An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

January 2022

Published by the UK Microwave Group

In This Issue

Articles for Scatterpoint 2

Subscription Information..2

UKμG Project support 3

UKμG Technical support 3

UKμG Chip Bank – A free service for members........3

UK Microwave Group Contact Information.............4

Loan Equipment...4

Thoughts on feeding an 18-inch Edmund dish at 122GHz 5

Effect of surface roughness on dish antenna gain.....12

12GHz Microwave frequency counter FA-2, type BG7TBL review 13

12 Things you should know about Filters Part 3.....15

Editors Comments...19

Scatterpoint activity report 20

UKuG MICROWAVE CONTESTS - 2022.......................23

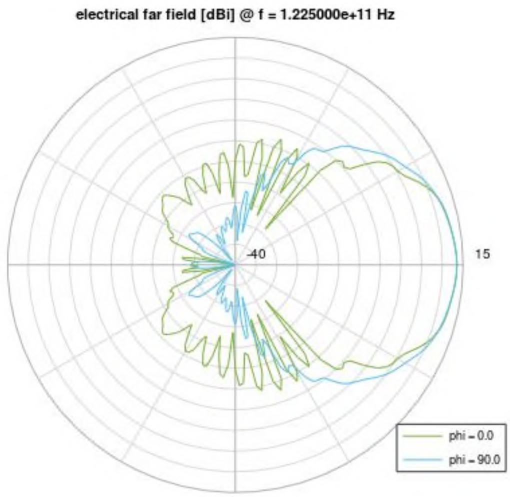
UKuG MICROWAVE CONTEST CALENDAR 2022.........27

MICROWAVE CONTESTS - 2022 28

For Sale..29

EVENTS 2022 30

80m UK Microwavers net 30



Polar Pattern of modelled W2IMU horn – Barry G8AGN

Ed G3VPF Portable on 13cm

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

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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

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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 Neil G4DBN for more information**

5.7GHz 10GHz 24GHz 47GHz 76GHz

Thoughts on feeding an 18-inch Edmund dish at 122GHz

Barry Chambers, G8AGN

From reading last month's Scatterpoint, it would seem that many "microwavers" are becoming interested in using the low-cost Edmund 18-inch optical parabolic reflectors as high gain antennas at 122GHz. As I already had such a dish which was originally meant for my 30THz experiments, I decided to investigate the design of a 122GHz feed system from scratch and the following notes outline my thought processes and the resulting design. It should be stressed that my solution is only one of many which are possible when using a Cassegrain feed system because of the large number of variables whose values can be chosen by the designer to satisfy to his or her initial requirements.

The first point to note is that the Edmund dish has a very small f/D of 0.25; hence any direct feeding method will be very inefficient since the whole area of the dish cannot be illuminated properly. This suggests that much better results should be obtained using a Cassegrain feed system since the inclusion of an intermediate shaped reflector enables the virtual dish f/D to be increased, which in turn facilitates the use of a feed horn with a sharper and better controlled radiation pattern. This should result in a well-defined field taper across the dish aperture, thus leading to a much higher antenna efficiency (a measure of how well the area of the dish is being utilised to provide gain).

My starting point in the design was to consider the choice of feed horn. Since my workshop facilities are very limited and I do not own a lathe, I decided to concentrate on the design of a W2IMU horn since its geometry is very simple, as shown in Figure 1, and it can give a radiation pattern which is well suited for feeding a dish with a f/D in the region of 0.6 to 0.8. Accordingly, I chose a virtual dish f/D of 0.7 as a starting point.

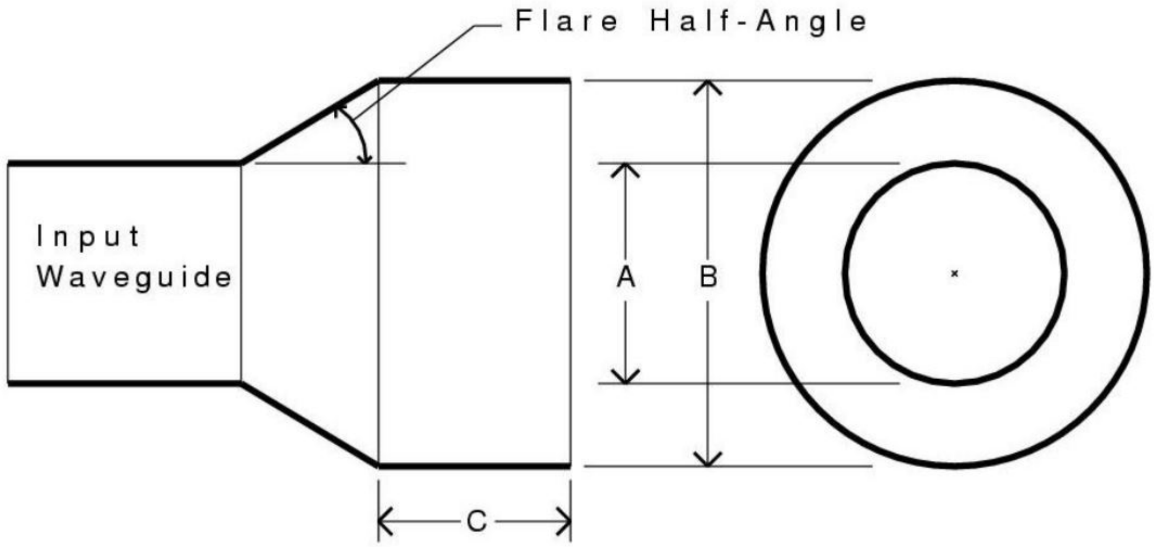

Figure 1 Basic geometry of W2IMU feed (from W1GHZ Antenna Book)

The next parameter to be chosen was the diameter, A, of the horn input circular waveguide. This is value is important for two reasons, since not only will it be a factor in determining the horn flare angle but more importantly, it will determine the input waveguide attenuation. The Edmund dish is deep (i.e. the distance from the apex of the dish to the focal point is about 111mm), so it is likely that the horn input waveguide will need to be at least 70mm long. The original VK3CV Chaparral feed horn input waveguide has an ID of 2mm. Hence if we decide to keep this value for our W2IMU design, it will result in a theoretical waveguide attenuation for the TE11 mode in a copper tube with 2mm ID of about 2.8 dB/m. In practice, the attenuation will be higher than this because of the metal's surface roughness which increases the waveguide internal area. This increase in attenuation can be reduced by polishing using a mildly abrasive paste such as Autosol™. Another way of decreasing the waveguide attenuation is to use a circular waveguide with a larger ID. So, for a 3.1 mm ID, the theoretical attenuation is decreased to about 1dB/m. This waveguide size is also suitable in terms of suppressing unwanted higher order mode excitation since only TM01 mode propagation may also be possible at 122.5GHz but this mode is unlikely to be excited. Hence, let us choose the input waveguide ID to be 3.1 mm. The reason for this odd size is that use can then be made of standard copper tubing which is widely available in model shops and elsewhere [1]. This tubing has a wall thickness of 0.45mm, which results in an OD of 4mm. This OD is exactly the correct size for the tubing to fit into the standard VK3CV transducer section which was supplied with the original Chaparral feed.

From Figure 1, it can be seen that the W2IMU horn phasing section and aperture have a larger diameter,B, compared with that of the input waveguide and so it would be convienient to make use of a length of model tubing whose ID is such that it is a sliding fit onto the OD of the input waveguide tubing. Hence a suggested diameter for this copper tubing has ID = 4.1mm and OD = 5mm (again a wall thickness of 0.45mm). Such tubing is also readily available from sources such as [1]. The final step is to determine the lengths of the taper between the input and output waveguide sections and the phasing section, C. These are both important as they facilitate the excitation of the TM11 waveguide mode in the horn phasing section and provide the correct phasing of the fields due to the TE11 and TM11 modes. This then results in a horn radiation pattern having nearly identical E and H plane main beam characteristics. The lengths of the horn phasing section and taper were calculated using equations from the W1GHZ Antenna Handbook which is available on-line [2]. The results for my feedhorn and a virtual dish f/D of 0.7 are shown in Figure 2 which is a screenshot from a small program I wrote for the purpose using the free to download Salford Fortran IDE [3].
As a check on the proposed feed horn design, I used the free to download openEMS FDTD software package [4]. This was introduced in a previous article which appeared in Scatterpoint in 2019, where I used it to compute the radiation patterns of the original VK3CV 122GHz antennas [5]. Figure 3 shows the geometry of the W2IMU feedhorn which was modelled using openEMS at a frequency of 122.5GHz. It should be noted that the horn aperture is actually 5mm since it includes the aperture tubing wall thickness (i.e. 0.45 + 4.1 + 0.45 mm). The model also assumes an arbitrary 5mm overlap between the input and output copper tubes making up the horn.

```
Plato IDE
Enter frequency in GHz122.5
Enter feed waveguide diameter in mm3.1
Enter dish f/D (*** MIN IS 0.52 ***)0.7
Enter aperture in mm4.1
 aperture B in wavelengths =      1.67533
 phasing section length C(mm) =      7.30862
 horn flare angle (degs) =      26.6216
 axial length of horn flare section (mm) =     0.997535

 CHECK
 BTM11 min (mm) =      2.98568
 B is OK for TM11 mode propagation
 BTE12 max (mm) =      4.16038
 B is OK for no TE12 mode propagation
```

