



# scatterpoint

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G3PIA/P on 23cm



RAL Microwave Round Table

## Subscription Information

The following subscription rates apply.

UK £600      US \$1200      Europe €1000

This basic sum is for **UKuG membership**. For this you receive Scatterpoint for **FREE** by electronic means (now internet only) via

<https://groups.io/g/Scatterpoint> and/or Dropbox. Also, **free access to the Chip Bank**

Please make sure that you pay the stated amounts when you renew your subs next time. If the amount is not correct your subs will be allocated on a pro-rata basis and you could miss out on a newsletter or two!

You will have to make a quick check with the membership secretary if you have forgotten the renewal date. Please try to renew in good time so that continuity of newsletter issues is maintained. Put a **renewal date reminder** somewhere prominent in your shack.

Please also note the payment methods and be meticulous with PayPal and cheque details.

## PLEASE QUOTE YOUR CALLSIGN!

Payment can be made by: PayPal to

[ukug@microwavers.org](mailto:ukug@microwavers.org)

or a cheque (drawn on a UK bank) payable to 'UK Microwave Group' and sent to the membership secretary (or, as a last resort, by cash sent to the Treasurer!)

## Articles for Scatterpoint

News, views and articles for this newsletter are always welcome.

Please send them to

[editor@microwavers.org](mailto:editor@microwavers.org)

**The CLOSING date is the FIRST day of the month**

if you want your material to be published in the next issue.

Please submit your articles in any of the following formats:

Text: txt, rtf, rtf, doc, docx, odt, Pages

Spreadsheets: Excel, OpenOffice, Numbers

Images: tiff, png, jpg

Schematics: sch (Eagle preferred)

I can extract text and pictures from pdf files but tables can be a bit of a problem so please send these as separate files in one of the above formats.

Thank you for your co-operation.

**Roger G8CUB**

## Reproducing articles from Scatterpoint

If you plan to reproduce an article exactly as in Scatterpoint then please contact the [Editor](#) – otherwise you need to seek permission from the original source/author.

You may not reproduce articles for profit or other commercial purpose. You may not publish Scatterpoint on a website or other document server.

## UKμG Project support

The UK Microwave Group is pleased to encourage and support microwave projects such as Beacons, Synthesiser development, etc. Collectively UKuG has a considerable pool of knowledge and experience available, and now we can financially support worthy projects to a modest degree.

Note that this is essentially a small scale grant scheme, based on 'cash-on-results'. We are unable to provide ongoing financial support for running costs – it is important that such issues are understood at the early stages along with site clearances/licensing, etc.

The application form has a number of guidance tips on it – or just ask us if in doubt! In summary:-

- Please apply in advance of your project
- We effectively reimburse costs - cash on results (eg Beacon on air)
- We regret we are unable to support running costs

Application forms below should be submitted to the UKuG Secretary, after which they are reviewed/ agreed by the committee

[www.microwavers.org/proj-support.htm](http://www.microwavers.org/proj-support.htm)

## UKμG Technical support

One of the great things about our hobby is the idea that we give our time freely to help and encourage others, and within the UKuG there are a number of people who are prepared to (within sensible limits!) share their knowledge and, what is more important, test equipment. Our friends in America refer to such amateurs as “Elmers” but that term tends to remind me too much of that rather bumbling nemesis of Bugs Bunny, Elmer Fudd, so let's call them Tech Support volunteers.

While this is described as a “service to members” it is not a “right of membership!”

Please understand that you, as a user of this service, must expect to fit in with the timetable and lives of

the volunteers. Without a doubt, the best way to make people withdraw the service is to hassle them and complain if they cannot fit in with YOUR timetable!

Please remember that a service like our support people can provide would cost lots of money per hour professionally and it's costing you nothing and will probably include tea and biscuits!

If anyone would like to step forward and volunteer, especially in the regions where we have no representative, please email [john@g4bao.com](mailto:john@g4bao.com)

The current list is available at

[www.microwavers.org/tech-support.htm](http://www.microwavers.org/tech-support.htm)

## UKμG Chip Bank – A free service for members

**By Mike Scott, G3LYP**

Non-members can join the UKμG by following the non-members link on the same page and members will be able to email Mike with requests for components. All will be subject to availability, and a listing of components on the site will not be a guarantee of availability of that component.

The service is run as a free benefit to all members of the UK Microwave Group. The service may be withdrawn at the discretion of the committee if abused. Such as reselling of components.

There is an order form on the website with an address label which will make processing the orders slightly easier.

Minimum quantity of small components is 10.

These will be sent out in a small jiffy back using a second class large letter stamp. The group is currently covering this cost.

As many components are from unknown sources. It is suggested values are checked before they are used in construction. The UKμG can have no responsibility in this respect.

The catalogue is on the UKμG web site at [www.microwavers.org/chipbank.htm](http://www.microwavers.org/chipbank.htm)

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## Loan Equipment

Don't forget, UKuG has loan kit in the form of portable transceivers available to members for use on the following bands: **Contact John G4BAO for more information**

5.7GHz

10GHz

24GHz

47GHz (coming soon)

76GHz

## Updating to the Latest PIC devices

Andy Talbot G4JNT

The latest PIC devices need the latest programming tools. If you want to avoid the bloatware and complications of Microchip's MPLAB Integrated design environment, getting these is a bit more complicated these days as the Microchip site doesn't offer much support for standalone programmers.

### How It Used To Be

I have been using PIC microcontrollers now for close on a quarter of a century but until recently had not ventured into the latest devices with enhanced instruction set and more advanced peripherals. Most of what I needed to do could all happen in 16F268A, 16F688, 12F629 / 675 or others of a similar vintage. They would all 'go' using the old PicKit 2 programmer. As a dyed-in-the-wool assembly language programmer I use a text editor, the *MPASM* assembler driven from a command line, and the PicKit standalone programmer driver software. Avoiding Microchips developer suite *MPLAB* completely. I'd had to update *MPASM* and support files several times over the decades to cope with later devices, but the Microchip site back then was easy to navigate and download from. I had even had a foray into DSPics, and had to use *MPLAB* for that (not the latest *MPLAB-X*, please note) and got a PicKit 3 for use with it, but for most basic 16F family work just stayed using the PicKit 2 programmer.

About a year ago I needed to use a 12F617 device – an 8 pin chip with Pulse Width Mod output and more memory than the 12F615 used so far. That '615 device worked with the existing programming tools but I soon discovered the PicKit 2 couldn't programme the only slightly later 12F617. The PicKit 3, using its standalone support software could. The PicKit 3 has to download and 'flash' a different operating system into itself to be used this way, then reverse the process when going back to using *MPLAB*. Tedious. But all was fine until now – although it was obvious the writing was on the wall.

### Trials and Tribulations

I wanted to get Graham's 'Scriber' utility up and running (See '*Writing in the Waterfall*', Scatterpoint Feb 2019) and that used one of the latest generation, enhanced instruction-set PICS. At this stage Graham only supplied the source file on his web page, so I initially tried assembling that using the standard *MPASM* tool. No chance; 1649 error messages generated! The necessary include file was not in my archive so I went off to the Microchip site to find it. After much fruitless searching, couldn't find it or any reference to .INC files.

Wondering where to go next, I realised all .INC files were included as part of my previous earlier installation of *MPLAB*, so back to the Microchip web site to download the latest version of *MPLAB-X*. I had no intention of using it, just wanted all the support files it would have. Sure enough, digging down into the install folders there was the file *P16F1615.INC* I needed; copied to my user folder and tried assembling again. Almost as many error messages – it seems my version of the *MPASM* assembler wouldn't cope with the enhanced device family.

