An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

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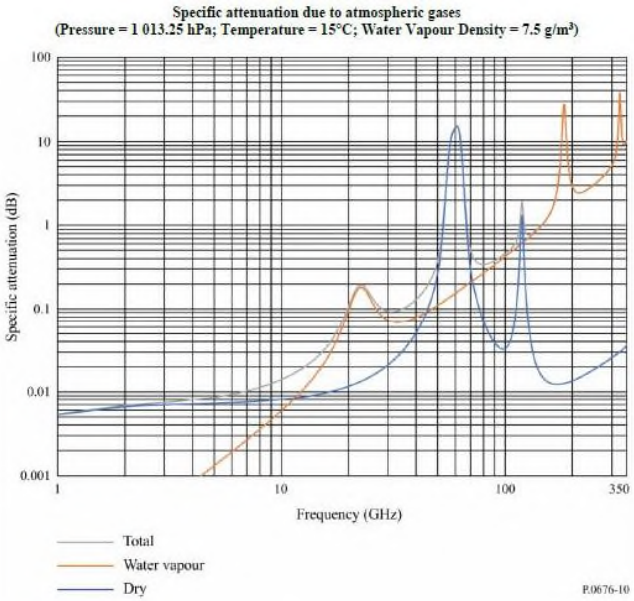
In This Issue



122GHz Propagation – Barry G8AGN

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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)

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 you co-operation.

Roger G8CUB

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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.

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- 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

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

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

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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 76GHz

Propagation at 122GHz

Barry Chambers G8AGN

Introduction

In view of the increased world-wide interest in operating at 122GHz which has been generated by the introduction of VK3CV's integrated "system on a chip" transceiver design based on the Silicon Radar TRA-120-002 device [1], and the fact that nearly 70 boards have been ordered by UK amateurs, now seems to be a good time to have a look at how well they might perform "in the field".

The aim of this article is two-fold; firstly to examine what factors will affect radio wave propagation at 122GHz and secondly to try and estimate what DX might be possible and under what conditions.

Propagation at 122GHz

It is well known that microwave propagation is affected by the atmosphere. Since its pressure, temperature and water content vary with height, this gives rise to wave refraction or bending with the result that the Earth's radius appears on average to be about 1.33 times larger than it really is. In addition, anomalous propagation or "lifts" may be caused by localised variations in atmospheric properties. Finally, propagation is affected by precipitation in the form of rain or snow and this can often result in enhanced propagation in the form of "rain scatter".

At mm-wave frequencies, other atmospheric phenomena may also become important and these are principally due to the presence of water vapour and oxygen. At certain frequencies these give rise to additional wave attenuation due to atomic resonance effects and these are responsible for the peaks in the attenuation curves shown in Figure 1[2]. For example, when operating at 122GHz, the closest resonance, due to oxygen, occurs at about 118.75GHz and so it is of interest to ascertain how much extra path loss will accrue due to this. The additional path loss at 122GHz due to water vapour must also be taken into account and this increases steadily with frequency. Because the frequency axis in Figure 1 is logarithmic, it is difficult to locate exactly where 122GHz lies and so to estimate the magnitude of the extra path losses due to the influence of oxygen and water vapour. Also, Figure 1 was calculated using the parameters for the so-called "standard atmosphere" and this may not be typical for most of the time in practice.

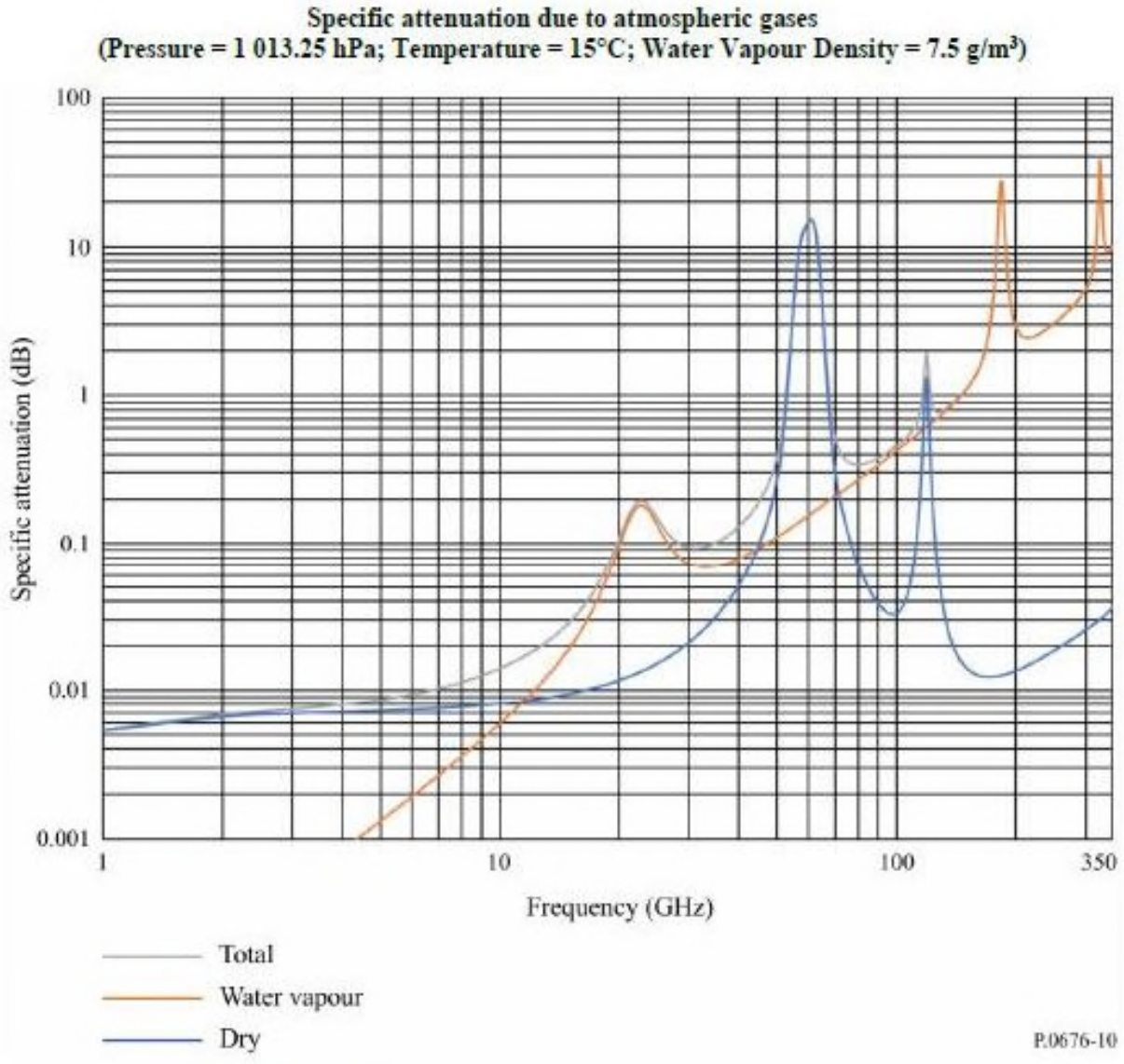


Figure 1 (from ITU-R P.676-10)

The calculation of atmospheric losses at mm-wavelengths has been discussed in an ITU (International Telecommunications Union) report [2] and an associated one on calculating atmospheric water content [3]. These are highly mathematical but form the basis of the computer software which has been used to generate the results discussed below. [2] and [3] may be downloaded from the excellent weather web-site maintained by Iain, VK5ZD [4]. A copy of my software may be obtained on request; it is written in FORTRAN, but a FORTRAN 95 compiler for personal use may be downloaded from [5] and this can be used under Windows 7 or 10.

Before discussing results obtained from the software, it is necessary to explore what meteorological input data is required from the user. This comprises three pieces of information about the state of the atmosphere along the path to be worked, namely barometric pressure, temperature and a measure of the water content. In practice, the barometric pressure is made up of two components, the partial pressure due to the dry air and the partial pressure due to the water content and these need to be known independently. The water content of the air is indicated indirectly by one of two measurements of either the relative humidity (RH) or the dew point. The relative humidity can be measured using a calibrated sensor and many inexpensive "weather stations" can display the approximate RH as a percentage value (0% being completely dry air and 100% being saturated air). A more accurate measure of water content is the dew point. This is measured using a wet and dry bulb thermometer pair, as shown in Figure 2.

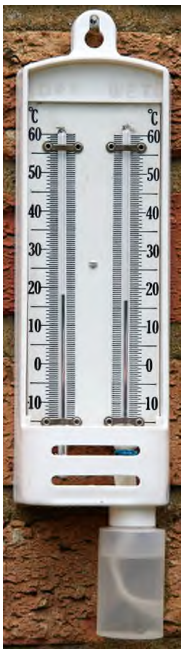


Figure 2

The dry bulb thermometer measures the ambient air temperature and the wet bulb thermometer measures the air temperature when its bulb has been cooled by evaporation of water from the moist cotton "wick" surrounding it. If the air is dry, then the rate of evaporation from the wick will be large and so the indicated wet bulb temperature will be lower than ambient. This depressed temperature is known as the dew point and the lower its value relative to the ambient temperature then the drier is the air. Thus the water content of the air can be obtained from either a measurement of the RH or of the dew point and this must then be related to the water partial pressure and its density, expressed as the number of grams of water contained in each cubic metre of air [3].

Once the meteorological data has been entered into the software, together with the frequency, it will calculate the additional path losses due to oxygen and water vapour; these losses are expressed in dB/km and so doubling the path length doubles the losses and vice-versa. Figure 3 shows a typical screen shot of part of the software output. The estimated meteorological data was kindly supplied by John, G8ACE, and relates to one of his 122GHz tests carried out on a summer's day over a 17.5km path. As well as calculating the oxygen and water vapour attenuation, the software has also calculated the free-space path loss using

$$PL = 20log_{10}\left(\frac{4\pi D}{\lambda}\right)$$

where D is the path length and λ is the wavelength.

