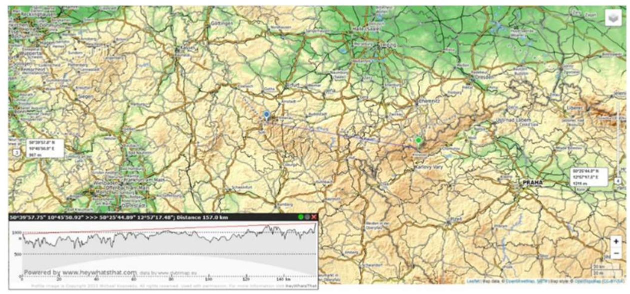
An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

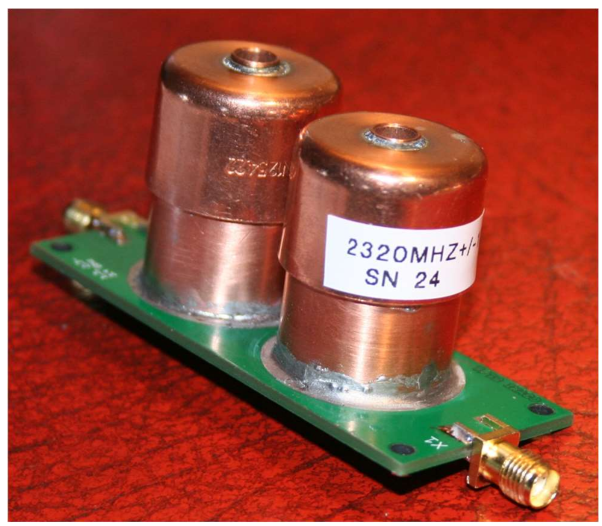
March 2022

Published by the UK Microwave Group

In This Issue



134GHz World Record – 157km Matthias DK5NJ



Pipe cap filters – Ken G3YKI

UK Microwave Group

Subscription Information

The following subscription rates apply.

UK £6.00 US $12.00 Europe €10.00

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

payukug@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

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, rtfd, doc, docx, odt, Pages

Spreadsheets: Excel, OpenOffice, Numbers

Images: tiff, png, jpg

Schematics: sch (Eagle preferred)

Please send pictures and tables separately, as they can be a bit of a problem.

Thank you for you 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.

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 (e.g. 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

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 contact the committee.

The current list is available at

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

UK Microwave Group Contact Information

Chairman: Position vacant	General Secretary: John Quarmby G3XDY	Membership Secretary: Bryan Harber G8DKK
email: chairman@microwavers.org	secretary@microwavers.org Suffolk JO02OB Tel: 01473 717830	membership@microwavers.org Hertfordshire IO91VX
Treasurer: David Millard M0GHZ	Scatterpoint Editor: Roger Ray G8CUB	Beacon Coordinator: Denis Stanton G0OLX
email: treasurer@microwavers.org	editor@microwavers.org Wiltshire IO91DK Tel: 07900 261121	beacons@microwavers.org

Scatterpoint Activity news: John G4BAO scatterpoint@microwavers.org
Contests & Awards Manager: G3XDY as above g3xdy@btinternet.com

Assistants

Murray Niman	Webmaster	G6JYB	g6jyb@microwavers.org
Kent Britain	USA	WA5VJB/G8EMY	wa5vjb@flash.net
Mike & Ann Stevens	Trophies	G8CUL/G8NVI	trophies@microwavers.org
Noel Matthews	ATV	G8GTZ	noel@noelandsally.net
Robin Lucas	Beaconspot	G8APZ	admin@beaconspot.uk
Chris Whitmarsh	mmWaves	G0FDZ	chris@g0fdz.com
Mike Scott	Chip Bank	G3LYP	g3lyp@btinternet.com
Paul Nickalls	Digital	G8AQA	g8aqa@microwavers.org
Heather Lomond	SDR	M0HNO	m0hno@microwavers.org
Neil Smith	Tech Support	G4DBN	neil@g4dbn.uk
Barry Lewis	RSGB uWave Manager	G4SJH	barryplewis@btinternet.com

UK Regional Reps

Martin Hall	Scotland	GM8IEM	martinhall@gorrell.co.uk
Gordon Curry	Northern Ireland	GI6ATZ	gi6atz@qsl.net
Peter Harston	Wales	GW4JQP	pharston@gmail.com

International

Kent Britain	USA	WA5VJB/G8EMY	wa5vjb@flash.net

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 Neil G4DBN for more information**

5.7GHz 10GHz 24GHz 47GHz 76GHz

UK Microwave Group AGM Calling Notice

Notice is hereby given that the 2022 Annual General Meeting of the UK Microwave Group will be held at 10:00am on Sunday, 1st May 2022, by Zoom. Meeting details are given below.
This will include the election of the officers of the committee and the presentation of the Chairman's, Secretary's and Treasurer's Annual Reports.
There are vacancies for the Chairman of the group, a PR Manager, and other committee roles.
New committee members will be very welcome.
Any UKuG member wishing to stand should notify the UKμG Secretary, John Quarmby G3XDY, by 24th April 2022.
If you have any agenda or AOB items for the AGM then please contact the UKμG Secretary, John Quarmby G3XDY by 24th April 2022, email: secretary@microwavers.org

UK Microwave-Group is inviting you to a scheduled Zoom meeting.
Topic: UKuG AGM 2022
Time: May 1, 2022 10:00 AM London
Join Zoom Meeting
https://us06web.zoom.us/j/86243385552?pwd=TUx3blgrOTBmVTU2bitaM1NyQndLdz09
Meeting ID: 862 4338 5552
Passcode: 904759

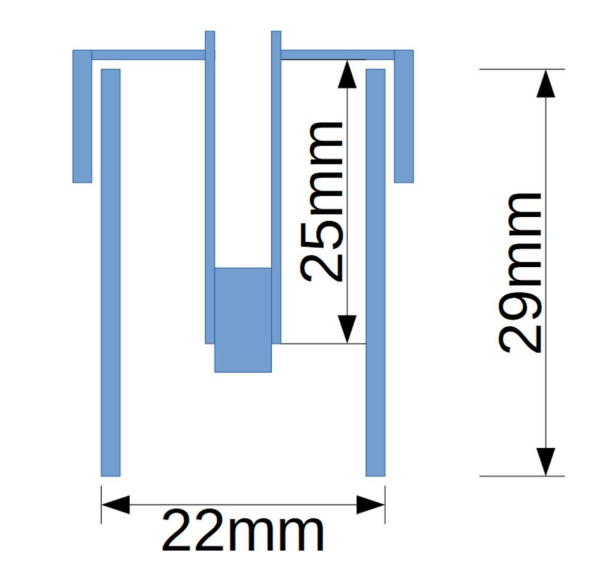
Pipe Cap Filters… Some variations on a theme

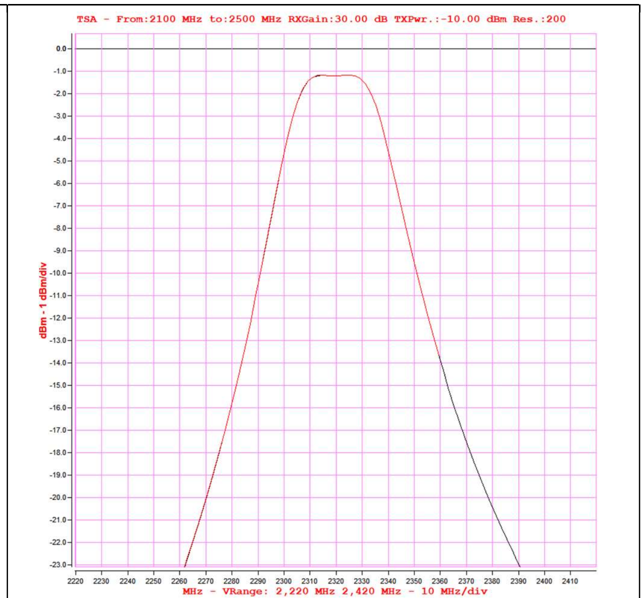
Ken G3YKI

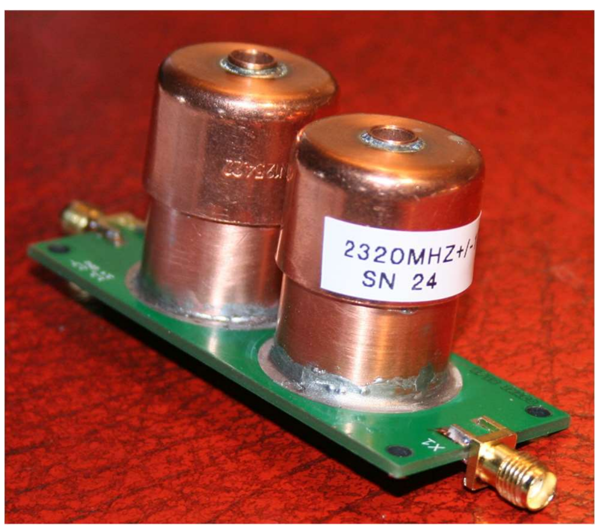
The pipe cap resonator is well known, originally as inter-stage selective coupling in multiplier chains and transverter amplifiers. Here are a few variations which may be of interest.

Resonators for lower frequencies

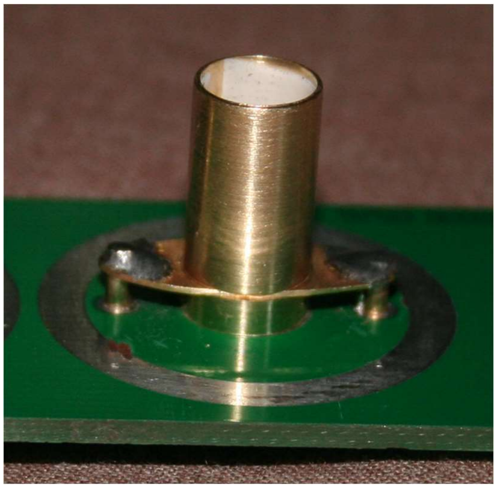
15 mm and 22 mm pipe caps can easily be used at frequencies in the range 3 to 10 GHz. For lower frequencies, I have seen it suggested to go to larger pipe sizes. However, for this type of resonator what you really want is extra length, and the length does not increase very much for larger pipe sizes. It is possible to use a short length of pipe to extend a resonator. My filter for 2.3 GHz was done like this.





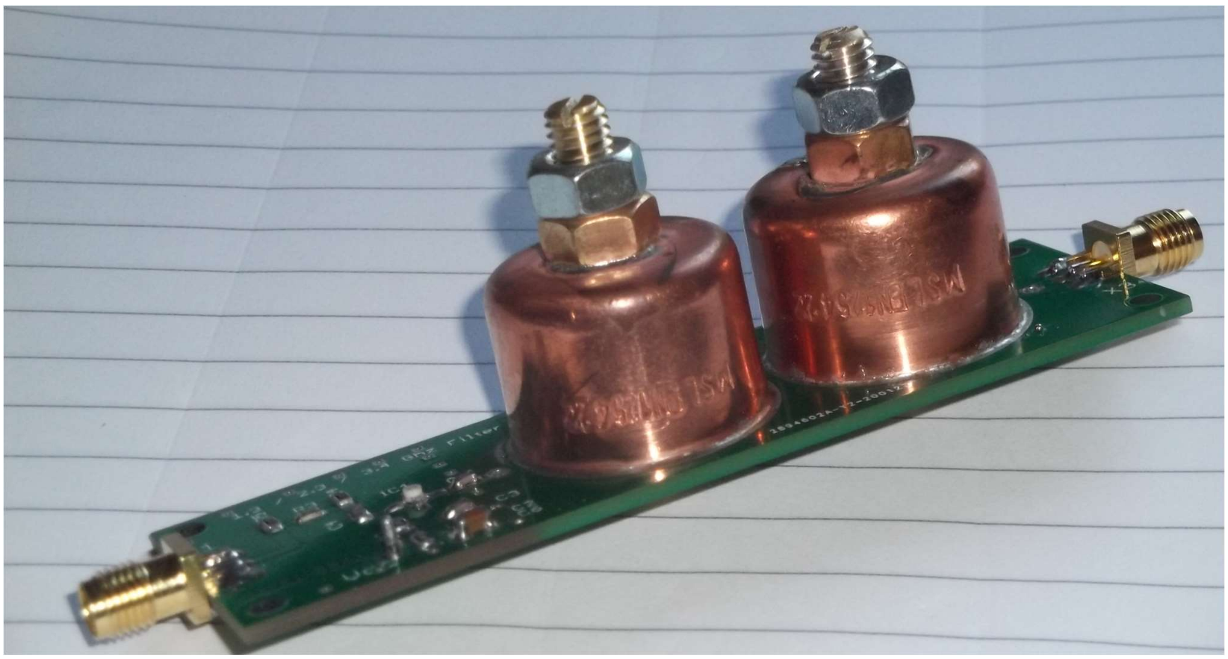


Compact resonators for lower frequencies

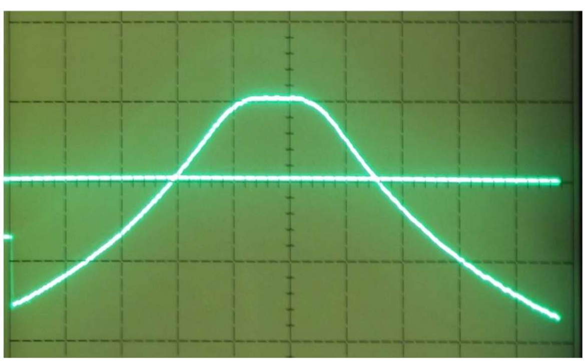


It is possible to make a resonator that tunes down to 1.2 GHz entirely within a 22mm pipe cap if a hollow inner is provided and the tuning screw can penetrate down into it

My version used taps on the inner for the couplings because I suppose the usual arrangement relies on capacitive coupling between the 'hot' end of the screw and the probes. As the screw end is screened here, I assumed the probes would not work, though I have not tried it.

