

# CARC

**CRAWLEY AMATEUR RADIO CLUB**

## News Bulletin October 2019

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# Note from the Editor

The cover picture on this issue was supplied by a member, Rob Scaife G4ALH who lives on the Isle of Wight. You might be forgiven for thinking that Sky reception there needs a dish this big, but it is actually for moonbounce 23cm operations!

The newsletter can only survive if you give me articles to include! Many thanks to those who contributed to this edition:

G3VKW

G4ALH

M0WID

G8DOH

73 Phil

# Chairman's Chatter



Hello All,

Sorry I have been absent from the club recently, but following an eye operation, I have not been driving, but hope to be a more frequent visitor soon.

The RSGB convention takes place over the 11<sup>th</sup> – 13<sup>th</sup> of October in Milton Keynes. This is a major event, if you have never been, it is worth doing so. There are many interesting talks, demonstrations, award ceremonies. Many amateurs from around the world attend. If you are a LF/HF/VHF Contester or Dx'er you should attend at least once.

The Band conditions have been very poor just recently with very few stations on the higher 15m, 12m, and 10m bands. We have now passed the Autumn Equinox so that normally means we get improved conditions, well there are signals from the Pacific coming in:- from Tokelau ZK3A, Tonga A35JT and Nauru, closer to home Somalia 6O7T and MD/OP2D Isle of Man. Trouble is the Rotator at my QTH is stuck pointing the Quad South East, which is 180deg out for most of them.

I finished from a net on 80m a week or two ago only to be called and worked by 4 CARC members yes 5 of us total! And all on 80 metres at the same time. Perhaps you take a look around 3.793 at 0845 to 0900 Mon / Weds / Sat's.

The Microwave Round Table was a big success again, with a very high attendance recorded. Some club members did take advantage of some of the lectures from some of the guest speakers on a variety of subjects.

Dick MORXZ did CARC proud as a short order chef, providing Bacon Rolls and Hamburgers for the visitors, many of whom travelled quite a distance to attend. The tea and coffee made quite an increase in funds for the club. Well done Dick.

There was nearly a spanner in the works as the M23 was closed by police just before we were due to open as there were horses loose on the motorway which fouled the traffic for a while, fortunately the police sorted it out fairly quickly.

Stewart G3YSX has been doing a good job of finding Club Talks for us but you can help him out if you have any ideas of speakers with topics who can be contacted to give the club members a talk on an interesting radio related subject.

The weather will be coming more wet as we are in autumn so do take care in how you park your car, as we would not like to find you stuck in the mud which can happen quite easily if you go off the hard standing.

# Chairman's Chatter P2



Those new club members who are waiting for exams, we have not forgotten you, but will be trying to get organised to get you an exam slot and some pre exam coaching.

The CATS Bazaar is approaching at the end of November and CARC has a two tables at this event, we need helpers to man the stand and to sort out what we are taking along to try to sell. Also as club members you can sell your surplus equipment on the club stand, CARC takes a small commission for this facility.

There is a Website called [clublog.org](http://clublog.org) I mention this because if you use computer logging, and operate on 160 - 6 mtrs it provides an excellent tool to keep your own Country or Entity score. It also has the facility for a CARC member's specific score board or league table. There are quite a few of us using it, and a little competitive activity tends spur on members to turn on their rig more often. The table runs from Jan – Dec so if you familiarise yourself with it now, you will be ready to start in earnest for next year league table. Even those with modest antennas can join in, you will not win, but it is fun trying!

If you want more info please contact me, or Phil M0TZZ.

As we get into the darker evenings, do not forget that the RSGB club calls contests are again taking place, these are short 90min contests on various bands working other RSGB affiliated clubs , they happen on various evenings and the scoring is all band scores and operator scores added together to give the club score. These are quite busy events. Stewart G3YSX, mike G0KAD and Phil M0TZZ can give you more info in how to take part.

I saw today that David M0WID has a nifty little Antenna Analyser he bought from China that has an amazingly cheap price of £36-00. This is a steal if you want this type of device (see the article – Ed). All amateurs should have one of these in their shack, as they are a boon in setting up and tuning antennas etc. If interested have a word with David.

# Chairman's Chatter P3



Remember winter is nigh, and what happens in winter, I'll tell you! Your aerial will probably fall down! So take a tip make sure all is well and any remedial work gets done before it gets cold! Because somebody's Law says if you do not, it will fall down.