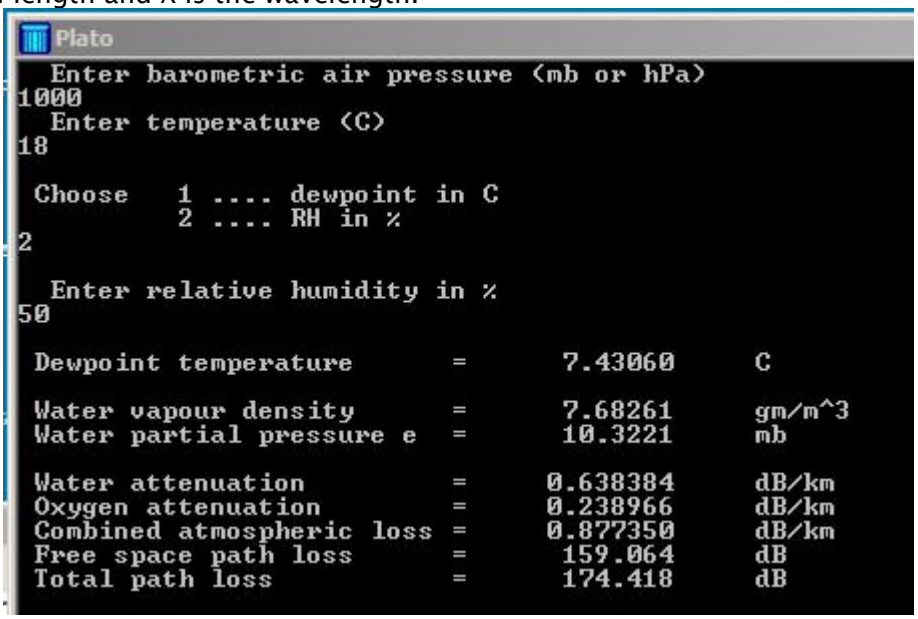


Figure 3

For a 17.5km path, the free-space path loss, PL, is 159.1dB, whereas the combined oxygen and water loss is about15.3dB, i.e. an additional 10% loss which is quite significant for such a short path. If the path length were now to be increased to 35km, the free-space path loss would only increase by 6dB but the oxygen and water losses would increase by another 15.3dB, giving a new total path loss of 159.1+15.3 + 6 + 15.3 = 195.7dB. This large increase, over 20dB, for a doubling of the path length, illustrates the challenge of operating at 122GHz.

Having set the scene, let us now consider what steps might be taken to lessen this challenge, but to do this further information is required. Firstly, how do the oxygen and water vapour losses vary with frequency? This question is an important one since the 122GHz band, while lying close to the oxygen resonance peak, is also quite wide (122.25-123.00 GHz).

Secondly, how do the oxygen and water vapour losses change with the weather?

To answer the first question, Figure 4 shows the variation of the oxygen and water vapour losses with frequency over the range 122 - 123 GHz for p = 1000mb, t = 10°C and RH = 70%. It can be seen that over the band, the combined losses vary by about 0.07dB/km. This may not seem much but over a 100km path this would amount to 7dB which is significant. Although Figure 4 was calculated for one particular set of meteorological data it can be seen that for DX working, it would be advantageous to use frequencies at the top of the band rather than at the bottom.

To answer the second question, the variation of the losses as the barometric pressure, temperature and RH are changed needs to be explored. Figure 5 shows the variation in losses when the temperature and RH are kept constant and the barometric pressure is varied from 950mb to 1050mb. These pressure values represent the extremes to be expected over the UK.

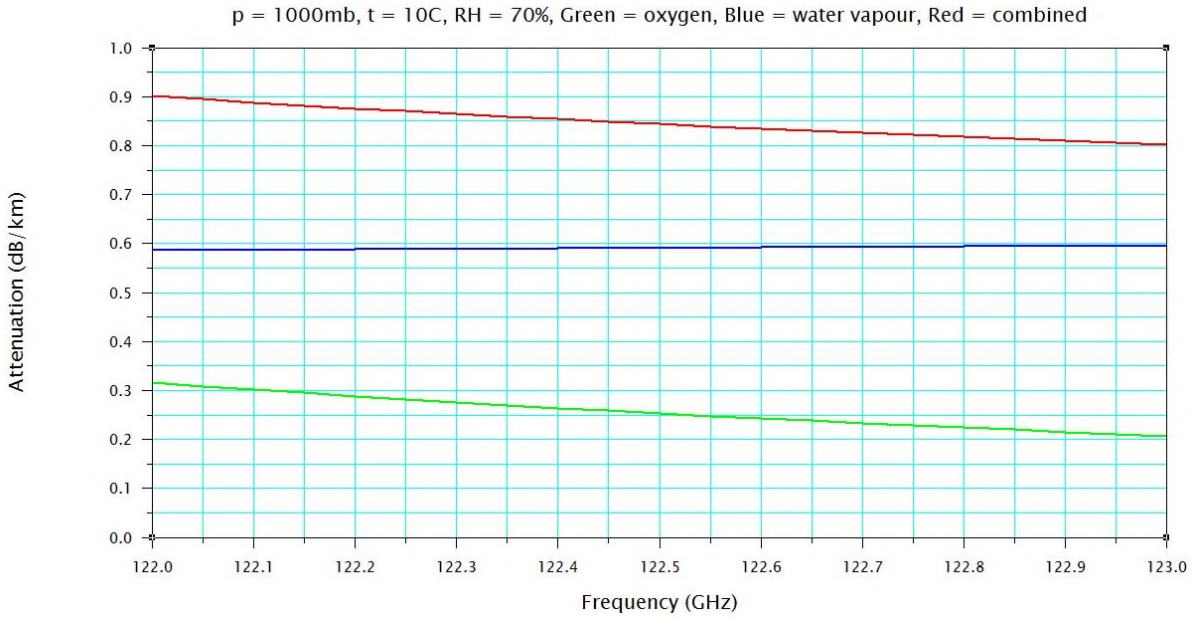


Figure 4

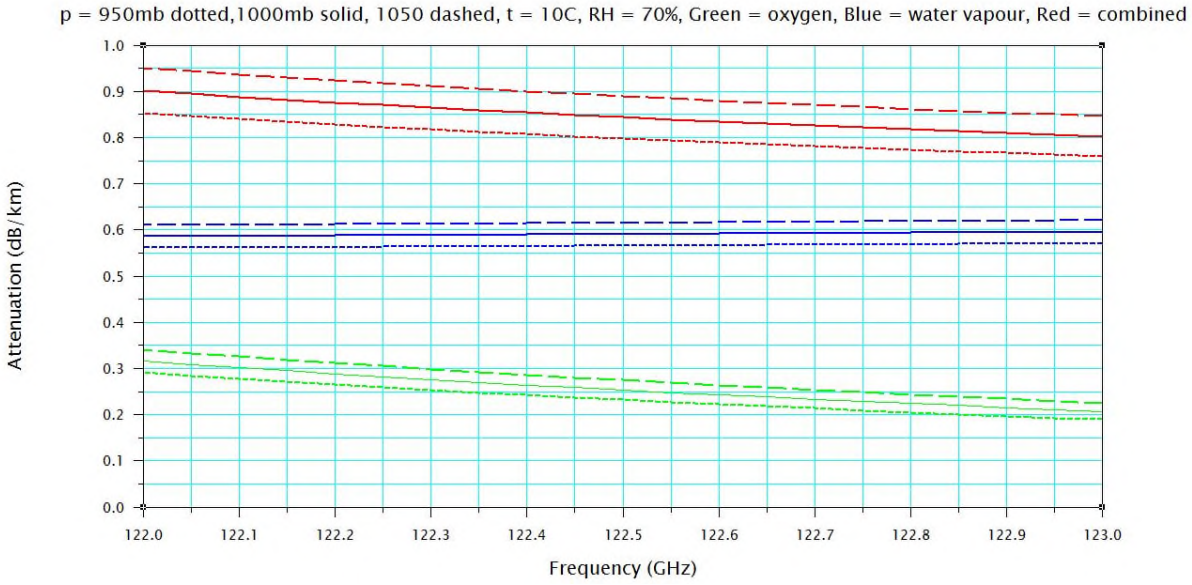


Figure 5

Figure 5 shows that the losses increase as the barometric pressure is raised. It may seem obvious that the oxygen losses should increase with increasing pressure but not the water vapour losses since the water content is unchanged, but [2] implies that it occurs due to “spectral line broadening”.

Figure 6 shows how the losses change when the pressure and RH are fixed and the temperature changes.

