An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

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2009 MARCH

The new 2metre diameter dish at the QTH of John, M0ELS. John has recently completed the elevation control mechanics and to his delight found that the local planning officer pronounced that no planning permission was required! (Essex can't be so bad after all! ... editor).

There's more about the dish inside this issue of Scatterpoint.

In this issue ...

Latest News ...

- **G4DDK takes over the Dubus microwave column**
- **Propagation and microwave activity at a low ebb**

MANY THANKS TO ALL OUR CONTRIBUTORS THIS MARCH ... WITHOUT YOU THERE WOULD BE NO SCATTERPOINT!

UK Microwave Group Contact Information

Chairman: G4NNS Brian Coleman **Email:** chairman@microwavers.org **Located:** Hampshire (IO91FF) **Address:** Woodlands, Redenham, Andover, Hants., SP11 9AN **Home Tel: - n/a**	**General Secretary: G8KMH Lehane Kellett** **Email:** secretary@microwavers.org **Located:** Hampshire (IO91) **Address:** Honey Cottage, Bent Street, Nether Wallop, Hants., SO20 8EJ **Home Tel:** ++44 (0)1264 781786	**Membership Secretary: G8DKK Bryan Harber** **Email:** membership@microwavers.org **Located:** Hertfordshire (IO91VX) **Address:** 45 Brandles Road Letchworth Hertfordshire, SG6 2JA **Home Tel: n/a**	**Treasurer: G4FSG Graham Murchie** **Email:** treasurer@microwavers.org **Located:** Suffolk (JO02) **Address**: 42 Catherine Road, Woodbridge, Suffolk, IP12 4JP **Home Tel:** ++44 (0)7860 356775
Scatterpoint General Editor: G3PHO, Peter Day **Email:** editor@microwavers.org **Located:** South Yorkshire (IO93GJ) **Address:** 146 Springvale Road, Sheffield, S6 3NU, United Kingdom **Home Tel:** ++44 (0)114 2816701 (after 6pm)	**Scatterpoint Activity News Editor: G8APZ Robin Lucas** **Email:**Scatterpoint @microwavers.org **Located:** Essex (JO01) **Address:** 84 Woodman Road Brentwood Essex, CM14 5AZ **Home Tel:** ++44 (0)1277 211126	**Contest & Awards Manager: G3XDY John Quarmby** **Email:** g3xdy@btinternet.com **Located:** Suffolk (JO02OB) **Address:** 12 Chestnut Close, Rushmere St. Andrew, Ipswich, Suffolk, IP5 1ED **Home Tel:** ++44 (0)1473 717 830	**RSGB Microwave Manager: G6JYB Murray Niman** **Email:** mjniman@iee.org **Located:** Essex (JO01) **Address:** 5 5 Harrow Way Great Baddow Chelmsford Essex, CM2 7AU **Home Tel:** ++44 (0)1245 474969

From the Editor's Desk

Hello from sunny Sheffield!

It's been a difficult month for both Robin and myself as we have had so little in the way of articles and news items this time. We both have had to trawl the internet to gather sufficient material to make this issue worthwhile. Please send us your news, views and technical items as soon as possible, before the end of the first week in March, if we are to avoid cutting down the number of pages to 16 or so in the next edition of Scatterpoint.

What "narks" (upsets) both Robin and myself at times is the amount of good stuff that gets put on the UK Microwave Reflector by some Scatterpoint readers. This material could come to us first please! Has the printed word gone out of fashion and are reflectors now taking over monthly newsletters and magazines? Please remember that both of us merely EDIT this journal ... we don't expect to have to write the articles as well !

The season of Microwave Round Tables is almost upon us, with the RAL event due in a month's time, followed by the South Yorkshire one in July. Both these are open for registration, though all you need to do for South Yorkshire Microwaves is email myself with your intention to come. RAL is another matter because security protocols demand prior registration. Go to **www.microwavers.org** for further details.

73 from Peter, G3PHO

News, views and articles for this newsletter are always welcome. Please send them to G3PHO (preferably by email) to the address shown above. **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.

3.4GHz EME ACTIVITY WEEKEND

In the last two years we have held a 9cm activity weekend in June and I would like to propose that we do the same again this year. June 20/21 looks like a good weekend to hold it. If you have a 9cm allocation in your country but are not yet active then look at the links below for some more information:

http://www.moonbounce.info/3.4 GHz Moonbounce Made Easy.pdf

http://www.ntms.org/files/Florence_203_4.pdf

http://vk3nx.com/9cm.html

There is also more info on QSOs, etc, in the 432 and Above newsletters for July / August 2007 and 2008 see http://www.nitehawk.com/rasmit/em70cm_arc.html

All the activity last year was on 3400.100± but if you have only 3456 MHz capability then all the NA stations and several other stations around the world can operate on 3456 or work crossband, so don't be put off giving 9cm EME a try.

73 from Peter G3LTF

THE NEW DUBUS MICROWAVE COLUMNIST ...

Sam Jewell G4DDK

UK MICROWAVE GROUP SUBSCRIPTION INFORMATION

The following subscription rates now apply. **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!

Your personal renewal date is shown at the foot of your address label if you receive Scatterpoint in paper format. If you are an email subscriber then you will have to make a quick check with the membership secretary if you have forgotten the renewal date. From now 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 (the editor suggests having it tattooed on your forearm!).
Please also note the payment methods and be meticulous with Paypal and cheque details.

Renewal of subscriptions requiring a **paper copy** of Scatterpoint are as follows:

Delivery to:	**UK £**	**US $**	**Eur €**
UK	14.00	-	-
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Payment can be made by:

*** Paypal to ukug@microwavers.org**

or

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

The standard membership rate for 2009 is:

UK	**£6.00**
US	**$12.00**
Europe	**€10.00**

This basic sum is for **UKuG membership.** For this you receive Scatterpoint for FREE by email. If you want a paper copy **then the higher rates apply.**

My 23/13cm Dish Project

... by John, M0ELS

Last year, I purchased a 2m diameter wire mesh dish kit from RFHAM-DESIGN, to use on 23cm as well as 13cm with EME and tropo usage in mind. I am pleased to say that it's now complete excepting for the azimuth control system, which will follow in due course.

The three photographs show the dish mounted on a 3m galvanised pole in the back garden, with elevation hardware mounted. Unfortunately, arthritis is preventing me from working on the dish at the moment but, hopefully, I can enlist some volunteers to help me complete the project, if needed.

The dish appears to work very well even at 3m AGL, having worked F1RJ and ON4IY at around 350km range.

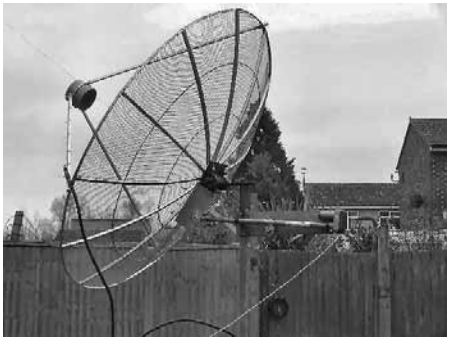
The elevation hardware consists of two saddle bearings for 20mm diameter tubing, purchased off eBay for under £20.00, including postage. These are mounted onto a 6mm steel plate as shown below. Incidentally, this is the heading to ON4IY. The feed is dual band linear for 23 & 13cm. I will also be mounting a webcam in the front cavity section of the feed for visual alignment of the dish. The coaxial cable used is 8m of LCF12-50 Cellflex.