\*\*\*\*\*

**I am giving "Notice" that I will be standing down as Chairman of CARC** at January's AGM. I have done this job for 8 years and I feel it is time that someone else should take the reins and drive CARC forward with some new ideas and interests. The hobby is evolving rapidly with many new modes and designs appearing regularly so this will provide my successor with infinite ways to evolve the club.

**If you are interested in filling this role please contact me soonest.**

\*\*\*\*\*

73 Keith G3VKW.

**Event memorial sheet  
HG19ITU**

We, Hungarian Radio Amateur Society, are happy to confirm two way radio contact on the occasion of ITU Telecom World Conference 09-12 September, 2019 with amateur radiostation

**G3VKW**

ITU TELECOM WORLD '19 Budapest 9-12 September

Dallos László, chairman of Hungarian Radio Amateur Society



# A very cheap VNA by David MOWID



## NanoVNA

A post on the GQRP forum recently mentioned a low cost Vector Network Analyser (VNA) called the NanoVNA at around £36 from the usual Chinese auction sites. Sounds interesting? I investigated a little, found there was very active group on the web who were in general reporting good results, so went ahead and purchased one to try out.

My item is eBay id 202735742365 from a vendor called evertech666 and cost £36.99 delivered. It seems the unit is a development of another unit, and this has then been cloned again, so there are a few versions around, with and without battery, with and without shielding, and some reports of items not being delivered at all. My NanoVNA was delivered by Yodel in 10 days, which was much faster than expected, and the package stated it was posted from Birmingham!

## What do you get?

The NanoVNA was received well packaged, in a small, rather flimsy plastic box.



# A very cheap VNA by David MOWID P2



In the box is the NanoVNA, two 300mm RG174 leads with SMA male connectors each end, an open, short and 50R calibration set and a through connector. There is also a USB cable which is used for charging the internal LiPo battery and for communication with a host computer, if needed. Surprisingly the connection at the NanoVNA end is USB C.

The specs for the Nano VNA state it covers 50Hz to 900MHz, has a 2.8inch touch sensitive display and 400mAh battery. Dynamic range is claimed to be >70dB up to 300Mhz, >60dB 300-600Mhz and >50dB 600-900Mhz.

No documentation is included in the package; you have to download from the web.

## **What Can You use it for?**

The NanoVNA (or indeed any other VNA) can be used to make reflection measurements (like an antenna analyser) using the CH0 port, and transmission measurements (e.g. filter response, attenuator measurements, amplifier gain and response) where the signal is sent out through the CH0 port while the output from the device being measured is received in the CH1 port at the same time as reflected signals from any mismatch are measured at CH0.

The VNA is able to detect the phase of the reflected and transmitted signals relative to the source. This enables for example the reactance and sign of the connected device to be measured. The NanoVNA can be used to measure components such as capacitors and inductors at the frequency they will be used at. A Smith chart for the connected load can also be drawn.

The NanoVNA can also be used as a basic Time-Domain Reflectometer (TDR) to measure the length of cables (requires the velocity factor to be known) or perhaps find the actual velocity factor for a known length of cable.

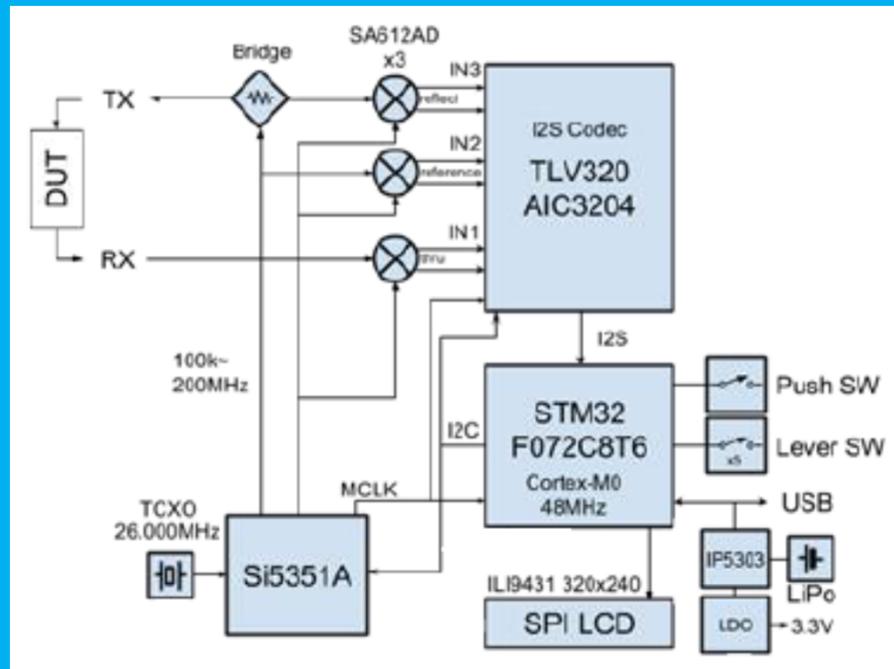
Setting the start and stop frequency the same allows use as a basic signal generator (square wave).

