



An Amateur Radio publication for the Microwave enthusiast

# MICROWAVE NEWSLETTER

Published by the Radio Society of Great Britain and edited by G3PHO and G8AGN.

Lambda House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JE

## FROM THE EDITOR

Having just returned from my first Microwave Update, held near Philadelphia, USA, I am left wondering where we have gone wrong in the UK! The enthusiasm of American microwavers and the quantity and quality of the surplus microwave "goodies" available is quite breathtaking. This year's event was bigger than all the three major UK microwave round tables put together! Over two hundred microwavers, including four Gs, one VE and three JAs, attended the four day event (which included a Sunday rally) and were treated to high quality lectures for two days, a grand tour of local microwave surplus outlets, nightly convention-based "flea markets" and a Saturday night banquet. Attendees came several thousand miles to meet other like-minded microwave amateurs. Of course, the USA has a bigger amateur population than the UK but there seemed to be more microwavers in the NE part of the USA than in the whole of Britain and even on 24 and 47GHz there are more active amateurs in the Great Lakes area than in UK! Americans do things big and in style ... it behoves all of us to make the pilgrimage to Microwave Update at least once in our lives. Next year's event is in California's "Silicon Valley" so it should be good. Be there!

To get a idea of what Update was like this year you can visit The World Above 1000MHz website at: <http://www.g3pho.free-online.co.uk/> The photos tell the story!

## 2000 – OCTOBER



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Our thanks are extended to all our contributors this month. Without them there would be no Newsletter!

News, views and articles for this newsletter are always welcome. Please send them to G3PHO (preferably by email) to the address shown below. The closing date is the Friday at the end of the first full week of the month if you want your material to be published in the next issue.



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**SUBSCRIPTION ENQUIRIES SHOULD BE SENT TO RSGB HEADQUARTERS AT THE ADDRESS SHOWN AT THE TOP OF THIS PAGE AND NOT TO THE EDITOR ..**



## **Adastral 2000**

### **Adastral Park Microwave Roundtable, November 11th and 12th, 2000**

As in previous years, the Roundtable is free, but you **must** have pre-booked as a security requirement of BT site management. All bookings will, this year, be handled by **John, G3XDY**. No tickets will be issued. Where possible, email your registration to John at [G3XDY@BTINTERNET.COM](mailto:G3XDY@BTINTERNET.COM). He will acknowledge your application and the regularly updated list will appear on here. For anyone without email, please send an SAE to John at J H Quarmby, 12 Chestnut Close, Rushmere St. Andrew, Ipswich, Suffolk. He will acknowledge with a list number. Make sure you give the name of all persons you are applying for. This is most important.

As you will see from the heading, this is to be a two day event. However, the Saturday will be afternoon only and provisionally is to be given over to measurements. If any groups want to take advantage of the afternoon to book a room and hold their own meeting, then this can be arranged. We plan to book a block of rooms at local hotel to provide overnight accommodation. There will also be the annual '**Microwave Dinner**' on the Saturday evening. Details of accommodation and the dinner can be obtained from **Jason Flynn, G7OCD** at: **32 Church Road, Felixstowe, Suffolk, IP11 9NF** or email [himat\\_jason.flynn@btinternet.com](mailto:himat_jason.flynn@btinternet.com)

Our provisional programme for Adastral Park Microwave Roundtable 2000 is as follows:

#### **Saturday 11th November**

14:00 Measurements  
20:00 Evening Dinner

#### **Sunday 12th November**

09:00 Open  
09:30 - 12:30 Measurements (G8DKK will bring a selection of gear from his company). The usual nf , spectrum, network and power measurements will be provided by G4MRS members (and some from BT). We have a promise of an exciting new NF meter on show as well! (G8DKK and the new NF meter may only be available on the Sunday.)  
10:00 - ? Bring and buy  
10:30 - 15:00 talks (provisional), to include WA5VJB on antennas, WW2R/G4FRE on his intelligent beacon keyer, G0FDZ on his Guernsey Microwave trips. There will be several more talks, yet to be finalised.  
13:00 lunch break  
During the day: AGM UK Microwave group, Microwave Contests 2001...

# Large Dish Cassegrain Development Using CAD & Spreadsheet For Millimetric Bands & Practical Implementation.

by  
Martin Farmer G7MRF  
(g7mrf@compuserve.com)

## Introduction

The aim of this paper is to make available the design calculations and a spreadsheet program to enable microwavers to design their own hyperbolic sub reflector for a cassegrain feed system as well as a suitable W2IMU feed horn and to explain the implementation of quick band change on my portable set up.

After using flat plate type reflectors on both 24GHz and 47GHz portable systems to good effect, the decision was made to incorporate both of these bands into one box during a major rebuild over the winter months. The decision also included using one dish, with interchangeable bands contained within a quick-change system that could eventually end up with 5.7, 10, 24 & 47GHz as a possible combination on a portable expedition.

The decision to move away from the flat plate type reflectors was influenced by the small improvement in system gain but, more importantly, I wanted to use a W2IMU dual mode feedhorn, using circular waveguide, to feed the new dish (which has a f/D ratio of 0.38).

Looking at the reference books, the optimum f/D for the dual mode feedhorn is 0.8 but it can be used on parabolic dishes with f/D ratios as low as 0.5. The use of a cassegrain system and, in particular, the ability to slightly change values in the calculation makes it possible to modify the f/D ratio of the virtual parabolic dish to suit whatever f/D you require for your feedhorn, as in my particular case from 0.38. If I used a flat plate type reflector, the virtual dish would appear to be 0.38 and not suit the feedhorn type that I wanted to use. For details of the 24GHz and the 47GHz W2IMU dual mode feed horn see **figure 6**.

The original flat plate reflector used on 24GHz was constructed from double-sided PCB material and brazing rods for the supports from the WG20 dish feed. A similar approach was used on my original 47GHz transverter, using a 60mm circular disc reflector.