I have now added the elevation hardware and it works quite well. Next will be the azimuth control.

73 John – M0ELS

Late news flash!

I had a visitor in the form of a council planning officer (someone "shopped" me !) who took one look at the dish and could not see what the fuss was about. He took several pics (to which I added, with a smile on my face, that they were copyright,) and after a quick cuppa off he went. Two weeks later, a letter arrived saying that no planning permission was required AND DECLARED DE-MINIMUS and the case was closed!



NEW PRODUCT FROM G4HUP.COM

Hello all,

Just to let you know that I've added a 4 way distribution amplifier kit to my products at http://g4hup.com/DA/DA1_4.htm.

I'll also openly tell you that is not intended as a high quality lab instrument but is a simple general purpose tool intended for distribution of signals anywhere up to 1800MHz, where phase and output level accuracy variations are not very critical. There is (deliberately) no frequency tailoring or transformer isolation provided in the unit but details of how to achieve this externally are given in the documentation for the unit. It is ideal for sending 10MHz to your test equipment stack for general purpose measurements or for distributing an rf signal to a number of destinations, such as sharing an IF signal between conventional and SDR receivers.

Having run it down in the last paragraph, when driven from a nominal +10dBm source the measured phase variation between the outputs at 10MHz is less than 3 degrees, and it provides 4 +10dBm outputs within +/- 0.25dB. There is also a variant that will provide distribution of GPS antenna signals, including providing power feed for the active GPS antenna itself.

regards,
Dave Powis, G4HUP
g4hup@btinternet.com
http://g4hup.com

Heelweg 2009 : A Great Microwave meeting!

A new record has been set. 173 registered visitors attended the 2007 Heelweg Microwave meeting in Westendorp the Netherlands during February this year. The visitors came from:

DL 22x
G 2x
HB 1x
ON 10x
PA 138x

We received a lot of positive remarks about this meeting and especially the measuring team, which has been great this year. Every year they are able to improve the number and quality of their equipment. Of course this is very positive for our hobby.

We like to address our special thanks to the following people:

The 2009 measuring team:
Hans PA0EHG, Jos PA3ACJ, Bert Crama, John PA7JB, Bram PB0AOK, Gerrie PA3EXV, Andries PE1BMC, Timo PE1FOD, Richard PE1FYB, Oebele Slofstra, Frank PE1NFE, Henk PE0SSB, Harm PA3AST, Eene PA3CEG

The location:
Gert PD0HCV and his team for allowing us to use his location.

The camera team of CH73:
Paul PA0SON and Jan PD0HOT

See the 2009 movie at: http://www.ch73.net/player.php?id=319&table=1&ln=nl

The old 2008 version is at:
http://www.ch73.net/player.php id=206&table=1

And of course all the 173 visitors!!

See the pictures at:
http://pamicrowaves.nl/website/index.php?option=com_content&task=view&id=18&Itemid=32

We hope to see you all, next year on Heelweg 2010

In the meantime we like to welcome you on **www.pamicrowaves.nl** and check from time to time our "The Technical Articles".

We look forward to seeing your questions, remarks, information etc. in our Forum. If you have some nice Microwave articles, please respond to **info@pamicrowaves.nl** for sharing your knowledge and projects with others!

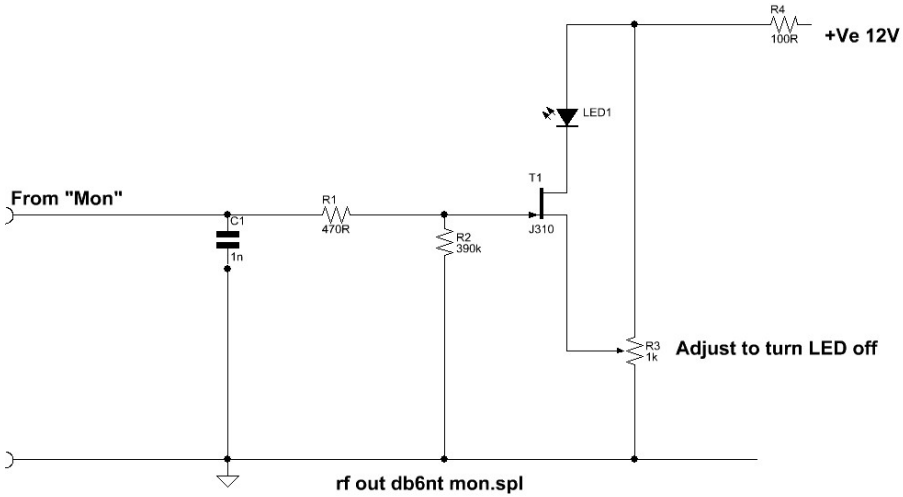
73 from PA3CEG, PA7JB, PA0BAT, PE1FOT

USEFUL AND VERY SIMPLE OUTPUT INDICATOR FOR THE DB6NT TRANSVERTER

…. by Geoff GI0GDP

Here is the simplest circuit ever! The potentiometer is adjusted until the LED goes out and then, when you key down, the 200mW of the bare foot 10GHz transverter should light the LED, giving at least an indication that RF is leaving the transverter.

Regards GI0GDP



23 cm beacon update from Belgium - ON0VRT JO20CS 1296,950

On 13th March 2009, a picobeacon was activated at 117m agl on 1296.950MHz and running 20mW in a 10 dB gain panel antenna, oriented 45° opening angle 140°. The location is the tallest building in Belgium, the VRT broadcast tower in Sint-Pieters-Leeuw west of Brussels. The power is going up in the future and it will be soon be upgraded with GPS lock and it'll get a brother on 70cm to replace the for-all-time dead ON0UHF.

CW text is ON0VRT-JO20CS using narrow FSK

73 from Pedro ON7WP
ON0VRT station manager
(Reports are welcome on the DX cluster)

Amateur Microwaves and Helping the Younger Generation

How a chance email from a young French Canadian lead the Scatterpoint Editor to forge a bond between the old and the young!

Preamble... Some 18 months ago, I received an email from a young French Canadian student, **François-Guillaume Landry**, who had found my website while Googling for information towards a science project. He'd noticed the simple X band Gunn wideband FM transceiver that has been on the website for some years now and wanted further information so he could use it in his science project. In July last year, I received a further email from him containing the following information and photos showing what his project was about and the excellent news that he had won a major prize in the Canadian Wide Science Fair. I make no apologies for publishing his work here in Scatterpoint. It's the first time he has had anything published and he'll be getting a complimentary copy of course!