Figure 2 Dimensions of W2IMU feedhorn

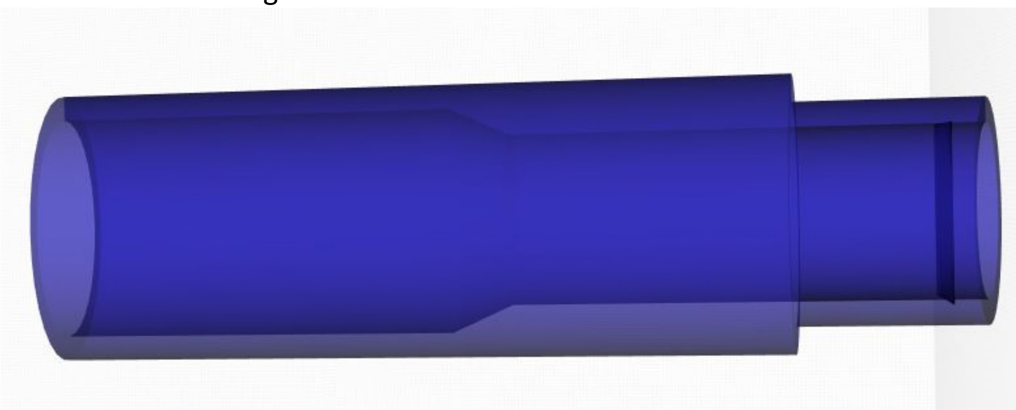

Figure 3 Geometry of openEMS model of W2IMU horn

The openEMS FDTD model was comprised of about 22 million cells, each with a resolution of $\lambda/30$ and calculation of the horn radiation pattern took about 1.5 hours using a laptop with an i7 processor. Figure 4 shows the horn polar E and H plane radiation patterns and Figure 5 shows these in rectangular format. The main beam for each plane is similar in shape but there is divergence in the sidelobe structure as expected.

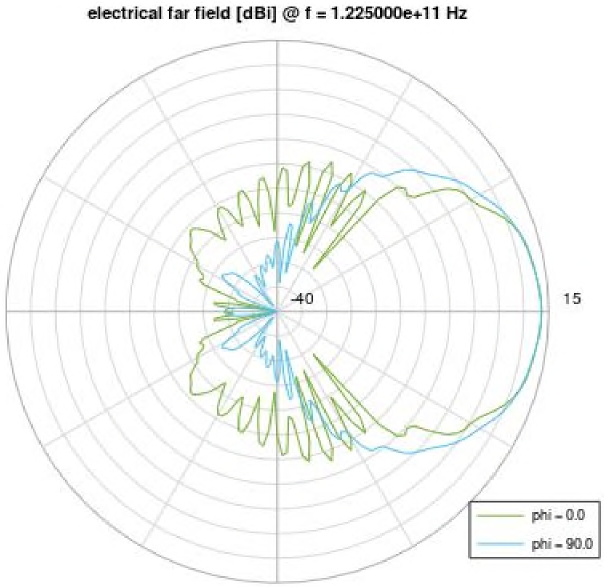

Figure 4 Polar radiation pattern of W2IMU horn design modelled using openEMS

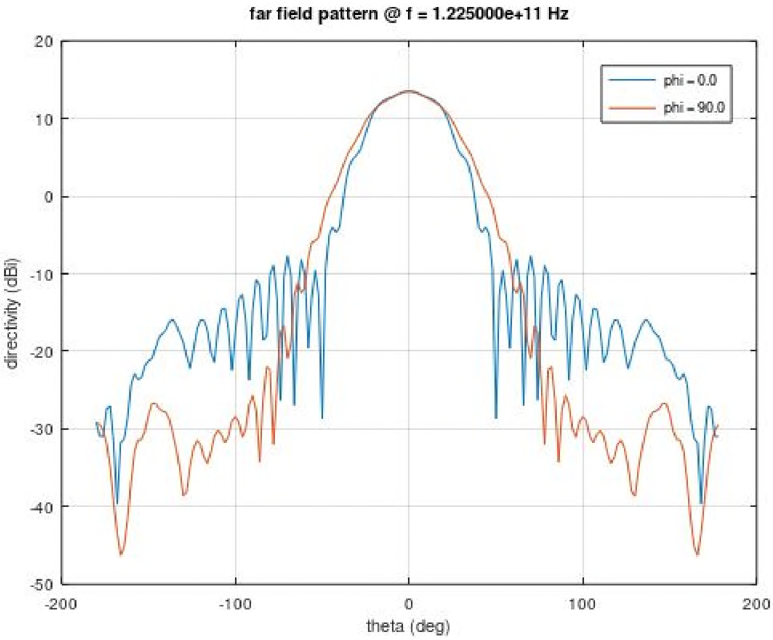

Figure 5 Rectangular radiation pattern of W2IMU horn design modelled using openEMS

Construction of the horn only requires sliding one piece of copper tubing over the other to achieve the required overlap and soldering the two together using a minimum of solder. The horn requires a flare section half-angle of about 26^o and this value is much smaller than the 59^o which would result from using a standard 4.1mm twist drill bit. Hence the latter would have to be reground to make the tip more pointed. The obvious question which then arises is what would be the effect on the horn radiation pattern if the flare half-angle were to be increased to 59^o or even 90^o (in effect just a step)? As might be expected, further openEMS simulations showed that increasing the horn flare half-angle resulted in a degraded radiation pattern and so this idea was not pursued any further.

Next, we need to consider the design of the sub-reflector. The mathematical steps needed for this are rather involved but a fairly readable discussion is given by W1GHZ in [5] and an accompanying Excel spreadsheet can be downloaded from [6]. I used the spreadsheet to perform some basic checks on my proposed sub-reflector design but found that it did not provide the actual required profile directly.

Let us start by looking at the W1GHZ Cassegrain_design.xls spreadsheet. Figures 6 - 8 show the important parts of this and the input data I used.

	A	B	C	D	E	F	G	H
2	**CASSEGRAIN ANTENNA DESIGN CALCULATOR**							
3		***W1GHZ 2004***						
4								
5	**ENTER INPUT PARAMETERS HERE:**		***(Bold blue numbers)***					
6	Frequency	**122.500**	GHz					
7						pi =	3.141593	
8	**Units:**	**mm**	Inches	Wavelengths				
9								
10	Dish diameter	**445**	17.5	**181.7**				
11	Dish **f/D**				**0.25**			
12	Feedhorn equivalent **f/D**				**0.7**			
13	Feedhorn diameter	**5**	0.197	**2.041666667**				
14	Feedhorn Phase Center (negative = inside horn)			**0**				
15								
16	**Wavelength**	**2.449**	0.096	**1**				
17	Dish Focal Length	111.3	4.4	**45.4**				
18	Dish Illumination halfangle				90.0	degrees	1.571	radians
19	Feedhorn illumination halfangle				39.3	degrees	0.686	radians
20	Redge (prime focus to rim)	222.5	8.8	90.9				
21	Space attenuation for main dish				6.02	dB		
22	Space attenuation for virtual dish				1.04	dB		
23	**Decision point:**							
24				***Suggested illumination taper =***	**11.98**	dB		
25				**Enter desired illumination taper :**	**11.98**	dB		

Figure 6

My input data were: dish diameter = 445mm, dish f/D = 0.25, equivalent f/D = 0.7, feedhorn aperture = 5mm. The dish illumination taper was then suggested as 11.98dB.