Discussions with Dr Dennis Hawkins of Qpar Angus [1], at the end of one of the UK Microwave Round Tables during 1999, resulted in the exchange of correspondence on the subject of cassegrain feeds.

Armed with this information and calculations from a paper [2] regarding Microwave antennas derived from the cassegrain telescope, we started to lay out, in AutoCAD, the profile from the main dish that was going to be used and, by using geometry, we arrived at a shape for the reflector. This profile from the CAD system was sent to Dr Dennis Hawkins who compared what we had laid out with his commercial antenna software and confirmed it to be ok. It was decided to go ahead with the manufacture. I found a machine shop that was willing to make the component for me using CNC technology and they had the ability to take the CAD profile of the sub reflector in to their computer system to generate NC code automatically. The end result (shown in **figure 1**, opposite) is the 100mm-diameter sub reflector and support boss used on my new portable system.



**Figure 1: 100mm subreflector and supports**

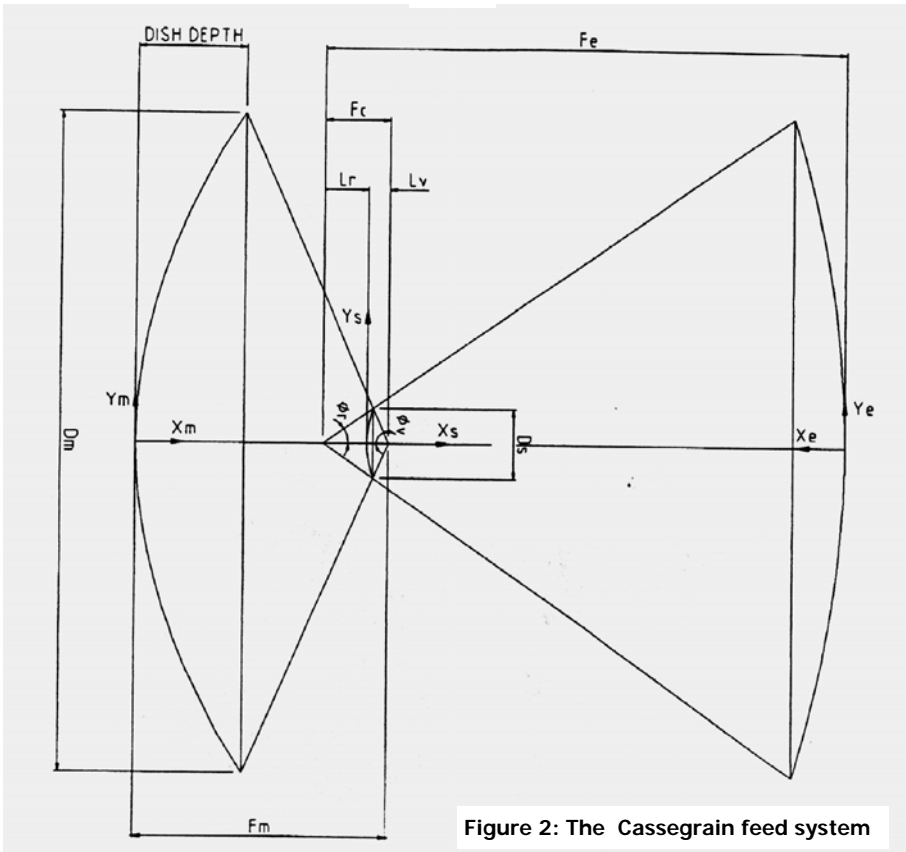


Figure 2: The Cassegrain feed system

### Nomenclature

$D_m$  = EFFECTIVE DIAMETER OF CIRCULAR MAIN DISH (TO EDGE RAYS)

$D_s$  = EFFECTIVE DIAMETER OF CIRCULAR SUB DISH (TO EDGE RAYS)

$F_m$  = FOCAL LENGTH OF MAIN DISH

$F_c$  = DISTANCE BETWEEN FOCI OF SUB DISH

$F_e$  = EQUIVALENT FOCAL LENGTH OF CASSEGRAIN SYSTEM

$L_v$  = DISTANCE FROM VIRTUAL FOCUS (OR MAIN DISH FOCUS) TO SUB DISH

$L_r$  = DISTANCE FROM REAL FOCUS (OR FEED) TO SUB DISH.

$\phi_v$  = ANGLE BETWEEN AXIS AND EDGE RAY, AT VIRTUAL FOCUS

$\phi_r$  = ANGLE BETWEEN AXIS AND EDGE RAY, AT REAL FOCUS

$E$  = ECCENTRICITY OF CONIC SECTION.

$A$  = TRANSVERSE HALF-AXIS OF CONIC SECTION.

$B$  = CONJUGATE HALF-AXIS OF CONIC SECTION.

$X_m$  = AXIAL CO-ORDINATES OF MAIN DISH.

$Y_m$  = RADIAL CO-ORDINATES OF MAIN DISH.

$X_s$  = AXIAL CO-ORDINATES OF SUB DISH.

$Y_s$  = RADIAL CO-ORDINATES OF SUB DISH.

$X_e$  = AXIAL CO-ORDINATES OF VIRTUAL DISH.