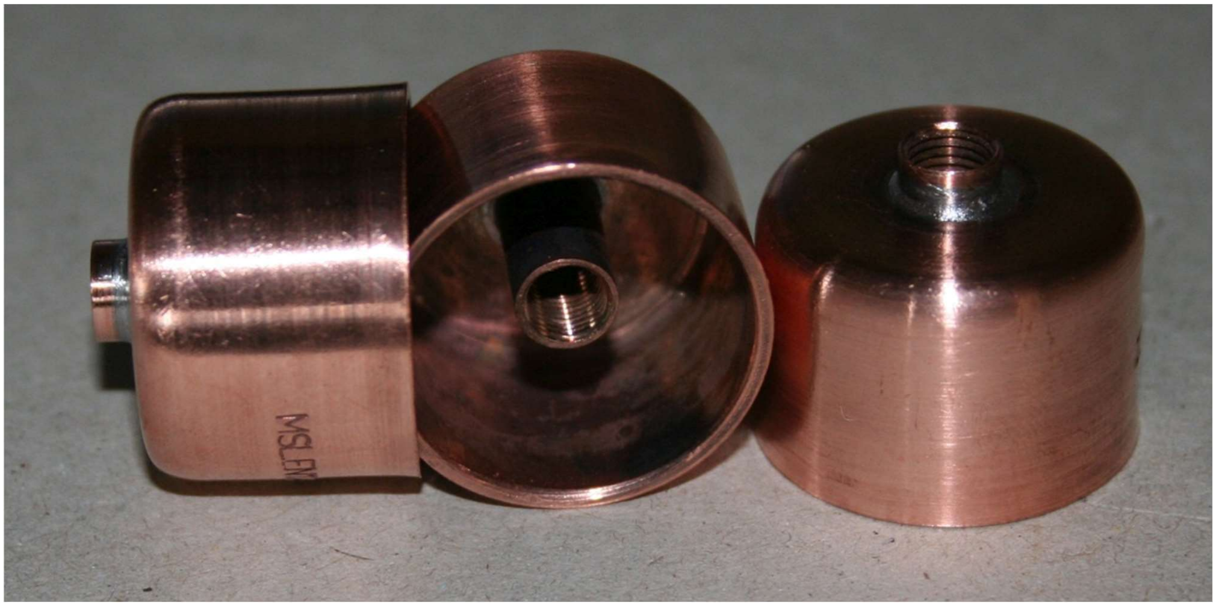


The 1.3 GHz filter shown here is followed by a MMIC amplifier and an attenuator on the same PCB which would make it suitable for use where it might be used into a variable or unknown load without any undue influence on the filter response. It shows an overall gain of 10dB and bandwidth of 18MHz at 3dB.



Reducing the losses in resonators

With the outer of the resonator being copper, losses in the standard arrangement are predominantly in the tuning screw. The screw thread means that the current traverses a path about twice the actual length of the screw and the contact between the screw and the pipe cap is at the point of maximum current. These disadvantages can be overcome by adding an inner made of copper tube as shown in the sketch above. With the tuning screw just protruding from the inner, the current across the threads is greatly reduced. In a 22 mm cap I have used ¼" tube which can be threaded inside 7/32" by 40 TPI and can achieve a sufficiently tight fit that adjustment is convenient but no separate locking device is required. The resulting resonator is also more compact than one with a protruding screw and locknut.

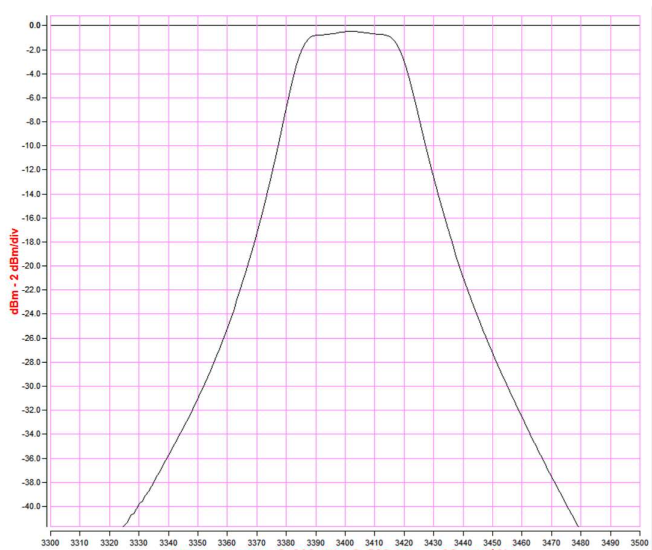


In many cases the loss of the usual tuning screw will not be a problem, but if you are aiming for a narrow passband this modification may result in a significant improvement.

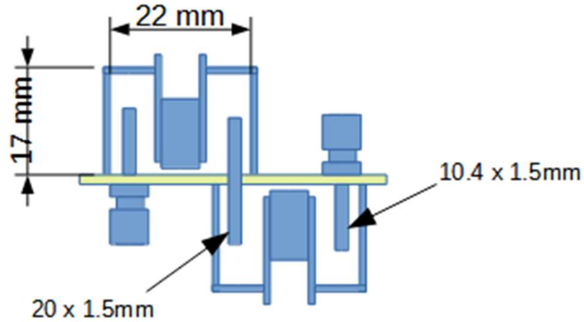
Multi-stage filters

Several people have shown how to make such filters, generally mounting the resonators on a piece of double sided PCB, with the input and output as well as the link between resonators made from semi rigid cable. The cable linking the two resonators (length not always specified, but must surely make a difference to the results) is not necessary if the two resonators are on opposite sides of the PCB. They can then be coupled by a single piece of wire. This style of filter can be extended to three or more resonators. Cable or connectors can be used at the input and output.

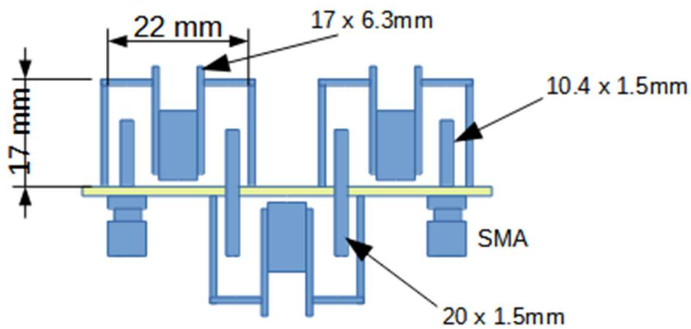
Using the low loss resonators, a 3 cavity filter for 3400 MHz with a bandwidth of 30 MHz has a through loss of 1 dB.



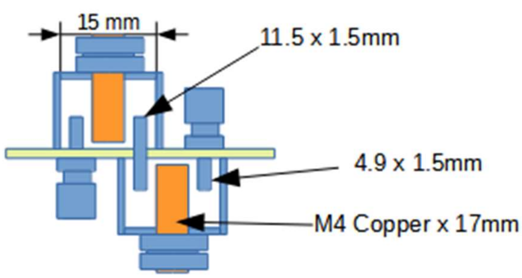
3.4 GHz 2 Cavity Filter 30 x 48mm

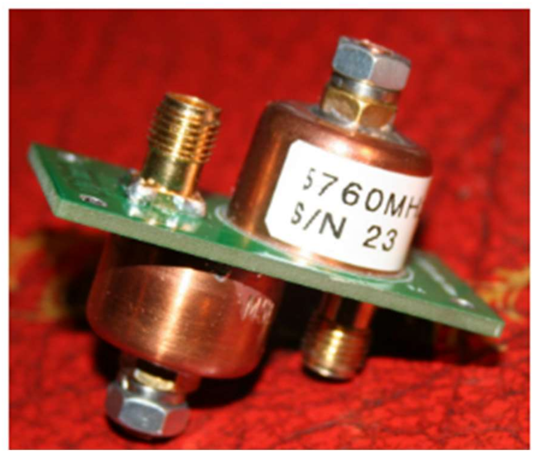


3.4 GHz 3 Cavity Filter: 30 x 64mm



5.7 GHz 2 Cavity Filter 24 x 42mm





Some Initial Testing of Mobile Data Modes via QO-100

Andy Talbot G4JNT March 2022

Introduction

In the mid-1980s I attended a conference at the IEE entitled "Mobile Systems for Satellite Communications and Navigation". One of the papers that was particularly intriguing was about some military experimental tests of mobile data transmission through the then-new Skynet-4 satellite, using 300 baud FSK on the 7/8GHz up/down links. The antennas were dielectric "mushroom shaped things" for omnidirectional azimuth coverage, with an elevation pattern that was optimised for the area of operations. The gain would have been roughly around 6 - 8dBi and, if memory serves correctly, transmit power was a 'few' watts. Solid state power at GHz was expensive and rare in those days. Roll on to now, with the advent of the geostationary QO-100 satellite transponder I wondered what might be possible for one way transmission of data through that satellite from a mobile platform like a car.

Antenna

The antenna used for the Skynet trials was a customised dielectric unit for which I had no details and, in any case, would be appreciably larger for 2.4GHz than that for the Skynet tests, so some other design was needed. It needed ideally to be circularly polarised and omnidirectional in azimuth. I did originally contemplate using a 'big-wheel', one of the small printed antennas available, from WA5VJB and did try a test transmission from a 1 Watt PA through the satellite using one of these, but being horizontally polarised there is an inherent 3dB loss in gain. A carrier was just detectable when looking at the receiver output in narrow bandwidth of a few Hz with the '*Spectran*' spectrogram software, but the signal was quite weak, and didn't appear strong enough to be useable.

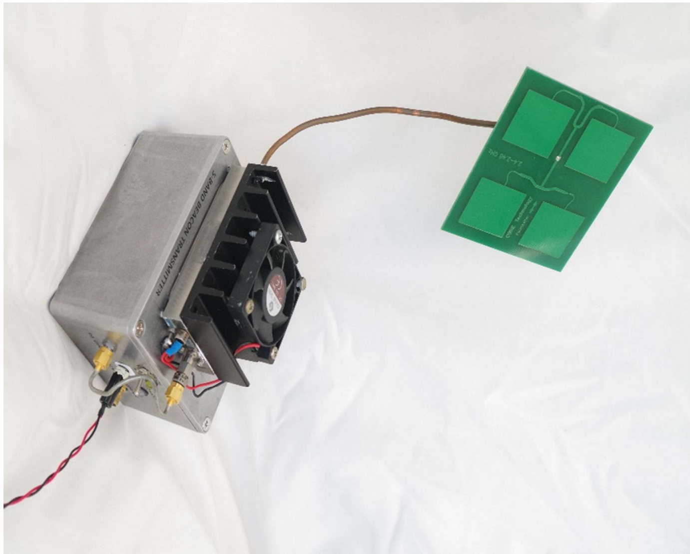
The Quadrifilar helix or QFH is popularly used for GPS/GNSS receive antennas and fits the omni / circular requirement perfectly. There are a few versions of this for home construction to be found on the web and I had successfully built a couple in the past. The dimensions were linearly scaled for the higher frequency, reducing them by a factor of 1.575/2.4 and a similar QFH antenna constructed for 2.4GHz. The gain is of the order of 2 – 3dBic. A test with 1 Watt of carrier did indeed result in a signal a few dB up on that from the big-wheel.

Doppler Shift

At 2.4GHz, Doppler shift from a moving antenna in a line directly to or from the receiver results in 8Hz per metre per second, or about 3.6 Hz / mph, change in frequency. The satellite is at an elevation of 26° so the resolved velocity at that elevation is reduced by COS(26°) = 0.9 of the resolved ground speed in the satellite direction. So travelling at 40mph on a bearing exactly towards or away from the satellite would introduce 128Hz of Doppler shift; 70mph would give 224Hz.

Initial Tests

Several years ago I had put together a small S-Band personal beacon source transmitting the nine-tone JT9D mode, part of the WSJT suite, on 2.3GHz. The hardware was based around a GPS module, PIC controller and LMX2541 Fractional-N synthesizer using an ovenned oscillator as the reference. A surplus 1 Watt power amplifier completed the personal beacon source. With the QFH antenna, this gave around +3dBW EIRPc towards the satellite



JT4D was selected as a datamode, its 39Hz tone spacing being enough to take care of any scattering from moving objects likely to occur on a path between fixed locations.