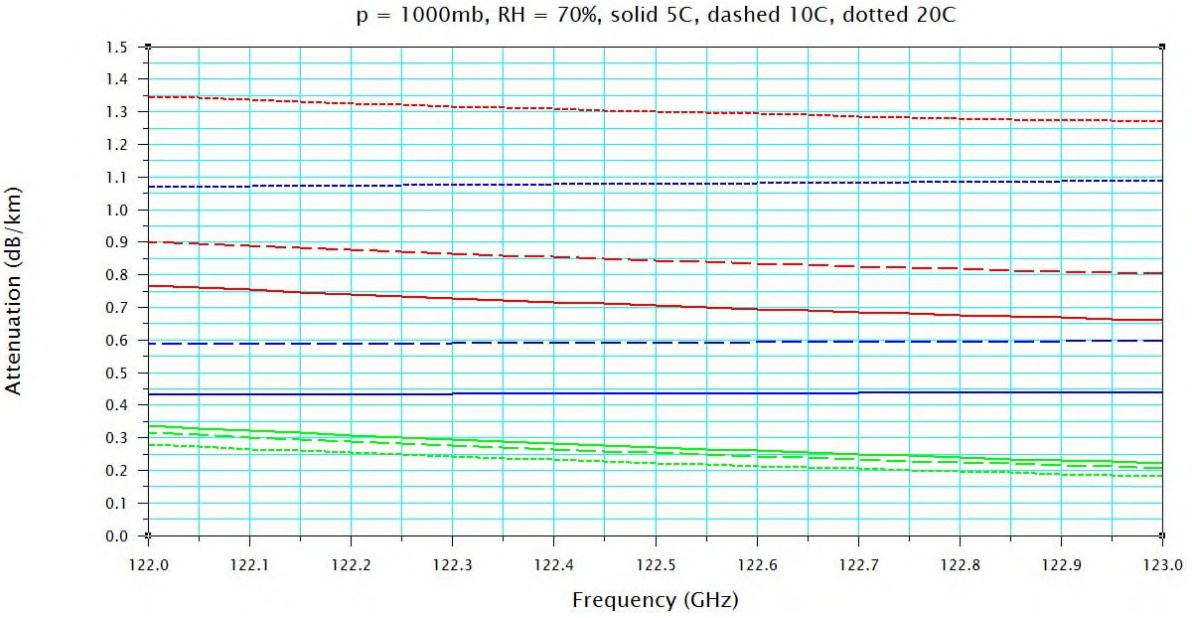


Figure 6

As can be seen, the overall loss increases as the temperature is increased and this is due to the fact that the atmosphere can hold more water even though the RH is fixed (4.76 gm/m^3 at 5°C but 12.1 gm/m^3 at 20°C). Close examination of the oxygen curves (green) shows, however, that the oxygen loss seems to have decreased as the temperature has increased. This is an artefact of the barometric pressure being held constant at 1000 mb. The latter value is made up of two components, the dry air partial pressure and the water vapour partial pressure, so if the latter increases due to a higher water content, then the dry air component (oxygen) must decrease (the nitrogen not being important in our discussion).

The third possibility in our investigation is that of keeping the barometric pressure and temperature constant and varying the RH. From the previous discussion, however, it is known that increasing the RH will lead to an increase in water losses and hence the overall losses.

In practice, the weather on any particular day will determine the actual values of all three variables barometric pressure, temperature and RH and so if accurate estimates of losses are to be established then

they must all be measured at the time of making a contact if a later comparison between measured and predicted received S/N is to be made.

System calculations

The software can also be used to estimate the received carrier to noise ratio (C/N) for a given set of system parameters such as transmitter power, receiver noise figure and bandwidth, and antenna gains. In the examples given below, it should be emphasised that the estimated values of received C/N will be optimistic because of uncertainties in factors such as the actual values of transmitter power, receiver noise figure, antenna gains and the exact atmospheric conditions along the path between the transmitter and the receiver. The specification for the TRA-120-002 chip quotes typical values for RF output power and receiver noise figure of 0.5mw and 9dB. The latter figure assumes image rejection and so 3dB has been added to account for the lack of image rejection on the VK3CV board (as supplied). System degradation factors which have not been accounted for will include antenna match and phase noise.

Figure 7 shows the predicted results at 122.4 GHz for a path length of 1km with VK3CV horn antennas (nominal gain of 21dBi) at each end and a receiver bandwidth of 3 kHz. The total path loss is 135dB, almost all of which is the free-space loss. The resulting estimated C/N is about 31dB. Because the path is so short, this value of C/N is not expected to vary much with frequency within the band.

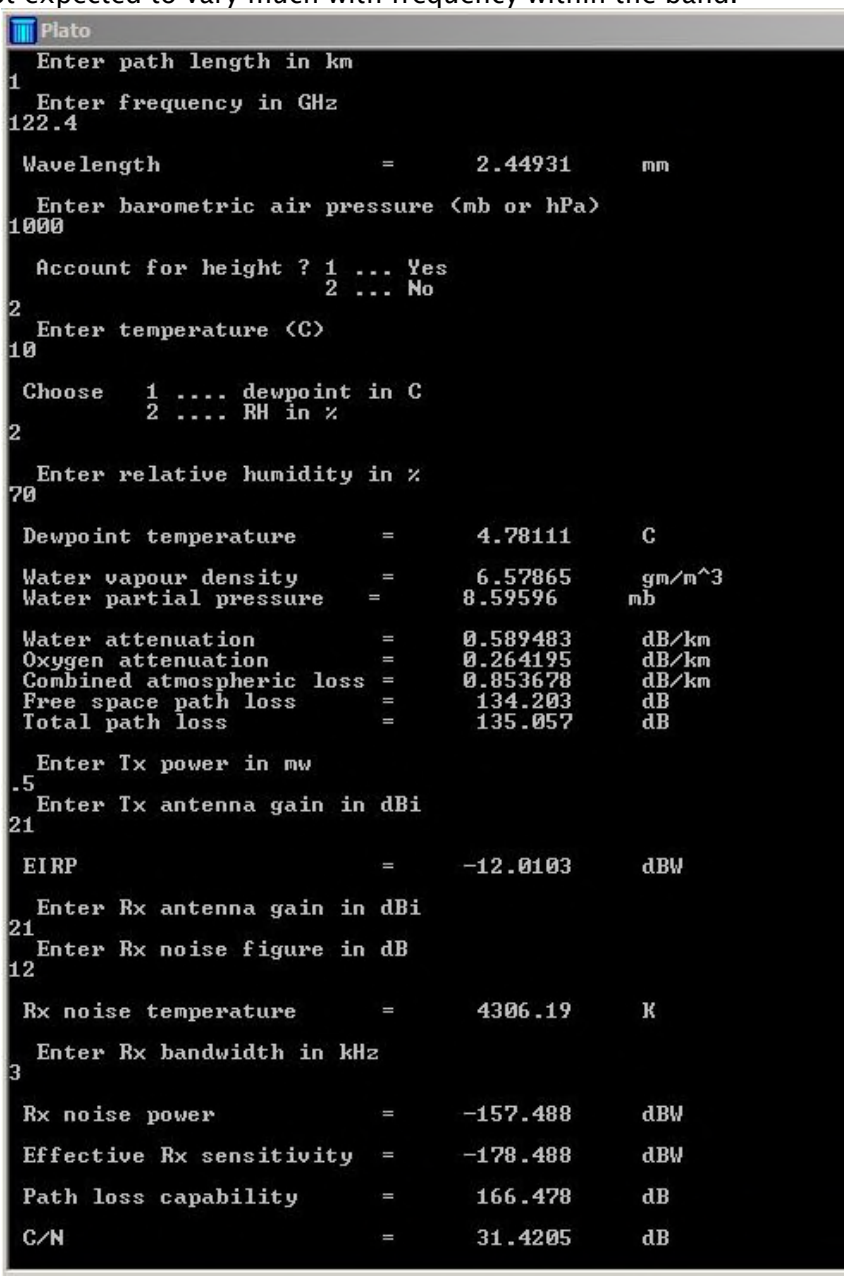


Figure 7

Figure 8 shows the predicted results at 122.999GHz for an 80km path worked recently by K6ML and KB6BA using 60cm dishes and transceivers based on the TRX-120-001chip. This has a similar specification to the later TRA-120-002 chip but incorporates separate transmit and receive antennas comprised of 4-patch arrays which can be used to illuminate a dish directly (i.e. no additional horn feed required). The dishes were intended for use at 11GHz, rather than 122GHz, and so following discussions with K6ML a gainof 48dBi has been assumed, but the margin of error on this "guesstimate" is unknown.
The receiver noise figure has been taken as 12dB since no image rejection hardware was implemented. The software then predicts a received C/N of about 17dB in a 500Hz bandwidth as compared with K6ML's measured value of about 15dB but he also noted the presence of a mist/fog layer which was visible around the midpoint of the path during the contact and this has not been accounted for.