$Y_e$  = RADIAL CO-ORDINATES OF VIRTUAL DISH

### Manual Calculation Method

Here is a worked example based on the following data:

Dm = 935 mm  
MAIN DISH DEPTH = 152 mm  
Ds = 100 mm  
Fc = 94 mm

#### CALCULATING F/D RATIO

$$\begin{aligned} \text{F/D RATIO} &= \text{Dm}/(16 \times \text{DISH DEPTH}) \\ &= 935/(16 \times 152) \\ &= 935/2432 \\ &= 0.3845 \end{aligned}$$

#### CALCULATING MAIN DISH FOCAL LENGTH

$$\begin{aligned} \text{Fm} &= \text{Dm} \times \text{F/D RATIO} \\ &= 935 \times 0.3845 \\ &= 359.5 \text{ mm} \end{aligned}$$

#### CALCULATING ANGLE $\phi_v$

$$\begin{aligned} \phi_v &= \text{INV TAN} [ (\text{Dm} \div 2) \div (\text{Fm} - \text{DISH DEPTH}) ] \\ &= \text{INV TAN} [ (935 \div 2) \div (359.5 - 152) ] \\ &= \text{INV TAN} [ (467.5) \div (207.5) ] \\ &= 66.0659^\circ \end{aligned}$$

#### CALCULATING ANGLE $\phi_r$

$$\begin{aligned} (1 \div \text{TAN } \phi_v) + (1 \div \text{TAN } \phi_r) &= 2 (\text{Fc} \div \text{Ds}) \\ (1 \div \text{TAN } 66.0659^\circ) + (1 \div \text{TAN } \phi_r) &= 2 (94 \div 100) \\ 0.4439 + (1 \div \text{TAN } \phi_r) &= 2 (0.94) \\ (1 \div \text{TAN } \phi_r) &= 1.88 - 0.4439 \\ \phi_r &= \text{INV TAN} (1 \div 1.4361) \\ \phi_r &= 34.85^\circ \end{aligned}$$

#### CALCULATING DISTANCE Lv

$$\begin{aligned} 1 - [ \text{SIN } 1/2 (\phi_v - \phi_r) \div \text{SIN } 1/2 (\phi_v + \phi_r) ] &= 2 (\text{Lv} \div \text{Fc}) \\ 1 - ( \text{SIN } 1/2 (66.0659 - 34.85) \div \text{SIN } 1/2 (66.0659 + 34.85) ) &= 2 (\text{Lv} \div 94) \\ 1 - (0.269 \div 0.771) &= 2 (\text{Lv} \div 94) \\ 0.651 &= 2 (\text{Lv} \div 94) \\ \text{Lv} &= (0.651 \div 2) \times 94 \\ \text{Lv} &= 30.597 \text{ mm} \end{aligned}$$

#### CALCULATING ECCENTRICITY 'E'

$$\begin{aligned} \text{E} &= \text{SIN } 1/2 (\phi_v + \phi_r) \div \text{SIN } 1/2 (\phi_v - \phi_r) \\ \text{E} &= \text{SIN } 1/2 (66.0659 + 34.85) \div \text{SIN } 1/2 (66.0659 - 34.85) \\ \text{E} &= \text{SIN } 1/2 (100.9159) \div \text{SIN } 1/2 (31.2159) \\ \text{E} &= 0.771 \div 0.269 \\ \text{E} &= 2.866 \end{aligned}$$

**CALCULATING VALUE 'A'**

$$A = Fc \div 2E$$

$$A = 94 \div 2 \times 2.866$$

$$A = 16.4$$

**CALCULATING VALUE 'B'**

$$B = A \sqrt{E^2 - 1}$$

$$B = 16.4 \sqrt{(2.866)^2 - 1}$$

$$B = 16.4 \sqrt{7.213956}$$

$$B = 16.4 \times 2.6859$$

$$B = 44.05$$

**CALCULATING CONTOUR OF MAIN DISH (PARABOLA)**

$$Xm = Ym^2 \div 4 (Fm)$$

FOR  $Ym = 50$

$$Xm = (50)^2 \div 4 (359.5)$$

$$Xm = (50)^2 \div 1438$$

$$Xm = 2500 \div 1438$$

$$Xm = 0.017$$

REPEAT FOR VARYING VALUES OF  $Ym$  TO CALCULATE CORRESPONDING VALUE OF  $Xm$ .

EG. FOR  $Ym = 50$      $Xm = 1.739$

$Ym = 100$          $Xm = 6.954$

$Ym = 150$          $Xm = 15.647$     Etc

**CALCULATING CONTOUR OF SUB DISH (HYPERBOLA)**

$$Xs = A [ \sqrt{1 + (Ys \div B)^2} - 1 ]$$

FOR  $Ys = 5$

$$Xs = 16.4 [ \sqrt{1 + (5 \div 44.05)^2} - 1 ]$$

$$Xs = 16.4 [ \sqrt{1 + 0.01288} - 1 ]$$

$$Xs = 16.4 (0.006419)$$

$$Xs = 0.105$$

REPEAT FOR VARYING VALUES OF  $Ys$  TO CALCULATE CORRESPONDING VALUES  $Xs$ .

EG. FOR  $Ys = 5$                  $Xs = 0.105$

$Ys = 10$                  $Xs = 0.417$

$Ys = 15$                  $Xs = 0.925$     Etc

**CALCULATING EQUIVALENT FOCAL LENGTH  $Fe$**

$$Fe \div Fm = (E + 1) \div (E - 1)$$

$$Fe \div 359.5 = (2.866 + 1) (2.866 - 1)$$

$$Fe \div 359.5 = 3.866 \div 1.866$$

$$Fe \div 359.5 = 2.072$$

$F_e = 2.072 \times 359.5$   
 $F_e = 744.88$

**CALCULATING CONTOUR OF VIRTUAL DISH (PARABOLA)**

$X_e = Y_e^2 \div 4F_e$   
 FOR  $Y_e = 50$   
 $X_e = (50)^2 \div 4 (744.88)$   
 $X_e = 2500 \div 2979.52$   
 $X_e = 0.839$

**REPEAT FOR VARYING VALUES  $Y_e$  TO CALCULATE CORRESPONDING VALUES OF  $X_e$ .**

EG. FOR  $Y_e = 50$        $X_e = 0.839$   
 $Y_e = 100$        $X_e = 3.356$   
 $Y_e = 150$        $X_e = 7.552$  Etc

After going through the above set of calculations a series of X, Y points are obtained. With this the shape of the sub reflector can be laid out onto paper to produce a template. This could then be used to check profile accuracy if manually turning the reflector in a lathe.