# A very cheap VNA by David MOWID P3



## Whats inside?

The block diagram, full schematics, source code for the firmware and user instructions are all open source and can be obtained from the GitHub site (<https://github.com/ttrftech/NanoVNA>). This is the block diagram from the user guide:



The basic principle is the same as the well-known DG8SAQ VNA which has somewhat higher specification and wider frequency range, albeit at roughly 13 times the cost.

The Si5351A produces three square wave clock signals (clk0, 1, 2), all derived from the same crystal. The processor is able to control the frequency of each clock signal.

# A very cheap VNA by David MOWID P4



One clock signal (clk1) is fed to the RF bridge, and the signal across the bridge is fed into a SA612 where it is mixed with clk0, the mixer output at audio frequency is fed through a simple filter to provide the reflected signal input to one of the channels on the TLV320 stereo audio codec which is used as a high speed A-D convertor.

Clk1 is also fed to a second mixer where it is mixed with clk0 to provide a reference signal required for phase information, while for transmission measurements the signal at the RX input is also mixed with clk0 to provide the through signal.

The Microprocessor sets the frequency of the Si5351 oscillator, gets the data from the stereo codec, does some FFT, filtering, and maths and displays the result on the 320 x 240 pixel display.

More detailed explanations of the principles can be found in ["A Small, Simple, USB-Powered Vector Network Analyzer Covering 1 kHz to 1.3 GHz"](http://sdr-kits.net/DG8SAQ/VNWA/Baier_VNWA2_QEX.pdf) ([http://sdr-kits.net/DG8SAQ/VNWA/Baier\\_VNWA2\\_QEX.pdf](http://sdr-kits.net/DG8SAQ/VNWA/Baier_VNWA2_QEX.pdf)) and for the mathematically inclined ["Error Correction in Vector Network Analyzers"](http://sdr-kits.net/DG8SAQ/VNWA/12_term_dg8saq.pdf) ([http://sdr-kits.net/DG8SAQ/VNWA/12\\_term\\_dg8saq.pdf](http://sdr-kits.net/DG8SAQ/VNWA/12_term_dg8saq.pdf)).

The number of frequency points per scan is fixed at 101, so if you have a scan starting at 50kHz and running to 900Mhz, the interval between data points is roughly 8.9 MHz, so detail is easily missed. The display is 320 pixels wide, so a data point roughly every 3 pixels. In almost every case it is necessary to set a reduced frequency range to zoom in on the area of interest, or use software on the PC where the number of points is essentially unlimited. The data can also be sent out via the USB interface to a host computer, and commands from the host computer can be acted upon.

The IP5303 chip handles the charging of the LiPo battery and protects it from deep discharge.

# A very cheap VNA by David MOWID P5



## Does it work?

As delivered the battery had some charge in. Plug in to a USB power source and a blue led flashes until the unit is fully charged.

When turned on using the rather cheap switch the NanoVNA loads up the calibration and settings that are stored in Cal0. So in my unit that was a scan over the 50Hz to 900Mhz range, with traces for reflected loss, through loss, through phase and a Smith chart, all superimposed on top of each other in different colours.

The unit is delivered with a basic calibration to cover the 50Hz to 900Mhz range, but with only 101 steps this calibration is for indication only. This can be overwritten by the user to whatever settings are most used, for example 3MHz to 30MHz. There are another four calibration stores that can be saved in the unit itself, perhaps for a smaller frequency range (e.g. HF, VHF, UHF), alternative trace settings or alternative reference planes.