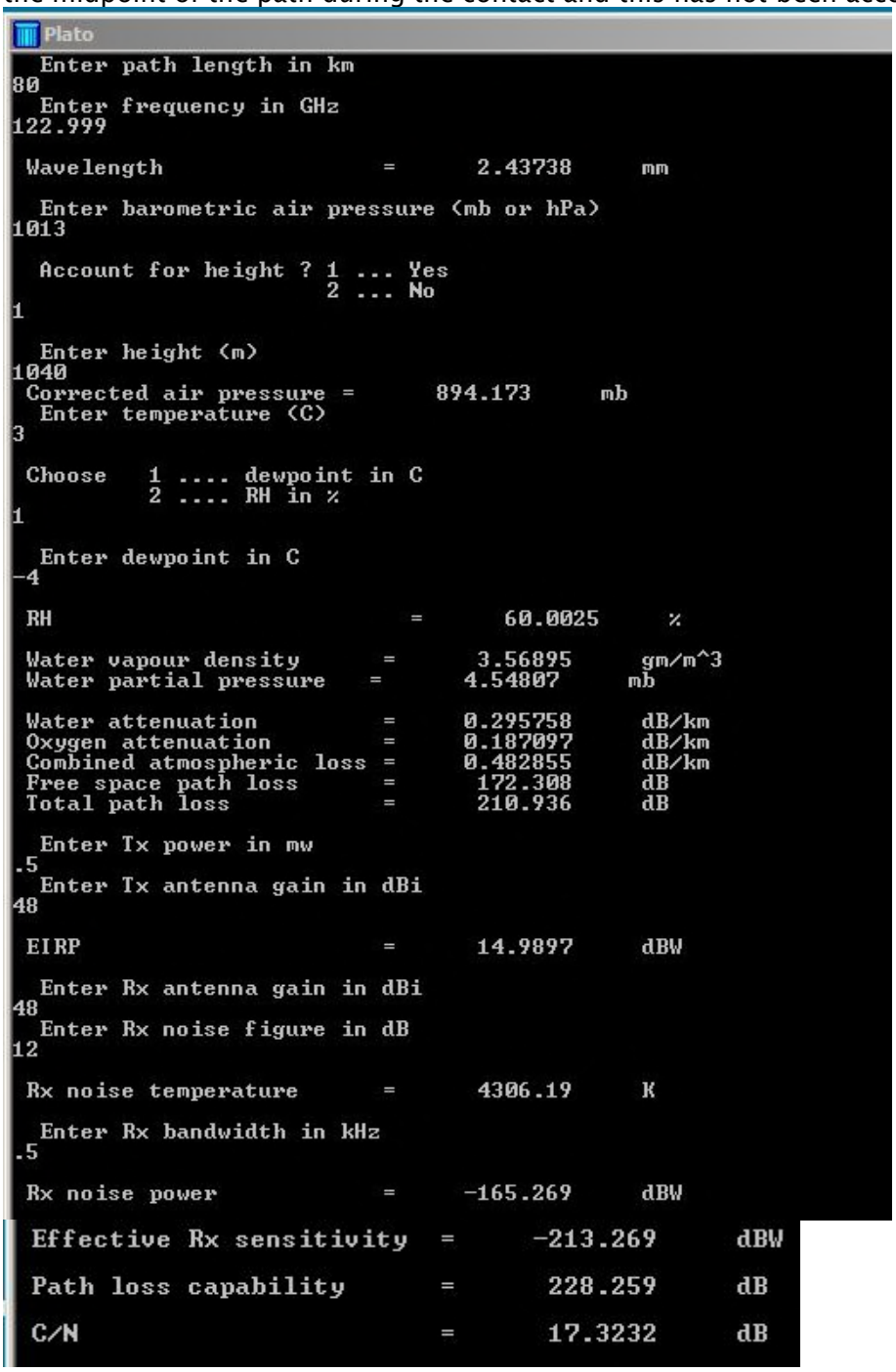


Figure 8

Thus given the uncertainties in the equipment parameters and the atmospheric conditions along the path, the agreement between the predicted and measured values of C/N is surprisingly good. To do better requires better characterisation of the equipment parameters and more comprehensive measured atmospheric data.

Conclusions

Our knowledge of propagation at 122GHz must be regarded as a "work in progress" and will surely be advanced as more contacts are made over different forms of terrain and under different climatic conditions. From the above study, it is possible to make some recommendations regarding the most auspicious conditions required for working DX at 122GHz. These are:

(a) Use as high a transmit frequency within the band as possible.

(b) Operate when the temperature is low since then the air will contain a smaller amount of water even though the measured RH may still appear to be high.

(c) If it is necessary to operate when the temperature is high, then check to see how high the value of RH is; an upper limit of 40% might be acceptable. It should be a "good drying" day.

(d) Note that higher losses will occur when the pressure is high, so it is advantageous to operate from elevated sites.

In summary, the main factor which determines atmospheric losses at 122GHz is the water content; the effect of oxygen is small because, luckily, the band is located just far enough away from the oxygen resonance to make the associated losses acceptable.

References

[1] https://groups.io/g/The122GProject

[2] Recommendation ITU-R P.676-11 (09-2016), "Attenuation by atmospheric gases"

[3] "Humidity conversion formulas", Vaisala.com

[4] http://weather.vk5microwave.net/Weather.aspx?State=H

[5] https://www.silverfrost.com/32/ftn95/ftn95_personal_edition.aspx

WeatherBox – an Arduino-based system for real-time measurement of atmospheric data and microwave propagation prediction

Barry Chambers G8AGN

In a previous Scatterpoint article, it was shown that the presence of water vapour in the atmosphere can result in a large increase in path attenuation, especially on the higher mm-wave bands. Because of the current interest in operating at 122GHz, it was thought that a real-time monitor of atmospheric conditions would be a useful tool to have "in the field" since this would provide a good indication of whether a particular contact might be worth attempting "on the day". The resulting monitor is *WeatherBox* and this is described below.

Hardware

In its present form, *WeatherBox* consists of five main components: an Arduino Mega2560, a NEO-6 or 7 GPS module, a Bosch PME280 sensor, a 20x4 LCD display module and a 16-key keypad. The *WeatherBox* sketch is too large to run on an Arduino Nano or a Uno, hence the choice of a Mega2560.

The Arduino receives date/time and location data from the GPS module through a software serial interface whereas the interface for the weather sensor and the LCD display is via the I2C bus.

The PME280 sensor samples on demand the barometric pressure, air temperature and relative humidity. It is contained within a very small ventilated metal can mounted on a small PCB. The 20x4 LCD display has an integral I2C interface which reduces the number of interconnections needed between the display and the Arduino from 16 to only 4. Because the PME280 sensor and the LCD display are both connected to the same I2C pins on the Arduino, they must each have a separate I2C address but these are usually already pre-set at the time of purchase.

The keypad has 16 keys, labelled 0...9, A...D, * and #. At present, only 13 keys are used, leaving the others available for future hardware or software upgrades.

WeatherBox can be configured in software to use either a conventional keypad or one using membrane switches. The two types are shown in Photo 1.

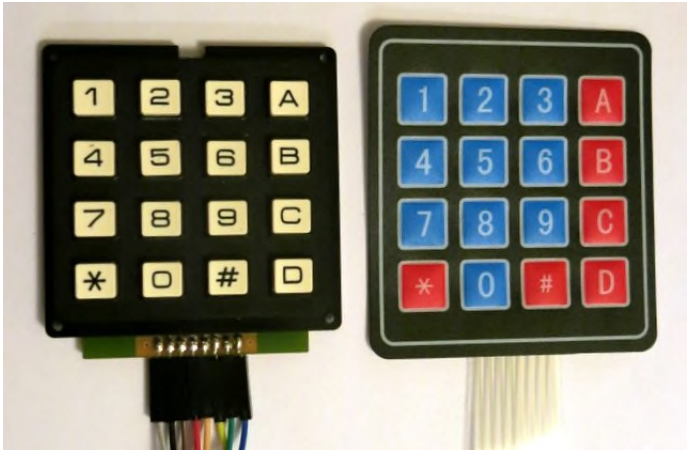


Photo 1

The interconnections between the various components are as follows:

Component	Pin Function	Connect to Mega2560 pin
GPS module	VCC	5V
	GND	0V
	TX	19 (RX1)
PME280 sensor default I2C address 0x76	VIN	3.3V
	GND	0V
	SCL	21 (SCL)
	SDA	20 (SDA)
20x4 LCD display default I2C address 0x27	VCC	5V
	GND	0V
	SCL	21 (SCL)
	SDA	20 (SDA)
Keypad	LH lead or pin	5
	Intermediate leads or pins	6, 7, 8, 9, 10, 11
	RH lead or pin	12

Power must also be fed to the Arduino board itself either via a 7 - 12V DC supply connected to the on-board power jack (2.1mm plug needed) or via 5V DC fed to the VIN pin or through the USB interface.

Software

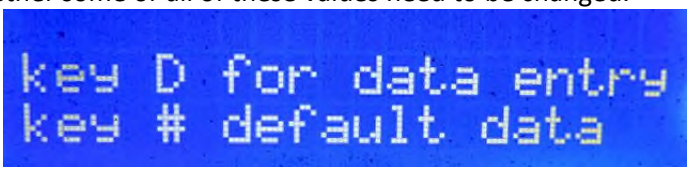
A copy of the Arduino sketch for *WeatherBox* may be obtained from the author on request via b.chambers@sheffield.ac.uk. It has been tested using Arduino IDE v1.8.10.

The sketch requires several libraries to be downloaded from the WWW and installed in the Libraries folder which normally resides within the user's Arduino Sketches folder. Details are listed below

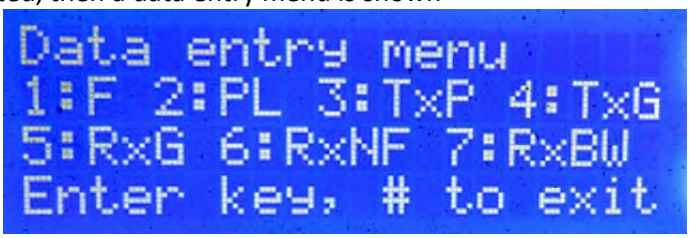
Library	Purpose
TinyGPSplus	Retrieve data from GPS module
SparkFunBME280	Retrieve weather data from sensor
LiquidCrystal_I2C	Display data on LCD display via I2C bus
Keypad	Interpret row and column addresses to decide which key has been pressed

After the sketch has been compiled and uploaded to the Arduino, the LCD display should show a splash screen for a few seconds.

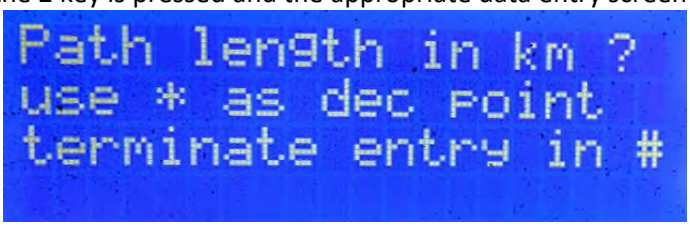
And this is followed by another screen which asks whether the user is intending to use default data values for the radio equipment in use or whether some or all of these values need to be changed.