After searching the Internet for any programs to calculate the reflector's profile nothing could be found and also not everybody has access to a CAD workstation on their desk so the decision was made to make the calculations available to other amateurs by writing a simple Microsoft Excel spreadsheet to do this task.

**Figure 3** shows the layout of the Excel screen. User data input is on the left hand side while to the right are data tables for the sub reflector, actual dish parabola and virtual dish parabola profiles. The dish and virtual dish profiles tables are given to allow the user to draw out the whole scheme if required. I am currently writing an AutoCAD Lisp program to take this data and draw a 1:1 layout within the CAD system.

The Excel program is available to download from [3] but we are getting close to the limits of what we as a group are able to do within Excel. Please feel free to play with the routine and comment.

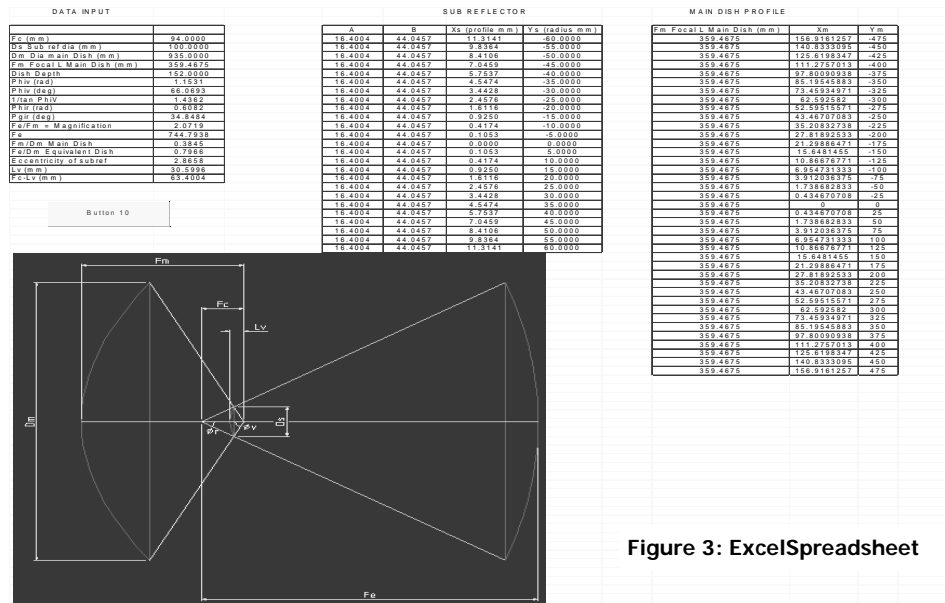


Figure 3: ExcelSpreadsheet

Figures 4 and 5 show the completed portable transverter in use. With using such a large dish, initial alignment when arriving onto the portable site is done by fitting a rifle site into the sub reflector boss on the front of the dish so that it looks back though a hole where the feed fits. By optically aligning the dish onto a visible landmark (180 degrees out) and then working out the beam heading to this point, the compass rose on the neck of the tripod can be altered to suit. After an initial contact, further refinement to the compass can be made.



Figure 4

After working someone with the 24GHz transverter, the head unit can be replaced with the 47GHz transverter, whilst still maintaining the correct beam heading, by the following method ...

I start with standard type die-cast boxes for the equipment and a three-point female conical mounting on the lid of every box that is to be used (see figure 5). This is done before any equipment is installed. The position of

the waveguide feed is marked using a laser pen innards mounted inside a machined cylinder slid into position where the sub reflector is to be located.

The laser light beam projects through a very small hole in the cylinder and the marking of the box entry is then quite straightforward. Mounted on the metal framework that supports the dish are three male conical points that allow the boxes to be repeatedly positioned with good accuracy.

Figure 5 shows the 24/47GHz transverters mounted on the metal frame that holds the dish onto the tripod.

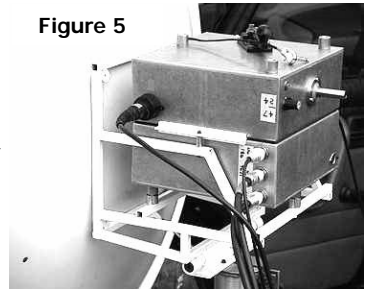


Figure 5

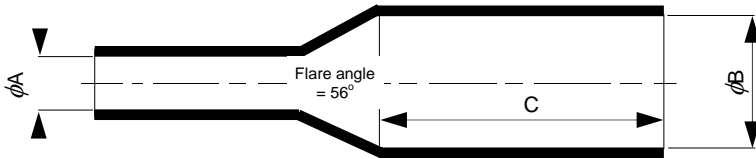


Figure 6: W2IMU Dual Mode Feedhorns for 24GHz and 47GHz

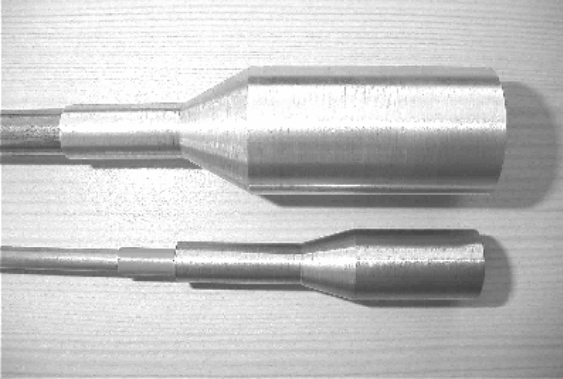
BAND:	24GHz	47GHz
DIMENSION A	8.73	4.0
DIMENSION B	23.06	11.81
DIMENSION C	46.50	23.81

Dimension A in the table above is the inside diameter of K&S modelmakers brass tubing that is being used for circular waveguide — for 24GHz, K&S Number 135 and for 47GHz K&S Number 129.