	A	B	C	D	E	F	G	H
26								
27	**With desired taper:**							
28	Feedhorn illumination halfangle				32.1	degrees	0.560	radians
29	Feedhorn equivalent f/D				0.87			
30								
31	Minimum subreflector diameter	31.9	1.255	**13.01**				
32	Subreflector focal length	25.4	1.002	**10.39**				
33	Subreflector f/D			**0.80**				
34	d_sub/D_main				0.07			
35	Maximum subreflector efficiency (Diffraction loss = blockage loss)				**91.0%**			
36	Feedhorn blockage halfangle				5.6	degrees	0.098	radians
37								
38	**Without feedhorn blockage -- increase subreflector diameter to eliminate feedhorn blockage:**							
39	Minimum subreflector diameter	26.4	1.039	**10.78**				
40	Subreflector focal length	21.1	0.830	**8.60**				
41	d_sub/D_main				0.06			
42	Subreflector efficiency (Diffraction plus blockage losses)				**93.8%**			
43	Feedhorn blockage halfangle				6.8	degrees	0.118	radians
44								
45	**Decision point:**							
46	**Enter desired subreflector diameter :**			**15**	**in wavelengths**			
47	*or go back and change feedhorn*							
48								

Figure 7

Based on the chosen geometry, the minimum sub-reflector diameter was next calculated and I chose a slightly larger value of 15 wavelengths or just under 40mm

52	Subreflector efficiency (only blockage loss increases)				90.4%		
53				Cassegrain loss =	-0.44	dB	
54							
55	For overall efficiency, find efficiency on feedhorn PHASEPAT curve for *f*/D=					0.87	
56				and multiply by		0.904	
57							
58	**CASSEGRAIN SUBREFLECTOR GEOMETRY:**						
59							
60	Feedhorn blockage halfangle				4.9	degrees	0.085 radians
61	Subreflector magnification M				3.48		
62	Hyperbola eccentricity				1.81		
63	Hyperbola a	**8.1**	0.320	3.31			
64	Hyperbola b	**12.2**	0.481	4.99			
65	Hyperbola c	**14.7**	0.577	5.99			
66							
67	**SUBREFLECTOR POSITION:**						
68	Apex to Dish focal point	**6.5**	0.258	2.67			
69	Apex to Feed Phase Center	**22.8**	0.897	9.30			
70		Feedhorn Rayleigh distance =		8.34			
71							

Figure 8

The last section, shown in Figure 8, gives details of the sub-reflector and its position with respect to the real dish and the feed horn. It should be noted that the "Apex to Feed Phase Centre" distance is larger than the horn Rayleigh distance which means that the sub-reflector is in the far-field of the horn. This is desirable, as will be discussed later. Also given in Figure 8 are the values for the variables a, b and c. These define the shape of the sub-reflector hyperbolic profile.

For computational purposes, the equation of the hyperbola can be more simply written only in terms of the variables a and c.

$$x = \sqrt{a^2 + \frac{y^2}{(e^2-1)}} \qquad (1) \qquad \text{where } e = \frac{c}{a}.$$

e is the eccentricity of the hyperbola.

For machining or 3D printing, the actual coordinates needed are (x-a) vs y and y is varied from 0 to R where R is the sub-reflector radius. (x-a) is the sub-reflector thickness, starting from zero at the sub-reflector edge where y = 0. Since we are using a real dish whose f/D = 0.25, the focus lies in the plane of the dish aperture and so from Figure 8, the value of the variable "Apex to Dish focal point" is equal to the maximum sub-reflector thickness, in our case 6.5mm.

At this point in the discussion, two points should be raised about choosing an appropriate diameter for the feed horn aperture. If too small a value is chosen, the spreadsheet will generate an error message as shown in Figure 9. This arises because the horn aperture is so small that its wide radiation pattern will cause **excessive sub-reflector** spill-over.

1							
2	**CASSEGRAIN ANTENNA DESIGN CALCULATOR**						
3		*W1GHZ 2004*					
4							
5	**ENTER INPUT PARAMETERS HERE:**		*(Bold blue numbers)*				
6	Frequency	**122.500**	GHz				
7						pi =	3.141593
8	**Units:**	mm	Inches	Wavelengths			
9							
10	Dish diameter	**445**	17.5	181.7			
11	Dish **f/D**				**0.25**		
12	Feedhorn equivalent **f/D**				**0.7**		
13	Feedhorn diameter	**2.5**	0.098	1.020833333	Warning: feedhorn diameter too small for f/D		
14	Feedhorn Phase Center (negative = inside horn)			**0**			
15							
16	**Wavelength**	2.449	0.096	1			
17	Dish Focal Length	111.3	4.4	45.4			

Figure 9 Spreadsheet error message indicating feed horn aperture is too small

Conversely, if the feed horn aperture is made too large, another error message is generated, as shown in Figure 10.

CASSEGRAIN SUBREFLECTOR GEOMETRY:						
Feedhorn blockage halfangle				23.1	degrees	0.403 radians
Subreflector magnification M				3.48		
Hyperbola eccentricity				1.81		
Hyperbola a	**8.1**	0.320	3.31			
Hyperbola b	**12.2**	0.481	4.99			
Hyperbola c	**14.7**	0.577	5.99			
SUBREFLECTOR POSITION:						
Apex to Dish focal point	**6.5**	0.258	2.67			
Apex to Feed Phase Center	**22.8**	0.897	9.30	**Warning: closer than feed Rayleigh distance**		
		Feedhorn Rayleigh distance =	**208.42**			

Figure 10 Spreadsheet error message indicating feed horn aperture is too large

In this example, the feed horn aperture has been increased to 25mm which is the OD of the VK3CV horn, with the result that the sub-reflector is then inside the near-field of the horn. This will result in phase errors and hence a loss in gain for the Cassegrain system.

Having completed the design of the sub-reflector, it is of interest to explore whether its hyperbolic profile might be replaced by a circular one? If this were to be the case, then a suitable substitute for the sub-reflector might be found by using the base from an aerosol can.

The hyperbolic sub-reflector is 15 wavelengths across, which equates to a diameter of 37mm, and it has a maximum thickness at its centre of 6.5mm. Using the sagitta formula [7], we can calculate the radius of a circle whose locus passes through the edges and mid-point of the sub-reflector hyperbolic curve. This gives a value of 29.5mm. The resulting half-profile of the sub-reflector and this circle are shown in Figure 11 as the red and green curves, respectively. Ideally, the two curves should not deviate by more than about λ/10, i.e., about 0.25mm and so it is obvious that this circle radius is not acceptable. After some trial and error, a good compromise seemed to be for a circle whose radius was about 22.5mm and this is shown in Figure 11 as the blue curve.

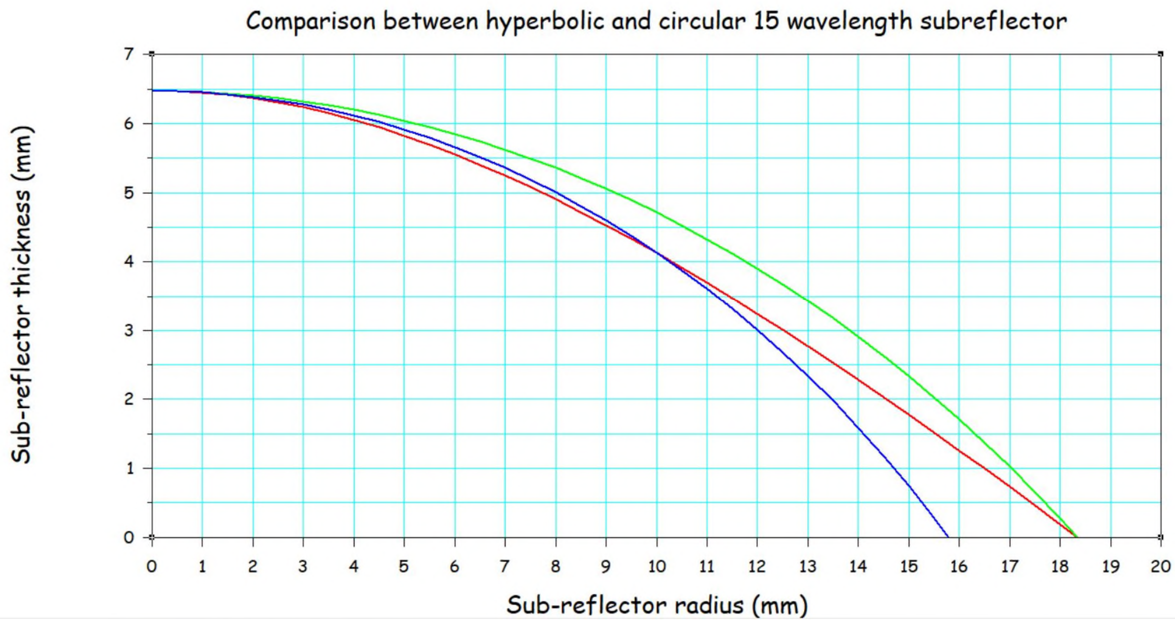

Figure 11 Red curve = hyperbolic profile. Green curve = original circular profile, R = 29.5mm,
Blue curve = best fit circular profile, R = 22.5mm

It can be seen that the blue and red curves have an acceptable agreement out to a sub-reflector radius of about 12mm which is equivalent to a diameter of about 9.7λ. Only experiment would tell whether this is adequate in terms of dish sidelobe performance and gain.