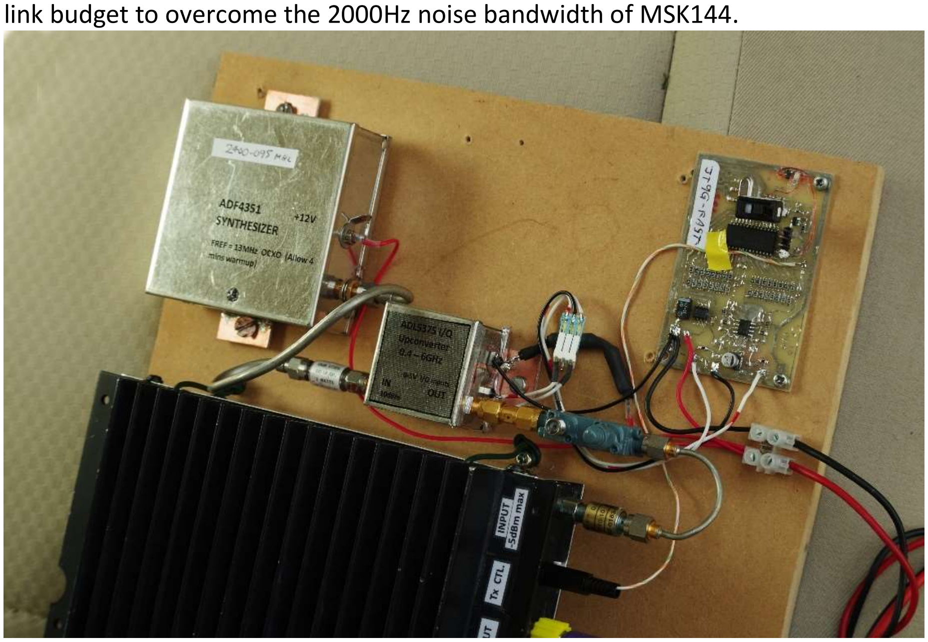
In the absence of any real published QO-100 payload specification, a spreadsheet was put together for the link budget to QO-100, based on estimated and approximate guesstimates for the transponder parameters. From this it could be seen that with 3dBW EIRP in the reference bandwidth of 2500Hz used for all WSJT modes, a perhaps rather optimistic S/N in that bandwidth of -10dB might be expected from this beacon source. Even after allowing a decent fade margin this ought to be more than adequate for JT9. However, JT9 is a narrow band mode with a symbol rate and equivalent noise bandwidth of just 1.74Hz. So it would be unlikely to be able to withstand much changing Doppler shift over the 50 second transmission period.

	Satellite Link Budget			G4JNT				
Tx Power	1	*Watts*						
Tx Ant Gain	3	*dBi*	Ground Station EIRP	3.0	*dBW*			
Uplink Frequency	2400	*MHz*						
Signal (ref) Bandwidth	2500	*Hz*						
			Satellite Parameters			Ground Station Parameters		
Distance	38000	*km*	Uplink Path Loss	191.6	*dB*	Downlink Path Loss	204.4	*dB*
			Rx Signal power at sat	-170.6	*dBW*	GS Rx noise Temp	115.1	*K*
Sat Rx Ant Gain	18	*dBi*	Sat Rx noise Temp	300.7	*K*	GS G/T	13.4	*dB(/K)*
Sat Rx Ant Temp	250	*K*	Sat G/T	-6.8	*dB(/K)*	Prx (signal)	-182.0	*dBW*
Sat Rx Noise Figure	0.7	*dB*				Sat Noise Received	-181.3	*dBW*
Transponder Gain	140	*dB*	Signal Tx Power from sat	1	*mW*	Local Rx Noise (ref BW)	-174.0	*dBW*
Sat Tx Antenna Gain	19	*dBi*	Tx signal EIRP	-11.6	*dBW*	Sum of noise sources	-173.3	*dBW*
			Tx noise EIRP (in ref BW)	-10.8	*dBW*			
Downlink Frequency	10490	*MHz*						
Rx Antenna Gain	34	*dBi*						
Antenna Temp	40	*K*						
Rx Noise Figure	1	*dB*						
Received S/N	**-8.8**	*dB*	**Sat Tx / Local Noise**	**-7.2**	dB			
			Total Noise Floor Elevation	**0.8**	dB			

This proved to be the case when transmitting from a car with the QFH antenna on a mag-mount on the roof. Decoding of the beacon transmission was consistent and reliable when the vehicle was stationary for the entire transmission period of 50 seconds, and the antenna had a clear view of the sky in the satellite's direction. But not one single decode was ever achieved while moving. Even a test on a long straight road at constant speed failed. It was quite clear that the normal slow modes in the WSJT suite were completely unsuitable for mobile QO-100 operation.

Fast Modes
WSJT-X has a couple of fast modes in its armoury. These are not used in a time synchronous manner, have no need for GPS timing and are targeted at burst type communications such as meteor scatter and aircraft reflections. The two of note are MSK144 and four variants of JT9, JT9E/F/G/H-Fast. The short transmission nature of these and their wider bandwidth ought to be able to overcome the issues of Doppler spreading and fast-fading inherent with mobile operation. But a faster symbol rate leads to reduced sensitivity and needs a higher received S/N to work.
The WSJT-X user guide https://physics.princeton.edu/pulsar/k1jt/wsjtx-doc/wsjtx-main-2.5.4.html does not quote threshold S/N values for these fast modes, but values can be estimated from a knowledge of the symbol rate and by studying text book curves for S/N versus error rate for the particular modulation in use. This suggested a S/N of around 0 to +1 dB (ref 2.5kHz) would suffice for MSK144 and around -10dB for JT9G-Fast with its 100Hz symbol rate. The other JT9-fast rates scale in threshold sensitivity with their respective symbol rates.
A 10 Watt power amplifier had become available since the original tests were made, but to compensate for the now increased power, transmission should now be limited to short bursts that could lead to a low duty cycle; aiming for an averaged power consumption similar to the original slow-mode tests.

MSK144 Beacon
MSK144 using Minimum Shift Keying modulation is quite straightforward to generate in a Direct Digital Synthesizer. The frequency is shifted by exactly +/- 500Hz according the '1' / '0' pattern in the message data string at the 2000 baud data rate. 144 symbols per frame at 2000Hz takes 72ms, and frames are repeated for a whatever burst length is requested. DDS sources cannot, however, directly generate 2.4GHz.
A design for a baseband quadrature DDS using a PIC microcontroller is given in annexe A of http://g4jnt.com/PIC_DDS.pdf. This supplies dual I/Q channels at positive or negative frequencies from a Numerically Controlled Oscillator in the PIC firmware, with the audio/baseband output generated via a D/A converter made from an R-2R ladder. This can be seen at the top right of the photograph below.
Connecting the low pass filtered I/Q output to an AD8346 or ADL5375 quadrature upconverter chip with an LO at 2.4GHZ allows a signal at this frequency to be generated, modulated by programming the DDS. The simplicity of MSK144 modulation meant that only small changes to the PIC code were needed to allow the baseband DDS to generate a fixed MSK144 message from a set of pre-stored symbols. A complete 2.4GHz beacon transmitting 10 Watt bursts of MSK144 was put together into a package that could be moved around rapidly for testing. A photo of the breadboard can be seen below.
Unfortunately the satellite link budget was a bit marginal with 13dBW EIRP of MSK144. From a fixed location with a clear view of the sky, and a bit of antenna position optimising, some MSK144 bursts were decoded through QO-100. But only perhaps 30 – 50% of all those transmitted. An attempt to try this mobile with the antenna on a vehicle roof ended up as a total failure, with no decodes at all even when stationary. Clearly several more dB were needed in the link budget to overcome the 2000Hz noise bandwidth of MSK144.



Breadboard 2.4GHz Beacon Test Source, ADF4351 Synthesizer, ADL5375 Quadrature upconverter and 10W PA.
JT9 tones are generated as baseband I/Q signals in a 16F870 PIC and R-2R ladder D/A converter, low pass filtered and fed to the upconverter.

JT9-Fast

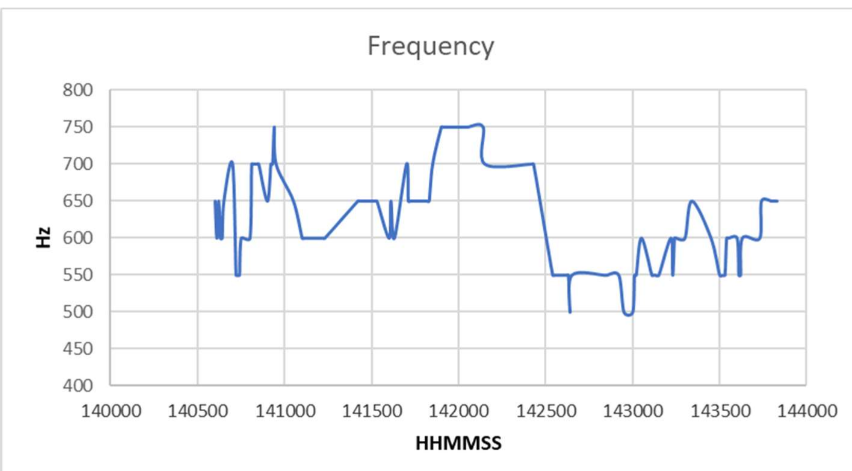
With a bit of care over optimising code and speed of execution, it was possible to rewrite the existing Baseband DDS hardware to generate JT9 at any desired speed or tone spacing, with a fixed test message from a pre-stored set of symbols. The JT9-Fast submodes E-H have symbol rates / noise bandwidths of 25/50/100/200Hz respectively and as a starting point the 100Hz spaced JT9G-Fast mode was programmed into the PIC. Free Text message format was chosen so that the WSJT software would not try to use any form of averaging during the decode process – which might otherwise distort reception tests with a message that remained unchanged from one timeslot to the next.

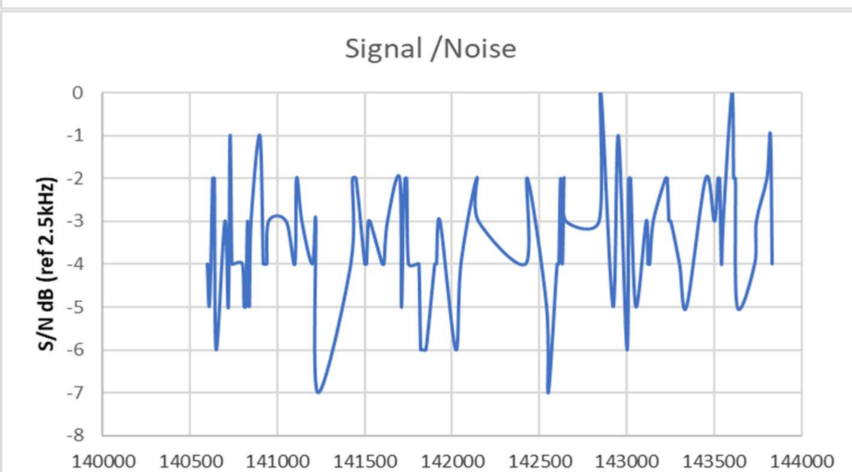
The burst length was set to be about 2.5 seconds, which means that a frame of data is transmitted four times within each burst. (JT9 has 85 symbols, so when transmitted at 100 baud it takes 0.85s per frame, with identical frames stacked end to end for each transmission period). The repeat period was set at 10s, merely in order to save having to wait too long during tests and give plenty of result sets for analysis.

Mobile Tests

The first test was an immediate success. A circular drive around suburban roads and country lanes over a period of 32.5 minutes (1950 seconds) resulted in 100 successful decodes using a 10 second decoder cycle time to match that of the transmitter. This is a success rate of 100/195 = 51%. Successful decodes were generally bunched together so it is quite reasonable to assume most of the failed decodes are caused by shading and blocking of the signal path to the satellite by trees and houses along the route.

A plot of the reported decode frequency and S/N over the test period are shown below. The measured frequency has a direct relationship to the Doppler shift on the uplink caused by relative vehicle velocity in the direction of the satellite. WSJT-X only reports this to a resolution of 50Hz for the JT9G-Fast mode; the plot clearly showing this granularity. As the drive was over meandering roads at modest speeds of no more than 40mph, and generally a fair bit slower, it is difficult to relate the Doppler pattern to the route taken. Time is shown as HHMMSS on the X axis.