Back to the Microchip site for the latest *MPASM* – nothing. Googled, but it appears everyone just seems to use *MPLAB-X IDE*. All very frustrating. Then on the off chance I looked again at the installation files for *MPLAB-X* and noticed a subfolder several levels down in the directory tree called '*mpasmx*'. In there was a standalone programme *mpasmx.exe*. Ran that and going via its own Windows GUI my copy of *Scriber* assembled perfectly. For future use, I wrote a batch file that called up this version of *mpasmx* so I could assemble from a command line as before. So... home and dry? Not yet.

### Latest Programming Tools

Naturally I'd hoped I could use the PicKit 3 and its standalone driver to programme this chip in the same way as had worked for the later generation 12F617. But the programmer just wouldn't do a 16F1615. It was pointless going back to the Microchip site again, but Google threw up the term "Integrated Programming Environment". I hadn't noticed initially that when *MPLAB-X* installed, it had created two icons, *MPLAB-X IDE* and *MPLAB-X IPE*. Integrated Development, and Programming. So still keeping well-clear of the *MPLAB-X IDE* bloatware, I ran the *IPE*. That appeared to be a little bit more user-friendly, but it does have an advanced mode. (WHY ??????) that needs a password to enter – but they give the default one, it's 'microchip', and then you can lock advanced mode for future use by ticking a box. You need advanced mode to get access all the detailed programming featured likely to be needed in the future – like 'Supply Power from Programmer' if blowing chips standalone rather than having them externally powered via in circuit programming. After eventually finding how to supply power from the programmer (go to the 'Power' tab, and scroll down the window to find the appropriate button), loaded the .HEX file produced earlier, hit 'program' and it worked.

All that lot took several hours to go through one evening, but the next day, doing a similar installation on my shack PC took only a few minutes – in fact the most time consuming part was the MPLAB-X installation itself - a suite I'll only ever be using a tiny part of.

### How to Install the Latest PIC programming tools

Go to [www.microchip.com](http://www.microchip.com) or more specifically <https://microchipdeveloper.com/> and download MPLAB-X, then install. It's quite a large download and installation, but does have everything.

Go into Explorer and dig down into the folder structure for something like this:

`c:\Program Files(x86)\Microchip\MPLABX\v5.20\mpasmx` Find *MPASM.EXE* in there and create a shortcut to it. Place the shortcut in an easy-to-find spot.

I wanted to be able to call the assembler from a command line, so a batch file *MPASM.BAT* was written, containing the instruction :

```
"C:\Program Files (x86)\Microchip\MPLABX\v5.20\mpasmx\mpasmx" %1 %2 %3
```

 (the inverted commas are mandatory to allow file names with spaces).

Identify the *MPLAB-X IPE* icon that will have been generated when MPLAB-X was installed and run the Integrated Programming Environment software. Connect your PicKit 3 programmer and a target PIC device then click 'connect'. Click on 'advanced mode', enter the password when prompted and tick the box to save for the future. After that, the programmer is almost as easy to use as the old PicKit 2 and 3 standalone packages – once you've learned where all the control buttons sit, and scrolled a few windows to find 'missing' ones..

And that's it: set up for assembling and programming the latest PIC devices, but it's all a lot more complicated to do that it was 25 years ago.

## Message from ex group member

Would the member who bought a Marconi TF1053 noise generator/noise figure test set from me several years ago and collected it from my Petersfield, Hampshire, QTH, please contact me ([Pete.weedon@ntlworld.com](mailto:Pete.weedon@ntlworld.com)). I have lost your contact details. You might find it to your advantage!

Best regards,

Pete W.  
(G8ZKZ)

## News from Down Under

Andrew VK3CV and Noel VK3NH set a new Australian 122GHz National record on 24<sup>th</sup> June 2019.

Distance was 59.6 km. Signals 52 with QSB using NBFM.

Stations were portable of course, with one station @ 600m asl. Temperature was 14 deg.C, and dew point 1 deg.C. Pressure 1033mB, with a stationary high. Thanks to David VK5KK for the information.

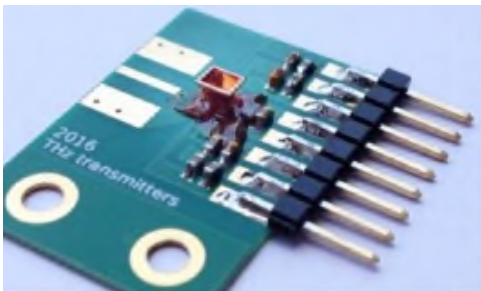
Both stations used a 122GHz Radar chip from Silicon radar (TRX\_120). The advantage of this type of IC is that all the millimetre stuff is 'on-chip' fed from a synthesiser on the pcb running at a few GHz. The antenna 'feed' including lens is also on the device. 600mm offset dishes were used,

Which leads onto another recent announcement that could make THz transceivers common place!

*A 400GHz 28nm TX & RX with Chip-to-Waveguide Transitions used in Fully Integrated Lensless Imaging System  
Alexander Standaert ; Patrick Reynaert*

*Abstract:*

*This paper presents a 400 GHz CMOS TX and RX chip with two different chip-to-waveguide transitions. A first design is based on a coupled microstrip to waveguide coupler and is integrated together with a 400 GHz oscillator in 28nm bulk CMOS. When this transmitter is combined with a micromachined horn antenna, it is capable of providing an EIRP of 1.26 dBm. In a second design, a folded dipole based coupler is utilized to make the transition between a waveguide and a 400 GHz mixer first receiver. This receiver fully integrates an on-chip LO, mixer and baseband circuits and achieves an effective conversion gain of 39 dB and a noise figure of 45 dB. Both chips are combined into a lensless active imaging setup with a spacial resolution of 2 mm.*



## 50<sup>th</sup> Anniversary of Apollo 11 MOON Landing

Various activities are happening on the forthcoming weekend of 20<sup>th</sup>/21<sup>st</sup> July 2019

With eme operation from the Goonhilly 32 metre dish as GB6GHY. Check the 'reflector for latest news'



Parkes Radio Telescope Australia photo Mike Sexton ABC News

# 24GHz Personal Beacon using Alcatel 'White Box' Tx Module

Andy Talbot G4JNT

Previously I showed how the Tx module of the 24GHz Alcatel 'white boxes' could be modified for direct access to the mixer diodes, allowing them to be driven externally by low frequency baseband signals as a direct quadrature upconverter [1]. Apart from a few tests made at the time, the idea sat on the back-burner until recently when I decided to use it, along with a spare 26dBm output PA module, as a personal beacon.