References

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7. https://en.wikipedia.org/wiki/Sagitta_(geometry)

Postscript

As a postscript to the above discussion, I used W1GHZ’s spreadsheet to look at the case of feeding the Edmund dish with the original VK3CV Chaparral feed which has a larger aperture of 7mm. A workable solution was found with the following data:

Frequency = 122.5GHz, dish virtual f/D = 0.9, feed-horn diameter = 7mm, illumination taper = 11.98dB, sub-reflector diameter = 20λ.

The resulting sub-reflector data are shown in Figure 12.

57								
58	**CASSEGRAIN SUBREFLECTOR GEOMETRY:**							
59								
60	Feedhorn blockage halfangle				3.8	degrees	0.066	radians
61	Subreflector magnification M				4.55			
62	Hyperbola eccentricity				1.56			
63	Hyperbola a	**17.0**	0.668	6.93				
64	Hyperbola b	**20.4**	0.803	8.32				
65	Hyperbola c	**26.5**	1.044	10.83				
66								
67	**SUBREFLECTOR POSITION:**							
68	Apex to Dish focal point	**9.6**	0.376	3.90				
69	Apex to Feed Phase Center	**43.5**	1.712	17.76				
70			**Feedhorn Rayleigh distance =**	**16.34**				
71								

Figure 12 Sub-reflector data for Edmund dish with VK3CV Chaparral feed

It can be seen that the sub-reflector thickness is now 9.6mm but its surface is less curved than the sub-reflector for the W2IMU feed as the virtual f/D has been increased somewhat. Again, the sub-reflector lies outside the feed-horn far-field as desired.

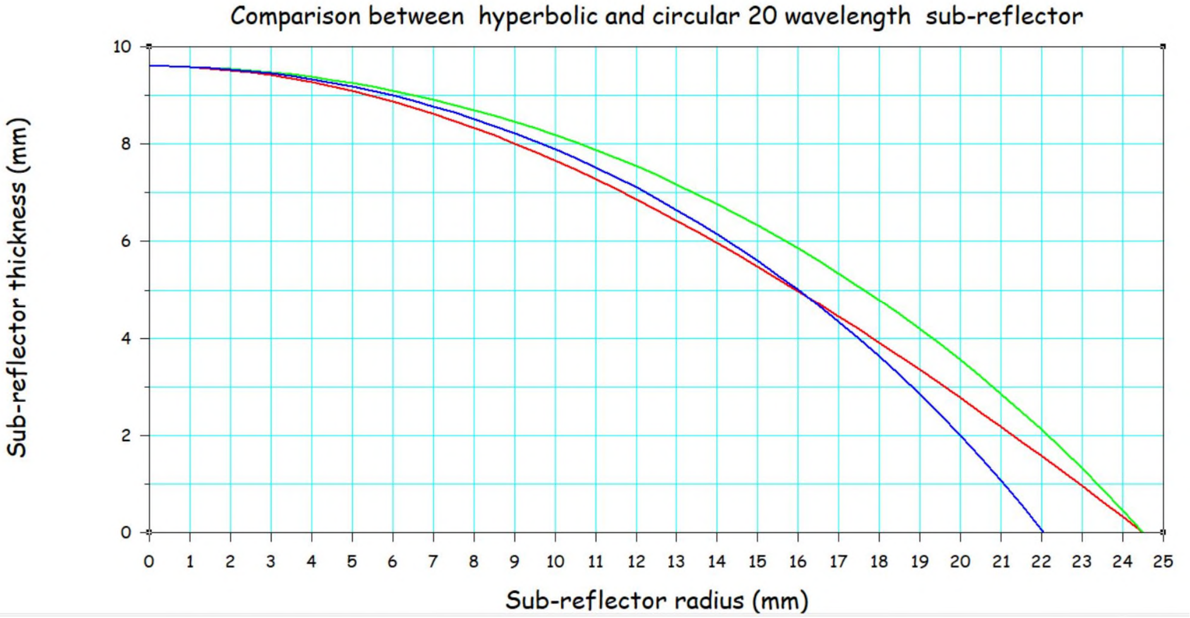


Figure 13 Comparison between hyperbolic and circular sub-reflector profiles for Chaparral feed

Figure 13 compares the hyperbolic profile of the sub-reflector, (red curve), with a circular profile whose locus passes through the edges and centre point of the hyperbola, (green curve). The latter has a radius of curvature of 36mm but is not seen to be usable since its profile deviation is more than λ/10. The blue curve, however, shows a better circular profile which is within λ/10 of the hyperbola over a radius of about 18mm, corresponding to a sub-reflector diameter of about 14.7λ. This better circular profile has a radius of curvature of about 30.1mm.

Effect of surface roughness on dish antenna gain

Barry Chambers, G8AGN

There has been quite a lot of discussion recently in connection with using the Edmund optical reflector dishes at 122GHz and in particular, how smooth the dish surface needs to be. This short note attempts to answer that question since it will also have a bearing on the smoothness of any associated Cassegrain sub-reflector.

The first point to make is that electromagnetic wave phenomena are determined by dimensions expressed in wavelengths rather than "real world" units such as mm or um. Thus, a dish with a visually very rough surface might work well at 2.3GHz but not at 122GHz since the roughness at 2.3GHz is still small when compared to the wavelength but this would not be the case at 122GHz. Secondly, a dish whose surface is mainly smooth, but marred by a few scratches or minor dents will still perform well since it is the average smoothness over the whole dish surface which matters.

In 1966 Ruze [1] published a formula which enables us to estimate the loss in dish gain with increasing average surface roughness. This is

$$Loss\ in\ dish\ gain\ (dB) = 685.81\left(\frac{\varepsilon}{\lambda}\right)^2$$

where ε is the root-mean-square surface error over the dish surface, and λ is the dish operating wavelength.

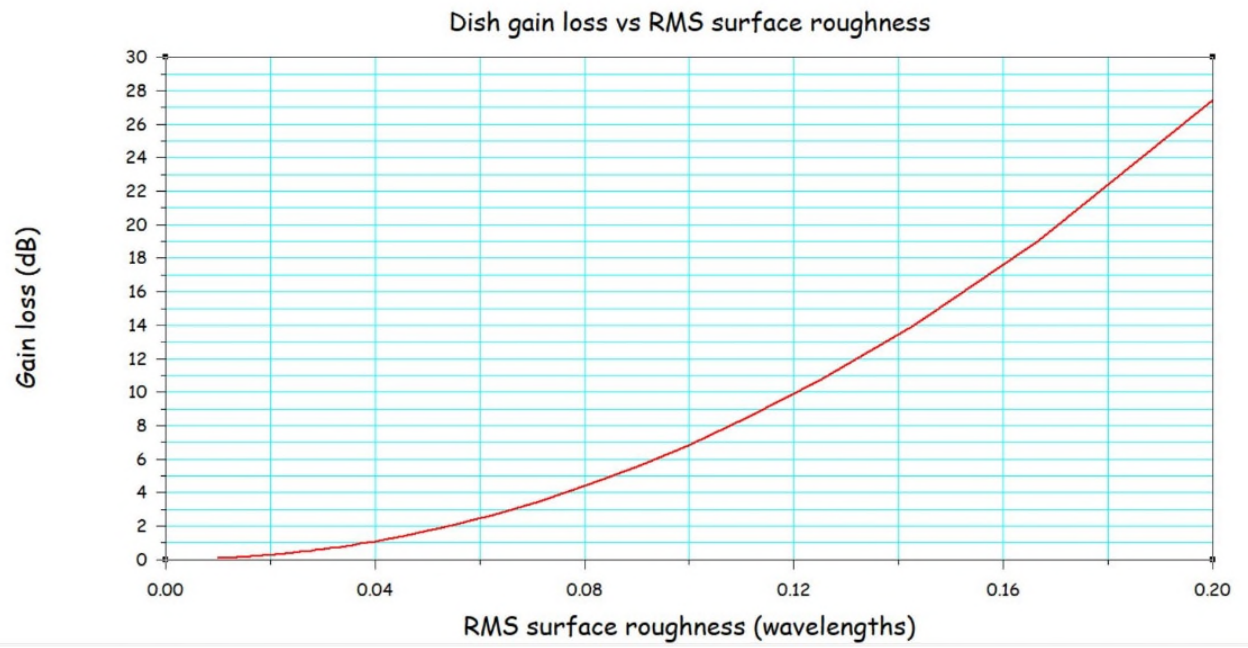


Figure 1 shows how the dish gain loss varies for rms surface errors in the range 0 to 0.2λ; the latter corresponding to a value at 122.5GHz of about 0.49mm.
To a first approximation, the rms surface error is equal to one-third of the peak-to-peak surface error.
The loss in dish gain as the surface becomes rougher is due to energy being scattered rather than contributing to forming a well-defined antenna radiation pattern.