To have played a small part in someone's achievement like this is extremely gratifying and one can't help wonder just how many young people there are out there who need a similar helping hand. It might even lead one day to them taking up Amateur Radio and eventually microwaves. So..... get your local club to liaise with school science departments in your area and see what you can do to recruit the younger generation into the finest hobby in the world! **Peter G3PHO**

Hello Peter,

I have some news for you of my project! First, I have to say I won the best in fair award at the regional science fair and went to the Canada Wide Science Fair. There I surprised myself and won a bronze medal in Earth and Environmental sciences, the Michael Smith innovation award and a scholarship! All the prizes together gave me $2000! So, for next year, I won't have financial problems

Photo below: My project after the regional science fair

I didn't have the chance to explain in detail what my project was about. The title of my project was ***Plants and radio waves: a curious combination!*** (It doesn't make a lot of sense in English – it's a French expression). The first part was on the effects of radio waves on plants (it's where you helped me), and the second part was on the attenuation properties of trees (solution for the problem).

For my first study, I selected three types of plants: radish, wheat and bean. I had sown approximately 750 seeds in containers and placed them into greenhouses to grow in the same conditions. Seeds were exposed to electromagnetic waves of three frequencies:

- Microwaves produced by the Gunn transceiver (10GHz)
- Microwaves from the oven (Intensity 1-2-3 on the oven @ 2.45GHz)
- Radio waves from an AM transmitter (1MHz)

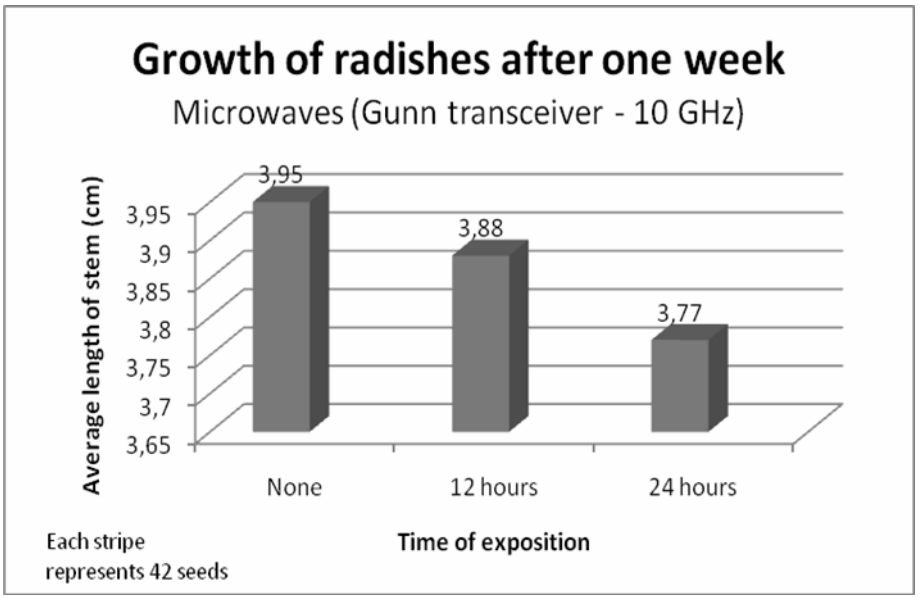
Left: Plastic containers housing the seedlings

Seeds were also exposed during different amounts of time (12 hours and 24 hours for the Gunn transmitter and AM transmitter and 15-25-40-60-90-120 seconds for the µW oven) and at different numbers of periods of exposure (some seeds were exposed only once, some two times separated by one week, and some three times separated by one week). The first period of radiation started one day after the seed has been sown. The length of stem and the weight were taken.

The results were very interesting. For the AM radio waves, there weren't any significant differences but for the microwaves produced by the Gunn transceiver, I measured a little diminution of the length of the stem the longer the exposure. The standard deviation was certainly high but in 90% (all except one) of the groups of periods (once, two times and three times) there was a diminution, comparing the groups with each other. I was very surprised because just a little heat augmentation was measured (+1-2 ºC), which I thought should accelerate plant growth...

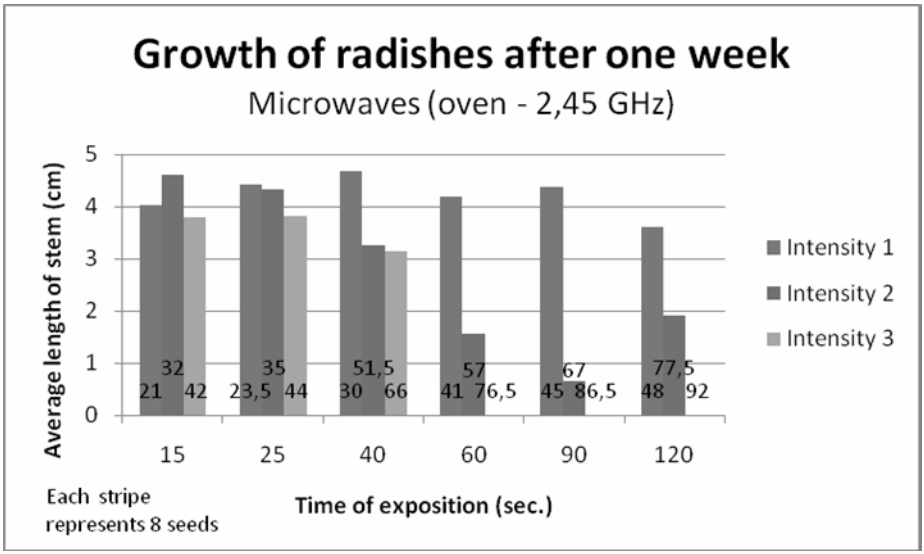
For the microwaves from the oven, nothing was found at the first intensity; even a little augmentation could be interpreted but at higher intensities, there was a significant diminution the longer the exposure, confirming my hypothesis that it was definitely thermal effects.

All my graphs are in French so I translated the two principals. The first shows you the length of the stem after one week for the Gunn transceiver, and the second, the average length of the stem after one week for µwaves from the oven. The numbers at the base of each stripe or column represent the temperature of the earth inside the containers after exposure (centre).



The results were similar for the other plants except for wheat exposed to the Gunn transceiver and low intensity/time oven radiations. The data wasn't regular, most probably because of the low germination ratio of wheat.

My study confirmed other studies had been done before for 2.45 GHz but, for 10 GHz, it was an innovation (or very few studies were already done). Even with all the variables I controlled vigorously, my study can't be compared to studies done in laboratories. I would also need to sow more seeds to have more accurate results, which is very difficult for the space I have. Judges said that the statistical analysis could be improved but my study is still itself very representative and a



great beginning. I'm not saying that everyone should immediately stop ham radio, but more that it would be better to take little precautions when operating high power transmitters!

I'll stop here for my first study. I didn't tell you a lot about the second one earlier. I tried to find a solution for the problem I discovered. In Canada, we have kilometres and kilometres of forest, so I thought trees would be a great idea.....