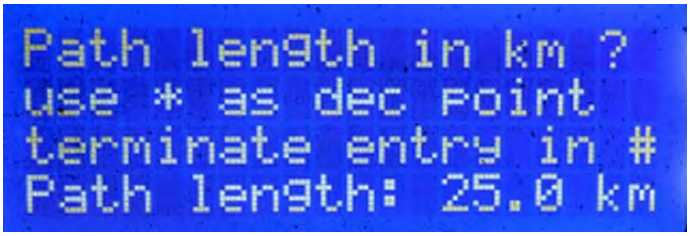
If key D on the keypad is selected, then a data entry menu is shown



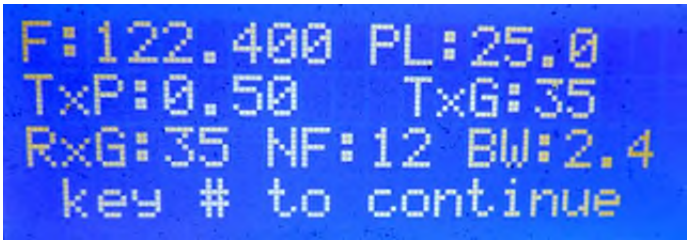
The data values which can be changed are: frequency, path length, transmitter power, transmitter antenna gain, receiver antenna gain, receiver noise figure and receiver I.F. bandwidth. These are selected, one at a time, by pressing the appropriate key on the keypad. A further data entry screen is then shown to aid the actual data input process and the value which has been entered is shown to confirm that valid data has been entered. So, for example, if the path length is to be changed, then the 2 key is pressed and the appropriate data entry screen appears.



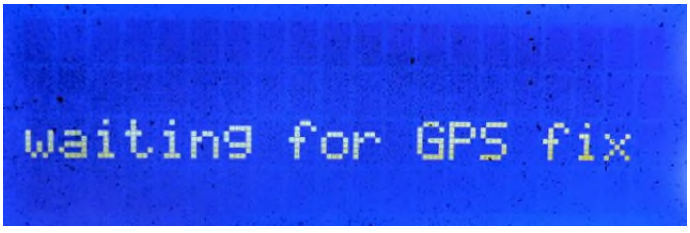
Once the data has been entered, the entered value is shown as confirmation and the original



data entry menu reappears for further data values to be entered as desired. If no further data entry is required, pressing the # key gives a “system” screen which summarises all the radio system data which will be used in subsequent calculations.



This screen may be left by pressing the # key and the software now waits until the GPS module receives a valid position fix.



Once a valid GPS fix has been obtained, the “propagation prediction” screen will be shown and this will be updated about every 10 seconds.

The top line of the display shows the *WeatherBox*’s 10-digit Maidenhead locator and the transmitter frequency in GHz. The latter value will be either the default value set by the user in the sketch or the value set via the keypad, as discussed above.
The data shown on the second line of the display are the date as DDMMYY, the time as HH:MM (UTC) and the path length in km between the transmitter and the receiver.
The third line of the display shows the measured values of atmospheric relative humidity (%), barometric pressure (mb or hPa) and temperature (^{o}C). These values are truncated for display purposes but their full precision is used in the calculations of system performance to be discussed below.
The fourth line of the display shows the calculated water content of the atmosphere (gm/m^{3}), the additional attenuation (dB) due to the presence of water vapour and atmospheric gases along the path between the transmitter and the receiver and the estimated received carrier to noise ratio (dB).The calculations behind the last two results, which for display purposes are rounded up and down, respectively, are based on the attenuation model given in the ITU-676-12 report and are valid for any frequency between 1 and 1000GHz; hence although *WeatherBox* could be used to predict real-time radio system performance on any of the amateur microwave bands, it will most likely be of value on the ones above 40GHz.

Editors Comments

This edition is being produced early, with possible omissions and hopefully not too many errors.
This is to inform members of forthcoming events and contest. Also to report on the interesting propagation around the New Year.
Many thanks to Barry G8AGN, without his articles there would have been little technical content.

By John G4BAO

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

Scatterpoint activity report

The Christmas period produced a welcome period of Tropo DX on the GHz Bands. First, a very interesting correspondence from G4OGI

From Nick G4OGI

The round of supertropo this weekend from the High-pressure systems over European mainland has produced some interesting results on 10GHz. This morning (30th December) GB3SCX and OZ1UHF are both being received on a skewed path where my dish is pointing at 50.5 deg etn It may be the pressure gradient is at just the right angle for GB3SCX but I can't explain a 10 degree offset for OZ1UHF. At one time last evening I counted 20 different beacons on the band. Strong signals from the normal range of beacons. No strong UK beacons, but OZ7IGY peaked at +40dB PI4 at 19.50utc. F9ZG (Le Havre) beacon appearing only when I pointed the dish at 50.3 deg. No direct path available due to a heavily obstructed path. GB3LEX also appeared on this heading at the same time. I was on the cliff tops at Margate yesterday afternoon looking out over the North Sea, as the mist and low cloud dissipated the sharply defined polluted brown coloured trapped air layer could clearly be seen.

Some observations from Nick on the effect of dish elevation .
One of the advantages I have now that I have taken weeks/months to learn about my installation on the North Kent coast and work out what can be done is that I can now measure to amateur station satisfaction dish angle and signal amplitude to an accuracy of about 0.1 deg.
This has opened up the possibility to investigate weather scatter and the higher level troposcatter paths.
Over the Christmas break I noticed strong changes in the dew point at about 650mb height (equivalent to about 3.5km) for London, Manchester, Helgoland and Essen (over much of this part of local Europe). Before the heavy cloud arrived, I noticed a scattered signal in clear air conditions peaking about 0.3 deg elevation This suggested a sharp change taking place at about 2.5km height. Once the weather system blew through on 26th December conditions became calm and I had a continuous incoherent scatter signal from PI7ALK through 27th December The angle of arrival increased to 0.7 deg representing a stable scattering layer at about 3.5km. As the evening progressed the arrival angle reduced to about 0.3 deg before becoming a coherent surface duct signal overnight. I looked for a scattered signal from DB0GHZ but nothing was found. This tends to confirm the scattering region I used was at about 3.5km. To stand a chance of a weather scattered signal from DB0GHZ cloud tops would have to be about 4km high. (Nick attached an animated gif showing cloud scatter from the Juelich radar and noted the height and how the upper level can be either a sharp definition or rough. Rough will give weak and highly scatter longer range for a very short time.) Please email john@g4bao.com if you'd like a copy of the gif

Summary of PI7ALK monitoring
25th December 2019
Early part of the day
Clear Air conditions - no detectable direct signal

Late part of the day
Clear Air Conditions – incoherent scatter at 0.3 deg elevation

26th December
Extremely Windy – 60km/h+ winds locally
Nil observation

27th December
Early part of the day (sunrise)
Calm conditions – 100% overcast. Cloud base 0 metres
Strong incoherent scatter at 0.3 deg elevation
Increasing in strength and elevation – to 0.7deg for most daytime afternoon

Late part of day
Calm conditions – 100% lightly overcast
Strong incoherent scatter dropping to 0.3 deg elevation
Becoming strong coherent scatter below 0.3 deg

Surface duct signal dominant overnight becoming steady s3 signal into 28th December (08.15utc)
New Website
Nick has produced a site http://gm4ogi.no-ip.org/Terrestrial%20Weather/index.html where he's assembling relevant data for microwave activities. At the moment it is simply a repository for the raw data, but as usual he has a cunning plan to expand this over the next few months. He has just been awarded a licence to access in real-time all the relevant data from Eumetsat and AVIS both direct from satellite and their web sites. I should therefore be able to expand data and analysis as I get to grips with the volume. What could be interesting is that I have access to Sea Surface Temperature data at regular time intervals. This gives me an opportunity to study correlation with low level troposcatter

Here are the other reports from members

From G3XDY

1.3GHz

28/12/19	F4CWN	JN03KN	
	F5ICN	JN03BF	59+40
	F6APE	IN97PI	
29/12/19	F6CIS	IN94WL	59+
	OZ8ZS	JO55RT	
	SR1KOL	JO74SE	Beacon 559
	SP2HMR	JO94DE	
	SQ2SAT	JO83XG	59
	DJ8MS	JO54UC	
	SM7LCB	JO86GH	
1/1/20	SM7LCB	JO86GH	599

2.3GHz

29/12/19	F6CIS	IN94WL

3.4GHz

28/12/19 Beacons DB0MOT and DB0HRF (both in JO40FF) heard for the first time.

5.7GHz

28/12/19	F6APE	IN97PI
	HB9G Beacon (JN36BK) heard	
29/12/19	F5ZBE Beacon (JN18KO) heard 599	

30/12/19 New beacon ON0VHF (JO20HP) on 5760880.0 (locked) heard soon after switch on at 599++

10GHz

28/12/19	F6APE	IN97PI
1/1/20	SM7LCB	JO86GH 1100km 529 CW

From GU6EFB

Here is a list of stations worked on 23cms whilst sitting on my "little rock in the English Channel." The opening was intense on the 29th December 2019 and some 400 stations worked across 144, 70cm and 23cms most signals were 59+ many dBs. Whilst I did operate on 144 FT8 most of the QSO's were on SSB. The signals on 23cms were unbelievable strong ant it was nice not to have to struggle and also nice to have a bit of a chat rather than operating contest mode. The highlight for me on 23cms was hearing a weak signal on a strange beam heading for me anyway the station got stronger so I gave a call only to be told that they were going to QSY to 10GHz but I was asked to wait on frequency and that he would come back to me. After a few mins he did come back and I called again this time the signal was 59+20dbs it turned out the station in question was Rudi OE5VRL/5 in JN78DK. OE was a new DXCC country for me and as it turned out also for OE5VRL/5 the distance was some 1233km which for my small station was amazing. Later in the evening I was called again by Rudi who informed me that this was the first every GU to OE QSO on 23cms. I don't know if this is correct or who keeps these kinds of records. Rudi also told me that that my signal was not as strong as the first contact but still around 57 It was only later that I discovered that I had put the amplifier into bypass, so was only running about 10 watts.

From Alexandre F5ICN

(badly translated by G4BAO)

Thank you to all the stations I worked on 144, 432 and 1296MHz. I was QRV on the 28th and 30th after work and on December 29th. In total I had 14 QSO on 23 cm over 800 Km including 4 QSOs over 1000 km. I wish you all a happy new year 2020 with many more openings like this one.