Reference

1. J. Ruze, "Antenna tolerance theory, a review", *Proceedings of the IEEE*, vol. 54, no. 4, pp. 633-640, 1966.

12GHz Microwave frequency counter FA-2, type BG7TBL review

Ian Dilworth G3WRT

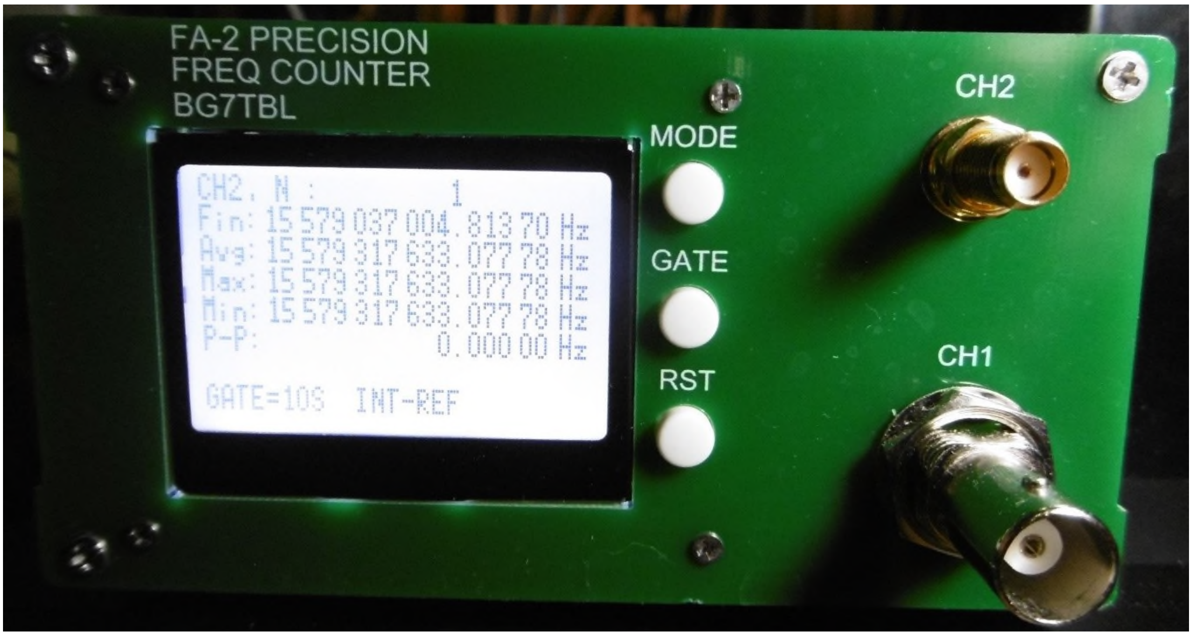


Figure (1) front panel

This frequency counter is very compact has a >200MHz+ and sensitive input and a less sensitive ~< 12GHz input with no less than 16-digit display in frequency!

It has three switched gate times: 0.1, 1.0 and 10 seconds.

Plus, interesting, and a useful, unique, statistical capability as indicated by studying figure (1). To 14 or 16 digits. E.g., 10GHz 10*10^9Hz is displayed as 10.000.000.000. 000.00 Hz. Yes, it takes a while to absorb the display format. The 16-digit averaging tells you how many passes have recorded, at the top of the display. It is a high accuracy device.

The CH1 BNC input, nominally ~> 200MHz, is conventional and sensitive to ~ -60dBm. It has a LPF that can be engaged. It also records the input power in dBm over a 60dB range. CH2 is sensitive, for example, my 1Watt handheld 433MHz a few feet away and with a poor antenna on the frequency counter has no problems accurately locking to the received transmission. It is sensitive.

The microwave CH2 (SMA) input self oscillates around 15.5GHz without being connected in my unit and is sensitive. Connecting an unterminated ut141 cable (20cm) lowers that self-oscillation by ~0.5GHz. Locking to a UHF and microwave input signal (~ 0.4 _12GHz) at or above ~ -20dBm. It does not, however, indicate the input power level in this mode.

It has an inbuilt high accuracy 10MHz reference and the capability of inputting an external (GPS etc.) 10MHz reference on the rear, as illustrated in figure (2). It also has a trimmer for the internal oscillator which is available as an output at ~+4dBm.

The one I purchased and present here works to 12GHz plus.

The LCD display is very clear and bright but has rather small characters that scale in size depending on the range, 14 digits in one mode and smaller 16 digits in statistical mode. The counter has a USB connection and a recommended software driver USB driver from the FTDI web site, (look on the web). With USB port, connect to PC, data format in the compact version of HP53131 mode, I read. I have not yet tried to use that facility, but I do envisage that being a useful way to track frequency drift. I confess that sorting out someone else's software I put off until I need it!

It is simply excellent value for money and there are versions available, I read which, frankly, I am confused about. So, it may be necessary to confirm the specification before ordering. I bought mine via Banggood. However, I have seen adverts from the Times newspaper/Europe/Amazon/eBay too. There are also comments on the web I have seen.

Figure (2) rear panel

It is solidly built yet clearly not anything other than cheaply e.g., the front and rear panels appear to be green quasi pcb board and the case is a simple extruded aluminum, it runs off 12V at about 400mA and can get mildly warm in operation.

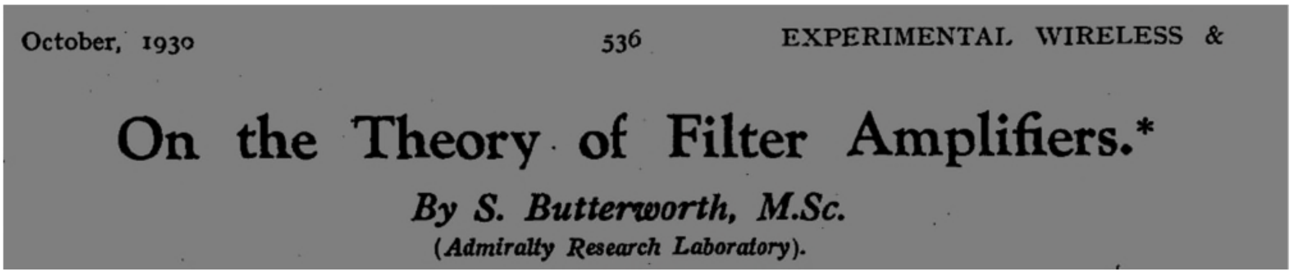
I am happy with my purchase and have used it extensively without problems. The averaging facility is certainly novel and potentially very useful.

12 Things you should know about Filters Part 3

Ken, G3YKI

What is a Butterworth filter?

In 1930 Stephen Butterworth applied a logical and mathematical approach to the design of filters. He published a paper showing that it is possible to design filters with a transition from pass-band to stop-band which is as sharp as may be required, without introducing any ripple at all in the pass band. He gave details of the values of the components required to do this.


October, 1930 536 EXPERIMENTAL WIRELESS &

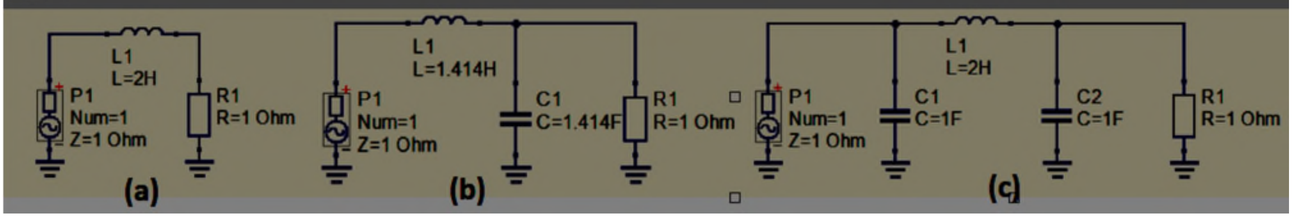
On the Theory of Filter Amplifiers.*

By S. Butterworth, M.Sc.

(*Admiralty Research Laboratory*).

To appreciate some of the features of this class of filter, firstly let us consider how the attenuation varies outside the passband. Look at the simplest filter, a single element low pass filter. The example shown in figure 1a is sometimes called the "Prototype" filter[1], designed for a cut off frequency of 1(radian per second)[2] and terminating impedance of 1 ohm.