Touching the display brings up a menu allowing the user to set the Display options (traces, their format, scale and so on), Markers, Stimulus (set the start and stop frequencies for the scan, pause the scan), perform a Calibration, and Save/recall saved calibrations and settings. The touch screen is old fashioned resistive, so using a stylus or rubber eraser on a pencil improves control a lot. I was able to work everything out (apart from calibration) without referring to the Chinglish manual.

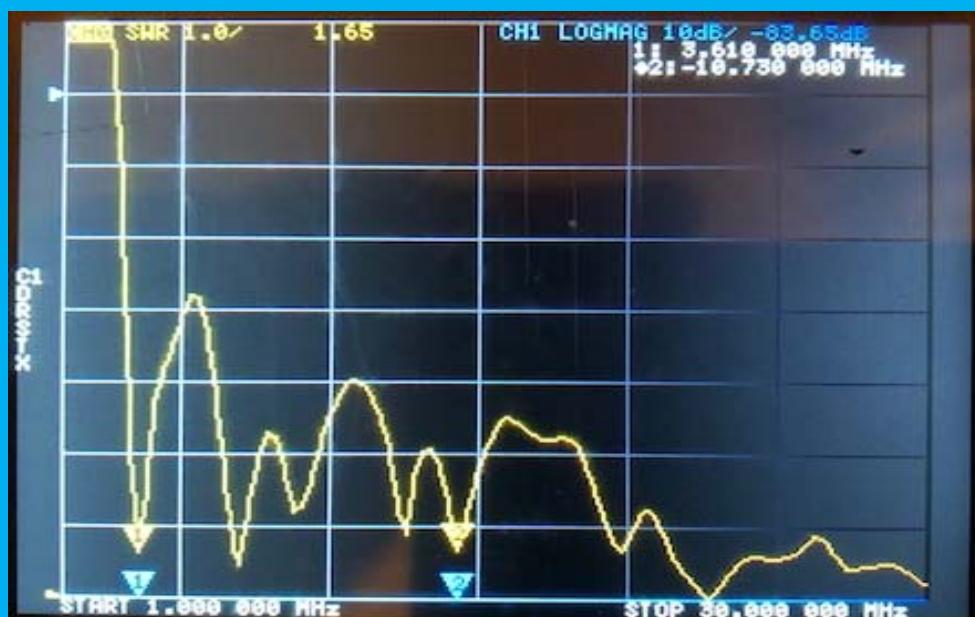
# A very cheap VNA by David MOWID P6



On top of the unit is a flimsy selector switch which also allows navigation through the menu structure and moving the markers across the trace. Using touch is easier and faster. I think this is the most likely part to fail but could easily be replaced by 3 pushbuttons when it happens, or just remove it and use the touch screen.

Calibration involves a standard procedure using open, short, load, through and isolation tests. The scan was set to 1MHz to 30MHz and a calibration performed using the supplied leads and cal kit. The calibration procedure is quick and simple – just remember to RESET the calibration before you start. The display settings were changed to SWR and through loss, turning off the smith chart and phase displays and this setup saved in Cal1. Connecting in the 50R load that came with my other VNA (MiniVNATiny) produced a nice flat 1:0 SWR line, a 100R load gave the expected 2.0 SWR and a 328R load gave an SWR of 6.55 (expected 6.56). Not bad.

Connecting the NanoVNA to my Windom OCFD revealed how it has lost tune (but remember with only 101 data points detail on this wide a frequency scan can be lost) and possibly a lot of loss on the feeder/balun at the higher frequencies.