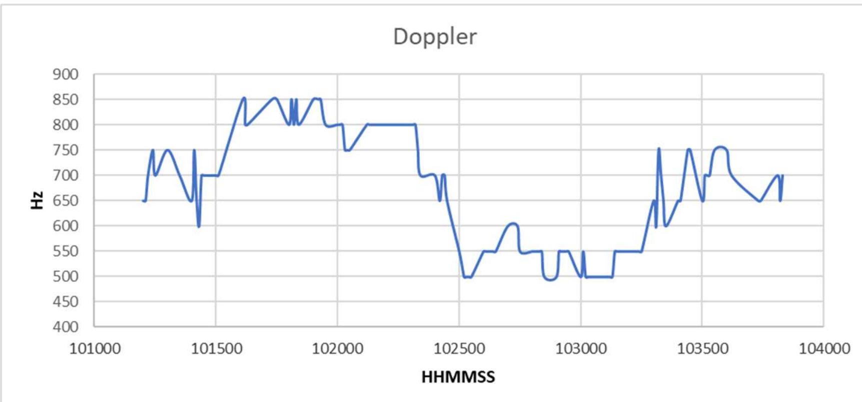


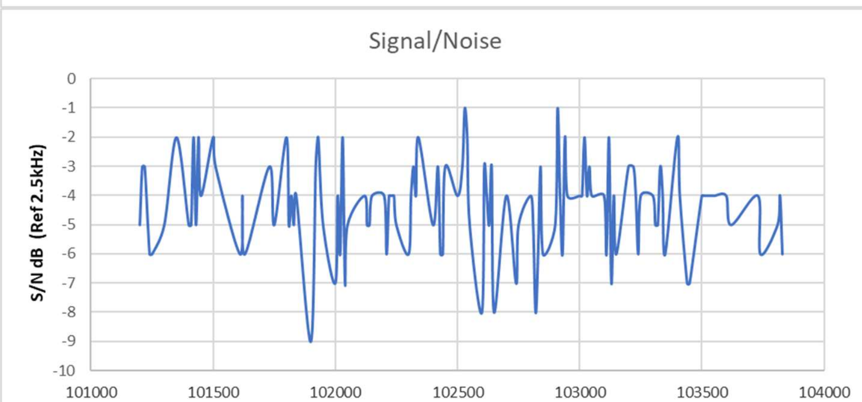


A second test was made along the M27 motorway, out and return from J8 (Hedge End) to J11 (Fareham), driving at a more or less constant 60mph. Speed limit signs were active, with all vehicles maintaining a well-behaved constant speed, very suited to this sort of test. This section of motorway is almost straight and runs on a bearing of roughly 120/240°, meaning that a significant portion of the vehicle's velocity is in a direction away from or towards the satellite at a bearing of 146°.

This time the run was 26.5 minutes or 1590 seconds, 159 time slots, from which there were 120 successful decodes; a 75% successful decode rate. The view from the M27 motorway to the satellite is significantly clear as it is almost in line with the road and no doubt leads to the higher success rate.

The Doppler and S/N plots from this run are shown below. Note how the out and return Doppler shifts are very evident, again subject to 50Hz decoder reporting granularity. The U-turn at Junction 11 was made at 102400. The small median sections at each end are from the 2 miles of local suburban roads used to access the motorway at Junction 8.





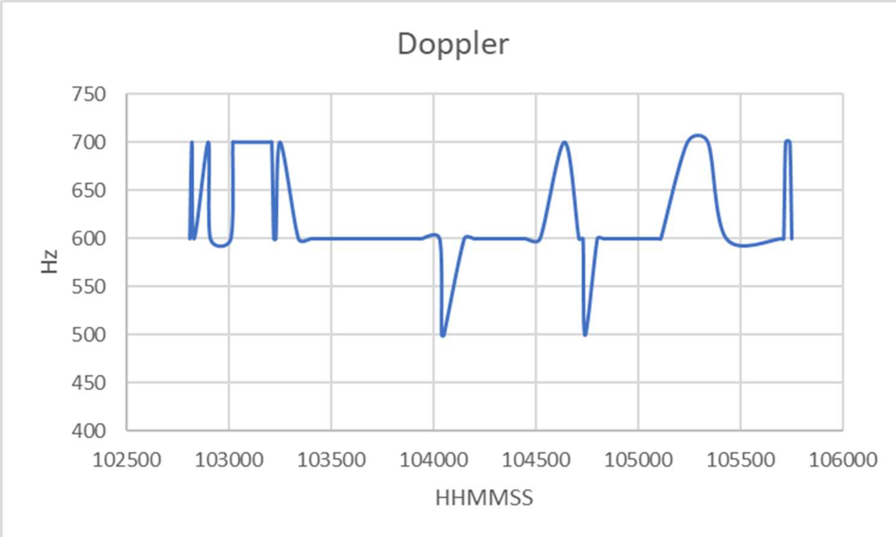
The lowest reported S/N at which a decode succeeded was around -9dB, with most lower troughs at -7 or -8dB, so the original estimate of a -10dB S/N threshold for JT4G-Fast was slightly optimistic. At this EIRP there is plenty of margin, with the best S/N report being 0dB and averaging at around -4dB.

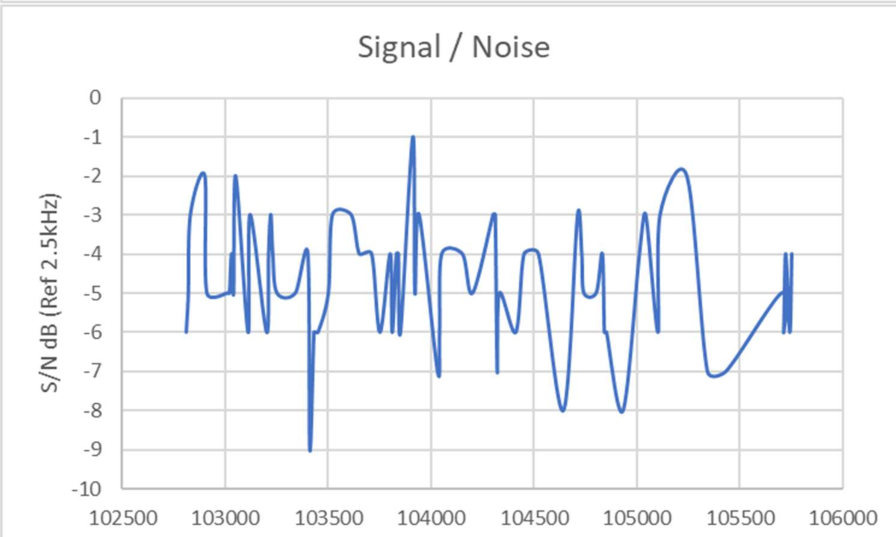
Higher Rate

The tests at 100Hz JT9G-Fast rate showed remarkable resilience, with at least 50% of all transmission bursts decoded, so a test was made at a higher symbol rate. The source was reprogrammed for JT9H-Fast, with 200Hz symbol rate. The burst duration was set to 1.7 seconds in order to keep the same number of frames, four, as used previously but repeated at the same interval of 10 seconds. The transmission duty cycle is now lowered to 17%.

A test route over suburban and rural roads similar to that of the first run was driven, for a transmission period of 29.7 minutes (1780 seconds, 178 Tx bursts). A total of 70 of these shorter bursts were successfully decoded, a success rate of 39%.

For this higher speed mode the WSJT-X software only reports decoded frequency to the nearest 100Hz, so the Doppler plot does not add much of value. The S/N plot shows a similar mean S/N, as would be expected as the same signal strength is normalised to the same bandwidth. A slightly higher minimum value shown reflects the higher minimum threshold S/N for the faster symbol rate, although interestingly both symbol rates did result in a decode at the same minimum S/N of -9dB





WSJT-X and Frequency Settings
The WSJT-S software requires that an Rx tone frequency be set, corresponding to the lowest tone of those transmitted. The default is 700Hz when the fast modes are selected by ticking the 'Fast' checkbox with JT9E – JT9H selected. A frequency tolerance around this value over which the decoder will search also needs be specified. This 'Tol' setting has to be made wide enough to accommodate the maximum expected Doppler shift likely to be expected, plus any tuning discrepancy or frequency drift. A value of 300Hz was used for these tests. The transmitter was locked to an oven controlled oscillator and stayed within a few tens of Hz of nominal. The Receive system used a fully locked LO chain accurate to a few tens of Hz at 2.4GHz; Q0-100 exhibits about 100Hz peak to peak of diurnal Doppler shift, so for these tests all frequency uncertainties were no worse than any expected Doppler.

Conclusions
This short test has shown that using one of the fast modes within the WSJT suite allows reliable one-way messaging through the QO-100 satellite from a moving vehicle at motorway speeds, from a small fixed antenna at a power level commensurate with readily available Wi-Fi power amplifiers. Such message bursts are useful for tracking, telemetry and warning / alerting purposes.
Both JT4G-Fast and JT4H-Fast show a quite acceptable level of reliability of burst decodes, 50% and 39% respectively on urban / rural roads with shadowing. The theoretical 3dB reduction in sensitivity of the H mode over G does not appear to be borne out on this single test, other than in a slightly reduced decode rate, 50% to 39%. This could be due to the shorter individual frame length making the faster version more resilient to fast fading and fluttering. Doppler

shift does not appear to be as issue, at least up to 60mph with the slower JT9G-Fast when used with a Rx tolerance of 300Hz. JT9H-Fast was not tested at speed on the motorway as, to be a worthwhile test, speeds up to 100mph really need to be used here! For slower vehicle speeds combined with lower power operation the two slower 25 and 50Hz variants might be worth investigating.
A fixed message was used for these tests for simplicity of source hardware. Encoding of JT9 into the 13 character free text format is a straightforward process and has been demonstrated in the older 16F family of PIC processors used here. With the high reliability of decodes, multiple repeats of messages are not necessary and longer messages could be built up by splitting into multiple 13-character message formats.

Editors Comments

Echoing the comments of Mike K6ML:
Congrats to DB6NT & DK5NJ; they set a new record of 157 km on 134 GHz (and had one way copy on 122, same path) using DB6NT designed triband QRO radio (200 mW on 122 / 100 mW on 134 / 50 mW on 241 -- wow!). Impressive!
The 122 / 134 GHz transverter used by Michael DB6NT, has a VDI doubler capable of 200mW out with 0.5-0.6W drive 61-67GHz.
Can I have a couple please…….

https://dk5nj.de/2022/03/16/new-world-record-on-the-134-ghz-band/
http://www.db6nt.de/fileadmin/userfiles/_pdf/download_archiv/CW-Power-TX-for-122-and-134-GHz.pdf

Thanks for all the copy this month, long may it continue…

Microwave Round Table Dates

Martlesham 24th April 10.00 – 15.30
RAL 19th June 10.00 – 16.15
Finningley 25th – 26th June - Provisional
Crawley 18th September 10.30 -14.00

More 122GHz records

New French record between F1VL/P & F5BLC/P now 59.2 Km on 122 GHz :

https://youtu.be/VEQVGa15VBw

Components

We are Chris and Jane Harrison of Harrison Electronics from Cambridgeshire and used to sell electronic components at the Amateur Radio Rallies but have now retired. We still have a lot of components left and have listed them on our web page at low prices as we now live on the west coast of Cumbria and is too far and uneconomical to travel to radio rallies any more
www.harrisonelectronics.co.uk
If any members of your club are interested in any of our parts we have for sale , we have a 25% discount code for amateur
radio club members.

CODE: ARCDiscount

We use ecrater for our shop front which has a shopping cart and PayPal payment facility. No registration required, easy to use. Best regards Chris and Jane

World Record on 134GHz

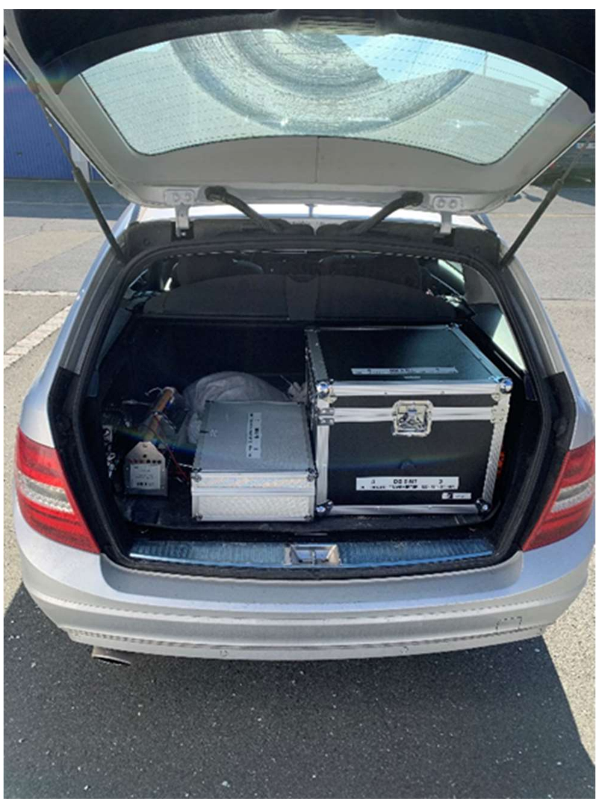
from the website of Matthias DK5NJ with permission

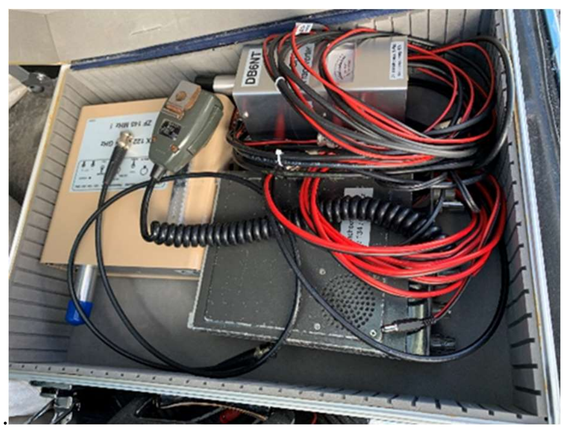
Since our records last year, see https://tinyurl.com/vjyfszmm, my father, Michael DB6NT and me, Matthias DK5NJ, have been thinking about how we could further expand our distance records in the 122, 134 and 241 GHz amateur radio bands.