From Ralph G4ALY

During the latter part of 2019 my lovely 2mtr talk-back antenna went Iffy after replacing the heliax Andrews and pre-amp it occurred again. It turned out the earthy end of the coax to the driven element (LFA 10 el) This caused a problem for working DX talk-back. Now in the recent storms and with a brief power cut my 3cm is not functioning As it should- The rx is ok but a delay has occurred on returning back to RX. Possibly the switching diode or sma tx/rx relay?? I cannot get at it until the spring due to the horrible weather. (Maintenance or lack of it was the main problem I think). I maintain my daily contact on 3cm with Claude but had to instruct F9OE to wait 20-30 seconds for the receiver to recover! Activity here in the South West W over this spectacular opening:-.

1.3GHz

28/12/19	F2CT IN93
	F6DRO JNO3 903km 57-8 ssb.
	F6DBI IN88
	F4CWN JN03 ALSO ON 13cm
	F6APE
	F6DRO 58 SSB 503km
	F1ZBC/B beacon

2.3GHz

28/12/19	F4CWN JN03
	F5ZMF/B beacon JN06

3.4GHz

28/12/19	GB3MHZ/B beacon

10GHz

28/12/19	F1BQ/B beacon JN09
	F9ZG/B beacon in98

1.3GHz

30/12/19 GB3MHZ/B beacon

10GHz

30/12/19 F9ZG/B beacon
F9OE 59 + SSB

From Andy G4JNT

The Bell Hill 24GHz beacon GB3SCK was spotted on 2019-12-30 24048.9050MHz at 11:38 UTC by G0JBA locator JO01PG63 distance 255km. IO80UU to JO01PG 529.

From Phil G0JBA

On Saturday 28th December signals were much improved from normal levels and I worked G4BAO on 3cm, I gave 57 and had 59 report this was at 1330. We then tried 24GHz on CW and signal on trace at G4BAO but very weak. Later that afternoon, following a Crash course in WSJT-X from G4BAO we tried again on 24GHz JT4G and exchanged -15db reports but conditions were too poor for CW/SSB. QRB was 135km for my ODX at 1529hrs. Later in the evening of 28th Dec on 3cm Band I worked F6DKW JN18CS, at 1930hrs, 284km on 3cm 59/59. We then tried 24GHz, he heard me but very weak, I could not detect a signal from Maurice.

On Monday 30th December F6DKW Maurice contacted me on KST and we tried a QSO on 3cm at 1020hrs - exchange was 59+++ on SSB. We then QSYed to 24GHz and I started to transmit a tone for 2 minutes - during this period Maurice meeped me on KST and said stop and go to SSB. At 1028hrs we had a very easy QSO, 57/57 each way report on 24GHz SSB - signals were steady and at 284km JO01PG-JN18CS my new ODX.
At 1040hrs G4ODA Keith contacted me and we quickly worked on 3cm at 59+++ SSB each way. We then changed to 24GHz band and at 1043hrs we exchanged easy 57/57 each way reports on SSB JO01PG IO92WS 192km. Later that afternoon G4BAO and G0JBA had another attempt at a QSO on 24GHz and this time 55/55 SSB 2 way at 1522hrs. G4BAO/ G0JBA JO02OB-JO01PG 135km At 1540hrs on 30th December I attempted a QSO with G8APZ (JO01DO-JO01PG 79km) on 24GHz I could detect a signal from Robin but too weak and the path is quite obstructed between us. At 1726hrs G4LDR Neil was contacted - we were unable to complete on 3cm as Neil had a TX problem but gave me 59++ on SSB. W then tried 24GHz on an obstructed path (locally I have tall trees in that direction) and we exchanged 529/529 on CW - SSB was a little too weak - G4LDR/ G0JBA IO91EC-JO01PG 207km.
Tuesday 31st December 2019 I tried a QSO with Marc F6DWG/P in JN19AJ at 2008hrs on 3cm SSB, signals were 59/59 but unstable and not as good as previous day's propagation. QRB 214km We then tried a QSO on 24GHz but humidity was 95% and conditions down. I heard Marc but very faintly and we tried to exchange reports for 15 minutes with no success. We could sometimes hear each other and something like JT4G would likely have worked.

Beacons heard on 24GHz , All on 30th December 2019

F5ZTS 185km 529
GB3CAM 156km -12db JT4G
GB3SCK 255km 529 and -16db JT4G
PE9GHZ 182km 559
ON0EME 243km 599
LX0CDF partial callsign so not logged but it was this beacon (got LX0…then F) RST419 at 396km.

My Grids now worked since September 2019 are JN18, IO91, IO92, JO01, JO02 and many others heard via Beacons.

From G4BAO

"From here on the Fen Edge. as well as the my 24GHz QSO with G0JBA, I worked ON7FLY and F6DKW on 10GHz both with 59 reports plus PE1CKK and PA0BAT on 3.4GHz and a 1.3GHz ODX of 1038km on CW with OE5BXL"

Contests

UKuG MICROWAVE CONTESTS - 2020

Aims and comments:

There are no changes to the rules from 2019. This year the last weekend of each month has been designated as an "Activity Weekend" and is included in the calendar attached to these rules.

The low band event dates will be similar to last year, with the March, May and June sessions running on IARU coordinated dates. Stations wishing to take part on 2300MHz are reminded that they must be in possession of the relevant Notice of Variation, and to take part on 2320MHz that they must register their station with Ofcom by emailing pssramateurs@ofcom.org.uk to provide the following information:

1. Name
2. Address
3. Call sign
4. Location of use
5. Frequency range used
6. Type of use
7. Regularity of use (e.g. evenings and weekends; 24/7; occasional)
8. Transmit power (i.e. EIRP) .

The high band events will continue on 5.7 and 10GHz, the dates will continue to be on the last Sunday of May, June, July, August and September. The sessions will run between 0600 to 1800 UTC, with operators able to choose any 8 hour slot (or two slots with at least a 1 hour gap). As in previous years the overall table and trophies will be determined using the best three scores made by each station across the five events. The high band events will coincide with the French Journée d'activité dates.

The millimetre events will run as last year, they will comprise the all band event in June covering 24GHz – 248GHz, and 24/47/76GHz events in May, September and October. The 24GHz trophy will be awarded for the June event, the 24GHz scores from the best three of the four events will count towards an overall score for the G0RRJ Memorial Trophy, and the best three session scores on 47GHz will determine the award of the 47GHz Trophy. The 76GHz events will contribute to the 76GHz championship where the best three session scores will count to the total.

Microwavers outside the UK are most welcome to join in our contests. There is already a core of French, Dutch and Belgian stations that appear regularly in our summer contests. We would like many more to do the same!

THE RULES listed below are final and binding for 2020.

The following contests are scheduled for 2020:

- Low Microwave Bands - 1.3GHz/2.30GHz/2.32GHz/3.4GHz (5 contest days). An overall championship will be decided on the best three scores out of five.
- 5.7GHz (5 contest days with 3 to count for the championship), on the same days as the 10GHz contests.
- 10GHz (5 contest days with 3 to count for the championship), on the same days as the 5.7GHz contests.
- 24GHz G0RRJ Memorial Trophy Contests (4 contest days with 3 to count for the championship).
- 24GHz Trophy awarded to the leading station on 24GHz in the 24GHz -248GHz event in June.
- 47GHz Trophy (4 contest days with 3 to count for the championship)
- 76GHz (4 contest days with 3 to count for the championship)

The full contest program and rules are published in the January 2020 issue of the Scatterpoint Microwave Newsletter and are also available on the Internet on the UKuG website at http://www.microwavers.org

General Rules (applicable to all events)

The Contests are open to all comers (you do not have to be an RSGB or UK Microwave Group member). Stations located outside the UK (G, GW, GM, GI, GD, GU, GJ) may enter a contest, and will be tabulated within the overall results tables, but will not be eligible for UK Microwave Group awards.

Contestants are expected to enter in the true spirit of the event and to adhere strictly to any equipment or power restrictions that apply to the particular contest. Operators may enter as home station or portable (either mixed or separately in the championships) unless specified in the rules for a specific event. In multi-band contests, single-band entries are always acceptable.

Stations: Entrants must not change their location or callsign during the contest, unless the Rover rule is invoked. In multi-band events, all stations forming one entry must be located within a circle of 1000m radius. An operator may reside outside the station's area ("remote station"), connected to the station via a "remote control terminal". In such a case, the Locator