Figure 7 shows the completed W2IMU dual mode feed horns.

### Conclusion

After initial outings with the system, I feel it was worth the effort to go to the trouble of researching and wading through the calculations. The ability to change the parabolic dish f/D ratio to suit a particular type of feed horn in my circumstance will only be proven in time but at the moment the 24GHz system is not yet near its path potential and the 47GHz has worked 140km without much problem.



**Figure 7: Dual mode horns for 24 and 47GHz**

As already seen, the calculations for the sub reflector are long but with the use of the spreadsheet it was easy to nudge figures one way then the other to see the effects of "what if". The spreadsheet is available to anybody to use and I welcome comments and improvements to it.

### **Acknowledgments**

I would like to thank Dr Dennis Hawkins of [1] for assistance at the early stages of this project and confirming our profile results, David Woodward G0IVA for his assistance in locating [2] and for his assistance the calculations, Simon John Pritchard for help with the understanding of the manual calculations and work done on the spreadsheet [3] alongside John McNeil who co-wrote the routine. This project was a team effort.

### **References**

1. Qpar Angus Limited, Barons Cross Lodge, Leominster, Herefordshire, HR6 8RS
2. Microwave Antennas Derived from the Cassegrain Telescope by Peter W Hannan
3. <http://www.g3pho.free-online.co.uk/> or <http://www.qsl.net/g3pho/>

*Editor's comment: Many thanks Martin for the excellent and most useful article.*

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## **CONTESTS, ACTIVITY LADDERS AND MICROWAVE LEAGUE TABLES**

Once again, due to space restrictions and priority given to articles, it has not been possible to publish the ladders and table in this issue. However they have been updated with inout received from readers and can be seen as such on the Internet. Just go to <http://www.g3pho.free-online.co.uk/>

Those of you without access to the Internet will hopefully see the tables in the next issue of the Microwave Newsletter!

The summer microwave contest season is now all but over. By the time you read this the October Millimetre Band Contest will have come and gone. However there are the designated winter Activity days at the end of each month so you still have the opportunity to get on the air. Don't forget also that Monday night is microwave activity night .... Keep using our frequency allocations!

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## VHF/UHF/Microwave Operation in Switzerland

Operating in Switzerland is quite different from the UK. This is not down to different licence regulations and only a little to do with the topography of the country, but everything to do with the

position of Switzerland itself. In effect Switzerland is on the edge of Europe, in a similar manner to Ireland.

The Alps represent a huge block on working stations to the south, therefore when choosing a site here no attempt is made to find a good location with a clear south view ... nice scenery, shame about the signals! Instead we try and optimise our locations from the north-west through to the north-east in order to work French, German and Czech stations.

Being effectively on the edge of activity, we rely on stations to point their antennas in our direction. Most stations would much rather beam into the Ruhr, OK, PA and G in order to work the many stations active there. Poor old HB9 is not active enough to warrant much attention. German stations only beam south from time to time in order to pick up a few HB9s and then return their antennas to more interesting directions. It doesn't help that southern Germany is not particularly active either.

Switzerland is not a country of high mountains that allow unlimited DX possibilities to anyone willing to go up one. When in the UK, I got used to hearing HB9AMH and HB9MIN operating from the western side of Switzerland putting huge signals into the UK and working bucket loads of DX but this is not true for the whole of Switzerland and not in all directions either. As mentioned above, the Alps represent a formidable barrier to working to the south and presumably the same is true of Italians wanting to work north. Even when on top of a mountain, finding Italians to work is difficult ... the Alps are just too big.

Working east is also difficult. Since I have been here, I have never heard or worked any Austrians, even when Austria was visible from the location I was operating from. There are a lot of mountains in the western part of Austria and most of the activity there is towards the eastern side, hence difficulty in working east. It is probably easier to work OE's from the UK than from Switzerland! The only consolation is that the mountains in the Czech Republic are almost line of sight to the mountains in Switzerland and so that path is workable, even on 3cm, with huge signals.

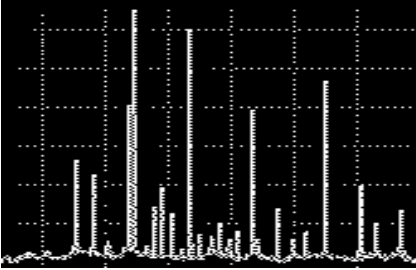
Finally, there is the Black Forest area in Germany. From certain parts of Switzerland, this area represents a big block on signals in certain directions. The general rule of thumb appears to be that stations in an area between Basel in the west and Zurich in the east cannot work to the north effectively. You will notice that HB9AMH and HB9MIN operate from west of Basel.

When I lived in Belgium, the amateurs there would complain about the Ardennes area which restricted them to working stations to the south-east.

**Jonathan HB9DRD (G4KLX)**

***Editor's comment:***

***Many thanks Jonathan for the interesting insight into operating from such a beautiful country ... a far cry from your home territory near Matlock, Derbyshire!***



## A UNIVERSAL MULTIPLIER FOR MICROWAVES - by F6BVA

translated by G3PHO from the  
French microwave newsletter "Hyper"  
July 2000 issue

Building equipment for 76GHz has made us review our ideas on local oscillators. In effect until then we had been very happy to use the DB6NT kits, which gave us every satisfaction, but then the helical and printed circuit filters are very nice and very effective. The other side of the coin, however, is that *that* type of circuitry is relatively narrow in bandwidth and does not lend itself to retuning to other frequencies other than those for which it was designed.