# A very cheap VNA by David MOWID P7



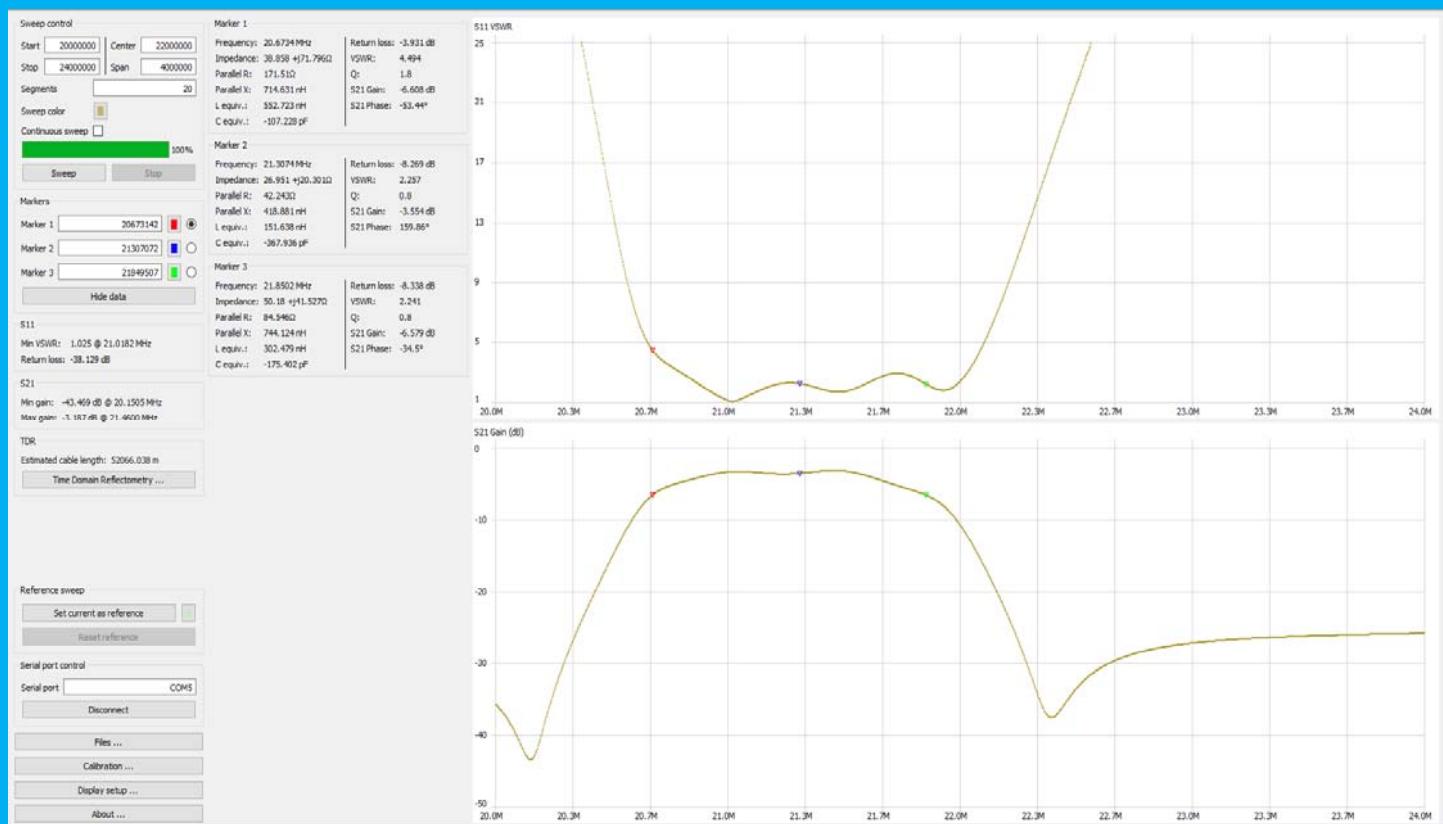
Note the markers. Selecting a marker you can choose to centre the scan on a marker or set the scan to be between the markers, so zooming in is simple.

The white text on the screen shows the frequency of the selected marker, the second line shows the difference in frequency between the selected marker and the previously selected marker.

The Yellow text corresponds to the yellow trace, showing it is set to SWR, 1 unit per vertical division and the value at the marker is in this case 1.65. The blue trace is showing the transmission loss. In this case nothing is connected hence the high loss.

## Computer Software

There are a few alternative software packages being developed. I used nanovna-saver-v0.0.11 available from <https://github.com/mihtjel/nanovna-saver/releases> which is being actively developed.



# A very cheap VNA by David MOWID P8



This software allows unlimited calibration sets to be saved, and also has a setting for the number of segments, so if you have 10 segments then it will split the frequency range up into 10 sections, each of 101 points to give a 1010 point sweep. Further options allow averaging over multiple scans to increase dynamic range or eliminate spurious results. The screenshot shows a sweep of a bandpass filter for the 15m band with markers to indicate the loss and 3dB bandwidth.