Problem

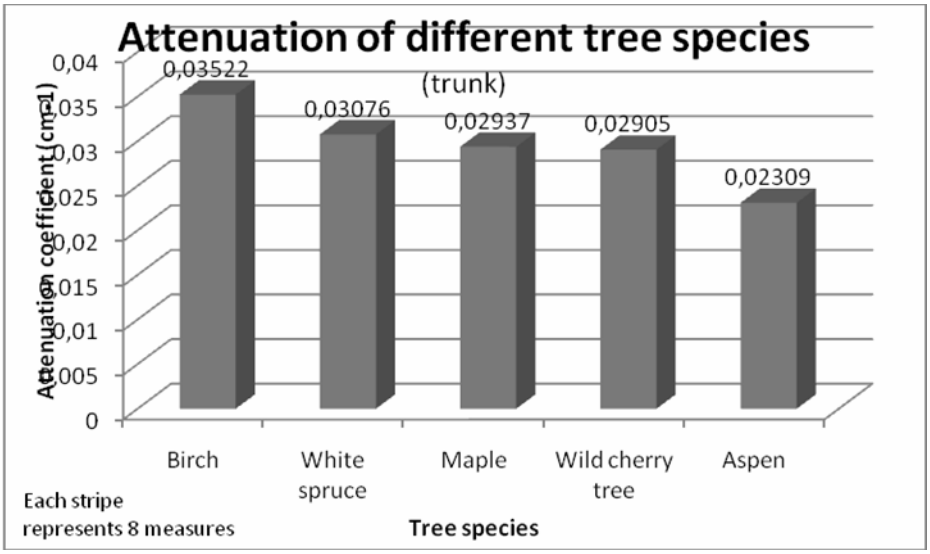
Which tree species attenuate radio waves the most and the less, and what is the impact of forested areas on the propagation of them.

Procedure

The transmitter and receiver are supported by a fixation system to the tree. (see photo right). The material was brought to specific sites to take data, like the intensity of radio waves transmitted, received, reflected, and also the length of the trunk. Attenuation of trees was measured with the attenuation coefficient.

Many variables were found and controlled, like the temperature inside the transmitter/receiver (insulation) and exterior disturbances (body, ...). Sure, the attenuation of trees is not very big but water they contain and cellulite should still absorb an important part of electromagnetic waves (not as a metal plate that will only reflect radiations). So I decided to do a study to find which tree species attenuate the most and if I was right.

When I began, I had problems with the Gunn module. The receiver was working but not the transmitter. I played a bit with the module, so it could be possible that it was static electricity. Nevertheless, I used an AM transmitter/receiver instead. I built two boxes for them (metal and insulated) and a fixation system. There was also another receiver in the transmitter box. Measure-



ments were only taken at the trunk because the receiver wasn't accurate enough when measuring through the entire tree and it was also winter. Here are my results:

My experiment showed that the difference between the birch attenuation and other tree species is relatively high. My hypothesis is that the birch trunk has a higher density. One birch will not have a significant effect: it's plenty of them that will create an important attenuation.

Using trees as a ''green shield'' around relay antennas, for instance, could be very interesting taking into account the fact that the average height of birches (28 meters) would be perfect to attenuate zones of high density of microwaves reaching habitations. It could be a great action to begin with: it wouldn't cost a lot and it is aesthetically really nice.

However my study is still incomplete. Soon, I want to do measurements of the entire tree with a better receiver and with other species (more conifers). It would be very interesting to measure attenuation at different frequencies to see if there are differences (which are probable). There are not many applications at 1MHz: it's in the microwave band where there are the most possibilities. Also, in theory, trees should have a more important attenuation at those frequencies. Another very interesting band would be ELF. Studying applications of trees around high tension lines would be very interesting.

I would like to thank you very, very much for your help during my project. I don't know what I want to do for next year but it will be in the same subject for sure. So if you have any suggestions (problems, things to improve...) they are welcomed! (*readers... please feel free to contact Francois ... editor*)

Sincerely, François-Guillaume Landry < fgl_9309@hotmail.com>

OFFSET FED DISH TILT ANGLES

by Dick, K2RIW

(our thanks to WA1MBA's Microwave Reflector for this information)

From: Richard Knadle <k2riw@riwproducts.com>
Date: 18 November 2008

INTRODUCTION -- There seems to be "a well kept secret", that should be repeated every few months, concerning the most popular type of design that is being used on Offset Fed Parabolic Dish Antenna systems. The "secret" (with its implications) is that the design of the Offset Fed Dish almost always includes the Apex of the Full Parabola. I'll explain .....

THE FULL PARABOLA -- A "Full Parabolic Reflector" (or a Complete Parabolic Reflector) is usually a round metallic surface that is curved in three dimensions and it looks like a shallow bowl. The magic of the Parabolic Shape is that it will take a planar wave that is being received from a long distance away, and focus it to a point (at the Focal Distance) and that is where the Phase Centre of the feed horn should be located.

THE FREQUENCY RESPONSE -- It does this focusing action simultaneously, at all frequencies. In most cases, the frequencies of operation of the total antenna system is determined solely by the Bandwidth (and Beamwidth) of the Feed Horn.

THE SHADOW EFFECT -- That feed horn will be located directly in front of the full parabola, at the centre of the parabola. Therefore, during signal reception, the presence of the horn causes a "shadow" to be cast onto the Parabola. Because of that shadow, the Sidelobe Levels will be increased, and the Gain-to-Temperature Ratio (G/T) of the parabolic antenna system will be slightly degraded.

THE OFFSET PARABOLA -- Antenna engineers discovered that there are multiple ways of placing the Feed Horn "out of the way" of the signal that is being received -- thus eliminating most of the Shadow. At first, this may seem to be a complicated three dimensional mathematical problem. However, there is a simple way of viewing the situation and it appears that most antenna designers took this simplified, five step approach:

1. On paper, they simply construct the full parabolic antenna in the conventional manner -- with the feed horn in front of the parabola.
2. Then they simply "cut away" the portion of the parabola they don't want; and, they almost always leave the centre portion (the Parabola Apex).
3. They construct the remaining portion of the parabola.
4. They leave the feed horn at the same location, but re-aim it at centre of the remaining parabola so as to minimize the Energy Spill-over.
5. They change the feed horn design so as to have a more narrow beamwidth that aims most of the energy at the now-smaller reflector.

BORESIGHT AIMING -- The bottom line of this design approach is that it becomes easy to aim the Offset-Fed Parabolic Antenna system at the target (on the horizon, for instance), once you know the "secret". That is, the antenna almost always includes the apex of the original full parabola. That means, if you place your eye at the lower edge of the reflector and sight through the phase centre of the feed horn, you are looking in the direction of the antenna's boresight. That's exactly the way the total antenna would behave if the rest of the full parabolic reflector was present.

FEED HORN TILT ANGLE -- The simplistic way of analyzing the antenna, by saying something like, "the reflector should be 'tilted down' 21.5 degrees", can cause errors. That 21.5 degree "tilt down" angle will only be true for a reflector of a particular f/D ratio. A dish with a higher f/D Ratio will have a "bowl shape" that is more shallow, the reflector "tilt down angle" will be less, the focal distance to the feed horn will be greater, the feed horn "tilt up angle" will be less and there will not always be a simple ratio between the reflector "tilt down angle" and the feed horn "tilt up angle".

A POPULAR EXAMPLE -- For instance, one popular design of an 18" diameter "Direct TV Dish" antenna (there may be 10 million of them, mine has the brand name of RCA printed on it), has an oval reflector of 19.75 by 18.25 inches, and a Focal Length of 10 inches. The full parabola of that antenna would have had a reflector diameter of 37.1 inches, a focal length (again) of 10 inches, and an f/D Ratio of 0.27. Because 1/2 of the full parabola has been "cut away" the remaining reflector appears to have an f/D of almost 0.6, as far as the feed horn design is concerned. That particular dish design has a reflector "tilt down angle" of 20 degrees, and a feed horn "tilt up angle" of 50 degrees. All angles are with reference to the antenna boresight, with the antenna aimed at the horizon -- not with reference to the feed horn support arm. Some designs might use a different support arm design.