The specification for my oscillator is quite straightforward:

- Output frequency adjustable from 9.5GHz to 12.8GHz
- Output power +10dBm (enough for our requirements) with clean spectral characteristics as far as possible (the first spurious is -25dBm)

### The Local oscillator is made in two separate modules:

The first is a 1250MHz generator, a modified version of one published by F6DER in Hyper some years ago. The frequency is maintained at the correct frequency by using an ovened crystal at around 50 degrees C. Five to ten milliwatts from this stage are sufficient to drive the multiplier.

The multiplier forms the second module. An ERA3 is used as a x4 multiplier from 1.250GHz, and produces 5GHz after the first filter. A second ERA3 amplifies the 5GHz and drives an ERA1 which doubles to 10GHz, which in turn is filtered and then amplified by another ERA1.

Several examples of the multiplier have been built using the filter dimensions provided in this article and used to produce output between 9.5GHz and 12.6GHz without further modification, other than tuning the filters.

The circuit was etched on double sided 0.8mm Teflon board ( $\epsilon_r = 2.35$ ). The filter cavities are soldered to the ground plane side. Prior to this, the copper around the holes for the filter probes is cleared with a 3.5mm drill bit, as are those for the input and output pins of the 5V voltage regulator. The ground pins of each ERA device are passed through very thin slots (carefully cut with a sharp scalpel) from the strip line side to the ground plane side of the board and soldered on both sides.

***(editor's note: an alternative method to this would be to use flat head veropins (as in G3WDG and DB6NT modules) pushed through holes drilled from one side of the board to the other. This would then allow minimum ERA ground lead length.)***

The filters are made from standard copper pipe fittings ('stop ends' ... *editor*) found widely in DIY stores. The 5GHz filter is 25mm o.d. and 17 mm internal height (*assuming 1mm wall thickness for the fitting ... editor*). The probes for this filter extend 3mm into the cavity, i.e. above the ground plane surface). The 10GHz filter is 20mm o.d. and 10mm inside height. The 10GHz probes extend 2mm into the cavity. *(editor's note: to accurately cut probes to length it is suggested they be first cut slightly long and checked with a micrometer. Don't forget to add 0.8mm to their length to account for the thickness of the pcb they pass through.)*

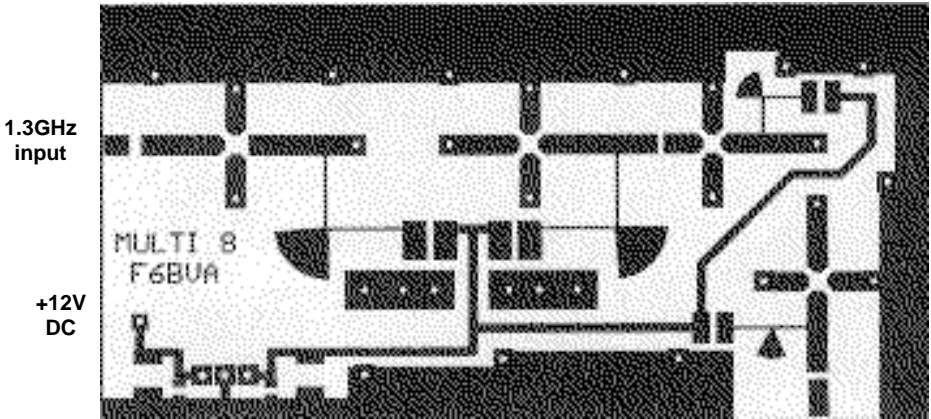
The printed circuit board is mounted in a standard tinplate box measuring 55mm wide x 110mm length x 30mm depth. The ground plane is carefully soldered all the way round at its interface with the sides of the box, 8mm above the bottom of the box.

The construction presented no particular difficulties ... just don't forget to make the through connections for the ERA devices. Pre-adjustment of the filters can be carried out with the aid of a signal

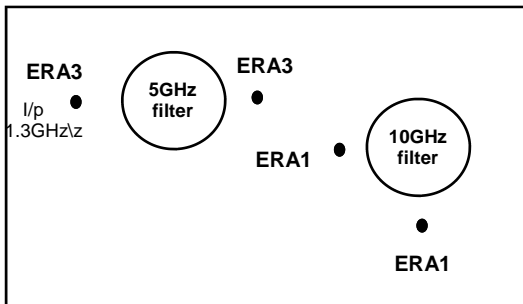
generator if you do not have access to a spectrum analyser. After this adjustment you should see an output of around 5mW. Depending on the chosen output frequency, it may be necessary to “snowflake” the lines with two or three stubs to obtain the +10dBm required. Lossy rubber or foam may be needed in the lid of the box if any instability is found to be present.

This Local Oscillator/multiplier has been fitted into equipment for 47, 76 and 145GHz with entirely satisfactory results.

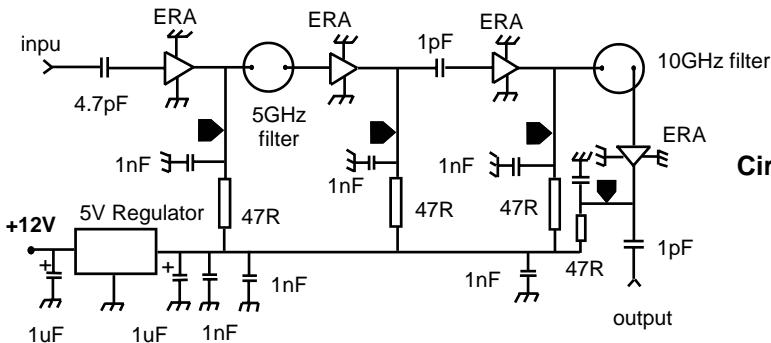
### PCB ~ FULL SIZE



OUTPUT: 9.5-13GHz



Physical layout



Circuit diagram



# ACTIVITY NEWS FROM THE WORLD ABOVE 1000MHz

## AUGUST 2000 ALL BANDS UK MICROWAVE CONTEST RESULTS

### RANKINGS BASED ON RAW SCORES:

<u>POSITION &amp; CALLSIGN</u>	<u>1.3GHz</u>	<u>2.3GHz</u>	<u>3.4GHz</u>	<u>5.7GHz</u>	<u>10GHz</u>	<u>24GHz</u>	<u>TOTAL</u>
1. G3PHO/P IO93AD51	1227			997	1832	85	4121
2. G6ARC/P IO91FH30	594			547	1331		2472
3. G4LDR IO91EC	364	30		421	862		1877
4. GW4KNZ/P IO70OW				678			678