for the contest is the Locator of the station's position. An operator may only operate one single station, regardless if it is locally or remotely operated, during the same event.
Contacts: Only one scoring contact may be made with a given station on each band, regardless of suffix (/P, /M, etc) during an individual contest or cumulative activity period, unless the station worked is a Rover when each QSO from a different location may be counted. When operating as a Rover, a maximum of one scoring QSO can be made with any given station from each location visited. Contacts made using repeaters or satellites will not count for points. Contacts with callsigns appearing as operators on any of the cover sheets forming an entry will not count for points or multipliers.
Scoring: Contacts are scored on the basis of 1 point per kilometre (rounded up to the nearest kilometre) for full, two-way microwave contacts and at half points for one-way (ie crossband) contacts. Any contacts made by EME are scored at 1 point per kilometer up to 1000km, and will be scored at 1000 points above that distance.
Exchanges: Contest exchanges on the microwave bands consist of RS(T) + serial number (starting at 001). In addition, the six (or eight) figure QTH Locator must be exchanged either via the microwave band or on the talkback medium. In multiband contests, the serial number will start at 001 for each band (ie a common sequence across the bands is NOT to be used). No points will be lost if a non-competing station cannot provide an IARU locator, serial number, or any other information that may be required. However, the receiving operator must receive and record sufficient information to be able to calculate the score.
Talkback: Talkback can be used to assist in setting up a QSO, but note that the contest exchange must be made via the microwave band. It is not permissible to use the talkback as a means of checking the report or serial number – they must be copied via microwaves – and after the QSO is complete, care should be taken to avoid accidentally repeating the exchange via talkback. There is no restriction on the talkback methods that can be used – other amateur band, internet, phone, etc. In setting up the QSO, it is also permissible to send back received audio to the other station, for example to help with antenna alignment. An exception is that our contests do allow one way (cross-band) QSOs for half points, and in this case, the other band can be used by one of the stations.
Entries: Contestants are asked to make sure their entries have been scored correctly and that all relevant bonus points and multipliers have been claimed.
Log entries must be submitted via the online log portal at http://microwave.rsgbcc.org/cgi-bin/vhfenter.pl. When uploading electronic logs, the format should be one of the following: ASCII text, RSGB Standard Format, Cabrillo, SDV and G0GJV log outputs, and IARU REG1TEST format (preferred). Paper logs may be entered using the online log editor at http://microwave.rsgbcc.org/cgi-bin/cover.pl. Entries must be submitted no later than 7 days after the conclusion of the contest session.
Awards: Certificates will be awarded to overall contest winners and individual section leaders and their runners up. Additional Certificates of Merit will be awarded to stations in certain categories, as indicated in the rules for each event. With these, as with the logs, the adjudicator's decision is final.
Special Rules: Applicable if called up for the specific contest:
Rover Concept: The 'Rover' concept is to encourage lightweight, low power portable activity. This allows the location of the station to be moved as many times as desired and by a minimum of 5 linear kilometres, at any time during the contest period. From each new location, stations worked from any of the previous locations during the event may be worked again, both stations involved in the contact gaining points. The serial number, however, will not revert to 001 each time a move is made but will carry on consecutively from the previous contact.

Low Band Microwave Contest Rules
First introduced in 2004, these contests aim to encourage operation on the lower microwave bands, particularly as there is growing UK availability of 2.3GHz and 3.4GHz equipment. There are five of these events, in March, April, May, June, and November. The March, May and June events are timed to overlap with UHF/SHF events in some other IARU Region 1 countries. The times for the November event are shortened to make portable operation more practical.
1. The General Rules listed above apply except as modified by these rules.
2. There are five contests, one each in March, April, May, June and November. The March, April and June events run from 1000 to 1600 UTC. The May event runs from 0800 to 1400 UTC to coincide with the RSGB UHF Contest. The November event is from 1000 to 1400 UTC.
3. Entrants in the May event need not start serial numbers from 001 if they are also participating in the RSGB UHF Contest.
4. Operation may take place on the following bands: 1240-1325MHz, 2300 – 2302MHz, 2310 – 2350MHz, 3400 – 3410MHz. The same station may be contacted for points on each of the four bands.
5. Each event will be scored and tabulated separately. There is an annual championship determined by taking the best three normalized scores from each entrant

across the five events for each band. The overall champion will be declared based on the normalized championship scores from each band.
6. For each session, certificates will be awarded to the leading entry plus runner-up on each band, the overall leading entry and runner-up across the four bands, plus for each band the leading stations in each of the following categories: home station, portable station, station running less than 10 watts output.
Championship certificates will be awarded to the winners and runners up for each band, and to the overall championship winner and runner up.

5.7GHz Contest Rules

The 5.7GHz and 10GHz contests are being run concurrently to grow activity on 5.7GHz. Although they are on the same days, they are completely separate contests. Any band or both bands can be used on any of the 5 days.
1. The general rules shown above apply.
2. There are five, monthly, events from May to September inclusive, and the events run from 0600 to 1800 UTC on a Sunday. Entrants can operate for a period of up to eight hours during each event, either as a single period or two separate periods with a minimum off time of 1 hour between.
3. Moving location during the contest is allowed - the Rover concept is applicable.
4. Certificates will be awarded to the leading station and runner-up, and to the leading fixed, portable and low power (<1W) stations.
5. The G3KEU Memorial Trophy will be awarded to the leading entry in the championship, determined from the best three normalized scores during the series of events.

10GHz Contest Rules

The 5.7GHz and 10GHz contests are being run concurrently to grow activity on 5.7GHz. Although they are on the same days, they are completely separate contests. Any band or both bands can be used on any of the 5 days.
1. The general rules shown above apply.
2. There are five, monthly, events from May to September inclusive, and the events run from 0600 to 1800 UTC on a Sunday. Entrants can operate for a period of up to eight hours during each event, either as a single period or two separate periods with a minimum off time of 1 hour between.
3. Contestants may submit logs for any one of the following sections:

Open

No power or antenna restrictions (other than those laid down in the amateur licence).
The 'Rover' concept does not apply to this section.

Restricted

10GHz transmit output not to exceed 1.0 watt to the antenna.
Moving location during the contest is allowed - the Rover concept is applicable.
4. Certificates will be awarded to the leading station and runner-up in each section, and to the leading portable and fixed stations.
5. The 10GHz championship will be determined based on the best three normalized scores from each entrant over the five sessions. In addition to winners and runners-up certificates for each section, the following certificates/trophies will be awarded:
- Leading entry in the Open section - The G3RPE Memorial Trophy
- Leading entry in the Restricted section - The G3JMB Memorial Trophy
- Certificates to the leading home station and portable station in each section.

24GHz G0RRJ Contest Rules

The 24GHz G0RRJ Contest will take place over four sessions, coincident with 47GHz events and also the all millimeter wave event in June.
1. The general rules shown above apply. Eight character locators must be used in this contest.
2. There are four events from June to October inclusive, and the events run from 0900 to 1700 UTC on a Sunday.
3. Moving location during the contest is allowed - the Rover concept is applicable. Please provide a list of which contacts took place from each locator used (this can be in the soapbox area of the log).
4. Certificates will be awarded to the leading station and runner-up in each section, plus the leading home and portable stations.
5. The G0RRJ Memorial Trophy will be awarded to the leading entry in the championship, determined from the best three normalized scores during the series of events.

24GHz Trophy Rules

The 24GHz Trophy contest coincides with the 47GHz/76GHz and 122GHz - 248GHz events
1. The general rules shown above apply. Eight character locators must be used in this contest.
2. The contest will run from 0900 to 1700 UTC on a Sunday.
3. Moving location during the contest is allowed - the Rover concept is applicable. Please provide a list of which contacts took place from each locator used (this can be in the soapbox area of the log).
4. Certificates will be awarded to the leading station and runner-up, and the winner will receive the 24GHz Trophy.

47GHz Contest Rules

The 47GHz contest will take place over four sessions, coincident with 24GHz/76GHz events and also the all millimeter wave event in June.
1. The General Rules listed above apply. Eight character locators must be used in this contest.

2. The contest will run from 0900 to 1700 UTC on a Sunday.
3. Moving location during the contest is allowed - the Rover concept is applicable. Please provide a list of which contacts took place from each locator used (this can be in the soapbox area of the log).
4. Certificates will be awarded to the leading station and runner-up.
5. The 47GHz Trophy will be awarded to the leading entry in the championship, determined from the best three normalized scores during the series of events.

76GHz Contest Rules

The 76GHz contest will take place over four sessions, coincident with 24GHz/47GHz events and also the all millimeter wave event in June.
1. The General Rules listed above apply. Eight character locators must be used in this contest.
2. The contest will run from 0900 to 1700 UTC on a Sunday.
3. Moving location during the contest is allowed - the Rover concept is applicable. Please provide a list of which contacts took place from each locator used (this can be in the soapbox area of the log).
4. Certificates will be awarded to the leading station and runner-up.
5. A certificate will be awarded to the leading entry in the championship, determined from the best three normalized scores during the series of events.

122GHz – 248GHz Contest Rules

The 122GHz – 248GHz contest coincides with the 24GHz Trophy, and 47GHz event in June
1. The General Rules listed above apply. Eight character locators must be used in this contest.
2. The contest will run from 0900 to 1700 UTC on a Sunday.
3. Moving location during the contest is allowed - the Rover concept is applicable. Please provide a list of which contacts took place from each locator used (this can be in the soapbox area of the log).
4. The overall score will be determined by adding together the normalized scores from all bands entered.
5. Certificates will be awarded to the leading station and runner-up on each band and overall.

Other Microwave Contests

The first weekend of May sees the RSGB 432MHz - 248GHz Multiband Contest staged in parallel with the RSGB UHF/SHF Contest. The 10GHz Trophy is run in parallel by the RSGB VHF Contest Committee on the Saturday of that weekend, and the rules can be found in the RSGB VHF contest rules.
BATC run the UK section of the IARU ATV contest on the second weekend in June, plus other ATV events, see
http://www.batc.org.uk/contests/contest_news.html
The first weekend in July is RSGB VHF National Field Day which includes 1.3GHz as one of the bands.
The first weekend of October sees the RSGB 432MHz - 248GHz Multiband Contest staged in parallel with the Region 1 IARU UHF/SHF Contest. The 1.3GHz Trophy and the 2.3GHz Trophy are run in parallel by the RSGB VHF Contest Committee on the Saturday, and the rules can also be found in the RSGB VHF contest rules.
The RSGB also runs a cumulative UK Activity Contest on 1.3GHz on the third Tuesday from 2000-2230 local time, and on 2.3GHz – 10GHz on the fourth Tuesday of every month, from 1930 – 2230 local time.
In addition there are other Continental UHF/SHF Contests held during the year and interested UK microwavers are urged to be active during these. Their details may be found on the Internet.