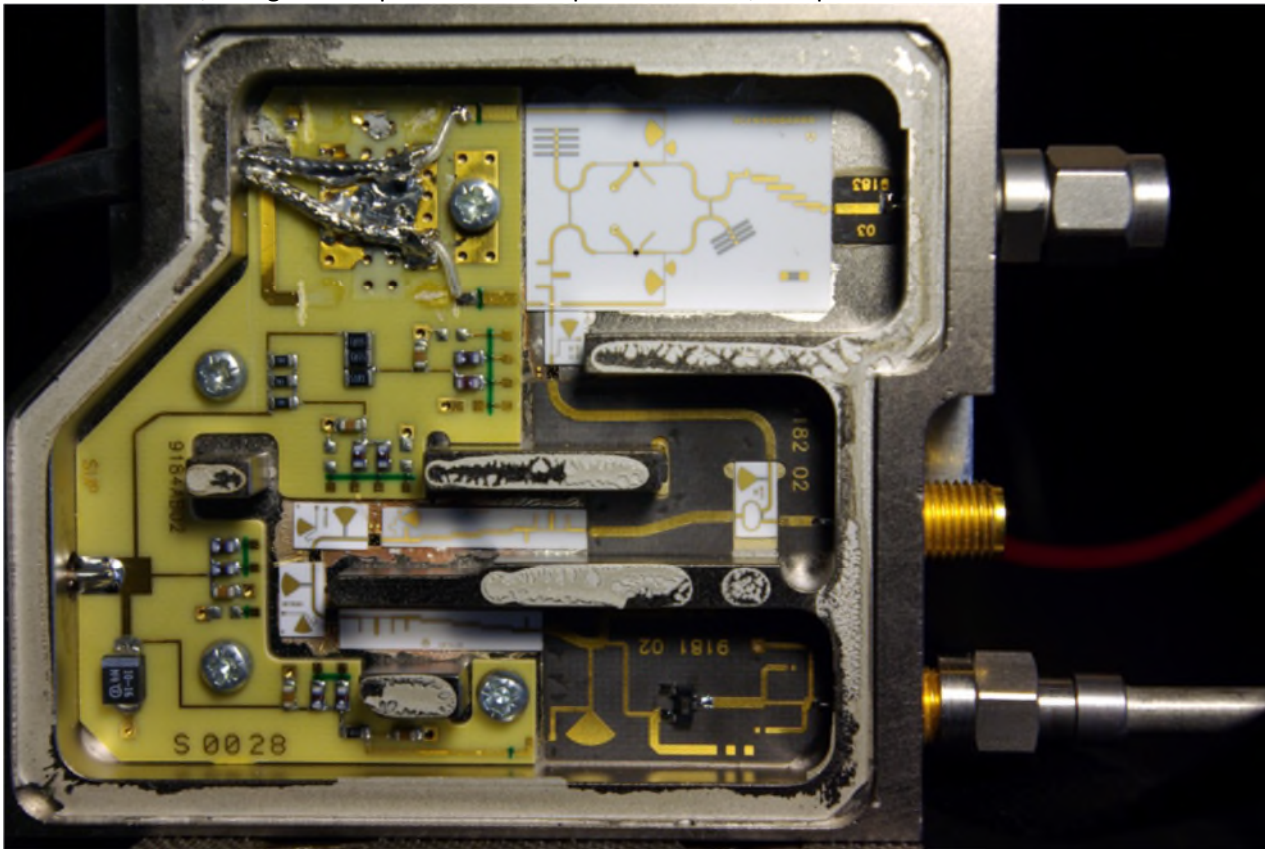


Photo 1 Connections for Directly Driving the mixer diodes on the Alcatel 'White Box' Tx module. The original IF 90 degree hybrid has been removed.

## RF Chain

The initial idea was to directly drive the upconverter with a low frequency waveform carrying the wanted modulation in baseband I/Q format. That way, any mixer image response is folded back on itself where it will not cause adjacent channel interference. So long as more than 15 – 20dB image rejection can be achieved, the unwanted on-frequency image will not harm the wanted modulation.

The Tx module requires RF drive at 6GHz which it effectively multiplies by four to give the RF upconversion frequency. To generate any arbitrary frequency with fine tuning steps within the 24GHz band would need a Fractional-N synthesizer running at 6GHz. The only ready-to-go one that meets that requirement is the relatively new (in amateur circles) ADF5355 device. I have one such module but didn't want to tie it up in a dedicated beacon source. Another alternative would be either an LMX2487 with external 6GHz VCO, or an LMX2541 operating at 3GHz with a doubler. The former already existed in the junk box but no suitable VCO was to hand; the latter seemed a bit of a kludge and the doubler would need a 6GHz filter. Neither solution was quite satisfactory so an alternative route was chosen. An LTC6946-3 integer-N synthesizer was already built and waiting. This allowed a Local Oscillator that could be set in, essentially, 8MHz steps at 24GHz from a 10MHz reference input (2MHz  $F_{COMP}$  inside the synthesizer, times four). So if, instead of driving the RF mixer at baseband it could be driven at a frequency of 8.xxx MHz, the wanted mixer product could be made to fall at the right place on 24048.xxx MHz with the synthesizer generating 6010 MHz  $\times 4 = 24040$ MHz. The unwanted image response now sits at around 24032MHz. This is still in the amateur primary allocation, in an unused portion of the band where a -20dBc signal is unlikely to cause any problems. So that was the solution adopted. An AD9852 Direct Digital Synthesizer module left over from an earlier project generates the  $\approx 8$ MHz IF signal. Modulation is generated directly on this signal, by the controller driving the DDS chip.

Previous tests on the mixer had suggested maximum drive to the diodes needed to be around +12dBm. An SGA6289 MIMIC amplifier raises the power from the DDS board to a maximum of around +19dBm, then a 90 degree hybrid



made from discrete components generates the quadrature drive to the two mixers. Figure 1 shows the circuit of the hybrid. The dual inductor is bifilar wound on an iron dust toroid. 3dB pads placed on the output help provide a better match for the Hybrid's ports as well as improving the mixer source impedance allowing a drive level up to around +13dBm for I and Q channels. If amplitude trimming to improve opposite sideband attenuation is needed, this attenuator is a convenient place to do it.

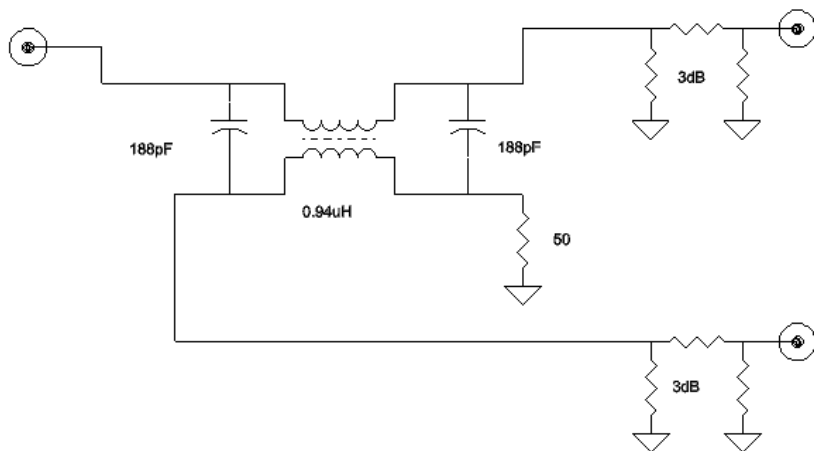


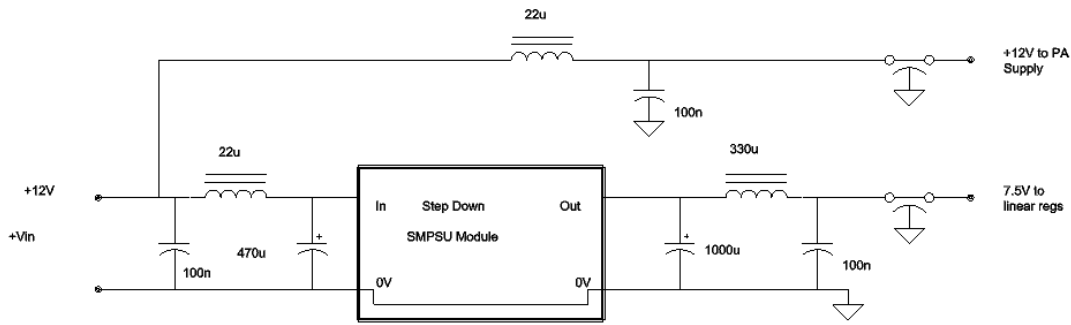
Figure 1 Discrete Component 90° Hybrid used to generate 8.4MHz quadrature drive to the mixer diodes

Test results were quite satisfactory. With no attempt at amplitude trimming the I/Q channels, an opposite sideband rejection of 25dB was seen at 8.4MHz, where I intended ultimately to operate it. Sweeping a few hundred kHz either side suggested > 30dB rejection could be achieved over a small range of frequencies, but I decided to leave it alone. - 25dBc at 24032MHz was not going to cause anyone any pain.