Our experience so far has shown that we rely on good weather conditions, e.g. very low humidity, no rain, little wind, low dew point and air temperatures that are as cold as possible. Michael DB6NT therefore observed the weather data on various websites on a daily basis, especially during the winter months. The weather conditions meanwhile fluctuate frequently even in the winter months and therefore it was necessary to react quickly if the weather met the conditions. Until August 2021, I, DK5NJ, lived near Munich, but then moved back to my original home in Upper Franconia with my family. So now the spatial proximity to my father and QSO partner Michael, DB6NT was guaranteed and nothing stood in the way of a quick departure with suitable weather conditions.

But of course, the locations must also meet certain requirements for record attempts on the mmWave bands. The two locations must be in sight of each other. In practice, however, the optical view of each other always depends on the weather. That rules out most locations right from the start – as is almost always the case in amateur radio, the higher the mountains, the better.

Unfortunately, high mountains and hills often cause another problem: They are difficult to reach by car (no access possible or permission is missing). The dishes, feeds, transverters, etc. are almost all one-of-a-kind items that were developed in-house or built by friends (e.g. dish tnx to Rudi, OE5VRL). Since our sensitive equipment – which is almost irreplaceable if lost – is stowed in transport-safe boxes and is a bit heavy, it naturally had to be possible to bring and set it up safely on site.





2x battery, case for FT-290 und 76 GHz Transverter and big case for mmWave-station with dish

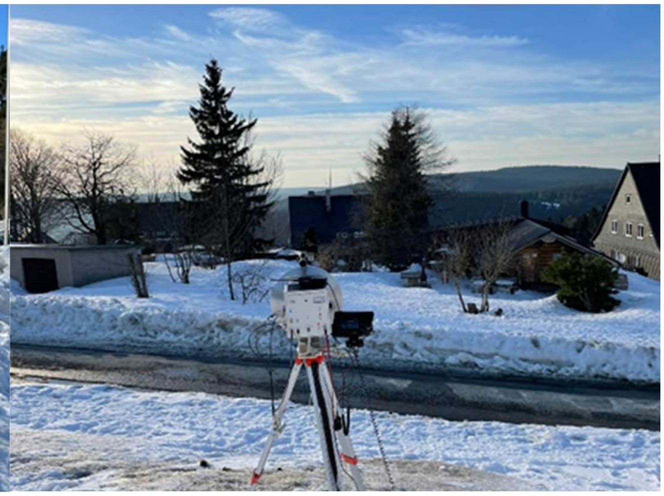
right: *Here is a photo from the trunk of DK5NJ:*

(Tripod is on the back seat)

Distance from the Aschberg to the Leipzig Tower 92.8 km

So, we started looking for a location. After a number of reconnaissance trips and on-site visits, two locations emerged that would be suitable for a spontaneous test (reachable in a max. 2-hour drive) if the weather conditions were right. The weather report on the evening before March 1st, 2022 looked promising and so we decided to give it a try.

Michael DB6NT packed his equipment in the car and drove to the Aschberg (913 m ASL) near Klingenthal in **JO60GJ03RO**.

Matthias, DK5NJ drove together with the equipment to the Leipziger Turm/Sachsenturm near Schmiedefeld am Rennsteig in **JO50ON60BJ.**

The tower itself was not accessible here and the restaurant was closed. However, this had the advantage that apart from a few hikers, there was not much public traffic to be expected. After many years of portable experience as an amateur radio operator, the polite inquiries of less passing tourists such as e.g. B. “Excuse me, what are you doing here” can be processed quickly and routinely

Here are a few pictures of the station setup at DK5NJ below the Leipzig tower:




To be on the safe side, we had – as we are used to from other DXpeditions – some of the equipment with us twice. So were e.g. 2 batteries, 2x FT-290 etc. taken up the mountain as a backup. As cross frequency we used the 70cm relay DB0NAI and two handheld radios.

On this cross-connection, we told each other that one had now arrived at the location, had set up and was QRV. On the mmWave bands it is extremely important that the parabolic antennas of both stations are precisely aligned with each other. So, it is usual to start "beaming" on a lower frequency band, then slowly optimize it and only switch to a higher band after the antenna has been perfectly adjusted.

To turn in the approximate direction of the antenna, Michael and I each used a conventional compass. We had calculated the corresponding angles at home beforehand. The first SKED should take place on the .200 in the 76 GHz band. However, the first CW carrier signal from DB6NT in the 76 GHz band arrived shockingly weak with just S5 very quiet. Disappointment spread and doubts arose: Were the weather conditions not as good as announced? I went through all the scenarios in my head: Did I wire everything correctly? In our beacon tests a few weeks earlier, was the scope set up correctly? Is the receiver working correctly?

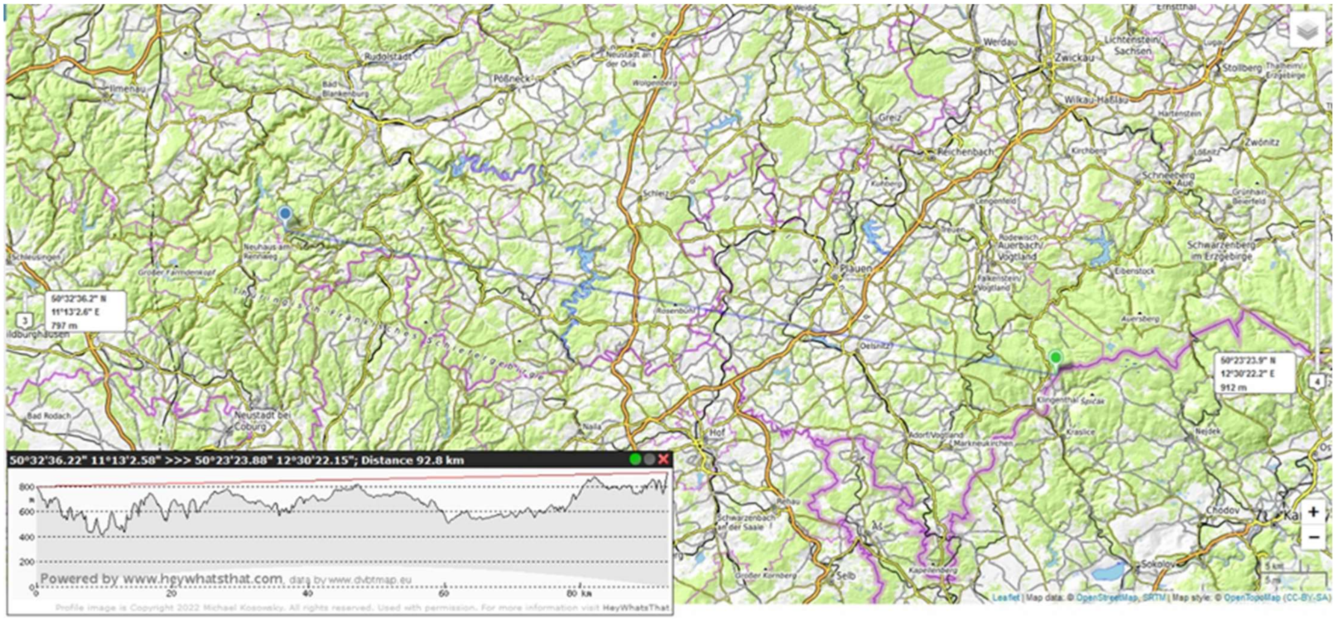
Now that we had come a long way and everything was set up, we didn't want to give up yet. Michael went to receive and I sent a continuous FM carrier on 76 GHz. My signal with S4 was similarly weak. We just didn't want to believe it was going so weak. I asked DB6NT to provide another FM carrier and simply beamed (rotated the antenna) back and forth in a large radius of about 25 degrees. Suddenly his signal could easily be heard with several dB over S9. Apparently, the compass was deflected by surrounding metal and thus the original alignment was not correct. On these bands, every degree counts. But it doesn't matter – the joy of the extremely strong signal immediately motivated me to continue. Now we turned the transmission/reception around again and then it was a matter of "weakening" the signal a little bit in order to be able to turn the mirror in even more precisely when the signal was quieter.

Then I converted my feed to the transmitter module for 122 GHz and put a CW beacon signal as a continuous carrier on the .200. You have to be extremely careful not to twist the laboriously aligned antenna again when changing the feed modules. The CW signals were very loud and on 122 GHz it worked with 59+. The signals in the 134 GHz were even louder due to the lower path attenuation caused by physical factors. At 241 GHz it was a bit quieter but still very loud. Out of sheer euphoria, we also exchanged the reports 599 here, which we corrected to 559 in the second round. To the great joy of both sides, we can now successfully announce that we were able to set 2 new IARU Region 1 records on the 134 and 241 GHz bands that day.

Here is the table with the data:

Tuesday, March 1st 2022
DK5NJ at the Leipigerturm (797 m ASL) near Schmiedefeld **JO50ON60BJ**
DB6NT at the Aschberg (913 m ASL) near Klingenthal **JO60GJ03RO**
distance **92,8 km**
Air temperature 6°C at Aschberg
Relative humidity 29% on the Aschberg
DK5NJ and DB6NT worked in CW QSO on 76 GHz at 14:45 UTC with 599 QSO on 122 GHz at 15:01 UTC with 599 QSO on 134 GHz at 15:03 UTC with 599 **IARU 1 Record** QSO on 241 GHz at 15:38 UTC with 559 **IARU 1 Record**

Here is a picture of the bridged route:



Route from Schneekopf (Thuringian Forest) to Fichtelberg (near Oberwiesenthal)

When we came home from our experiments on the Aschberg and the Leipzig Tower, we were full of energy and very happy. I called Roland, DK4RC to report the successful attempt. A few days earlier, Michael had already spoken to him about the upcoming interesting weather conditions and the locations from tests already carried out in 2021 should be activated again.

Since height is now known to be the measure of all things, we decided to go to even higher mountains on the next day, Wednesday, March 2nd, 2022, due to the persistently good weather conditions and to increase the distance again significantly.

So, it came about that Roland, DK4RC agreed and drove with me to the Schneekopf (977 m ASL) in the Thuringian Forest the next day. He picked me up at home and together we made our way to the hiking car park on the Schneekopf. Herbert, DL4AWK, was already waiting for us there. He is known in a figurative sense as the "caretaker" of the Schneekopf Tower, since he has been operating the ATV and relay radio stations there with extraordinary commitment for many years and therefore also has access. He and Roland also know each other through the activities of the contest group DL0GTH and Herbert showed interest and enthusiasm from the beginning to be able to help with a record attempt.

When we arrived at the parking lot, an ice sheet about 5 cm thick awaited us, but with a combined effort we managed to fix the necessary equipment on sleds and start the further ascent on foot.

Arriving at the top, Herbert unlocked the gate to the tower area and freed the entrance door to the tower from the snow by vigorously shoveling. We then carried the equipment into a room with a window facing Fichtelberg.

The weather was very good up on the mountain and we were able to set up the station with good visibility and sunshine. As always, to be on the safe side, I had brought all the important components such as batteries, transceivers, etc. with me twice, but fortunately there were no failures.

The weather was very good up on the mountain and we were able to set up the station with good visibility and sunshine. As always, to be on the safe side, I had brought all the important components such as batteries, transceivers, etc. with me twice, but fortunately there were no failures.

Here is a view from said window at Schneekopf and a view through the scope on the mirror:


In the meantime, Michael also arrived safely at the Fichtelberg, as we found out thanks to our cross-connection in the 70cm band. He also found excellent weather and a suitable place to set up his station. Here are some pictures from the Fichtelberg at DB6NT:

As with the tests the day before (Leipziger Turm – Aschberg), we set each other CW carrier signals (beacons) on the 76 GHz band. This time, however, it turned out to be much more difficult to find the signal and then to find a suitable maximum by aligning the antennas. Michael's 76 GHz signal only arrived at DK5NJ and DK4RC on the Schneekopf with S5 and thus abruptly dampened expectations.