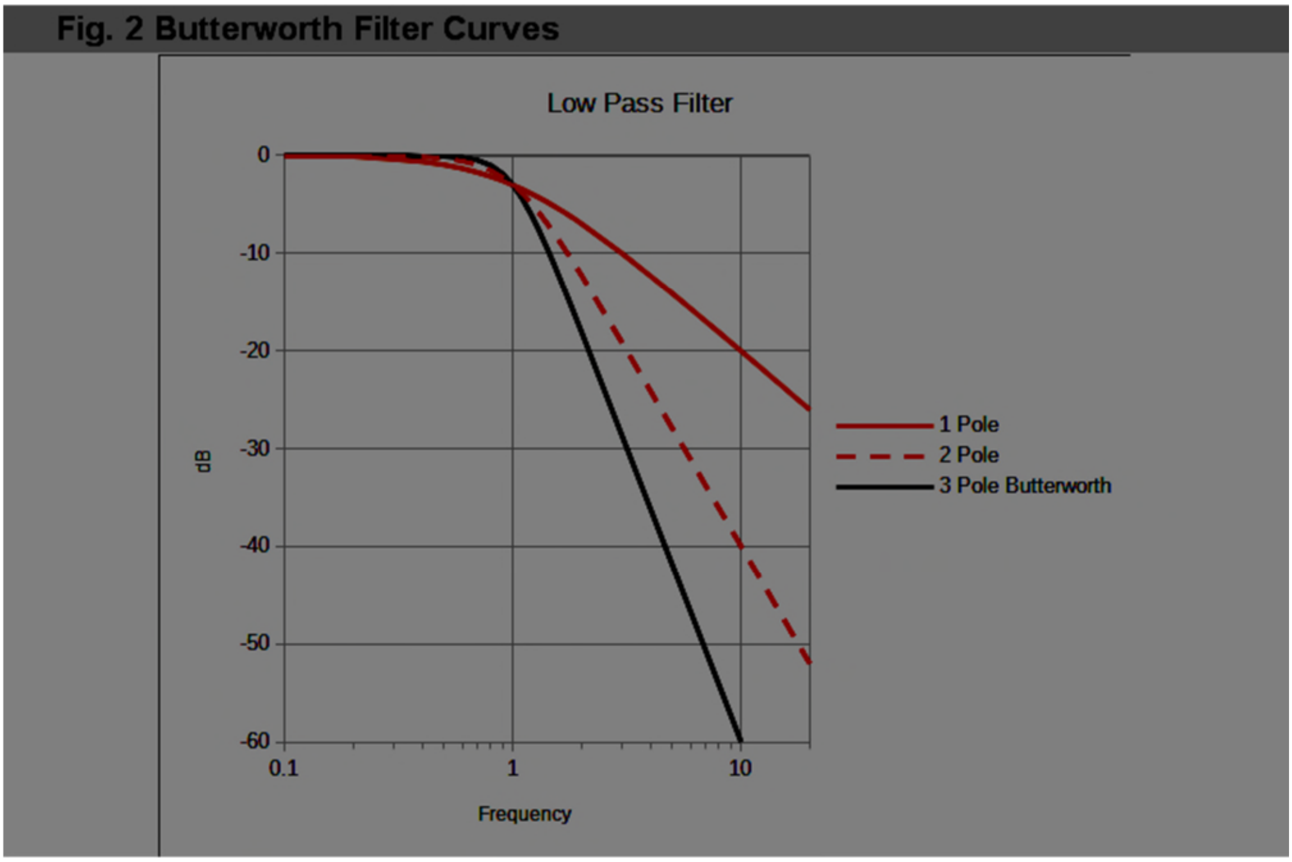
Fig. 1



It is not too difficult to see how the response of this system arises. At the cut off frequency the reactance of L1 (=ωL) is 2 ohms, equal to the total resistance, hence the current and output voltage are reduced to 0.7 (at angle -45 degrees) compared to low frequencies where the reactance of L is small, so that is the 3dB point on the filter response. Outside the passband the circulating current is controlled by the inductor as that is the largest part of the total impedance and so doubling the frequency will halve the current, and hence also the output voltage. The phase is now -90 degrees. This is often referred to as 6dB per octave or 20 dB per decade. If we make it a two element filter (Fig 1b) by adding a shunt capacitor at the output then the halved current is flowing through the halved impedance of the capacitor and so we get one quarter voltage or 12 dB per octave. And so on for any number of sections. A three section filter (Fig. 1c) has attenuation rising at 18dB per octave above the cut off frequency.

As for the frequencies below the cut off, it is easy to see that (a) will result in gradual roll off, but in case (b) and (c) there is a chance that a resonance would be introduced. It is all a matter of selecting the correct values for the components to get the flattest response.

If we plot the response of these low pass filters on Log-Log scale the constant dB per decade at high frequencies becomes very clear as a straight line on the graph.



To Note:

1. All filters have 3dB loss at the cut off frequency.

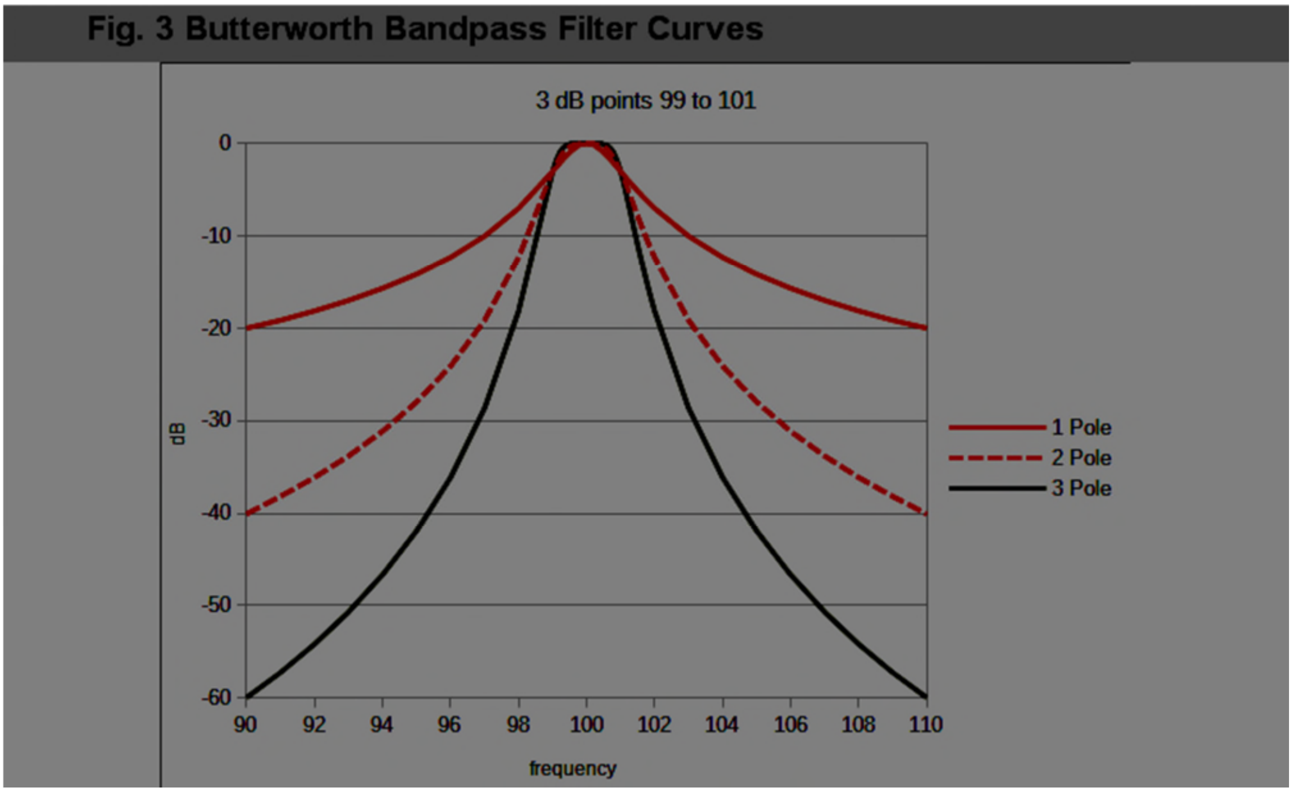
2. For 1, 2 and 3 pole filters the loss at 10 times the cut off frequency is 20, 40, 60 dB respectively.

3. If you were to scale the values of the components for a low pass filter at a different frequency, the same curves would apply. Just take 1 as the cut off frequency, 10 as 10 times cut off frequency etc.

4. If you make a Butterworth high pass filter the same curves are applicable, just flip them about a vertical axis coincident with the frequency = 1 line.

5. If you make a Butterworth band pass filter the same curves are applicable! In the bandpass case the low pass filter inductor has been replaced by a series tuned circuit. The reactance of the tuned circuit increases from zero at the resonant frequency in a linear fashion[3] as the frequency difference increases. Just as the reactance of the inductor increases from zero at zero frequency in a linear fashion. Hence the response curves will also correspond. Below the resonant frequency the reactance of the tuned circuit is negative. That gives the same amplitude response but a negative phase response.
   So just take the frequency scale as the difference from the centre frequency; above or below.