One big advantage that the AD9852 DDS has as a signal source is that amplitude as well as frequency control of the generated waveform is possible, so a wider range of modulation types can be generated other than constant amplitude MFSK typically used on beacons. Writing suitable beacon signal code for that is a job for the future; at this stage all it has is simple on-off CW keying with a nicely shaped raised-cosine rise and fall to the pulse edge. A ready-to-go PA module was to hand – conveniently this was one that had its own integral SMPSU and just needed to be supplied with a voltage between 9V and some (unknown) upper safe limit. It works well at 12V. The amplifier could be driven to saturation with the drive from the DDS backed off by around 4dB, so a 100 ohm preset was added on the DDS module output to optimise the drive level.

### Power Supplies

All modules apart from the power amplifier run from a nominal 5V rail. Strictly, the White Box Tx module wants 5.2V. My first idea was to use a SMPSU step-down regulator to go straight from 12V input to 5.2V. A low cost Ebay module was built into its own screened box and extra decoupling added to remove conducted interference. Figure 2. However, it proved near-impossible to get much below 10mV conducted switcher interference on the 5V output, and the thought of this passing directly to the RF modules and even worse the PLL synthesizer board, made a rethink necessary.



**Figure 2 Additional Decoupling needed to clean-up the output from a Step Down SMPSU module**

So two linear regulators are used instead. One an LM317 delivers 5.2V to the RF modules and the LTC6946 . An LM7805 delivers 5V for the DDS and buffer and also supplies the Morion OCXO frequency reference. To reduce overall power consumption both these regulators are supplied with 7.5V from the input SMPSU. Total current consumption of the whole assembly, including PA and when the oven has warmed up, is around 1.7 Amps at 13V input, so a little over 20 Watts dissipation.

### Mounting and Cooling

The unit needs to be installed in a waterproof box for occasional mast head or outside installations. Initially I planned on using a plastic box and employ natural cooling – having not really thought this issue through too well. All the modules, apart from the input SMPSU which is in its own screened tinplate box, were mounted on a baseplate that just fitted comfortably into the plastic housing. But running the beacon in the open on the bench revealed just how hot the baseplate got with natural cooling. Mounting this in the intended plastic box with no local airflow and significant thermal resistance through just one face of the case would not be acceptable.

A small 12V fan pointed at the baseplate worked admirably, so it looked as if fan cooling was going to be needed. Doing traditional fan cooling on an externally mounted bit of hardware would be a nightmare; thoughts of ducting air, making waterproof and insect proof tail pipes, etc. etc.

After a bit of discussion on the UK Microwaves Group, one suggestion was to use an internal fan in the enclosed space, blowing directly onto the baseplate so the warm air is kept in rapid circulation around the inside of the box allowing all the surfaces of the box to be in use for cooling. I found a larger IP65 type box that would take the existing baseplate raised 50mm above the bottom and leave plenty of space around it for airflow. The surface area of the box is around 0.2m<sup>2</sup>, and the 3mm thick wall was quoted to have a thermal conductivity of 0.3 W/K/m. Assuming the temperature inside is kept uniform by rapid air circulation, a temperature gradient of only a couple of degrees should exist across the plastic casing. The full surface area of the box is then available for heat dissipation.

Photo 2 shows an inside view, with the various sections annotated.

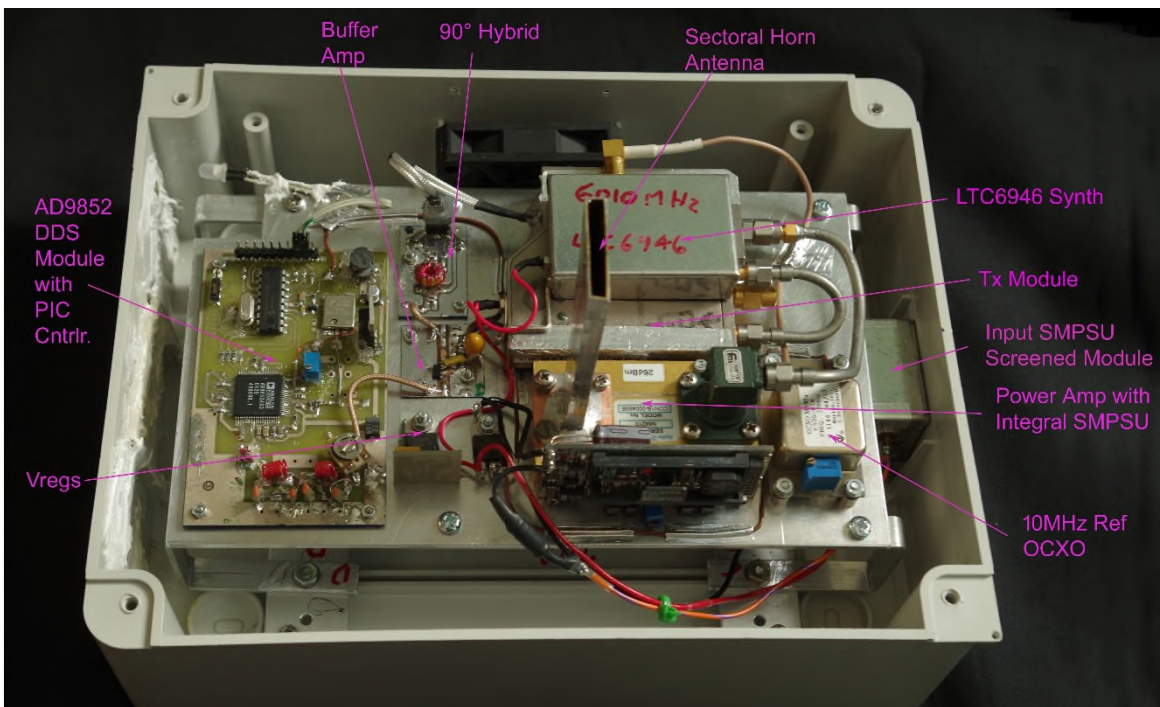


Photo 2 Internal view of the 24GHz Personal Beacon

### Antenna

In normal use a beacon needs a wide azimuthal beamwidth antenna, so it can be installed and left-alone. A favourite beacon antenna for this band is the slotted waveguide with nominally omnidirectional coverage in azimuth and a tight vertical pattern giving typically 10dBi. But this is a difficult antenna to make, especially at 24GHz where precision machining of slots is required.

The H-plane sectoral horn is a simpler alternative, offering an azimuth beamwidth of something like 100 – 120 degrees and a vertical beam width that depends only on the aperture. A 10dBi horn was constructed using design software originally written by G8AGN back in the Palaeolithic era and now modified for later windows generation PCs. [2]. A 3D view showing the dimensions appears in Figure 3.

When mounted, the mouth of the antenna protrudes out of the front face of the box – the lid. To maintain waterproof integrity, a slot was cut to allow the mouth of the horn to pass through when the lid was fitted. A 50mm diameter thin plastic radome made from the cap of an old aerosol was glued in place over this – photo 3. The glue used was one of the many adhesive / fillers now available from the DIY centres – this one was EVO-STIK's "Sticks like SH\*T" [3]. It is far stronger and grips and fills up gaps much better than silicone products do.