I hope this information is helpful. Feel free to correct the errors.

73 & Good SHF/EHF/EME DX from Dick, K2RIW

THIS BLANK SPACE COULD EXTEND TO MOST OF NEXT MONTH'S SCATTERPOINT IF YOU THE READERS DO NOT SEND ARTICLES AND OTHER MATERIAL TO THE EDITOR SOON !

OUR ARTICLE CUPBOARD IS NOW WELL AND TRULY EMPTY!

Sun Noise Measurements
Some Problems & Solutions
… Richard Nadle, K2RIW
(our thanks to WA1MBA's Microwave Reflector for this information)

INTRODUCTION -- Accurate System Noise Figure measurement by the use of Sun Noise can be troublesome, because there are many errors we often make due to a misunderstand of the principles of physics that are involved. Here are some of the major errors, and some possible solutions.

PROBLEM #1 -- It is logical to assume that you can place a Step Attenuator in front of a receiver system as a method of evaluating the magnitude of the Sun Noise that is being sensed by the receiver, and thus calculate the system's Noise Figure. In most cases this is not so.

You COULD make this kind of laboratory Noise measurement if all of the instrumentation was at room temperature, and all of the components were 50 ohms resistive. However, in that case you would really be measuring the Excess Noise of the Noise Source, not the Noise Figure of the receiver system. And, even that measurement will produce a significant error if a mathematical adjustment is not being made (explained below).

-- HERE ARE A FEW EXAMPLES TO ILLUSTRATE THE PRINCIPLES INVOLVED --

(1) ROOM TEMPERATURE MEASUREMENTS -- If I place a high quality Step Attenuator between a high quality (room temperature) 50 Ohm Termination and a receiver system, there will be essentially no change in the Noise Power Output of the RCVR as I run through the steps of the attenuator. The only thing that will change is where the External Noise Power is coming from. A room temperature Termination (that is impedance matched to the RCVR) will generate a Noise Power Density of -114dBm per MHz of RCVR bandwidth. As the Step Attenuator is dialled to high attenuation values it will become the new 50 Ohm Termination. At a 3dB attenuation setting, 1/2 of the Noise Power will be coming from the Termination and 1/2 of the Noise Power will be coming from the Step Attenuator. The RCVR will continuously see 50 Ohms, and it will continuously see -114dBm per MHz of external Noise Power as I run through the steps the attenuator.

(2) A CRYOGENIC TERMINATION -- If I cryogenically cool the Termination to 77.2 Kelvin (liquid Nitrogen boiling temperature), it will produce the weaker Noise Power of -119.75dBm per MHz. A perfect RCVR (0.0dB Noise Figure) will see a 5.75dB Noise Power decrease when the cryogenic Termination is compared to a room temperature Termination (at 290 Kelvin) with a Noise Power of -114dBm per MHz. At a 3dB Step Attenuator setting the RCVR input will get -116dBm per MHz of Noise Power. As I step the attenuator to higher values, the Noise Power will approach -114dBm per MHz from the weaker Noise Power direction, because the Step Attenuator will be making more Noise than the Termination. But, the Noise Power will never get all the way back up to -114dBm per MHz (my "reference" Power), because the cryogenic Termination will always be slightly "cooling" the total system. Therefore, I will not be able to get back to the "reference" Noise Power unless there also is a VSWR error in the setup that is being changed by the Step Attenuator settings.

(3) A HOT TERMINATION -- If I heat the Termination to 100 degrees Centigrade (373.15 Kelvin) it will produce -112.9dBm per MHz of Noise Power (1.1dB louder than at room temperature). As I step the attenuator to higher values the Noise Power will approach -114dBm per MHz from the higher Noise Power direction, but (again) it will never get all the way back down to -114dBm per MHz, because the hot Termination will always be slightly "heating" the total system.

(4) A SUN NOISE MEASUREMENT PROBLEM -- When a good antenna is looking at Cold Sky it acts like a cryogenic Termination to the RCVR, and this is where the "reference" Noise Power is usually measured. Then when the antenna is moved to the Sun it will act like a hot Termination. As the Step Attenuator in front of the RCVR is increased it will be adding noise to the system (compared to Cold Sky), and the "hot" Sun will also be continuously adding its "heat" to the system. Therefore, there will be no reasonable setting of the Step Attenuator in front of the RCVR that will bring you back to the Cold Sky Noise Power output of the RCVR -- the "reference" Noise Power. Also, a Step Attenuator placed between the antenna and the RCVR will not behave in a linear manner (in decibels) when making low Noise Power measurements.

(5) THE IMPEDANCE PROBLEM -- Very few antennas present an impedance that is exactly 50 Ohms Resistive, and particularly not on a rainy day. Therefore, as the Step Attenuator is used in various steps, the impedance that is presented to the LNA will be continuously changing. The exact Noise Figure that a LNA produces is usually quite dependant on the impedance it sees. This means that the RCVR System NF will be changing at the same time that you are attempting to measure the Noise Power that is being presented to the RCVR. For the above reasons I strongly recommend that no changes be made between the LNA and the antenna during the measurement of Sun Noise versus Cold Sky.

CONCLUSION -- When you are measuring an external Noise Power Density, a step attenuator that is placed in front of the RCVR will not behave in a linear manner (in decibels), for a number of reasons. You can not use it to directly measure the strength of an External Noise Source because, the Step Attenuator is simultaneously changing the amount of Noise it generates for at least two reasons. You could only directly make that kind of measurement if the antenna was exactly 50 ohms, and the step attenuator was cryogenically cooled to stop it from making Noise Power -- in most situations that is not practical. Even then you will not be able to get down to the Cold Sky "reference" reading unless the cryogenically cooled Step Attenuator is colder than the Sky Temperature. I'll admit that a smart mathematician could recognize the "slope" of the RCVR Noise Power changes as the Step Attenuator was being changed, and he could re-calculate the RCVR NF if he knows the true temperature of his Step Attenuator, but that will involve some unconventional math that will be subject to errors.

-- SOME SOLUTIONS --

(1) DOWN RANGE ATTENUATION INSERTION -- I say the Step Attenuator must be inserted between two of the later stages of the RCVR, preferably as far down range as possible. In this manner it will not be affecting the Front End Noise Figure, or the LNA impedance match. Also, in this manner it will always be possible to get back to the Cold Sky "reference" Noise Power measurement, because the total RCVR Noise Power in that location will be so large (in terms of kTB [-114dBm/MHz]) that the excess Noise Power made by the Step Attenuator will be negligible -- this is almost equivalent to using a cryogenically cooled Step Attenuator at the RCVR Front End.

(2) INTER-STAGE IMPEDANCE MATCHING -- Be concerned about the impedance between the two stages where the Step Attenuator is being inserted. If the output impedance of the first stage, and the input impedance of the second stage do not (both) match the impedance of the Step Attenuator that is being placed between them, then the first few attenuator steps will not behave in a linear manner. This is because the Step Attenuator will be changing the transfer characteristics as the inter-stage VSWR is being changed. This problem can be mitigated by making sure the Step Attenuator is never used at less than say, 10 dB. Or, by forcing a near-perfect impedance match by using good Balanced Amplifiers, or the right kind of Operational Amplifier circuits for those stages.