UKuG MICROWAVE CONTEST / ACTIVITY WEEKEND CALENDAR 2020

Dates, 2020	Time UTC	Contest name	Certificates
25-26 Jan		Activity Weekend	
22-23 Feb		Activity Weekend	
8-Mar	1000 - 1600	1st Low band 1.3/2.3/3.4GHz	F, P,L
28-29 Mar		Activity Weekend	
5-Apr	1000 - 1600	2nd Low band 1.3/2.3/3.4GHz	F, P,L
3-May	0800 - 1400	3rd Low band 1.3/2.3/3.4GHz	F, P,L
17-May	0900 – 1700	1st 24GHz Contest	
17-May	0900 – 1700	1st 47GHz Contest	
17-May	0900 – 1700	1st 76GHz Contest	
30-31 May		Activity Weekend	
31-May	0600 - 1800	1st 5.7GHz Contest	F, P,L
31-May	0600 - 1800	1st 10GHz Contest	F, P,L
7-Jun	1000 - 1600	4th Low band 1.3/2.3/3.4GHz	F, P,L
21-Jun	0900 - 1700	24/47GHz Trophy / 76/122-248 GHz	

27-28 Jun		Activity Weekend	
28-Jun	0600 - 1800	2nd 5.7GHz Contest	F, P,L
28-Jun	0600 - 1800	2nd 10GHz Contest	F, P,L
25-26 Jul		Activity Weekend	
26 -Jul	0600 - 1800	3rd 5.7GHz Contest	F, P,L
26 -Jul	0600 - 1800	3rd 10GHz Contest	F, P,L
29-30 Aug		Activity Weekend	
30-Aug	0600 - 1800	4th 5.7GHz Contest	F, P,L
30-Aug	0600 - 1800	4th 10GHz Contest	F, P,L
13-Sep	0900 - 1700	3rd 24GHz Contest	
13-Sep	0900 - 1700	3rd 47GHz Contest	
13-Sep	0900 – 1700	3rd 76GHz Contest	
26-27 Sep		Activity Weekend	
27 -Sep	0600 - 1800	5th 5.7GHz Contest	F, P,L
27 -Sep	0600 - 1800	5th 10GHz Contest	F, P,L
18 -Oct	0900 - 1700	4th 24GHz Contest	
18 -Oct	0900 - 1700	4th 47GHz Contest	
18 -Oct	0900 – 1700	4th 76GHz Contest	
24-25 Oct		Activity Weekend	
15 -Nov	1000 - 1400	5th Low band 1.3/2.3/3.4GHz	F, P,L
28-29 Nov		Activity Weekend	
26-27 Dec		Activity Weekend	

Key:	F	Fixed / home station
	P	Portable
	Low-power (<10W on 1.3-3.4GHz, <1W on 5.7/10GHz)	L

Month	Contest name	Certificates	Date 2020	Time GMT
Jan	1.3GHz Activity Contest	*Arranged by RSGB*	21-Jan	2000 - 2230
Jan	Activity Weekend		25- 26 Jan	
Jan	2.3GHz+ Activity Contest	*Arranged by RSGB*	28-Jan	1930 - 2230
Feb	1.3GHz Activity Contest	*Arranged by RSGB*	18-Feb	2000 - 2230
Feb	Activity Weekend		22-23 Feb	
Feb	2.3GHz+ Activity Contest	*Arranged by RSGB*	25-Feb	1930 - 2230
Mar	REF/DUBUS EME 3.4GHz	*Arranged by REF/DUBUS*	7-Mar to 8-Mar	0000 - 2400
Mar	Low band 1.3/2.3/3.4GHz	F, P,L	8-Mar	1000 - 1600
Mar	1.3GHz Activity Contest	*Arranged by RSGB*	17-Mar	2000 - 2230
Mar	2.3GHz+ Activity Contest	*Arranged by RSGB*	24-Mar	1930 - 2230
Mar	Activity Weekend		28 - 29 Mar	
Apr	Low band 1.3/2.3/3.4GHz 2	F, P,L	5-Apr	1000 - 1600
Apr	1.3GHz Activity Contest	*Arranged by RSGB*	21-Apr	1900 - 2130
Apr	REF/DUBUS EME 5.7GHz	*Arranged by REF/DUBUS*	25-Apr to 26-Apr	0000 - 2400
Apr	Activity Weekend		25 - 26 Apr	
Apr	2.3GHz+ Activity Contest	*Arranged by RSGB*	28-Apr	1830 - 2130
Mar	REF/DUBUS EME 2.3GHz	*Arranged by REF/DUBUS*	2-May to 3-May	0000 - 2400
May	*10GHz Trophy*	*Arranged by RSGB*	*2-May*	*1400 - 2200*
May	*432MHz & up*	*Arranged by RSGB*	*2-May to 3-May*	*1400 -1400*
May	Low band 1.3/2.3/3.4GHz 3	F, P,L	3-May	0800 - 1400

May	24GHz/47GHz/76GHz		17-May	0900-1700
May	1.3GHz Activity Contest	*Arranged by RSGB*	19-May	1900 - 2130
May	REF/DUBUS EME 10GHz & up	*Arranged by REF/DUBUS*	23-May to 24-May	0000 - 2400
May	2.3GHz+ Activity Contest	*Arranged by RSGB*	26-May	1830 - 2130
May	Activity Weekend		30 - 31 May	
May	5.7GHz/10GHz	F, P,L	31-May	0600-1800
Jun	Low band 1.3/2.3/3.4GHz 4	F, P,L	7-Jun	1000 - 1600
Jun	24GHz-248GHz Contest		21-Jun	0900-1700
Jun	1.3GHz Activity Contest	*Arranged by RSGB*	16-Jun	1900 - 2130
Jun	2.3GHz+ Activity Contest	*Arranged by RSGB*	23-Jun	1830 - 2130
Jun	Activity Weekend		27 - 28 Jun	
Jun	5.7GHz/10GHz	F, P,L	28-Jun	0600-1800
Jul	VHF NFD (1.3GHz)	*Arranged by RSGB*	4-Jul to 5-Jul	1400 - 1400
Jul	REF/DUBUS EME 1.2GHz	*Arranged by REF/DUBUS*	18-Jul to 19-Jul	0000 - 2400
Jul	1.3GHz Activity Contest	*Arranged by RSGB*	21-Jul	1900 - 2130
Jul	Activity Weekend		25 - 26 Jul	
Jul	5.7GHz/10GHz	F, P,L	26-Jul	0600-1800
Jul	2.3GHz+ Activity Contest	*Arranged by RSGB*	28-Jul	1830 - 2130
Aug	1.3GHz Activity Contest	*Arranged by RSGB*	18-Aug	1900 - 2130
Aug	2.3GHz+ Activity Contest	*Arranged by RSGB*	25-Aug	1830 - 2130
Aug	Activity Weekend		29 - 30 Aug	
Aug	5.7GHz/10GHz	F, P,L	30-Aug	0600-1800
Sep	ARRL Microwave EME	*Arranged by ARRL*	12-Sep to 13-Sep	0000 - 2359
Sep	24GHz/47GHz/76GHz		13-Sep	0900-1700
Sep	1.3GHz Activity Contest	*Arranged by RSGB*	15-Sep	1900 - 2130
Sep	2.3GHz+ Activity Contest	*Arranged by RSGB*	22-Sep	1830 - 2130
Sep	Activity Weekend		26 - 27 Sep	
Sep	5.7GHz/10GHz	F, P,L	27-Sep	0600-1800
Oct	*1.3 & 2.3GHz Trophies*	*Arranged by RSGB*	*3-Oct*	*1400 - 2200*
Oct	*432MHz & up*	*Arranged by RSGB*	*3-Oct to 4-Oct*	*1400 - 1400*
Oct	ARRL EME 50-1296MHz	*Arranged by ARRL*	10-Oct to 11-Oct	0000 - 2359
Oct	24GHz/47GHz/76GHz		18-Oct	0900-1700
Oct	1.3GHz Activity Contest	*Arranged by RSGB*	20-Oct	1900 - 2130
Oct	Activity Weekend		24 - 25 Oct	
Oct	2.3GHz+ Activity Contest	*Arranged by RSGB*	27-Oct	1830 - 2130
Nov	ARRL EME 50-1296MHz	*Arranged by ARRL*	28-Nov to 29-Nov	0000 - 2359
Nov	Low band 1.3/2.3/3.4GHz 5	F, P,L	15-Nov	1000 - 1400
Nov	1.3GHz Activity Contest	*Arranged by RSGB*	17-Nov	2000 - 2230
Nov	2.3GHz+ Activity Contest	*Arranged by RSGB*	24-Nov	1930 - 2230
Nov	Activity Weekend		28 - 29 Nov	
Dec	1.3GHz Activity Contest	*Arranged by RSGB*	17-Dec	2000 - 2230
Dec	Activity Weekend		26 - 27 Dec	

Events calendar

2020

January 11	Heelweg	http://www.pamicrowaves.nl/
February 15	Tagung Dorsten	www.ghz-tagung.de/
March 7	Cardiff Roundtable	**http://www.cardiffars.org.uk/roundtable/**
March 31	Millimetre & Terahertz Colloquium	https://events.theiet.org/
April 4	CJ-2020, Seigy	http://cj.r-e-f.org
April 18-19	Martlesham Roundtable & AGM	**http://mmrt.homedns.org/**
May 15-17	Hamvention, Dayton	www.hamvention.org/
June 26-28	Ham Radio Friedrichshafen	http://www.hamradio-friedrichshafen.de/
August 20-23	EME 2020 Prague	www.eme2020.cz
September 11-13	65.UKW Tagung Weinheim	http://www.ukw-tagung.de/
September 13-18	European Microwave Week, Utrecht	www.eumweek.com/
October 15-18	Microwave Update, Sterling, Virginia	www.microwaveupdate.org
October 10-16	IARU-R1 General Conference, Novi Sad	www.iaru2020.org
October 24-25	BATC Convention, Coventry	https://batc.org.uk/events/
November 7	Scottish Round Table	www.gmroundtable.org.uk/

80m UK Microwavers net

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

73 Martyn Vincent G3UKV