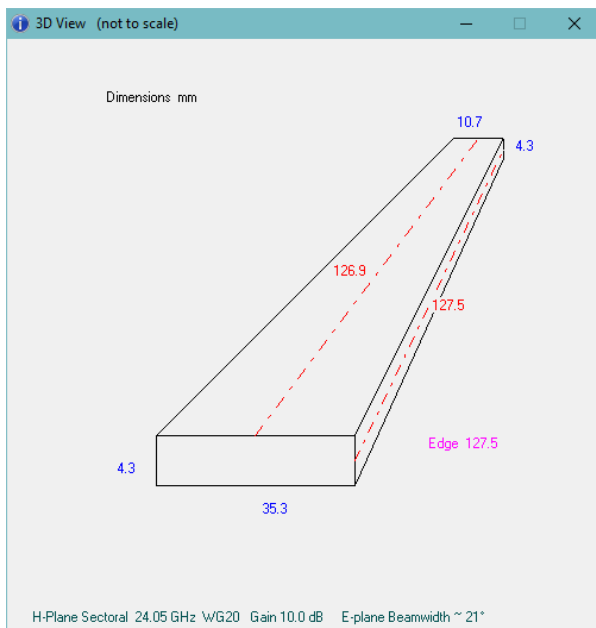


Figure 3 Sectoral Horn Antenna dimensions



Photo 3 External view showing the Radome glued in place. The connector on the side carries the 12V DC input

## References

- [1] *“Direct IQ upconversion with the Alcatel White Box Transmit Module”* Andy Talbot, G4JNT, Scatterpoint October 2015
- [2] Horn Design Software <http://www.g4jnt.com/HORN2.ZIP>
- [3] Yes, really, that is it’s actual name!

## Editors Comments

With the holiday period looming, the next Scatterpoint will be published in early September. Articles will include the G3XDY 23cm low pass filter, a write up from the Finningley round table. Plus the first of a series of Technical articles, attempting to share some of our collective wealth of knowledge. As always construction articles for publication greatly appreciated.....

Roger G8CUB

## Activity News: June 2019



By John G4BAO

**Please send your activity news to:** [scatterpoint@microwavers.org](mailto:scatterpoint@microwavers.org)

### Introduction

A report from the activity news editor John G4BAO. A great month for activity reports!

### From Jules G0NZO



Working with Flight Refuelling ARS, up on the ridge by the well-endowed "Cern Giant". The club were running only 4mtrs and 6mtrs, but I brought along a simple 23cm station, just to play with and give away a few points. The station was a 25ft pole mast, with a bare SG labs transverter (2W o/p) taped to the mast and a one of FRARS 23cms 38ele yagis, fixed to the top with tie wraps. With an FT817 for drive. The whole station ran from LiPo batteries. Rotating the antenna was by the Armstrong method. But with the guy's fixed to the top of the mast, with no rotation mount, it was challenging to try and hold a heading with one hand, against the tension of the guys, whilst having a qso and writing the log.

I only ran for a few hours in total, over the two days. As there was work to do on the main contest stations, and tea to drink. But even with that quick lash up of a station, I worked 12 stations. Best DX was the EI9E/P contest station at 354km. And none of the QSOs were particularly hard work. Most paths were pretty much done on a direct path with little enhancement. But it was all good fun and hopefully we can run a contest station next year.

## From David G4GLT



I am active now on the microwave bands but because I live behind Haytor I'm totally screened by granite all sides my microwave operations are portable. I had looked at the tropospheric predictions on F5LEN and was excited by what I saw. My monitoring of GB3VHF and GB3UHF showed that both were very strong which is unusual as both are usually weak in the noise. When I got to Haytor (IO80DO) at over 300m ASL, I first started hearing F1BQ/B at 599 on 10GHz at 10-20 local time from JO09CM then while tuning around I heard HB9G beacon in JN36BK at 1100 local time at 599. At 1132 local time I heard HB9BBD/P (JN47GA) at 599. At 1300 hrs local time I heard F5ZBB beacon at 579 from JN18HN. I was pretty excited by hearing this tropo opening as all I have heard to date has been a few UK beacons and the Rotterdam PI7RTD beacon early in June during a lift. I did not have any QSO's as the computer that I had been using for KST2Me stopped working but I was very excited, as much as hearing a VK6 beacon on 6 metres!

## From Mike G8CUL



For the second year in a row G3PIA/P operated on VHF NFD on all 5 bands in the restricted section. This year both our number of QSOs and claimed score for 23cm was up by 100% probably due to the preamp last year having a noise figure of about 10dB (which we found after the event). Our best Dx this year was DJ5AR in JN49 - a distance of 694 km. Who says that 1.3GHz is limited to line-of-sight? For a change, everything worked well with no failures and even the weather was kind and cooler than last year. Like most clubs we have a limited number of operators to run all the bands with just Ann, G8NVI, Neil, G4BRK and Mike, G8CUL on the 70/23cm station.

## From John G8ACE



G8ACE Operating out of the loft window

Roger G8CUB and myself G8ACE were active on all six bands for the annual 24GHz and up contest in June. Roger came down to Hampshire and we worked on 122, 134 and 241 GHz to local Winchester sites out and out to 17km. Roger /P and myself operating fixed station from my loft window. These were all proven paths and the longest path recently tested showed enough margin on 122 GHz with humidity 40% to make a longer path possible perhaps to the Chute Causeway 34km. However the humidity was extremely high and signals with RH around 70% + were well down on expectations and we managed only one way on 122 GHz. The atmospheric losses alone being around 27dB for 17 km distance at the RH encountered which quickly uses up any signal margin. Oxygen attenuates these higher frequencies rapidly.

G8ACE then moved to Cheesefoot Head local to Winchester and Roger G8CUB to The Chute Causeway north west of Andover where we completed the lower three bands (24, 47, 76GHz). The time consuming nature of the higher bands meant with site moves all eight hours were used and we didn't have enough time to work many other lower band stations. We believe this is a first time to have two way QSO's on six bands for this contest. It is possible better distance results could be obtained by starting at 06.00 with lower temperatures but of course there is no control over weather conditions for good dx results on a set date.



G8CUB at Shroner Wood left to right 241G RX, 241 TX, 134 TX, 134 RX

## From John G3XDY

June 1/2 EU Microwave contest and UKuG Low Band Contest

On June 1st I operated on 5.7/10GHz and worked DK0PU (JO31), DF0MU (JO32), and F5KMB/P (JN19) on both bands, plus DK2MN (JO32), DK0NA/P (JO50) and F1AZJ/P (JN28) on 6cms only on the Sunday morning.

During the Low Band Contest I made 32 QSOs on 1.3GHz, 19 on 2.3GHz and 10 on 3.4GHz. Highlights were DM5D (JO61) and DL4NFA (JO50) on both 1.3GHz and 2.3GHz, plus DL3IAS, DL3IAE (JN49) and DK0NA/P (JO50) on all three bands.

Good tropo conditions to both the SW and NE on the 28/29 June resulted in some nice QSOs, the best were:

1.3GHz SK7MW (JO65), OZ9PP (JO47), F6CIS (IN94), SM6PGP (JO67), EA2TZ (IN83), EA2EGM, EA2AWD, F2CT (IN93), LA3EQ (JO28), OZ9GE (JO66).