(3) AGC CONTROL -- When a RCVR system is designed for the best compromise between Cascaded Noise Figure (high total Gain), and High Dynamic Range (low total Gain), usually the AGC is operational, and the S-meter will show some deflection. If the stages preceding the AGC stage are Gain Starved to the point where the S-meter doesn't move (no AGC action, which has been suggested in this forum) then frequently the over all (cascaded) RCVR Noise Figure will be compromised.

I believe it would be better to "Cage the AGC and S-meter". Here is how it can be accomplished. Most RCVRs have an AGC circuit that has a very high operating impedance -- frequently close to a megohm. It should be a simple matter to notice the S-meter setting under normal RCVR operation, and then flip a switch that will connect the AGC line to a potentiometer that has a regulated voltage applied to it. Then adjust the potentiometer until the S-meter is returned to the normal setting. If the impedance of the potentiometer circuit is low by comparison to the AGC circuit impedance, then the AGC voltage will be "caged" or "clamped" to a fixed operating state, and Cold Sky to Sun Noise measurements can be accurately made, as long as the Sun Noise increase isn't so large that the RCVR system is being pushed into the saturation region. If so, select a higher "clamped" AGC voltage, and repeat the Sun Noise measurement.

There are many RCVRs that are already using this kind of circuit. The so-called RF Gain control is really a potentiometer and diode circuit that forces a minimum voltage onto the AGC line. This type of RCVR is recognizable by the fact that the S-meter moves up-scale when the RF Gain control is rotated.

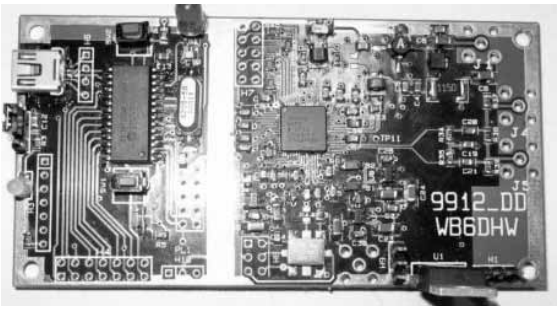
I hope this information is helpful. Please feel free to correct the mistakes!

73 & Good VHF/UHF/SHF/EHF/EME DX, from Dick, K2RIW

Spurs and how to avoid them
… by Richard Bown G8JVM

A clean and spurious free signal is an extremely rare beast, nearly extinct. Last summer, I decided to rebuild the whole local oscillator chain in my homebrew transceiver. It has served well over the last 25 years but, with three phase locked translation loops, it was difficult to expand further.

The chosen new LO uses DDS, all based around Analog devices AD9912. As I don't have multilayer pcb facilities, either at work or home, I used the pcb from Dave WB6DHW. It's a very good price and the board (see photo right) is of a high quality. (Editor's note: see http://wb6dhw.com/For_Sale.html#9912)



So now I have just one LO tunable from HF up to 70 cms, which makes getting on any band within its range very simple.

I did however spot two sidebands at about -75dBc at HF frequencies, rising to -60dBC at 420MHz. A DDS system like any one will have a few spurs but as they are very dependent on the 14 bit DAC settings they tend to move dramatically, even with just a 1Hz change in frequency of the DDS VFO.

Further investigation led me to the power supply. I always use the old but very useful LM723. The DDS has its own separate 8V supply and, as far as I knew, the output was clean ... well, nothing seen on the 'scope and I can get down to 5mV/div. However, I was still very suspicious due to the fixed nature of these two sidebands. Like many of you, I have an old HP141 spectrum analyser and sitting on the shelve was the HP8553B 110 MHz plugin, unused for many years. It's a very useful plugin for HF work but not a lot of use VHF upwards. So, using a a X10 scope probe I looked at the 8V supply line and there was a 400KHz signal, at much less than a millivolt. Looking on the base of the darlington series pass transistor on the 8V power supply, there was much more of the 400 KHz. Increasing the frequency compensation capacitor in the feedback loop of the power supply killed it and it also removed the 400 KHz sidebands.

DDS LO systems are very prone to supply noise, but any oscillator will produce sidebands at the same frequency intervals of what ever is on its supply.

I will not use switched mode power supplies on any equipment generating RF, especially now the switching frequencies use are getting higher and higher. Getting rid of unwanted RF on a supply line is difficult, you need several stages of filtering to get it to a satisfactory level.
The most common misconception is that the feed through capacitors on the transverter will stop everything. Not so, the typical 1000pF feed through capacitor has very little effect on low frequencies and not that much above 1GHz either, unless you have deep pockets. The feed through filters that are good above 1 GHz are expensive.

The spectrum analyser is one of the most useful pieces of test equipment you can have. Companies such as Agilent, formerly HP, spend a lot of time to provide coverage down to 9kHz and below. The use of a X10 scope probe will protect the input attenuator on the analyser but, if you are nervous that there is still a risk, put a 10 dB pad on the input as well.

73 from Richard G8JVM

By Robin Lucas, G8APZ

CONTEST and ACTIVITY REMINDER

March

28-29 Mar 24GHz and up **(French JA)**
29-Mar 0900 - 2000 All-band Activity Day
(Non competitive) Last Sunday in month

April

5-Apr 0900 - 2000 Low band 1.3/2.3/3.4GHz
21-Apr 1900 - 2130 1.3/2.3GHz Activity Contest
Arranged by VHFCC (RSGB Contest)
25th-26th Apr 1296MHz and up **(French JA)**
26-Apr 0900 - 2000 All-band Activity Day
(Non competitive) Last Sunday in month

May

2-May 1400 - 2200 10GHz Trophy
Arranged by VHFCC (coincides with IARU)
2-May to 3-May 1400 -1400 432MHz & up
Arranged by VHFCC (RSGB Contest)
3-May 0900 - 1700 1st 24/47/76 GHz Cumulative
Aligned with IARU date

FRENCH JOURNEES d'ACTIVITE (JA 2009)

30-31 May - 1296MHz and up
20th-21 June - 1296MHz and up
12th July Sunday morning - 5.7GHz and 10GHz
Reflections from Mont Blanc
25-26 July - 1296MHz and up
29-30 August - 1296MHz and up
26-27 September - 1296MHz and up
24-25 October - 1296MHz and up
Duration of all the JA's (except for 12th July) is from 17:00 Saturday to 17:00 Sunday

The weather and propagation conditions during February have been pretty dire, and very little has been happening on the bands for the past month.

Since the beginning of 2009, only one email has been received at the column address (scatterpoint@microwavers.org) and as a result, I am having to rely on the use of reports that you may have read on MoonNet, or the ukmicrowaves reflector. I usually try not to do this!

10GHz WINTER HILL OUTING

From: Richard, G3CWI

On Friday 20 Feb 2009, my daughter and I arrived at the summit of Winter Hill to find the access road was shut. I explained to the man on the gate that I was doing some microwave tests and he let me through.