Nevertheless: Now that you had driven up the mountain, you should also test it. In the 122 GHz band, Michael didn't hear our beacon at first. Even when he sent it afterwards, we couldn't find his signal. As a result, our mood was much more subdued, but we still wanted to try one more thing: For physical reasons, the line attenuation in the 134 GHz band is lower than in the 122 GHz band. Here is a graphic for this:

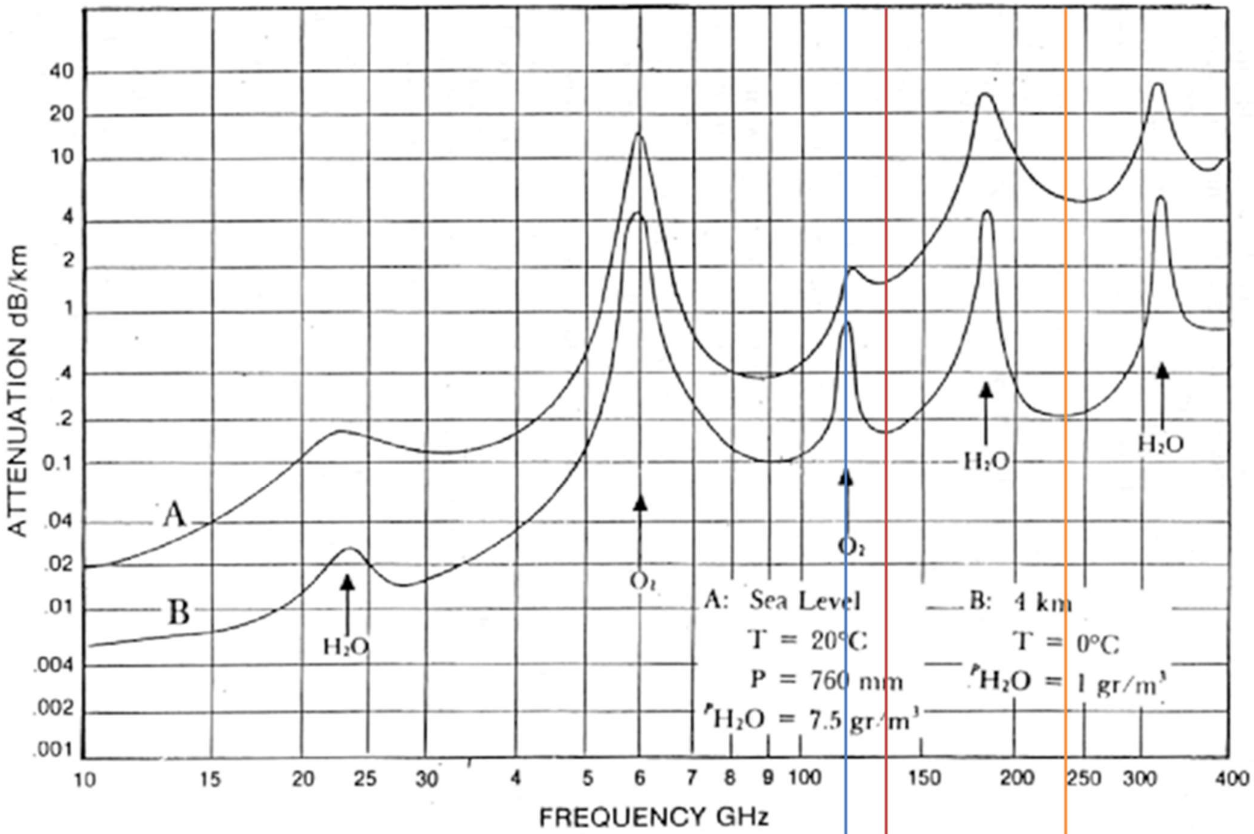


Figure 4: **Average Atmospheric Absorption of Millimeter Waves.**

Quelle_wikimedia.org

So, we switched and put a beacon signal in the 134 GHz band on the .200 in the direction of Fichtelberg. Michael promptly informed DB6NT on the cross frequency that he could hear us. The joy was huge and the feed with the receiver module was inserted into the mirror. Subsequently, a CW QSO could be carried out successfully:

Wednesday, March 2nd 2022 at 14:23 UTC
DK5NJ (with DK4RC and DL4AWK) on the Scheekopf (977 m ASL) near Gehlberg JO50JP19QU
DB6NT on the Fichtelberg (1210 m ASL) near Oberwiesenthal JO60LK43LC
distance **157,0 km**
temperature 2°C at the Fichtelberg
humidity 24 % at the Fichtelberg
DK5NJ and DB6NT worked QSO on 76 GHz at14:00 UTC mit 599 QSO on 134 GHz at 14:23 UTC mit 599 = **World record!**

Then, after setting up the antennas again, Roland DK4RC tried to establish a connection in the 122 GHz band:

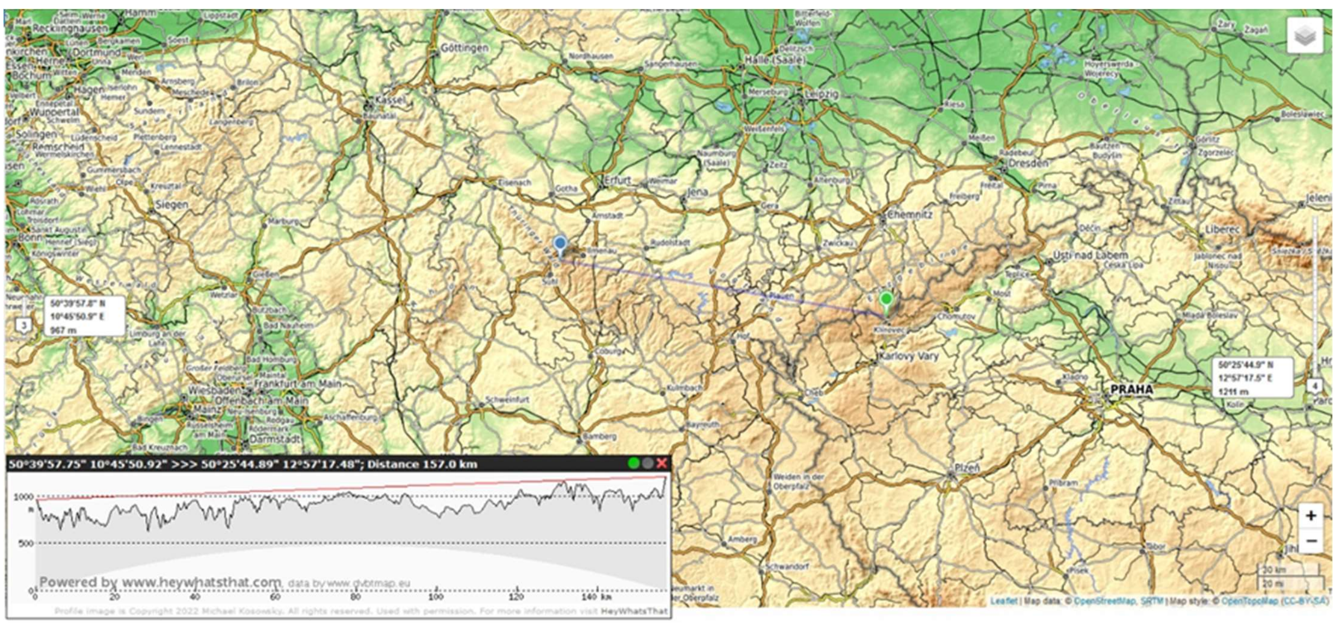

Roland, DK4RC at giving CW on 122 GHz Band.


Left to right: DK5NJ, DL4AWK und DK4RC after a successful descent from the Schneekopf

The hope flared up briefly that there might still be a connection in the 122 GHz band, because Michael DB6NT heard Roland's CW signal with 529. Unfortunately, however, no QSO was made because we didn't hear anything from Michael's signal. At 122 GHz, the receiver of DK5NJ has significantly worse properties (approx. 2 S-levels) than that of DB6NT. However, we want to further improve the station for the future and install a preamplifier in the receiver module for the 122/134 GHz bands.

The cross-section of the route also shows that there are points in the middle of the route where the signal is only sent a few hundred meters above the ground. Of course, this can have significant negative effects on the connection in relation to rising damp:

DB6NT operating. Map of route and cross-section of terrain:



In the 241 GHz band, unfortunately, it was just a try. Neither DK5NJ nor DB6NT could pick up a signal here. It was not always possible to determine an exact maximum of the antenna direction on the 134 GHz band due to the weather conditions – probably rising moisture fields in the middle range. Normally you set the antenna direction with micrometer screws and at these frequencies it is about antenna accuracy in the tenth of a degree range. We switched the station from receiving to transmitting and from band to band countless times that day. The feed module has to be changed in the mirror every time, which is why I refrain from describing the test runs in more detail.

A ¼ Watt No-tune Amplifier for Cheap and Simple Transverters

Paul Wade W1GHZ © 2022
w1ghz@arrl.net

I have described transverters for bands from 10 GHz down to 144 MHz (www.w1ghz.org), keeping them cheap and simple as well as easy to build. Most of them have an output power around 10 milliwatts, +10 dBm, or a few dB more with some of the newer MMICs. Higher power requires an external amplifier, but compatible ones are not readily available for some of the bands.

A few newer MMICs offer higher power: the GVA-92+ for ~1/4 watt, the ADL5324 for ~1/2 watt, and the GVA-91+ offers nearly 1 watt. These are all specified for the wireless networking bands around 900 MHz or 2.4 GHz, and require external tuning for the specific frequency range. They will work at other frequencies, but the data sheets give no hints for tuning at other frequencies. I once played with a GVA-91+ at 144 MHz and saw lots of power before I let the smoke out – that's a lot of power in a tiny SOT-89 package, and heatsinking is definitely required.

Recently I saw a new MMIC from Minicircuits, the PHA-102+, rated at +24 dBm in a 50-ohm system (no tuning) with gain up to 6 GHz. I soldered one to a Universal MMIC PC board and fired it up. At the usual 5 volts, it showed the specified gain of about 13 dB, but output power was only about +21 dBm, around 120 mW. The higher power is specified at 9 volts, so I started cranking up the voltage; at 9 volts, output power at 902 MHz was 25.2 dBm with +13 dBm drive, all I had from the signal generator. Things were pretty warm to the touch.

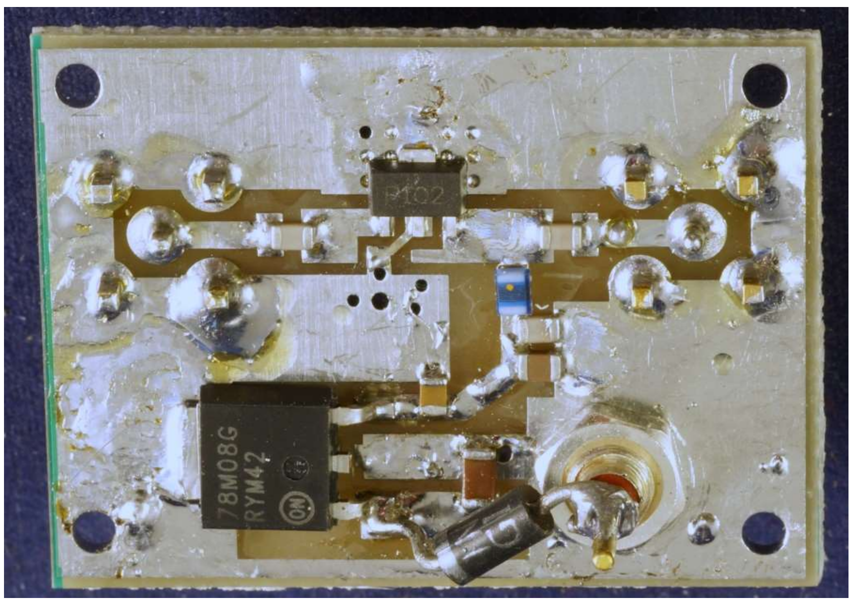


Figure 1 – Complete GVA-102 ¼ watt amplifier

The Universal MMIC PC board has a footprint for an SMT three-terminal regulator. I had some 8-volt 78M08 regulators on hand, but no 9-volt version. Since the output power at 8 volts was nearly as good, +24.9 dBm, with lower current, this seemed like a reasonable approach. Figure 1 is a photo of the finished amplifier prototype. I used 18 pf blocking capacitors and an 82 nH RF choke; the values are rather arbitrary and not optimized. They are rather small for VHF, which is why performance seen below drops off at lower frequencies. The other capacitors are bypassing for the MMIC and the voltage regulator.

With 12 volts into the voltage regulator, even more heat is dissipated. I ran it overnight at full power to make sure the amplifier is viable – the PC board temperature was about 50°C, while the temperature of the top of the MMIC and IC packages was lower, showing that the packages are heat sunk to the PC board. I think a little better heatsink is needed, perhaps one of the stick-on variety used for chips like the Raspberry Pi.

While it was still hot, I connected a VNA to measure gain and input VSWR, with the results shown in Figure 2. Gain is about 13 dB with good VSWR up to 3.4 GHz, then rolling off but with a convenient peak around 5.7 GHz. This covers all the transverters except 10 GHz.