### FINAL RANKINGS, BASED ON NORMALISED SCORES:

<u>POSITION &amp; CALLSIGN</u>	<u>1.3GHz</u>	<u>2.3GHz</u>	<u>3.4GHz</u>	<u>5.7GHz</u>	<u>10GHz</u>	<u>24GHz</u>	<u>TOTAL</u>
1. G3PHO/P IO93AD51	1000			1000	1000	1000	4000
2. G4LDR IO91EC	297	1000		422	471		2190
3. G6ARC/P IO91FH30	484			549	727		1760
4. GW4KNZ/P IO70OW				686			686

### Adjudicator's Comments:

- 1) Where was everyone else and why was no one on 3.4 and 47GHz?
- 2) Who IS this Sheffield station that seems to win all the events these days ?!!
- 3) Make sure you put enough postage on the envelope. One entrant owes me the grand total of 26p ..... 6p postage excess, 20p Post Office handling charge!!

73 from Andy G4JNT

**Editor's Comments:** Can someone give us a little competition please?! More logs are needed next time or these multiband contests could very well disappear ... that's a threat, not a promise!

There's not much input this month. September saw two Microwave Committee Contests, the Millimetre wave on the 10th and the 10GHz Cumulative on the 17th....

### SEPTEMBER MILLIMETRE WAVE CONTEST:

Nine UK operators turned out for this essential portable event. Conditions seemed good in the morning but rapidly tailed off after mid-day.

Paul, G0HNW/P (Alport, IO93FB) had a

one-way QSO from there to G3UYM/P (Dunstable Downs). This is a non-line of sight path. Paul was heard by Harold but the signals did not go the other way. Paul also worked G3FYX/P and G4KNZ/P, both on Cleeve Common, (IO81XW) and in excess of 100km, over a non optical path.

Peter, G3PHO/P operated from three sites during the day, Bradfield near Sheffield, IO93EK, Oxstones, nr Sheffield, IO93EI92

**and Alport, near Matlock, IO93FB44.**

**G0HNW/P(Alport) and G7MRF/P (Merryton Low, IO93AD)** were easily worked over the short distances involved from Bradfield. The Ox Stones site produced an 80 odd kilometre one way contact with **G3ZTR/P (Nunburnholme Wold, East Yorkshire, IO93PV)**. David's transceiver had developed a fault and he was only able to transmit, but not receive, using a beacon module on CW. From Alport, Peter had limited success, the only contact being with **G7MRF/P on Merryton Low** about 26km away. Attempts with **G4KNZ/P and G3FYX/P** on Cleeve Common were unsuccessful.

**From: John Hazell G8ACE**

**[hazell@cwcom.net] Winchester:** The Millimetre Wave Contest got off to a bad start for me. I placed the 24G system on the roof of the car to work G8BKE/P, using the feed horn only for speed and, in using 2m talk back, the 2m whip also on the roof. It would appear I blew the 24G IF Amp. This still to be checked out! The other slightly annoying aspect was the high humidity level. So far this year I think every occasion has seen less than good conditions for 76G. However it turned out to be excellent sunny weather otherwise and an enjoyable one, with good overall 47/76G results. Four contacts made on 47G and two on 76G although these were only one way. Both these at good distance for 76G, based on current experience for the band.

**My first location was Cheesefoot Head, Winchester IO91JB** and from there I worked **G8BKE/P, Walbury Hill, IO91GI**. After dish alignment Chris was able to copy the 76G on FM at a distance of 35.5km, a new UK one-way best. I used the **Impatt source** with **cassegain dish** for this one way contact. It's interesting to compare 47G performance with 76G. The signals on 47G with no Tx dish being similar to 76G with dish for similar power at our present equipment performance levels.

**The second location was Hackpen, IO91CL** and the distance to Walbury this time 27.7km, much the same as a previous contact with G3PYB. Chris got good FM copy from the Impatt source and manageable ssb copy from the transverter. On 47G G8BKE/P was worked from both locations and G4KNZ/P and G3FYX/P from Hackpen 52km. Regrettably, Roy was unable to find the 76G signal, both the haze and

increased distance being against us.

The total number of contacts, was two one ways on 76G and four two ways on 47G. Many thanks Chris, Steve and Roy.

**From: G4KNZ/P, (steve.davies@nokia.com)** Steve operated from **Cleeve, IO81XW**, with **G3FYX**, in the September 24/47G contest. Three stations were worked on 24G by both G4KNZ/P and G3FYX/P (G4BRK at 38km, G0HNW/P at 131km, and G8BKE/P at 73km), and two stations on 47G (G8BKE/P at 73km, and G8ACE/P at 52km). G7MRF (at Merryton) heard signals from Cleeve early in the day, but perhaps due to the high humidity, these were not heard later and no contact made; a later test with G3PHO/P was also unsuccessful. A test on 76GHz between Roy and G8ACE/P (Hackpen) was unsuccessful, with nothing heard, despite strong signals on 47GHz.