The software allows the data from a sweep to be saved to a Touchstone file (.s1p, .s2p) which can be used by other software tools, and also recalled as future reference. Unfortunately it does not fully work yet!

I do not have a DG8SAQ VNA. However the software (VNAW) can be downloaded and run but will not work with the NanoVNA. The VNAW appears to be much more sophisticated and has many features not currently found in nanoVna-saver.

## Measurements

Several other measurements were made, summarised below, and compared to the same test performed with the miniVNA Tiny.

Before each test the units had been powered up for more than 5 minutes to allow temperatures to stabilise and were calibrated using the same cal set and test leads over the specified sweep frequencies.

# A very cheap VNA by David MOWID P9



Test Item	Parameter	Freq (MHz)	MiniVN A Tiny (1000 point cal)	NanoVNA Display (101 point cal)	NanoVNA-Saver (1010 point cal)
<b>Bandpass Filter Unit – Straight through 1-30Mhz sweep</b>	TL(dB)	20	-0.36	-0.17	-0.271
		25	-0.62	-0.23	-0.338
<b>Bandpass Filter Unit – 15m 1-30Mhz sweep</b>	TL(dB)	20	-35.54	-35.71	-35.932
		21.5	-3.58	-3.33	-3.374
		25	-25.87	-25.31	-25.65
<b>Homebrew 100R load 144.5Mhz</b>	SWR		2.04	2.01	1.99
<b>2m LFA antenna + bias T + feeder + bypassed pre-amp 144-145Mhz sweep</b>	Min SWR 2m band		1.12	1.09	1.096
<b>2m LFA antenna + bias T + feeder + bypassed pre-amp 144-145Mhz sweep</b>	Freq for min SWR (MHz)		144.05	144.04	144.03
<b>2m LFA antenna + bias T + feeder + bypassed pre-amp 430-440Mhz sweep</b>	Min SWR 70cm band		1.01	1.01	1.001
<b>2m LFA antenna + bias T + feeder + bypassed pre-amp 430-440Mhz sweep</b>	Freq for min SWR (MHz)		436.53	436.60	436.59
<b>Frequency accuracy</b>	Freq vs GB3VHF beacon 144.43MHz		-2.4kHz	+5kHz	
	Freq vs GB3UHF beacon 432.43MHz	z	-7.5kHz	+14.5kHz	

# A very cheap VNA by David MOWID P10



## Upgrades

Since receiving my NanoVNA an updated firmware is available allowing use up to 1500MHz, but with reduced dynamic range. I have not tested this.

## Conclusions

While not a lab grade instrument, the NanoVNA is an extremely useful piece of test gear at a remarkably low price. It is small enough to fit in a shirt pocket, while having the built-in touch-sensitive display and on-board battery enables test and adjustments of antennas, filters and so on to be made extremely conveniently. The limitation of only 101 points when using standalone can give misleading results if you are trying to measure something that falls between the points.

For more detailed analysis connecting to a computer allows higher resolution results, improved calibration and measurements to be saved and compared. The NanoVNA-saver software is easier to use than the VNA-J software for the MiniVNATiny and is capable of showing both reflection and transmission plots at the same time.

Measurements up to UHF are comparable to the MiniVNATiny while frequency accuracy is good enough.

The on-off switch and particularly the selector switch are flimsy and may need early replacement.

73 Dave MOWID

# VHF/UHF Contesting with CARCRATS- 2019

By Alwyn Seeds G8DOH



The Crawley and Reigate Clubs have been active in VHF and UHF contests since the 1960's. More recently they have combined in a joint group Crawley Amateur Radio Club-Reigate Amateur Transmitting Society or CARCRATS for short.

We operate in the Open Section of the major contests from a remarkable site overlooking the English Channel, near Dover, an easy drive from Crawley, and which allows large numbers of contacts into the other European Countries, even when propagation is poor. From here our average distance worked is greater than 350 km on all the VHF/UHF bands and best DX is often greater than 1,000km.

This year's contest season started with the March 2m and 70cm Contest. Weather is rarely nice for this one, but this year we had Storm Freya to contend with. The aerials survived, as did we and our determination was rewarded with 1st place.