I set up on **10GHz** some distance from the car in a spot that looked likely for both Northern Ireland and Wolverhampton (for Russ **G4PBP**). The **GB3XGH** beacon was strong in all directions so frequency calibration was easy. **GB3CEM** was occasionally audible - very weakly. A quick phone call to Russ got him onto 10368.1 where we exchanged good signal reports.

Geoff, **GI0GDP**(IO74CR) was standing by on St Agnew's Hill but sadly nothing was heard in either direction. I moved location on the hilltop twice in case some of the clutter up there was in the way but the final site was completely and unambiguously open to **GI** and still no signals either way.

After half an hour of testing we decided to give up. Geoff went on to test with Russ but also to no avail.

My system was working but I think that Geoff has no-one local to test with. Next time I will travel to the western Lake District. Black Combe has a predicted path loss of 20dB less than Winter Hill.
I have posted some photos on this URL...

www.flickr.com/photos/richardnewstead/

73, Richard G3CWI

TYPO - GB3PYS

In the Nov/Dec column, I referred to "The **23cm** beacon in Powys **GB3PYS**". This should have read "The **13cm** beacon in Powys **GB3PYS**" .

FEBRUARY REPORTS

From: Dave Ackrill, G0DJA, Bolsover

I've not been very active on **23cm** this month, the signals from the beacons seem to have been well down on 'normal' and I am wondering whether I need to replace the feeder from the 4 way splitter to the preamp. It was an old piece of UR67, so I'm thinking of investing in a bit more Echoflex15 to replace it. I did manage CW contacts with Martyn (**G3UKV**) on the 15th of February and with Ray (**GM4CXM**) on the 17th, plus I've just had another CW contact (22/02/09) with David (**G4YTL**) and signal reports were about 'average' so perhaps the antennas and feeders are OK and it's just the band conditions over a long period have been poor.

Most of my time and effort this month has been fitting the **DB6NT** transverter and 4 Watt PA into a box and wiring it all up. I then went to a spot within sight of **GB3MLE** and tuned for the beacon. I did positively identify the signal from the North facing beacon, sending "de GB3MLE N N N IO93eo" and the display on the IC-817 read 432.930.55 (CW mode) and 432.930.17 (USB mode) after the system had settled down after a few minutes warm up period, so I didn't think that was too far off.

I had a business appointment in Birmingham, so took the transverter with me and, on the way home, popped up Barr Beacon to listen for **GB3CEM** near Wolverhampton. The problem here wasn't the gear but the fact that, since I last went there, they've fitted barriers on the entrance to the car park at Barr Beacon and they close them at the end of the afternoon. A hand written note said that, due to bad weather, the barrier was remaining locked until the snow melted, so I had to make do with parking just off the main road. I did hear the **GB3CEM** beacon at about S8 with just the small horn. I tried fixing it in front of a small ex-Satellite TV dish using some insulating tape, but it didn't seem to make much difference to the signal strength. However, it was all a lash up inside the car and I was probably in the signal path as well, and then it started snowing again, so I gave up and went home.

The next activity was to try and make my 1st **3cm** contact with my own gear since 1992, with Richard (**G3CWI**) who was at Axe Edge and me looking out westwards from Bolsover. Although I did hear him briefly the signals were not strong, but although he said he briefly heard me, it wasn't possible to complete a contact, so I took the transverter home and replaced the flexible cables, with SMAs, for some 'proper' semi-rigid that I know had been used on 22GHz instead. Unless the relay is the problem, I'm hoping that should improve the transmitted and received signals.

Let's hope for better conditions on all of the microwave bands over the spring and summer!
Dave (G0DJA)

FEBRUARY LOWBAND UKAC

From: Ray James, GM4CXM, Glasgow

Talk about a game of two halves, this was a contest of same! In the first hour signals more local (GI & GW) were well up on usual, plus a sprinkling of contacts into the Midlands.

Afterwards it was a completely different story. The writing was on the wall when I noticed Alan, **GM0USI** had failed to work **G8OHM** (IO92) who I'd worked earlier and was peaking 56 with me. Earlier still I'd waited to tail-end Alan for a contact with David, **M0GHZ** who was LOUD but struggling to hear Alan. Rather than pull teeth I decided to return to work David later...bad move, neither of us could hear each other.

Sam **G4DDK** is normally a pretty easy contact from here but again this was doomed to failure with no tropo and only one aircraft reflection (of 539) for about 20 minutes hard graft. John **G3XDY** is usually even easier to work...zilch, not a bean.

I ended up with a grand total of 6 contacts in 5 squares and 4 countries. It was good to work Neil **G3RIR** for the 2nd time.....and my ODX!
73 Ray GM4CXM

Ray's log contains the following QSOs:
2012 **GM0USI**, 2015 **GW8ASD**, 2043 **G0DJA** 2050 **G3RIR**, 2056 **G8OHM**, 2103 **GI6ATZ**

From: Neil, G3RIR (IO92JL) Lutterworth

I had only one QSO before last night on **23cm** when two weeks ago Dave **M0BKH** brought round his FT-790 to test my new **23cm** antenna and mast head pre-amp. That one contact was with Ray, **GM4CXM** at 437km.

My set up now is an FT847 into MM1296/144 transverter with a mast head pre-amp into a single 35 ele Tonna at about 15m. I have a newly constructed GH Engineering 25W PA in the shack and using 25m of Ecoflex15 I have about 12W at the antenna. Clearly very modest but I have to start somewhere.

Activity seemed high and I heard quite a few stations I didn't manage to work. Most of these I didn't make any attempt to work largely through my inexperience at using 'KST I think.

I managed just 5 QSOs last night: **G8OHM**, **M0GHZ**, **GM4CXM**, **G4DDK**, and **G3XDY**, but I failed to work Bryn, **G4DEZ** despite several attempts. He reports that he heard me fleetingly and I heard his signal. I can work **GM4CXM** but I can't work Bryn at a quarter of the distance! I suspect Beacon Hill might be in the way.

Whilst trying to work Bryn with his signal just above the noise (CW) but audible, I suddenly heard another CW signal much stronger. I realised afterwards it was probably Bryn and I was copying his signal by a direct mode weakly but by some other mode and the signal was slightly off frequency and slightly delayed. I didn't copy the "other" signal as I was concentrating hard on the weak signal. The "lift" lasted no more than about 2 seconds. What mode was this? Aircraft scatter? *[it was almost certainly aircraft scatter - Editor]*

I have been licensed for 47 years starting on top band and his taken me that time to get up to the "dizzy" heights of **23cm**!

73, Neil, G3RIR

From: Chris Packman, G6XDI
chris@xdinet.demon.co.uk

There was some activity south of Watford! I got my new antennas and transverters all running just in time and it was nice to work some old friends. The **23cms** transverter had been completed some time ago and I had always been disappointed by the power out and the reports I got back. Last night confirmed that, when I struggled with **G8OHM** - usually OK with my old system.

After the contest I measured the voltage on the monitor pin of the **DB6NT** transverter 0.25V max! Having assembled the other transverters for **13cm** and **3cm** I knew this couldn't be right. I wiggled the input lead and the level varied. Suspicious, I undid the BNC plug that went to the input socket and dismantled it. It all looked OK so I remade it. I applied power, and .... 2.5V on the monitoring point !!! I'm not sure how much power I was running last night but it wasn't a lot! I really don't like BNC's !