   Bandpass filter characteristics are rarely plotted in his way, but normally on a linear frequency scale. Hence the straight line for 6dB per octave response is lost and we get the more familiar volcano shape.

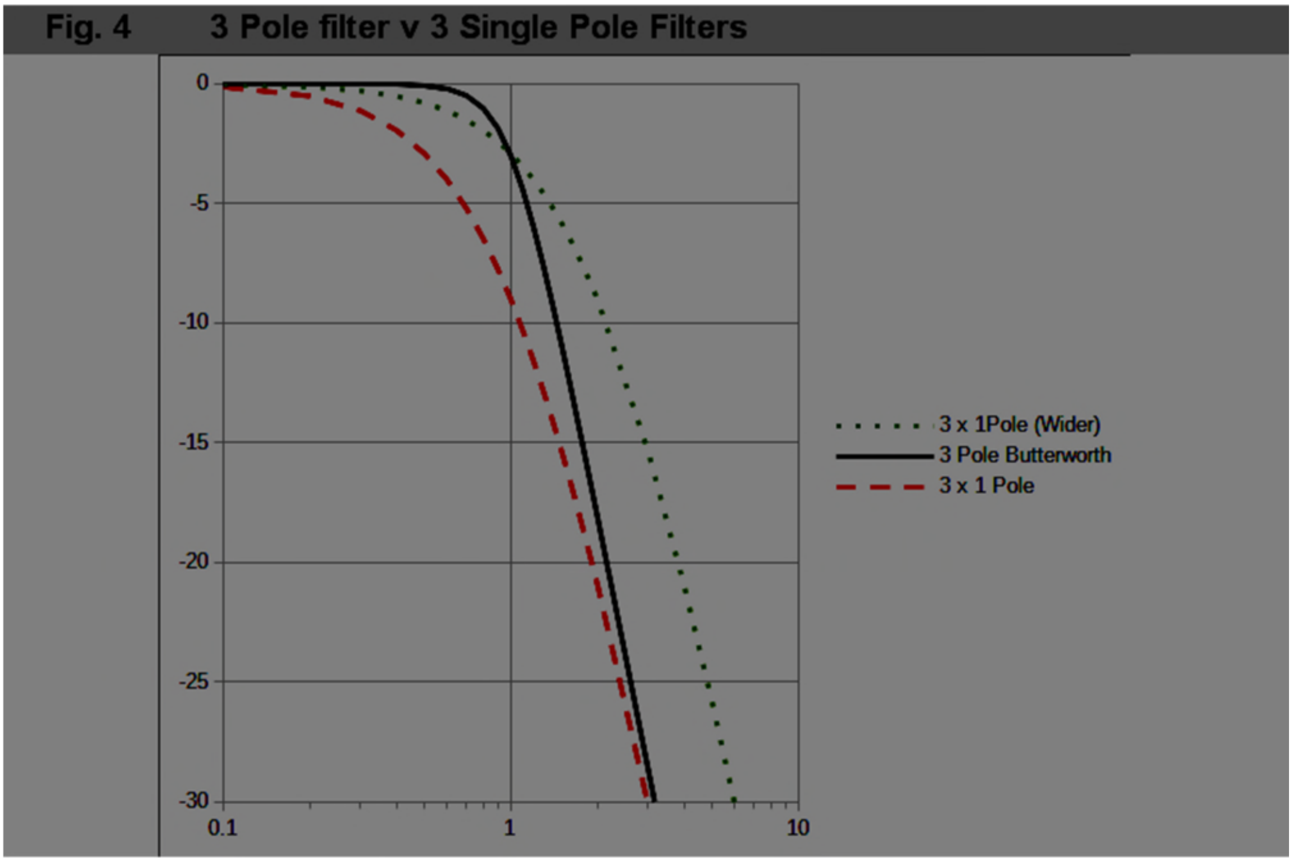


A system with 3 single pole filters (if they do not influence each other because they are separated by amplifiers or isolators or a significant amount of attenuation) will have a frequency response showing three times the attenuation of one single pole filter. So now we have the information required to answer the question:

How does the response of a 3 element Butterworth filter compare with that of three separate single resonators?

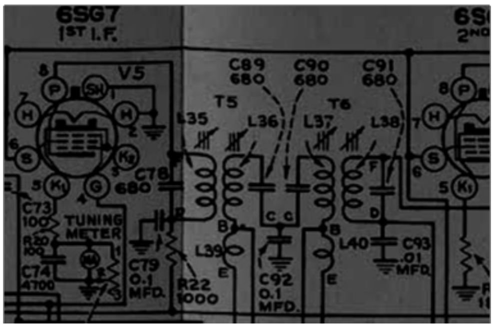
A three pole Butterworth filter is not the same as three separate single pole filters. They both will give the same attenuation at frequencies well outside the passband, but at the nominal cut off frequency the first has attenuation of 3 dB while the second has attenuation of 9dB.

It would be possible to choose a wider bandwidth for the three single pole filters so that the loss at the nominal edge of the passband is 3dB, the same as the Butterworth filter. It turns out that the wider bandwidth required for this is close to double. The consequence is that the attenuation in the stop band is going to be reduced by 18dB. As well as this disadvantage it will be seen that even when using the wider bandwidth, the loss in the pass band is always greater than the loss of the Butterworth filter. Perhaps this is not surprising given that the other name often used for the Butterworth filter is “Maximally Flat Passband” and that is the characteristic he was aiming for when he developed the series[4].



Conclusions.
For any given number of elements the Butterworth filter gives the best result in terms of flatness of the response in the passband.
The Butterworth response will only be achieved by having the correct degree of coupling between resonators in a microwave filters, not with a number of separate resonators.

There are many cases where a flat passband is not required. Selection of one harmonic of a crystal oscillator or one product at the output of a mixer are examples which are often found in amateur equipment. A band of frequencies such as 10368 to 10367 MHz in a transverter will be much narrower than the bandwidth of any practical resonator. In these cases the use of a chain of amplifiers separated by resonators as seen in several published designs by DB6NT and others is a perfectly valid way to proceed.
On the other hand, for a receiver IF amplifier it is not. Hence the cheap 1960s transistor radio with 3 single tuned IF transformers was just about good enough pick out one of the few stations on the daytime MF band but useless for DXing at night.



The AR88 (designed 1940) had two interstage IF filters each with 4 coupled tuned circuits. The resulting excellent selectivity is no doubt one of the reasons it became the premier communications receiver of WWII operations, and in commercial and amateur hands for many years afterwards.

Footnotes:
[1][Tables the values of component in various types of prototype filters were calculated and published. For any other frequency or impedance the values can simply be multiplied or divided by the appropriate factors. This is now history, as there are many “apps” that will give the required values directly.]
[2] [Butterworth used the term “pulsatance” in his paper for ω (=2πf), usually called angular frequency. I do not think this is in common use today, I had to look it up!]
[3][Linear for small changes in frequency.]

[4][Butterworth now seems to be a well-established name for this type of filter though Matthaei et al. never use it in their text apart from one small footnote]

End of Part 3.

Editors Comments

Many thanks to all the contributors this month. I am just about to move to Marlborough in Wiltshire, which will give me easier access to Microwave sites on the Ridgeway. Hopefully there will be minimal disruption to Scatterpoint production.

Scatterpoint activity report

Activity News: January 2021

By John G4BAO

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

From Ed G3VPF

I have recently resurrected the 13cms equipment I built two years ago but only used a couple of times due to high noise levels on the band from various sources. I have managed to exchange weak signals with Clive GW4MBS and both of us are working to improve our equipment. I use the Bulgarian transverter and power amplifier with the PA/preamp mounted immediately below the Wimo 40ele Yagi. During recent portable operation from Hardy's Monument (Picture) in Dorset noise peaks were heard in multiple directions, including on the same bearing as GW4MBS. A 13cms band-pass filter has now been ordered to try and cure this problem.

Other activity includes commissioning an 80cm dish for /P use with a dual-band feed for 5.7 and 10GHz and replacing the Kuhne G3 transverter with a G5 to allow the system to be re-packaged so it is close to the dish feed.

From G4BAO

No actual Activity radio to report from the Fen Edge as I've switched to writing Arduino code for my 24GHz EME TWT controller. I wrote a sequencer and local LCD monitor display for the Amplifier and have now added remote monitoring via Bluetooth. It displays Power, Cathode current and Helix current on a remote LCD. The distance to the dish from the shack is causing reliability problems on the Bluetooth link so stage 2 is to replace Bluetooth with WiFi, and also add overcurrent shutdown to the TWT end. Should be easy as the Wifi modules have very similar interfaces to Bluetooth.
I'm really learning LOTS about programming Arduinos with this project!