2.3GHz F6CIS (IN94)

3.4GHz OZ9PP(JO47)

5.7GHz OZ9PP(JO47)

10GHz OZ9PP(JO47), OZ1LPR(JO44), LA4YGA (JO48)

VHF NFD Highlights were:

1.3GHz EI9E/P (IO62), DR5T (JN47), OK2A (JO60), OZ1ALS (JO44), DM5D (JO61), OZ9PZ (JO46), DK0NA (JO50)

2.3GHz DL3IAS, DJ5AR (JN49), DM5D (JO61)

3.4GHz DL3IAS (JN49), DM5D (JO61) was heard at 539 over 834km running 35W to a 3m dish, but no QSO.

5.7GHz DK2MN (JO32), DK0PU (JO31)

10GHz PI4GN (JO33), DK2MN, DF0MU (JO32)

I ran my new W6PQL PRF13750 1.3GHz SSPA on VHF NFD for its first outing.

RF wise it performed flawlessly, but there one or two minor tweaks needed to finish the project. The output device seems quite rugged, having survived a spectacular flashover on the output coax connection (probably caused by contamination with copper swarf).

## From David G4RQI

I was active on the 28<sup>th</sup> and 29<sup>th</sup> June on 23cm using a single 18ele yagi and 90w (IO93RI). I found conditions from my QTH best towards the East and my best DX was SM6VTZ at 957km. To the south both G0JBA and M0GHZ were very good signals but the Tropo did not appear to penetrate into France from here.

Conditions took a dive around 09:30 on the Saturday and by the evening all the continental beacons I had been hearing had disappeared.

OZ1CTZ 28/06/2019 1817 1296.200 CW 529 539 JO46oe 723km

SM6VTZ 28/06/2019 1837 1296.200 SSB 57 59 JO58UJ Chris 150w 1.8m dish 957km

PA0JUS 28/06/2019 1853 1296.175 SSB 51 53 JO33nb 563km

DK1PZ 28/06/2019 1909 1296.200 CW 529 559 JO41TH 785km

G0JBA 28/06/2019 1936 1296.170 SSB 59 59 JO01PG Phil Sandwich 324km

DK2AN 28/06/2019 1946 1296.130 CW 519 559 JO51dr 810km

DK2MN 28/06/2019 2036 1296.225 CW 549 549 JO32MC 587km

OZ9ZZ 28/06/2019 2042 1296.175 SSB 55 52 JO46OH 727km

PA0O 28/06/2019 2046 1296.175 SSB 57 59 JO33hg Jaap nr Groningen 1.2m dish 21m agl 30w IC706 driver 526km

M0GHZ 28/06/2019 2115 1296.220 SSB 57 59 IO81VK David Chippenham IC9700 55ele 262km

ON4KBE 28/06/2019 2132 1296.170 CW 559 589 JO20bi Edgard 527km



DK1PZ 28/06/2019 2223 1296.195 SSB 55 53 JO41th Heinz 785km  
DK2AN 29/06/2019 0648 1296.200 SSB 59 59 JO51dr 810km  
DL5EBS 29/06/2019 0657 1296.165 SSB 52 51 JO31NH 629km  
OZ9PP 29/06/2019 0751 1296.228 CW 549 599 JO47va 789km

## From Paul G4KZY

Andover radio club G0ARC/P were active on 23cm for the first time in many years (if ever) on 23cm in NFD. You may remember we tried out 23cm from our club location one Tuesday activity night late last year and I was really quite disappointed with our results (I got some good advice on the microwave forum after that attempt). This time, however, it was a very different picture. We made 33 QSOs, 13 of which were more than 200km. Best Dx was 621km (DF0MU). This was achieved with just 10 watts (probably nearer 5 watts at the end of the coax) from an IC-910 driving a 44 ele WIMO yagi on a 4m mast. We would have made a few more QSOs if the owner of the rig had told me in advance about the 7kHz frequency error!

A great learning experience for many at our club (especially myself) and an interesting demonstration of what is possible on 23cm with fairly modest equipment.

## From Roger G8CUB

The value of having a home station, became clear. When, on 28<sup>th</sup> June I heard the OZ5SHF beacon and tripled my home best DX on 10GHz, by working OZ1LPR (JO44) on 10GHz SSB @ 724km.

## From Martin GM8IEM – IO78HF

I'm now running 80 watts into a 67 element WiMo antenna on 13 cm (both 2300 and 2320 MHz), with VLNA13 at the masthead. Have only had one QSO since increasing the power – using SSB, with GM4JTJ (IO86RP) via Aircraft Scatter at a distance of 245 km. This is a surprisingly difficult path due to the mountainous terrain between us, and an almost total absence of suitable aircraft. Although SSB only at the moment I hope to have CW and JT modes up and running over the summer if I can find the time, and to get an improved feeder installed.

On 23cm Stewart GM0GTU (IO87BN) is now QRV with 10 watts into a 57 el yagi. I think he's the closest amateur to me who is currently active on this band at a distance of 116 km. Despite having a few mountains in the way we have managed a couple of (rather difficult) CW QSOs. I run 180 watts into 60 el with VLNA23 at the masthead.

Anyone who'd like to try working IO78 on either of these bands please e-mail me – I'm also active during most of the UK contests.'

## .....and finally

The deadline for activity reports to be included in the next issue is Monday 1<sup>st</sup> September 2019. John G4BAO coordinates activity reports. Reports should be sent to [scatterpoint@microwavers.org](mailto:scatterpoint@microwavers.org)

## Contests

### 24/47/76GHz Contest May 2019

The rules changed for 2019 to require the use of 8 character locators for more accurate distance measurement. This caused a few adjudication problems due to software issues hence the delay in publishing results, for which I apologise. Many of the "usual suspects" were active in this event, with a slight uptick in activity and entry levels from 2018. Congratulations go to Neil G4LDR/P for taking the leading position on 24GHz, and to Roger G8CUB/P for wins on 47GHz and 76GHz.

John G3XDY

UKuG Contest Manager

### 24GHz May 2019

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G4LDR/P	IO81XG25	6	483	G3ZME/P	139
2	G3ZME/P	IO82QL83	4	429	G4LDR/P	141
3	G8CUB/P	IO91CL35	3	314	G3ZME/P	125
4=	GW3TKH/P	IO81LS19	3	268	G8CUB/P	92
4=	GW4HQX/P	IO81LS19	3	268	G8CUB/P	92
6	G1EHF/P	IO91KF42	2	78	G4LDR/P	64

### 47GHz May 2019

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G8CUB/P	IO91CL35	3	218	GW3TKH/P	94
2	GW3TKH/P	IO81LS19	2	185	G8CUB/P	94
3	G4LDR/P	IO81XG25	2	121	GW3TKH/P	91
4	GW4HQX/P	IO81LS19	1	94	G8CUB/P	94

### 76GHz May 2019

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G8CUB/P	IO91CL35	3	218	GW3TKH/P	94
2=	GW3TKH/P	IO81LS19	1	94	G8CUB/P	94
2=	GW4HQX/P	IO81LS19	1	94	G8CUB/P	94
4	G4LDR/P	IO81XG25	1	30	G8CUB/P	30

### May 5.7GHz Contest 2019

This was a closer fought contest than some on this band, with all entrants managing 5 or 6 contacts. Congratulations to Neil G4LDR as winner and Dave G1EHF/P as runner-up.

73

John G3XDY

UKuG Contest Manager

## May 2019 5.7GHz Contest

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G4LDR	IO91EC	6	828	G3XDY	223
2	G1EHF/P	IO91GI	6	776	G4ALY	216
3	G3ZME/P	IO82QL	5	610	G4LDR	168
4	M0GHZ	IO81VK	5	540	G4ALY	177

## May 10GHz Contest 2019

Some minor enhancements due to rain scatter were noted by several entrants, but activity seemed quite low, and the number of entries in the restricted section in particular is disappointing.