Our experiment with adding vertical polarisation to our 4 x 7 ele array for the May 2m Contest was not a success, so we had to content ourselves with 3rd place; having come second in 2018.

The big event of the year is VHF National Field Day. This is a huge logistical and operating challenge with complex multi-aerial array systems now being fielded for 6m, 4m, 2m and 70cm, to which we have added an 8 x 28ele array for 23cm; We use multiple receiver systems for 2m and 70cm and a collection of generators to power everything. All of this has to be assembled and tested in the 24 hours before the 14.00 UTC Contest start time. Set-up was not uneventful with one mast bending a steel scaffold pole, as it was hauled to the vertical. Fortunately, damage to the array was not severe, but precious height was lost. We had a simplified IT system for linking the three station locations, which worked smoothly.

## VHF/UHF Contesting with CARCRATS- 2019 P2

By Alwyn Seeds G8DOH



6m was a hard struggle this year, with little sporadic E propagation available. Such conditions favour stations far from the centres of activity, so that the Aberdeen Group came 1st and the Trowbridge Group 2nd. Alex M1YAP, Eugene G0VIQ and Jonathan M0JGH were undaunted and got us a creditable 3rd place, up from 4th last year.

Similar conditions applied on 4m for most of the time, but there were occasional sporadic E opportunities and Peter G0VVE and Mike G0KAD took full advantage of them, getting us 2nd Place to the Aberdeen Group, up from 4th last year.

2m is a crucial band, where we expect to do well irrespective of propagation. The shortened mast for one array has already been referred to; we also suffered from the long yagis of the second array snagging against the guy ropes, leading to time wasted pointing in unanticipated directions. We also had a QRM issue from the 70cm station, which was eventually traced to a poor connection on one of the driven elements of the 4 x 28ele array causing spark transmission. These were small issues in themselves, but resulted in our coming 2nd behind the Colchester/A1 Group (we came 1st in both 2018 and 2017). Operators included Peter G0VVE, Andy G7FWE and Jonathan M0JGH.

We added a big (4 x 25ele) second array to the 70cm system and this, together with determined operating by Stewart G3YSX and Tim G8JXV won us 1st place on 70cm, up from 2nd last year.

On 23cm going was fairly slow, moving to very slow on Sunday morning. Something was amiss and we wound down the tower to investigate- on 23cm the PA and preamp are mounted just below the aerial array to minimise feeder loss.

## VHF/UHF Contesting with CARCRATS- 2019 P3

By Alwyn Seeds G8DOH



A blown preamp was diagnosed, later found to be due to the 4m signal getting into the transmit receive control circuitry. With no spare preamp available, we bridged the preamp and accepted the noise figure penalty for the remainder of the contest. Despite these difficulties we managed to work an OK and come 2nd to the Colchester/A1 Group. Last year we did not submit an entry, owing to an aerial feeder fault. Operators were Rob M0ZAF and Adrian 2E0FAV, with some assistance on Sunday from Andy G7FWE.

Weather was reasonable, with no rain during set-up and take-down, no gales and no thunderstorms. Over the 24 hours of the contest we achieved (2018 results in brackets) 21,624 km from 97 contacts on 6m (38,653 from 96); 25,364 km from 103 contacts on 4m (24,031 from 94); 214,932 km from 539 contacts on 2m (259,967 from 656); 60,058 km from 172 contacts on 70cm (77,154 from 219) and 22,102 km from 71 contacts on 23cm (no entry).

The overall result uses the best four band scores and this year we came 2nd, with the Colchester/A1 Group taking first place, the same result as in 2018.

As usual, we will enter the December 2m Affiliated Societies Contest. A change in the RSGB Contest Rules from 2017 has enabled CARC to register as a National Club, so that all members, irrespective of station location, will be able to contribute to the Club score.

We plan to start next year's contest season with the March 2m and 70cm Contest, 7th and 8th March 2020.

In addition to these major contests, team members operate frequently in the UK Activity Contests and other minor contests throughout the year.

# VHF/UHF Contesting with CARCRATS- 2019 P4

By Alwyn Seeds G8DOH



Thanks to everyone who came down to Dover to help with CARCRATS activities this year, whether as an operator or not. There really is strength in numbers.