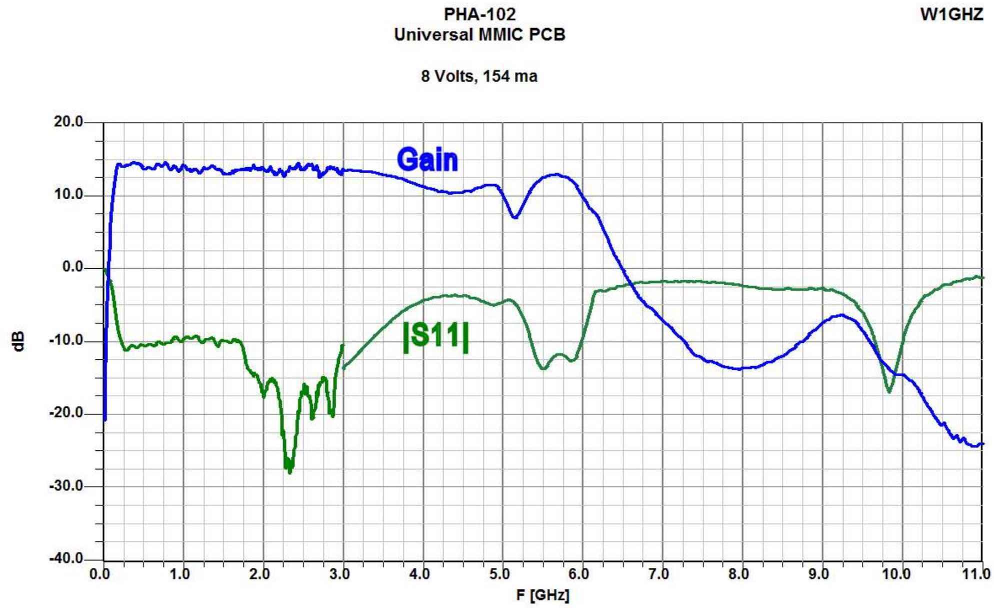


Figure 2 – PHA-102 amplifier small-signal performance

I measured output power at all the ham bands, although I didn't drive the amplifier to maximum; only +13 dBm was easily available up to 1 GHz, and +10 dBm above that, with only +7.4 dBm at 5760 MHz. Results are shown in Figure 3: even with the limited drive, +23 dBm is available up to 3400 and +17 dBm at 5760. With a bit more drive, the amplifier should easily provide ¼ watt or more up to 3400, which could provide a boost for a rover station without a lot of expense or power drain.

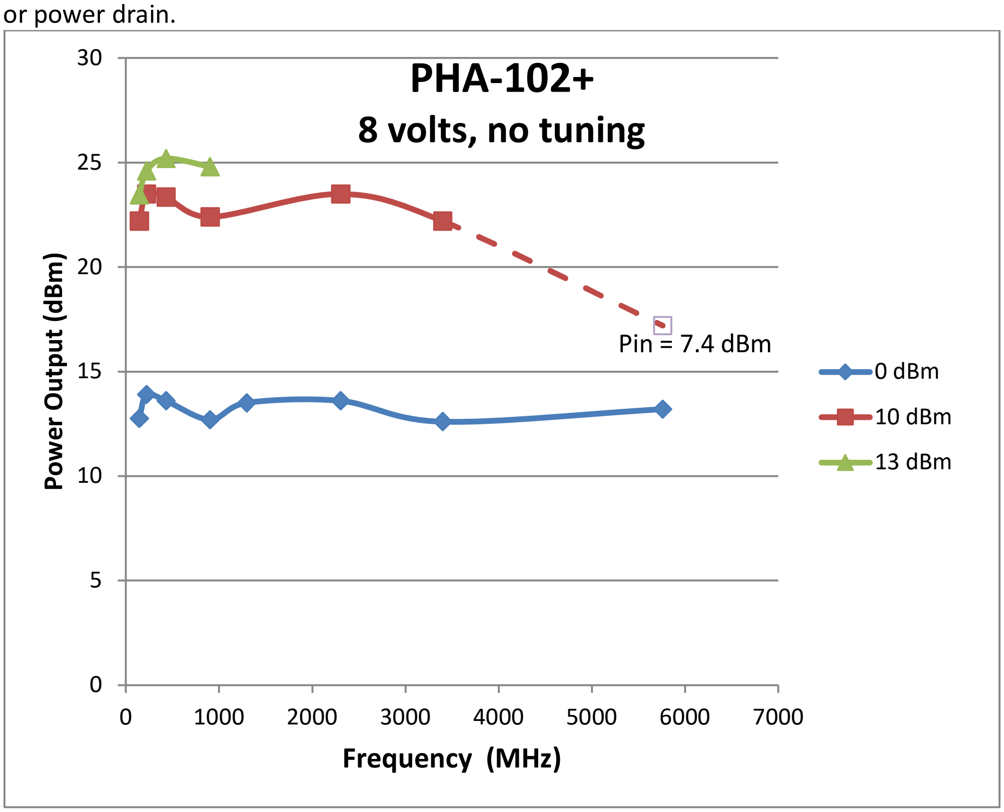


Figure 3 – PHA-102 amplifier power output

The amplifier looks to be pretty linear up to about ¼ watt out, as shown in Figure 4. An interesting thing about this MMIC is that the supply current is constant until the output power approaches the 1-dB compression point – then the current *decreases*. At this point the output harmonic levels increase dramatically. And the harmonic levels are fairly high even below this power level, as one might expect from such a broadband amplifier. With low-power transverters, we don't worry too much about harmonics and spurious responses, but ¼ watt is getting to the point where we might cause interference in some circumstances.

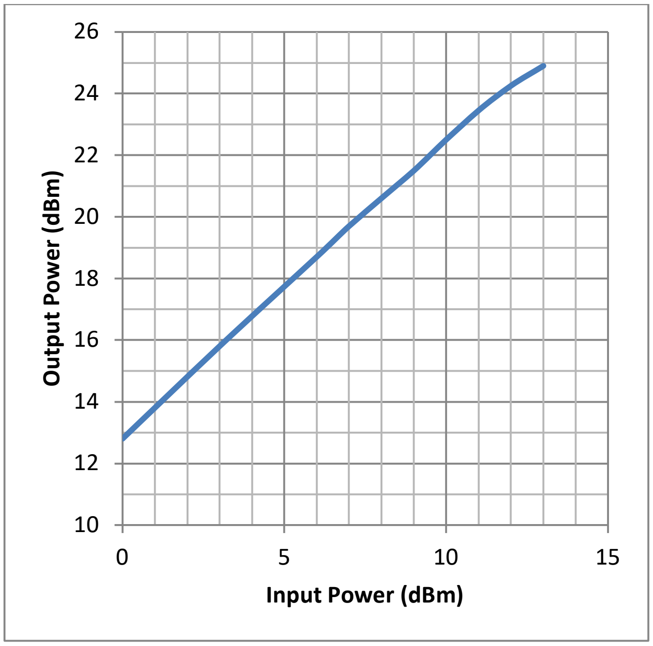


Figure 4 – PHA-102 Output power vs input power

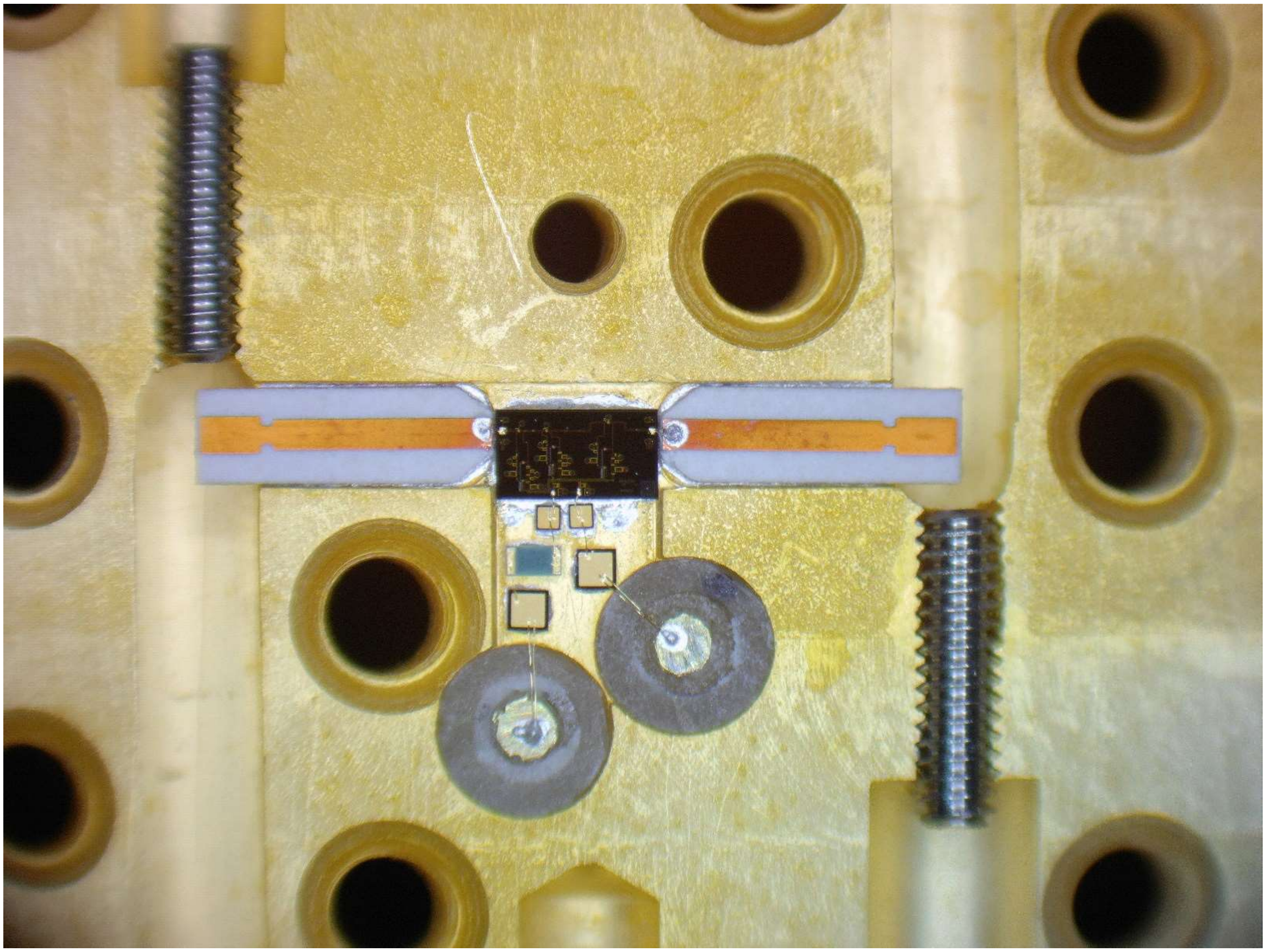
The PC boards are available, and the PHA-102+ is available from Mouser, or Mini-circuits is pretty good about providing free samples to hams. Assembly is pretty straightforward, and no tuning is needed. This should be an easy way to enhance the cheap and simple transverters, or just a handy amplifier for the test bench.

47GHz Low Noise Amplifier Update

Roger G8CUB

47GHz LNA Number 1, showing 1.9dB NF and 26dB gain.

I was very lucky to be in Spain at the right time, and collect my 47GHz LNA from Iban EB3FRN. The unit pictured, is my unit under test. The noise figure of 1.9dB @ 47GHz is excellent. That is an accurate noise figure. The noise source NC153350W together with attached attenuator was calibrated at Observatorio de Yebes, using a PNA-X (10M – 67G VNA) with source corrected noise figure measurement.

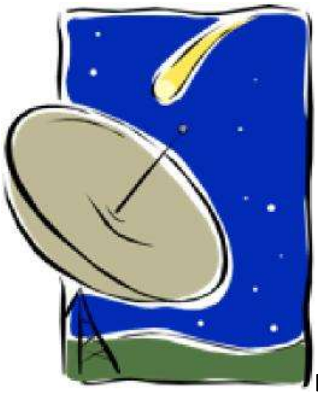


Internal picture of my LNA. Note the waveguide tuning screws, essential for both noise figure and match.

Comparison between the system NF of my transverter with commercial Miteq LNA on the left, and with the new LNA on the right. The new LNA using a far from ideal wr-28/2.4mm transition, butted up to a WR-19 square to small round flange adaptor. That combination likely adding significantly greater than 0.5dB to the measurement.
When I have a decent adaptor, I will use Iban's measurement to calibrate my source.
The test was made by swoping the amplifiers, as I was worried about having too much gain with 60mW capability in front of the mixer. So roughly Iban's LNA is around 2.5dB NF better than my existing one.

Scatterpoint activity report

Activity News: March 2022



By John G4BAO

Please send your activity news to: **scatterpoint@microwavers.org**

Activity report held over until the next issue of Scatterpoint

March 2022 Lowband Contest Results

More entries were received this year, bringing levels back to near the 2020 lock-down numbers, but most commented that activity was low.