**10GHz REPORTS**

**From: G3JMY (EDWING3JMY@aol.com) in Bristol:** During the September Cumulative! worked 14 stations all told, the morning being most rewarding. I was pleased to work John, G8ACE/P, at Tintagel - SSB both ways. F6ET1/P evaded me - the 2m link was not brilliant and there was a mutual language obstacle to add to the confusion! I was amused listening to the attempt by G3PHO/P to work F1ANH/P who calmly stated that there was a house 30m due North ! Surely almost the entire UK was inaccessible ? I did not hear the Scillies at all, possibly the range and their sea-level altitude made 2m difficult. A bit of rainscatter would have helped, but it came too late.

On September 18th GB3CCX (IO81XW) was S9 over a wide angle (normally S2) and GB3KBO (Taunton) was audible at S2 - normally, in Summer, inaudible. I have heard GB3CEM (Wolverhampton) a few times when the rain is in the right place.

**From: John Hazell, G8ACE**

**[hazell@cwcom.net]** - a short report of my /P 10GHz operation from above **Tintagel in Cornwall (IO70PP)** The best two way contacts were with G3WDG at 339.3 km and G4ZXO/P at 322.7 km. I'm quite pleased as these are my best overall distances ever, portable, on 10G with my qrp 250mw. Only two of the 2 way contacts less than 200 km. Only two, two way failures - G0HNW and G3PHO/P.

**Peter, G3PHO/P (Houndirk Moor, IO93EH98)** returned to his old haunts for the September 10GHz cumulative. 25 stations of the 42 active stations were worked, two of them one way only. There was a most encouraging level of French activity ... merci bien, nos amis francais! F6DKW was heard weakly for the first time from this location at a distance of 571km. This would have been Peter's best /P DX had the contact materialised. An interesting one way contact was with G0EHV (Gateshead IO94FW) who was using a 13 inch dish looking through a double glazed window! Eddie heard Peter but the 10GHz signal back to Houndirk was not strong enough for a two way contact. Just as the contest was drawing to a close, the 2m beam was turned NW and a CQ call raised Sam, G18GJX, who had been listening all day to no avail. A 10GHz two way contact was made at RS51 both ways for a day's best DX of 321km.

#### MISCELLANEOUS REPORTS

**From Don, G3JHM, Alton, Hants.**

Tuesday, 13th September saw wonderful early morning conditions with G3GNR being 59+++ on the end stop over the 222km path. However there was no other activity on 3cm although Don worked 5 DX F stations on 432. F6ETZ ( IN97) told him that he had worked G3MTG for his first UK QSO 10GHz.

Conditions were also good between G and PA,PA3DYS hearing GB3USK on 23cm and GB3CMS/MHX on 3 cms .

Don heard a station, 2 weeks before, calling CQ on 10369.103MHz. It was almost certainly PA5DD with whom Don had arranged a test via the Internet but positive identification was not made.

Finally, Don will be active from home looking especially to the Midlands/North for 10GHz tests, trying to break some new ground or to work stations over 150 km rather than line of sight locals.

**From: G3JMB, JackG3JMB@aol.com**

I have found out why the gain from my RX was very much less than the input signal. The SSB Electronics RX mixer pill box filter had split open ... obvious failing in old age! That, coupled with the loss of my HEMT pre amp means that I shall no longer be on 10GHz. *(Editor's note.. We are very sorry to hear this Jack and trust you will be on next season as usual)*

**From: F6BVA [f6bva@wanadoo.fr] Antonioli Michel, 23 impasse des cèdres 83260 La Crau France** send details of his station:

I am QRV and active (HI!) 10GHz 14 watts, 1dB NF, offset dish 120cm.

**24GHz** with 100mw. 2db NF, same dish 120cm.

**47GHz**, 0.1mw 8dB NF, 120cm and 75cm offset dish

**76GHz**, 0.1mw around 10 dB NF 75cm and 40cm offset dish.

**145GHz** with...microwatts and ...dB of NF. Ant 40cm offset.

My best DX: 24GHz:398km 26/10/97 with F5CAU/P.

47GHz:289km. 27/12/98 again with Gil.

76GHz : 103km. 27/02/2000 with Jean F6DER/P

145GHz: 10km. 18/05/2000 also with Jean F6DER/P.

My best 73 to you all of you, **MICHEL F6BVA**

**From: G3XDY [g3xdy@btinternet.com]**

The October IARU contest results were nothing to write home about, with the lowest number of QSOs on 23cm that I can remember for this event (49). Best DX was DL3YEE in JO42 at just over 500km. On 2.3GHz conditions were equally grim on Saturday but did improve a bit as Sunday went on. Best of 20 QSOs was DL1ELY in JO30EM at just under 400km. Many contacts took a long time to complete with signals right down in the noise and only really copiable when aircraft scatter provided some enhancement. I suspect that I need to do some more work on the antenna and preamp as QSOs that should be possible just did not work this time.

On 10GHz, I was pleased to manage 16 QSOs with PI4GN the best at 411km. There was a period with loud rainscatter signals from PA0 around lunchtime on Sunday, with PA0CIS and PA6NL both worked direct without talkback. As I had to take down my 144MHz antenna to get an extra group of 1.3GHz yagis on the mast, I was not able to add any UK contacts during the cumulative on the Sunday due to lack of talkback. I heard very few stations in the UK with 432MHz talkback.

**THAT'S ALL FOR THIS MONTH ....**

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73 Simon Lewis, GM4PLM

\*indicates rear mounting

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<b>SHF2344</b>	23cm	44	18.1	3.0	£95
<b>SHF2367</b>	23cm	67	19.9	5.1	£115
<b>SHF1340</b>	13cm	40	16.6	1.6*	£85
<b>SHF1367</b>	13cm	67	20.0	3.0	£125
<b>SHF1633</b>	Meteosat	33	16.3	1.6	£100
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