I worked 5 stations on **23cm**:- **G3ZMF**, **G3MEH**, **G3TCU/p**, **M0GHZ**, and **G8OHM**. I nearly managed to work **M0GHZ** on **13cms** - we exchanged dots and carriers but didn't manage a QSO. I must admit that after hearing David's dots, and then nothing I thought I had blown something up but I think conditions must have just taken a nose dive as I was later hearing **GB3MHS** at 41.

I am looking forward to many more contacts on **23**, **13** and **3cms**.

73 Chris G6XDI

3cm - MORE NEWCOMERS

From: Barry Chambers, G8AGN, Sheffield

John **G8FDJ**, in Sheffield, had his first **10GHz** narrowband QSO with me today over about two kilometres. It was my first contact on **10GHz** for about 7 years! So hopefully two more on the band this summer.

73 Barry, G8AGN

John, **M0ELS**, in Basildon (JO01GN) now has his DEMI transverter and 4W PA up and running, and is now thinking about how to feed and mount his dish. John has added a LNA which he made from a surplus Amstrad unit.

Steve, **G4GXL** (JO02GS) is now ready for his first contact on **3cm**. He has a 60cm dish, **DB6NT** transverter, and an FT817 on 432MHz.

BEACONS

Amateur band beacons are provided for the benefit of all of us. Beacon groups need to fund their own site rentals and electricity costs, and many groups are finding it increasingly difficult to make ends meet.

We take beacons for granted, but very often beacon keepers do not know who is hearing the beacon, or using the signal. It doesn't take much time to spot a beacon via the DX Cluster (remember to add /b to the callsign) and these reports are very helpful to the beacon keeper.

Two UK beacons are in need of spots - one of them is **GB3AZA** on **3cm**, and the other is **GB3FRS** on **23cm**. Please spot them if you hear them, along with any others you use.

EME - DXPEDITION TO GI

From: Michael, DL1YMK (via MoonNet)

From Sunday, 24th of May to Thursday 11th of June **MI/DL1YMK** will be QRV from Northern Ireland. It will hopefully be our first 4-band EME DXpedition, as we plan to activate 70cm, **23cm 13cm** and for the first time **9 cm**. The **23cm** DUBUS Contest 30th/31st May is in this period.

It is quite a difficult period of time moon-wise, because we have only the second half of the declination period. That is the reason for presenting a timetable with all 4 bands in the first week (with somewhat higher declination), despite the fact that it will be normal working days for many hams. Anyhow, we have planned a second day on all bands around weekends, despite the fact that the declination already is very low then (especially 5th/6th of June).

Because of the immense transportation costs for the equipment to Uruguay last year, this year we will perform a kind of low budget DXpedition by car (saving money for another DXpedition in 2010, by stuffing all the rigs into Monika's SUV (hopefully it fits!) and set out by car (including 2 ferries...) to Magee Island (IO74du), where we have booked a nice holiday home. Weather permitting (it is a very windy location AGAIN), we will able to activate Northern Ireland via the moon for the first time on **23cm**, **13cm** and **9cm**.

In short our operating plan is as follows: 24th and 25th May **23cm**, 26th May **13cm**, 27th May **9cm**, 28th May **23 cm**, 30th and 31st May **23 cm** (DUBUS), 1st June **13cm**, 2nd June **23cm** (JT), 5th June **23cm**, the rest of the days are spare time - just in case...

Joe, **K1RQG** has the complete operating plan and has kindly agreed to make skeds for us as in previous years.

73 de Michael and Monika

WORK IN PROGRESS

Richard, **G8JVM** from near Telford (IO82SP) has been very busy, but he is making some progress. His **23cm** will be driven by the Icom rig he uses for **10GHz**, and all that is needed now is to make a bias tee to pull off the PTT switching. Previously he was using separate TX/RX feeds for **23cm**.

For **6cms**, he still needs to realign the PA and PA driver, and put the mesh dish on the tower.

His **24GHz** plans are coming along too, he has all the bits he needs, and he is still toying with using 700 MHz as the IF for **24GHz**, since he has a nice interdigital filter for 700MHz.

Richard plans on not using 2m as an IF, now that the VFO in his rig can tune from 1MHz to 450Mhz in 10 Hz steps. He will look at the crud levels either side of 2m, since 146 to 148 used to be bad, but now it seems very quiet. (The main user there in the UK was the police, but they are using TETRA around 420 MHz now).

Richard adds that the bottom line is that you should hear some activity from him this year, and he will have 400W on 2mtrs at the feed point as well.

...AND FINALLY

Every Tuesday evening in this locality, a group of 50 or 60 "road-runners" run past my house. They do it in all weathers, and I wonder how it is possible to get such enthusiasm going for what I regard as sheer purgatory!

If only we could find some of that sort of enthusiasm in the microwave world, and find 50 or 60 people to come on the microwave bands for a few hours for an evening every week...

I'm as guilty as the rest of you, and I have some faults on the mast mounted gear which have not been looked at due to the weather. I cannot use that excuse for much longer, since we are coming into Spring, but I do hope we will soon see a return to the activity levels which I know are possible.

73, Robin, G8APZ

Please send your activity news for this column to:

scatterpoint@microwavers.org

RAL UPDATE

Please note that the program for the RAL round table has been updated as follows:-

10.00: Doors open. Please DO NOT attempt to gain entry before this time as we need to give the organisers time to prepare.

ALL DAY: Test equipment facilities/display of equipment/ surplus swap and trade

1200-1300: Lunch

1300-1305: Formal welcome: G4NNS Chairman UKuG

1305-1315: Presentation of Special Awards

1315-1400: G4HJW – `Using unmodified satellite LNBs in high stability receiver applications'

1400-1445: G4BAO –`The Bodger's Guide to LDMOS power Amplifiers'

1445-1500: Break

1500-1530: GW4DGU - Update on the 23cm LDMOS PA

1530 -1615: G8UBN – 'GeMMA - (Signal) Generator for Multiple Microwave Applications'

1630: Meeting closes

The program on the UKuG web site reflects this but it may be some time before the one on the registration site can "catch up".

Brian G4NNS ... UKuG Chairman

A Useful Technical Information Source

Darrell, VE1ALQ (ve1alq@nbnet.nb.ca) last month uploaded 38 very technical PDF Files to his website. The files are very heavy in Maths, and are mostly for Engineering Design applications but they also very educational for the 'minimal technical' folks .

They range in PDF File size from 3Meg to 160Meg so please download only those you need and keep in mind that the site is on a SHARED IP Address that can get slow if many are downloading at once. The Host provider could SHUT down the site, so please use GOOD judgement in downloading.

Samples are shown below

Please disregard the MISS SPELLING in the URL links..... Darrell says he will some day correct them!

www.ve1alq.com/RF and Microwave/index.htm

www.ve1alq.com/RF and Microwave/Analysis & Design of IC - Antenna Modules.pdf

www.ve1alq.com/RF and Microwave/Coplanar Waveguide Circuits, Components & Systems.pdf

www.ve1alq.com/RF and Microwave/Intermodulation Distortion in Microwave and Wireless Circuits.pdf

www.ve1alq.com/RF and Microwave/Antenna-Modern Design - Milligan.pdf