Congratulations to Telford & DARS G3ZME/P as winners and John G4ZTR as the runner up in the Open section, and to Barry G4SJH/P as the only restricted section entrant.

73

John G3XDY

UKuG Contest Manager

## May 2019 10 GHz Contest

### Open Section

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G3ZME/P	IO82QL	19	3035	G3XDY	265
2	G4ZTR	JO01KW	15	2475	G4KUX	353
3	G4KUX	IO94BP	8	2273	G4LDR	395
4	G8HAJ	JO01JR	13	2253	G4KUX	370
5	G3UVR	IO83KH	7	1509	G3XDY	324
6	G4LDR	IO91EC	11	1413	G3XDY	223
7	M0GHZ	IO81VK	8	1059	G4ZTR	220
8	G4RQI	IO93IR	6	862	G3XDY	250
9	G3YJR	IO93FJ	5	472	G4KUX	141

### Restricted Section

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G4SJH/P	IO91GI	10	1252	G4ALY	216

## June 2019 Lowband Contest Results

This year's event recovered from last year's nadir in activity, although UK participation was still reported as poor. On the other hand many commented on good levels of European activity, although some found it difficult to attract their attention.

On 1296MHz John G4ZTR won with one less QSO than the runner up M0HNA/P, by dint of working more European DX, including 13 DL's. As usual aircraft scatter provided the best DX in the absence of much tropo enhancement.

Two entries were received for 2300MHz, with M0HNA/P the winner. More stations active on this band segment would be welcome.

2320MHz saw a reasonable entry level, with M0HNA/P in first place again and Mike G6TRM/P as runner up. Best DX distances were over 500km for half the entrants which shows how systems are improving on this band.

3400MHz saw the closest tussle for places as all the entrants scores fell in a 100 point range, with David M0GHZ beating Mike G6TRM/P by just 19 points. Conditions were flat and best DX distances were in the 210-260km range,

Overall results were a win for M0HNA/P, who won 2300/2320MHz, and runner up position for G6TRM/P.

Although M0HNA/P have already made sure of holding the overall lead and band leader positions on 2300MHz and 3400MHz in the Low Band Championship, as last year the top places on 1296MHz and 2320MHz will be decided in the final event in November.

John G3XDY  
UKuG Contest Manager

## June 2019 Low Band Contest

### 1296MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G4ZTR	JO01KW	26	10485	DK0NA/P	704
2	M0HNA/P	IO91GI	27	8143	DF2VJ	637
3	G6TRM/P	JO01QD	19	6159	DJ6OL	618
4	G4LDR	IO91EC	12	4172	DF0MU	626
5	GM4BYF	IO85JV	5	1734	M0HNA/P	519
6	M0GHZ	IO81VK	8	1485	F6DKW	433
7	G3UVR	IO83KH	2	358	G4ZTR	311
8	G6GVI	IO83SN	2	309	M0HNA/P	255

### 2300MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0HNA/P	IO91GI	2	231	G3XDY	200
2	G4LDR	IO91EC	1	31	M0HNA/P	31

### 2320MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0HNA/P	IO91GI	11	3250	GM4JTJ	593
2	G6TRM/P	JO01QD	7	1966	DL3IAS	534
3	GM4JTJ	IO86RP	3	1531	M0HNA/P	593
4	G4LDR	IO91EC	6	1169	ON4CJQ/P	455
5	M0GHZ	IO81VK	5	783	G6TRM/P	252
6	G3UVR	IO83KH	2	619	GM4JTJ	373

## 3400MHz

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	M0GHZ	IO81VK	5	783	G6TRM/P	252
2	G6TRM/P	JO01QD	4	764	M0GHZ	252
3	G4LDR	IO91EC	5	714	G3XDY	223
4	M0HNA/P	IO91GI	5	699	G4ALY	216

## Overall

Pos	Callsign	1296MHz	2300MHz	2320MHz	3400MHz	Total
1	M0HNA/P	777	1000	1000	893	3670
2	G6TRM/P	587	0	605	976	2168
3	G4LDR	398	134	360	912	1804
4	M0GHZ	142	0	241	1000	1383
5	G4ZTR	1000	0	0	0	1000
6	GM4JTJ	0	0	471	0	471
7	G3UVR	34	0	190	0	224
8	GM4BYF	165	0	0	0	165
9	G6GVI	29	0	0	0	29

## Low Band Championship 2019

Results after four sessions, the best three events count towards the total

### Overall

Pos	Callsign	03/03/2019	07/04/2019	05/05/2019	02/06/2019	TOTAL
1	M0HNA/P	3595	3865	3289	3670	11130
2	M0GHZ	1091	2286	0	1383	4760
3	G6TRM/P	0	908	1266	2168	4342
4	G4LDR	1063	1321	548	1804	4188
5	G3UVR	1541	1511	663	224	3715
6	M3P	0	0	2874	0	2874
7	G3UKV	828	1563	0	0	2391
8	G4ZTR	0	841	0	1000	1841
9	G4KIY	464	283	358	0	1105
10	GM4JTJ	0	0	561	471	1032
11	M0UGA/P	0	1000	0	0	1000
12	G8OHM	0	0	997	0	997
13	GI6ATZ	0	950	0	0	950
14	GM4BYF	290	327	322	165	939
15	G8AIM	0	680	0	0	680
16	G3WJG	0	0	662	0	662

17	G4BRK	0	0	554	0	554
18	GM8IEM	406	0	0	0	406
19	G3YJR	53	302	0	0	355
20	GM4DIJ(/A)	103	195	10	0	308
21	G8DOH	0	0	282	0	282
22	G4BAO	0	228	0	0	228
23	G0LGS/P	0	209	0	0	209
24	G6GVI	0	38	58	29	125
25	G0HIK/P	63	0	0	0	63
26	G1DFL	0	42	0	0	42
27	M0KPW/P	34	0	0	0	34
28	M0XIG/P	0	24	0	0	24

**1296MHz**

Pos	Callsign	03/03/2019	07/04/2019	06/05/2018	03/06/2018	TOTAL
1	M0HNA/P	1000	1000	837	777	2837
2	G4ZTR	0	841	0	1000	1841
3	G6TRM/P	0	347	391	587	1325
4	G3UVR	541	545	179	34	1265
5	M0GHZ	396	622	0	142	1160
6	G4KIY	464	283	358	0	1105
7	M3P	0	0	1000	0	1000
8	G16ATZ	0	950	0	0	950
9	G4LDR	253	219	226	398	877
10	GM4BYF	0	327	197	165	689
11	G3UKV	288	260	0	0	548
12	G8OHM	0	0	441	0	441
13	GM8IEM	406	0	0	0	406
14	G3YJR	53	302	0	0	355
15	GM4DIJ(/A)	103	195	0	0	298
16	G8DOH	0	0	282	0	282
17	G0LGS/P	0	209	0	0	209
18	G8AIM	0	164	0	0	164
19	G6GVI	0	38	58	29	125
20	G4BAO	0	85	0	0	85
21	G0HIK/P	63	0	0	0	63
22	M0KPW/P	34	0	0	0	34
23	M0XIG/P	0	24	0	0	24

**2300MHz**

Pos	Callsign	03/03/2019	07/04/2019	06/05/2018	03/06/2018	TOTAL
1	M0HNA/P	1000	1000	1000	1000	3000
2	G4LDR	0	307	0	912	1219
3	M3P	0	0	450	0	450