On 1.3GHz Neil G4BRK takes the top spot by some margin from David M0GHZ in the runner up place. New entrant Mike G3SED takes the Low Power top spot in this event. The aircraft scatter contact between M0GHZ and PI4GN in JO33 at 641km was the best DX recorded. Conditions were flat with aircraft scatter providing DX contacts.

2300MHz saw a single entry from M0HNA/P, who worked G4ODA and G3XDY on this band.

Neil G4BRK also won the 2320MHz section, with John G3SQQ as runner up. Best DX was between G3SQQ and PI4GN at 528km.
G4BRK completed a trio of wins with the leading position on 3400MHz, Martyn G3UKV taking second place. Best DX was the QSO between M0GHZ and G4ODA at 206km.

John G3XDY
UKuG Contest Manager

1296MHz March Low Band 2022

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX kms
1	G4BRK	IO91HP	27	6406	PI4GN	579
2	M0GHZ	IO81VK	18	3617	PI4GN	641
3	G3TCT	IO81QC	18	3360	GI6ATZ	430
4	G3SED	IO90IV	14	3110	PI4GN	611
5	G0DJA	IO93IF	13	2643	PI4GN	532
6	G3SQQ	IO93JC	15	2111	G3SED	246
7	GW4JQP	IO71KR	12	2040	G3XDY	437
8	G3UKV	IO82RR	15	1982	GI6ATZ	292
9	GM4BYF	IO85JV	4	1548	G4BRK	488
10	G6GVI	IO83SN	9	1128	M0GHZ	237
11	G4BAO	JO02CG	6	825	G3TCT	235
12	G3YJR	IO93FJ	5	676	G3XDY	238
13	G8AIM	IO92FH	8	626	G3XDY	190
14	G4EPA	IO92KI	7	588	G3TCT	174
15	GM4DIJ/P	IO74MU	2	476	G4ODA	393
16	GM8IEM	IO78HF	1	428	GI6ATZ	428

Many thanks for check log received from G4ODA

2300MHz March Low Band 2022

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX kms
1	M0HNA/P	IO91GI	2	382	G3XDY	200

Many thanks for check log received from G4ODA

European Microwave Week ‘2021’ at ExCel London

Exhibition is open Monday 4th – Wednesday 6th April 2022

The Exhibition Registration to the exhibition is FREE! • Over 300 International Companies - meet the industry’s biggest names and network on a global scale • Cutting-edge Technology - exhibitors showcase their latest product innovations, offer hands-on demonstrations and provide the opportunity to talk technical with the experts • Industrial Workshops - get first hand technical advice and guidance from some of the industry’s leading innovators • MicroApps - attend our annual European Microwave Week Microwave Application Seminars (MicroApps) Be There Exhibition Dates Opening Times Monday 4th April 2022 09:30 - 18:00 Tuesday 5th April 2022 09:30 - 17:30 Wednesday 6th April 2022 09:30 - 15:00

Register at www.eumw2021.com

Martlesham Round table April 24th

This year the event is Sunday 24th April, using a different hall to usual within BT Adastral park
Time 10.00 – 15.30.

Please register via the UKuG website. www.microwavers.org/main/events/martlesham-roundtable-3/

UKuG MICROWAVE CONTEST CALENDAR 2022

Dates, 2022	Time UTC	Contest name
6-Mar	1000 - 1600	1st Low band 1.3/2.3/3.4GHz
10-Apr	1000 - 1600	2nd Low band 1.3/2.3/3.4GHz
8-May	0800 - 1400	3rd Low band 1.3/2.3/3.4GHz
15-May	0900 – 1700	1st 24GHz Contest
15-May	0900 – 1700	1st 47GHz Contest
15-May	0900 – 1700	1st 76GHz Contest
29-May	0600 - 1800	1st 5.7GHz Contest
29-May	0600 - 1800	1st 10GHz Contest
5-Jun	1000 - 1600	4th Low band 1.3/2.3/3.4GHz
26-Jun	0600 - 1800	2nd 5.7GHz Contest
26-Jun	0600 - 1800	2nd 10GHz Contest
10-Jul	0900 – 1700	2nd 24GHz Contest
10-Jul	0900 – 1700	2nd 47GHz Contest
10-Jul	0900 – 1700	2nd 76GHz Contest
31 -Jul	0600 - 1800	3rd 5.7GHz Contest
31 -Jul	0600 - 1800	3rd 10GHz Contest
28-Aug	0600 - 1800	4th 5.7GHz Contest
28-Aug	0600 - 1800	4th 10GHz Contest
11-Sep	0900 - 1700	3rd 24GHz Contest & 24GHz Trophy
12-Sep	0900 - 1700	3rd 47GHz Contest
12-Sep	0900 - 1700	3rd 76GHz Contest
25 -Sep	0600 - 1800	5th 5.7GHz Contest
25 -Sep	0600 - 1800	5th 10GHz Contest
16 -Oct	0900 - 1700	4th 24GHz Contest
16 -Oct	0900 - 1700	4th 47GHz Contest
16 -Oct	0900 - 1700	4th 76GHz Contest
13 -Nov	1000 - 1400	5th Low band 1.3/2.3/3.4GHz

MICROWAVE CONTESTS - 2022

Month	Contest name	Certificates	Date 2022	Time GMT	Notes
Jan	1.3GHz Activity Contest	*Arranged by RSGB*	18-Jan	2000 - 2230	RSGB Contest
Jan	2.3GHz+ Activity Contest	*Arranged by RSGB*	25-Jan	1930 - 2230	RSGB Contest
Feb	1.3GHz Activity Contest	*Arranged by RSGB*	15-Feb	2000 - 2230	RSGB Contest
Feb	2.3GHz+ Activity Contest	*Arranged by RSGB*	22-Feb	1930 - 2230	RSGB Contest
Mar	Low Band 1296/2300/2320/3400MHz	F, P,L	6-Mar	1000 - 1600	First 4 hours coincide with IARU event
Mar	1.3GHz Activity Contest	*Arranged by RSGB*	15-Mar	2000 - 2230	RSGB Contest
Mar	2.3GHz+ Activity Contest	*Arranged by RSGB*	22-Mar	1930 - 2230	RSGB Contest
Apr	Low Band 1296/2300/2320/3400MHz	F, P,L	10-Apr	1000 - 1600	
Apr	1.3GHz Activity Contest	*Arranged by RSGB*	19-Apr	1900 - 2130	RSGB Contest
Apr	2.3GHz+ Activity Contest	*Arranged by RSGB*	26-Apr	1830 - 2130	RSGB Contest
May	REF/DUBUS EME 1.2GHz	*Arranged by REF/DUBUS*	7-May to 8-May	0000 - 2400	REF/DUBUS EME 1.2GHz
May	*432MHz & up*	*Arranged by RSGB*	*7-May to 8-May*	*1400 -1400*	RSGB Contest
May	*10GHz Trophy*	*Arranged by RSGB*	*8-May*	*0800 - 1400*	Sunday, to coincide with IARU
May	Low Band 1296/2300/2320/3400MHz	F, P,L	8-May	0800 - 1400	Aligned with IARU event
May	24GHz/47/76GHz		15-May	0900-1700	
May	1.3GHz Activity Contest	*Arranged by RSGB*	17-May	1900 - 2130	RSGB Contest
May	2.3GHz+ Activity Contest	*Arranged by RSGB*	24-May	1830 - 2130	RSGB Contest
May	REF/DUBUS EME 10GHz & Up	*Arranged by REF/DUBUS*	28-May to 29-May	0000 - 2400	REF/DUBUS EME 10GHz & up
May	5.7GHz/10GHz	F, P,L	29-May	0600-1800	
Jun	REF/DUBUS EME 2.3GHz	*Arranged by REF/DUBUS*	4-Jun to 5-Jun	0000 - 2400	REF/DUBUS EME 2.3GHz
Jun	Low Band 1296/2300/2320/3400MHz	F, P,L	5-Jun	1000 - 1600	Aligned with some Eu events
Jun	1.3GHz Activity Contest	*Arranged by RSGB*	14-Jun	1900 - 2130	RSGB Contest
Jun	2.3GHz+ Activity Contest	*Arranged by RSGB*	21-Jun	1830 - 2130	RSGB Contest
Jun	5.7GHz/10GHz	F, P,L	26-Jun	0600-1800	
Jul	REF/DUBUS EME 5.7GHz	*Arranged by REF/DUBUS*	2-Jul to 3-Jul	0000 - 2400	REF/DUBUS EME 5.7GHz
Jul	VHF NFD (1.3GHz)	*Arranged by RSGB*	2-Jul to 3-Jul	1400 - 1400	RSGB Contest
Jul	24GHz/47/76GHz		10-Jul	0900-1700	
Jul	1.3GHz Activity Contest	*Arranged by RSGB*	19-Jul	1900 - 2130	RSGB Contest
Jul	2.3GHz+ Activity Contest	*Arranged by RSGB*	26-Jul	1830 - 2130	RSGB Contest
Jul	REF/DUBUS EME 3.4GHz	*Arranged by REF/DUBUS*	30-Jul to 31-Jul	0000 - 2400	REF/DUBUS EME 3.4GHz
Jul	5.7GHz/10GHz	F, P,L	31-Jul	0600-1800	
Aug	1.3GHz Activity Contest	*Arranged by RSGB*	16-Aug	1900 - 2130	RSGB Contest
Aug	2.3GHz+ Activity Contest	*Arranged by RSGB*	23-Aug	1830 - 2130	RSGB Contest
Aug	5.7GHz/10GHz	F, P,L	28-Aug	0600-1800	
Sep	24GHz/47/76GHz		11-Sep	0900-1700	
Sep	ARRL Microwave EME	*Arranged by ARRL*	17-Sep to 18-Sep	0000 - 2359	ARRL EME 2.3GHz & Up
Sep	1.3GHz Activity Contest	*Arranged by RSGB*	20-Sep	1900 - 2130	RSGB Contest
Sep	5.7GHz/10GHz	F, P,L	25-Sep	0600-1800	
Sep	2.3GHz+ Activity Contest	*Arranged by RSGB*	27-Sep	1830 - 2130	RSGB Contest
Oct	*432MHz & up*	*Arranged by RSGB*	*1-Oct to 2-Oct*	*1400 - 1400*	IARU/RSGB Contest
Oct	*1.3 & 2.3GHz Trophies*	*Arranged by RSGB*	*1-Oct*	*1400 - 2200*	RSGB Contest
Oct	ARRL EME 50-1296MHz	*Arranged by ARRL*	15-Oct to 16-Oct	0000 - 2359	ARRL EME Contest
Oct	24GHz/47/76GHz		16-Oct	0900-1700	
Oct	1.3GHz Activity Contest	*Arranged by RSGB*	18-Oct	1900 - 2130	RSGB Contest
Oct	2.3GHz+ Activity Contest	*Arranged by RSGB*	25-Oct	1830 - 2130	RSGB Contest
Nov	ARRL EME 50-1296MHz	*Arranged by ARRL*	12-Nov to 13-Nov	0000 - 2359	ARRL EME Contest
Nov	Low Band 1296/2300/2320/3400MHz	F, P,L	13-Nov	1000 - 1400	
Nov	1.3GHz Activity Contest	*Arranged by RSGB*	15-Nov	2000 - 2230	RSGB Contest
Nov	2.3GHz+ Activity Contest	*Arranged by RSGB*	22-Nov	1930 - 2230	RSGB Contest
Dec	1.3GHz Activity Contest	*Arranged by RSGB*	20-Dec	2000 - 2230	RSGB Contest

Sections	**F**	Fixed / home station
	P	Portable
	L	Low-power <10W 1.3/2.3/3.4GHz, <1W 5.7GHz)

Main changes from 2021 calendar

122GHz+ events removed (no fixed dates in 2022)

EVENTS 2022

For the latest information please see: https://microwavers.org

2022		
April 2-7	European Microwave Week, London, ExCeL	www.eumw2021.com
April 23	RSGB AGM – 0nline	www.rsgb.org.uk/agm
April 24	Martlesham Roundtable – Adastral Park	
1 May	UKuG AGM – Online	
May 20-22	Hamvention, Dayton	www.hamvention.org
June 19	RAL Roundtable - Chilton village Hall	
June 24-26	Ham Radio, Friedrichshafen	www.hamradio-friedrichshafen.de
June 25-26	Finningley Roundtable - provisional	
August 7	BATC Convention, Midland Air Museum, Coventry	www.batc.org.uk
August 12-14	EME 2022, Prague - rescheduled 2021 event	www.eme2020.cz
September 18	Crawley Roundtable, Crawley club, Tilgate forest	
September 25-30	European Microwave Week, Milan, Italy	www.eumweek.com
October 7-9	RSGB Convention	
October 15-15	National Hamfest	
October 22	Scottish Roundtable	https://www.gmroundtable.org.uk
December 3	Midlands Roundtable – Eaton Manor	

80m UK Microwavers net

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

73 Martyn Vincent G3UKV