We welcome new members to the team, whether seasoned operators or new licensees. Proficient CW operators are especially welcome. If you are interested in VHF/UHF Contesting, please contact Mike Davies, G0KAD to be added to our Group mailer so that you can be kept up-to-date with CARCRATS news.

73 Alwn G8DOH



The VHF NFD Aerial Farm, Left to Right: 70cm Array 1, 6m/4m Array 2, 70cm Array 2, 23cm Array, 6m/4m Array 1, 2m Array 2, 2m Array 1.

# VHF/UHF Contesting with CARCRATS- 2019 P5

By Alwyn Seeds G8DOH



The CARCRATS VHF NFD Team, Left to Right Stewart G3YSX, Mike GOKAD, Peter G0VVE, Rob M0ZAF, Jonathan M0JGH, Adrian 2E0FAV, David, M0WID, Alex M1YAP, Eugene G0VIQ, Andy G7FWE



## Dates for your diary:

October Wed 23rd The History of the Magnetron from WWII Radar to the Kitchen – and beyond? by Mike Underhill, G3LHZ

November Thu 7<sup>th</sup> HARC/CARC Challenge at HARC

November Wed 13<sup>th</sup> Coax connectors, the forgotten Ingredients of a high Performance VHF / UHF station by Alwyn Seeds G8DOH

December Fri 6<sup>th</sup> Annual Dinner at Heathy Farm – details from Richard G4ANN



# For Sale or Wanted

1	Icom IC-756 Pro III	£ 950
2	MFJ-969 300watt HF+6m manual ATU NEW - not unwrapped	£ 225
3	Signalink USB data interface NEW - not unwrapped.	£ 80
4	MyDel MP-304 Mk.II 30amp heavy-duty non-switching traditional style PSU.	£ 70
5	QJE PS 3011 30amp switch mode PSU.	£ 40
6	RM KL405V 200watt 3.6/30Mhz linear amplifier As new - used once only	£ 150
7	Nissei Tx-502 1.6/525Mhz cross needle power meter, as new used once only.	£ 90
8	Daiwa PS-120M II 10 amp PSU	£ 30
9	MFJ-260C 300watts 0-600Mhz dummy load NEW	£ 40
10	Heil ProSet HC5	£ 50
11	Vertex PA-26 (RC45-24) AC Adapter 24v/1.8A DC output For Yaesu NEW	£ 20

Please contact Howard G4PFW at [howardpalmer@sky.com](mailto:howardpalmer@sky.com) or  
01293-535002 (Answerphone)

# Interesting Reads or Watches

What went wrong with Maplins (article)

<https://www.retailgazette.co.uk/blog/2018/03/maplin-what-went-wrong/>

The ICOM 7610 In Depth(video)

<https://www.youtube.com/watch?v=lW-l-5Hlro&feature=youtu.be>

TX Factor (video series)

<http://www.txfilms.co.uk/txfactor/>

This week's GB2RS news on the web (audio)

<http://www.txfilms.co.uk/txfactor/podcasts.html>

Propagation and Solar Data (website)

<http://www.hamqls.com/solar.html>

National Grid Dashboard – see how the country's energy is being created and used in real time

<http://www.gridwatch.templar.co.uk/>

Digital archives of Radio related magazines –

[https://www.americanradiohistory.com/Radio\\_News\\_Master\\_Page\\_Guide.htm](https://www.americanradiohistory.com/Radio_News_Master_Page_Guide.htm)



# Info Page

## Local Repeaters

GB3MH: 145.625/88.5(FM) GB7MH: 439.6375(D-Star/DMR)

GB3NS: 439.675/82.5(FM) GB7NS: 439.1625(DMR) GB7ID: 430.975  
(438.575)(FM/Fusion)

GB3HO: 430.8875/88.5 (438.4875)(FM) GB3HY: 430.900/88.5 (438.500)(FM)

Local DX Cluster GB7DXS : Telnet 81.149.0.149 Port 7300

## Committee Members:

Keith Evans G3VKW - Chairman

John Pitty G4PEO – Vice Chairman, QSL Manager

Phil Moore M0TZZ - Hon. Secretary, Newsletter Editor, Exam Secretary

Howard Palmer G4PFW – Hon. Treasurer

John Longhurst G3VLH

Richard Hadfield G4ANN

Alex Sheppard M1YAP

Lead Training Instructor – Vacancy