**2320MHz**

Pos	Callsign	03/03/2019	07/04/2019	06/05/2018	03/06/2018	TOTAL
1	MOHNA/P	595	865	452	1000	2460
2	G3UVR	1000	966	484	190	2450
3	G6TRM/P	0	561	529	605	1695
4	G4LDR	540	647	158	360	1547
5	G3UKV	540	712	0	0	1252
6	MOGHZ	338	736	0	241	1074
7=	GM4JTJ	0	0	561	471	1032
7=	MOUGA/P	0	1000	0	0	1000
9	M3P	0	0	1000	0	1000
10	G8OHM	0	0	556	0	556
11	G8AIM	0	238	0	0	238
12	G4BRK	0	0	164	0	164
13	G3WJG	0	0	156	0	156
14	GM4BYF	0	0	125	0	125
15	G0HIK/P	51	0	0	0	51
16	GM4DIJ	0	0	10	0	10

**3400MHz**

Pos	Callsign	03/03/2019	07/04/2019	06/05/2018	03/06/2018	TOTAL
1	MOHNA/P	1000	1000	1000	893	3000
2	MOGHZ	357	928	0	1000	2285
3	G4LDR	270	148	164	912	1346
4	G6TRM/P	0	0	346	976	1322
5	G3UKV	0	591	0	0	591
6	G3WJG	0	0	506	0	506
7	M3P	0	0	424	0	424
8	G4BRK	0	0	390	0	390
9	G8AIM	0	278	0	0	278
10	G4BAO	0	143	0	0	143
11	G1DFL	0	42	0	0	42

## RAL Microwave Roundtable

Harwell Amateur Radio Society (HARS) hosted this year's RAL Microwave Round Table on Sunday 16th June.



A very pleasant day was spent at the RAL roundtable in June. We had over 50 visitors who enjoyed the various stalls with things to buy, other visitors to chat to, the talks and of course the food (especially the bacon baps in the morning!)

We had 2 talks during the day, the first on Es'hail 2 (QO-100) complete with a demonstration by Noel, G8GTZ and John, G4BAO.

The second talk was by Peter, G3LTF on 6cm EME when he extolled the virtues of this band for EME.

Round 2 of the G3VVB project competition had 2 entries: from Jen, G4HIZ with a QO-100 boxed transceiver and Dave, G1EHF with a 10MHz GPSDO locked 24GHz signal source. Both entries got the same number of judging points, but eventually Jen, G4HIZ was declared the winner. He was presented with a small engraved trophy by Neil, G4LDR, the UKuG Chairman.

Thanks go to Mike, G0MJW, Ann, G8NVI for organising the event and to the Harwell ARS who sponsored it.





Serious deliberation of the construction contest entries by John G3XDY and Neil G4LDR



Jen G4HIZ collecting the winning trophy from Chairman Neil

## Crawley Microwave Round Table Program Sunday 22nd September 2019



Pictures from last year's event – thanks to Chris G0FDZ

Welcome to the Crawley Roundtable hosted once again at the premises of the Crawley Amateur Radio Club. The morning session will feature the usual 'bring and buy' sale, so if you have surplus radio items then please bring them along.

Again this year following we will be holding a heat for the UK Microwave Group annual Project contest. Please do bring along your constructed equipment or project and enter. Entries do not necessarily need to have been finished during the last year. Please note that the contest will also accept software entries as well as hardware. CARC award the G3GRO trophy to the winner of this round. The winner will also go on to be considered, together with entries from all the other round tables over a year both before and after this event for the G3VVB trophy. We are also hoping that G3LYP will be attending with the UKuW Group chipbank. If you have a forthcoming project then why not contact Mike beforehand to place your orders, which are free for UKuW group members.

Below is the provisional timetable:

- 10:00: Venue opens
- 10:00: 'Bring and buy', general socialising
- 12:00 UKuW Group Project contest round/G3GRO trophy judging commences
- 12:15 Lunch (hot dogs and burger rolls etc. and tea/coffee available)
- 13:15 Welcome by Alun G4WGE/Denis G0OLX and results of the Project contest heat
- 13:30 TBD
- 14:00 TBD
- 14:45 Break – Tea and coffee available
- 15:00 TBD
- 15:45 TBD
- 16:30 End of meeting

The venue is the Crawley Amateur Radio Club's hut and directions can be found at:

<http://carc.org.uk/find-us/>

## UKuG MICROWAVE CONTEST CALENDAR 2019

Dates, 2019	Time UTC	Contest name	Certificates
28-Jul	0600 - 1800	3rd 5.7GHz Contest	F, P,L
28-Jul	0600 - 1800	3rd 10GHz Contest	F, P,L
25-Aug	0600 - 1800	4th 5.7GHz Contest	F, P,L
25-Aug	0600 - 1800	4th 10GHz Contest	F, P,L
15-Sep	0900 - 1700	3rd 24GHz Contest	
15-Sep	0900 - 1700	3rd 47GHz Contest	
15-Sep	0900 - 1700	3rd 76GHz Contest	
29-Sep	0600 - 1800	5th 5.7GHz Contest	F, P,L
29-Sep	0600 - 1800	5th 10GHz Contest	F, P,L
20-Oct	0900 - 1700	4th 24GHz Contest	
20-Oct	0900 - 1700	4th 47GHz Contest	
20-Oct	0900 - 1700	4th 76GHz Contest	
17-Nov	1000 - 1400	5th Low band 1.3/2.3/3.4GHz	F, P,L
Key:	F	Fixed / home station	
	P	Portable	
	L	Low-power (<10W on 1.3-3.4GHz, <1W on 5.7/10GHz)	

## Events calendar

### 2019

Sept 6-8	64.UKW Tagung Weinheim	<a href="http://www.ukw-tagung.de/">www.ukw-tagung.de/</a>
Sept 22	Crawley Roundtable	<a href="http://carc.org.uk/2019/07/09/microwave-round-table/">http://carc.org.uk/2019/07/09/microwave-round-table/</a>
Sept 27/28	National Hamfest	<a href="http://www.nationalhamfest.org.uk">www.nationalhamfest.org.uk</a>
Sept 29-Oct 4	European Microwave Week, Paris	<a href="http://www.eumweek.com/">www.eumweek.com/</a>
October 3/5	Microwave Update, Dallas, Texas	<a href="http://www.microwaveupdate.org">www.microwaveupdate.org</a>
October 3-5	RSGB Convention & Amsat-UK Colloquium	<a href="http://rsgb.org/convention/">http://rsgb.org/convention/</a>
Oct 28-Nov 22	ITU WRC-19, Sharm el-Sheikh	<a href="http://rsgb.org/wrc-19">http://rsgb.org/wrc-19</a>
Nov 2	Scottish Round Table	<a href="http://www.gmroundtable.org.uk/">www.gmroundtable.org.uk/</a>

### 2020

Apr 14	CJ-2020, Seigy	<a href="http://cj.r-e-f.org">http://cj.r-e-f.org</a>
Aug 20-23	EME 2020 Prague	<a href="http://www.eme2020.cz">www.eme2020.cz</a>
Sept 13-18	European Microwave Week, Utrecht	<a href="http://www.eumweek.com/">www.eumweek.com/</a>
Oct 10-16	IARU-R1 General Conference, Novi Sad	<a href="http://www.iaru2020.org">www.iaru2020.org</a>

## 80m UK Microwavers net

**Tuesdays 08:30 local on 3626 kHz (+/- QRM)**

**73 Martyn Vincent G3UKV**