From Andy G4JNT

Not activity per-se, but, after a power outage lasting more than two days, the Bell Hill beacons, GB3SCS, 'SCF, 'SCC, 'SCX, 'SCK, and 'SCQ have a problem. The two GPS receiver modules that lock the frequency reference and provide timing for the modulation have failed - both probably due to the 1023-week rollover issue. They probably think its June 2002). It is intended to replace the frequency reference with a Leo-Bodnar GPSDO, and the GPS timing with a Ublox-Neo module. This will necessitate all the beacons being out of commission for a short period while the necessary changes are made. The modifications are too much to be done on site.
At the moment 'SCF and 'SCC are radiating a plain carrier only. SCS, SCX and SCK are sending their JTxx message, but its timing (the DT value) is wrong and probably out of range of the decoding software.
The opportunity will also be taken to replace the GB3SCS frequency source. Its current driver, a DDS multiplied up in a PLL, is not terribly clean and has generated a few complaints of phase noise and spurii from band users on local hills. Just to be different, the new one may send Q65 modulation in place of the original JT4G.

From Peter GW4JQP

Having rebuilt my G4DGU 3cm transverter, and using an inverted Sky minidish, I headed to my old portable site at IO81AS to set up and work GW4MBS at IO71XW, 59+. I also heard Clive's personal beacon. Turning the dish in the opposite direction, I then worked Adrian G4UVZ in IO80KX, 57. GB3KBQ at IO80LX was coming in at 547, with the keying apparently modulated by multiple wind turbines. Next moves include improving the elevation adjustment, and adding a preamp.

From Barry G4SJH

Dave G1EHF, Noel G8GTZ, John G8ACE and I tried some 122GHz activity during January even though visibility was very poor and conditions didn't seem particularly favourable. Dave and I sat at Hannington (IO91JH01) with Noel and John 12.6km away at Fairleigh Lane IO91KF42. This was the first time out for my VK3CV unit with the "standard horn" looking at a regular 60cm offset Sky dish (Photo). John was using his own 122GHz transverter and a VK3CV unit. NBFM Signals were received both ways and after a bit of finger trouble, good signals were received by John from my unit and his signals were near fully quieting with me at some points. This was good experience underlining the challenges of dish alignment, but I was very pleased with over 12km for the first time out on 122GHz.

From Simon G7SOZ

Thanks to inspiration from John, G4BAO and Sam, G4DDK, I've been making slow progress towards building a small 1.3GHz EME station. This has all been made possible by the kind generosity of a number of people. John gave me a "permanent loan" of his 1.9m mesh dish (Photo) and 23cm feed, and back in October Geoff, G0DDX, helped me move the dish over to my QTH. At one point we thought it wouldn't fit in his camper van, but it just fitted. I'm not sure what my neighbours thought of us moving the dish into my garden, but then they are used to my radio exploits! Since then I've been gradually making a start on the station. I've
installed a SPID RAS HR on a 1.5m pole supported using a Barenco patio style mount, with a number of concrete blocks to weigh it down. This has caused some delay as the original pole suffered from excessive, and unacceptable, 'wibble'. A thicker walled tube has now fixed this and with help from John (see an emerging pattern!) I've now built a mounting bracket and have counterweights ready to install.
A number of cable feeds have been installed to power the controller and power the transverter, PA and LNA, and these feed into my house. Inside, I've been building a 19-inch rack, which houses the SPID controller, small tracking PC, PSUs, and various other bits and pieces, with the idea that everything will be self-contained and eventually be remote controllable. Thanks to Rob, M0ZPU, I've been donated a Storno case to mount the transverter and PA near the dish. This has all been stripped out and I now need to think about the layout of the internals and also building the DF9IC PA (thanks to Neil, G4DBN for the heat spreader and George, M1GEO for the surprise delivery of heat spreader, PCB and PA Devices). Building the DF9IC PA will be a bit of a challenge for me as I've never built a PA before!
The next steps will be to mount the dish, feed and G4DDK LNA (thanks to Sam for helping me to get my LNA working), and getting my ancient radio installed in the rack, with the aim of getting RX working.
I know that John is eager to see me get everything up and running, but this is likely to be a long-term project, due to having a busy job and me learning as I go!
(OK, noted, I'll stop hassling you….'BAO)

From Barry G8AGN

This morning (26 Jan 2022) Bob G4APV and Barry G8AGN worked Gordon G0EWN over a 15km path on 122GHz; all stations used VK3CV systems and small dishes. Bob's dish was a 30cm ex link dish and Barry and Gordon used BSB offset fed dishes. VK3CV Chaparral feeds were used on all three rigs.

Gordon was at a site near Keppel's Column, NE of Sheffield and Bob and Barry were at Roper Hill, W of Sheffield. We were on site by 0900 and the weather was sunny with a clearing sky and a cold stiff breeze. Visibility was moderate and red light boxes and sighting scopes were needed to establish initial dish alignment. One this was done, however, signals were around 20dB both ways.

UKuG MICROWAVE CONTESTS - 2022

Aims and comments:
Following suggestions from several mm-wave operators, in 2022 events on 122GHz and above will be run on a flexible basis where entrants organise activity in their own groups (publishing their plans) and operate on up to six days during the year, with the results adjudicated at the end of June and end of December. This is intended to allow operators to choose days when conditions are favourable for mm-wave contacts.
There will be four 24/47/76GHz events during the year, in May, July, September and October, with the G0RRJ Memorial Trophy awarded to the overall winner on 24GHz, the 47GHz Trophy awarded to the overall winner on 47GHz, and the 24GHz Trophy awarded to the leading station in the September event. The overall positions will be based on the best three scores from the four possible events.
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 should 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 (ie. 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 usually coincide with the French Journée d'activité dates.
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 2022.
The following contests are scheduled for 2022:

- 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 event in September.
- 47GHz Trophy (4 contest days with 3 to count for the championship)
- 76GHz (4 contest days with 3 to count for the championship)
- 122GHz and up held on up to 6 days per year with at least 2 weeks elapsed between activity dates for any individual station. Logs to be submitted by email at the end of June and end of December.

The full contest program and rules are published in the January 2022 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 kilometre 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.
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. Rover stations should list which contacts were made from each location in their logs.
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 47/76GHz events.
1. The general rules shown above apply. Eight character locators must be used in this contest.
2. There are four events from May 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

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 in September.
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 24/76GHz events.

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 24/47GHz events.

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.

122GHz – 248GHz Contest Rules

The 122GHz – 248GHz contest will take place in two phases, one in the period January to June, the second from July to December. Entrants can choose up to three dates in each half year to operate, coordinating with others to find common dates to take advantage of good conditions. Each day used must be separated by at least two weeks from preceding or following activity dates.

1. The General Rules listed above apply. Eight character locators must be used in this contest.
2. 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).
3. The overall score will be determined by adding together the normalized scores from all bands entered.
4. Entrants should publish details of planned activity in time for others to join in. Posting in the UKMicrowaves io group is recommended.
5. Entries should be submitted by email to g3xdy@btinternet.com by 8th July for the January – June period, and by 8th January for the July – December period

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 Sunday of that weekend.

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.

The RSGB runs cumulative UK Activity Contests 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 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)

For Sale

Power Meter Marconi Instruments 6960 with Power Sensor 6920, frequency range 10MHz to 18GHz. Power range of the sensor is -70dBm to -30dBm and it is equipped with a type N male connector. Included are operating manuals for meter and sensor and a sensor to meter connecting cable.

As the power meter has a built-in 1mW (0dBm) calibrator output a 30dB attenuator with type N connectors is supplied with the power sensor for the purpose of sensor calibration.

The meter is 240V AC powered and has a LCD digital readout.

Price is £150 plus postage when I have researched the cost.

I am offering this equipment to UK members only of the UK Microwave Group as it can be used for measuring the power output from microwave beacons via suitable couplers or attenuators. Apologies to members outside UK, I am not prepared to fill in the customs forms for shipping outside the UK.

If no takers within the group it will be advertised for sale elsewhere.

If further details are required, please contact Bryan G8DKK via email at: membership@microwavers.org

EVENTS 2022

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

2022		
February 12	Tagung Dorsten Cancelled	www.ghz-tagung.de
March 26	CJ-2022 Seigy	cj.r-e-f.org
April 2-7	European Microwave Week, London, ExCeL - revised date	www.eumweek.com
April 23	RSGB AGM	rsgb/agm
April 24	Martlesham Roundtable / AGM - provisional	
May 20-22	Hamvention, Dayton	www.hamvention.org
June 24-26	Ham Radio, Friedrichshafen	www.hamradio-friedrichshafen.de
August 12-14	EME 2022, Prague - rescheduled 2021 event	www.eme2020.cz
September 25-30	European Microwave Week, Milan, Italy	www.eumweek.com

80m UK Microwavers net

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

73 Martyn Vincent G3UKV