 *RadCom*. With 80, 40, 20 and 10 plus a 30W PA, I mounted it and a VSWR meter, mic and key into an aluminium camera case. Also with it I took a 6ft aluminium tube cut into four plus loading coils for each band. Like MORFY I did not want nuts and bolts to assemble, so I compressed into the ends of the sections of aerial tubing a bolt and nut at the other end so as to be able to just screw the rods together. Today I would have used MORFY's system.

INTERFERENCE

Colin Topping, GM6HGW

The recent letters concerning interference from power lines and observant amateurs reporting the same to the power companies before expensive damage occurred, reminded me of a situation I encountered some time ago and not long after receiving my licence.

Not too many years ago, most police forces in Scotland used a series of VHF FM repeaters with an input in the range of 146 – 148MHz and the output between 154 and 156MHz.

At the time I lived on a hilltop in North Fife and about two miles distant on another hilltop was one such repeater. Without going into the full scenario and time line of events, being the only radio amateur in the area the local police started telephoning and calling upon me just about every time I went on 145MHz with threats to confiscate my equipment (converted PMR and homebrew) and even imprisonment as I was transmitting on their 'wavelengths', the words of one red headed officer, very well known for having a fiery temper.

The red headed officer didn't like it when I showed them the relevant part of my licence pointing out that only representatives of the Secretary of State of the DTI could shut an amateur station down. I did, however, close down each time on a voluntary basis and suggest they report the interference to their technicians. This didn't bode well; according to PC Red-Head, the fault was entirely with my radio. How this could be deduced without testing equipment is still beyond me.

After two months of what was becoming police harassment every time I went on 145MHz, I contacted with the force's communications manager who was unaware of the interference.

The manager arranged for technicians to remotely monitor the repeater in question and found my signal breaking through. Subsequently a site inspection was carried out on both my equipment and the repeater. My equipment was found to be clean (in spite of PC Red-Head's expert observations), however it was discovered that the aging insulation on the aerial feeder cable at the police repeater had perished and water had seeped into the equipment.

Unfortunately, for the tax payer, the water damage was extensive and all the equipment had to be replaced. As the communications manager pointed out, if the local police had followed force instructions, the matter would have come to light before the damage became too great.

Following this episode, I was thanked in a letter from the Deputy Chief Constable for my help in identifying a failure of their equipment – along with an apology.

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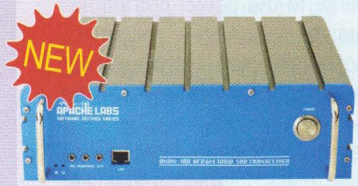
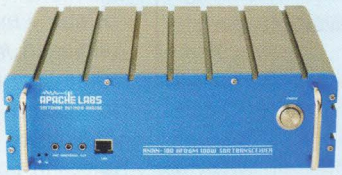
ANAN 100BE



The Apache Labs ANAN-100BE is a 100W HF/6m SDR multi-mode transceiver that has full QSK operation and a built in pre-amp. **£1,749.95**

ANAN 100E



The Apache Labs ANAN-100E is a 100W HF/6m SDR multi-mode transceiver that can support up to 7 receivers at a time. **£2174.95**

ANAN 100DE

The Apache Labs ANAN-100DE is a 100W HF/6m SDR multi-mode transceiver with dual ADC and full duplex operation. **£3149.95**

ANAN 10EE

The Apache Labs ANAN-10EE is a HF/6m all mode SDR transceiver. It is also an ideal entry level DDC/DUC SDR transceiver. **£999.95**

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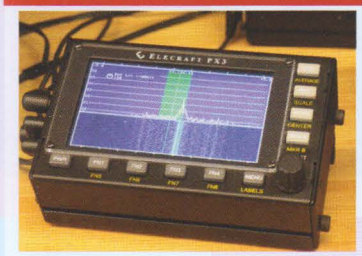
K3S-100 Built: £2,749.95D **K3S-10 Built: £2,199.95D**

SP3 BASE STATION SPEAKER

Elecraft's high performance base station speaker is ideal for not only the K3 series, but is equally great for almost any other transceiver at home. The **SP3** is different to most base station speakers as it includes internal acoustic modelling. The speaker has dual inputs that can be switched between two transceivers

£199.95

PX3 PANADAPTER



The PX3 is a great companion for the KX3. This fully specified panoramic display unit can be set from 2kHz to 200kHz. The sharp display can be split so that the top half provides signal strength whist the lower half provides a very efficient waterfall display for weak signal operation. The display can also be used for text showing the decoded CW, RTTY and PSK31 decoding. You can also switch between signal level readings and dB.

Kit: £449.95
Built: £559

KXPD3 PADDLE FOR KX3

KAT500 Auto ATU

The KAT500 Auto ATU is a remarkable high power unit that is a perfect match for the KPA500 or any similar amplifier. It matches a very wide range of impedance combinations and is fine for the old G5RV that proves difficult for some radios. At modest VSWRS up to 3:1, it will handle 1KW. There is also a 3-way antenna switch.

Kit: £699 **Built: £749**

KPA500 600W Amp

The KPA is the perfect amplifier for UK operation. It delivers 600W with ease from its fully protected power module and the internal AC supply makes it a very compact desktop unit. It can also be used with non-Elecraft radios and features auto band switching without the need for a data lead. It just needs a PTT connection.

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Now 15W

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KXPA100 POWER AMPILFIER

Great for FT-817

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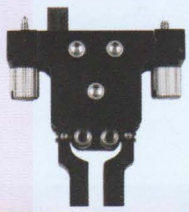
Kit: £799
Built: £849 KXAT100 £399

KXPD3 PADDLE FOR KX3

The Elecraft **KXPD3** is an iambic keyer paddle for the KX3, which directly places into the KX3 and provides smooth, sensitive, and compact operation anywhere. Its isize makes it a great travel companion and as it is a rigid plug in unit, it is very stable for portable operation.



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