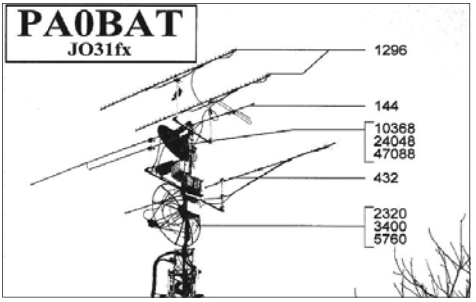
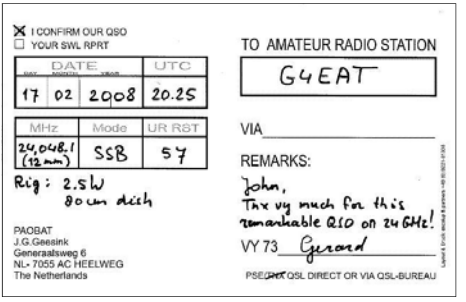
An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

Published by the UK Microwave Group

2008 MARCH





New UK 24GHz distance record. G4EAT and PA0BAT - See page 16

In this issue ...

Latest News ...

- 24GHz record smashed... where to next?
- Superb 24GHz conditions lead to long UK overland DX contacts
- Sheffield to host a two day microwave round table event

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

UK Microwave Group Contact Information

Chairman: G4NNS Brian Coleman	Secretary: G8KQW Ian Lamb	Treasurer:G4FSG Graham Murchie	Scatterpoint Editor: G3PHO, Peter Day
Email: chairman@microwavers.org	**Email:** secretary@microwavers.org	**Email:** treasurer@microwavers.org	**Email:** editor@microwavers.org
Located: NearAndover(IO91FF) **Address:** Woodlands, Redenham, Andover, Hants., SP11 9AN	**Located:** Hindhead, Surrey **Address:** Little Court, Churt Road, Hindhead, Surrey GU26 6PD, United Kingdom **Home Tel:** ++ 44 (0)1428 608844	**Located:** Woodbridge(JO02) **Address:** 42 Catherine Road, Woodbridge, Suffolk, IP12 4JP **Home Tel:** +44 (0)7860 356775	**Located:** Sheffield (IO93GJ) **Address:** 146 Springvale Road, Sheffield, S6 3NU, United Kingdom **Home Tel: ++**44 (0)114 2816701 (after 6pm)
Home Tel: -			

From the Editor's Desk

Another packed edition lies in front of you this month. We hope you find it interesting. Of particular interest in the activity news section is the new 24GHz UK record. Congratulations to John Wood G4EAT and Gerard PA0BAT!

Joining us or renewing lapsed memberships in recent weeks are: **G0ILO, G3CWI, DF1VB, G8SH**, **G3UOD, N6GHZ, G4BLH, G6JWR** — welcome aboard!

If you're after meeting your fellow microwavers then why not attend one or all of this year's **microwave "roundtables"?** The Bath meeting is almost upon us so hurry and register right now if you plan to attend. In the summer, Sheffield will be hosting a microwave roundtable once again. It's many years since one took place in Yorkshire. It's now at a new venue and is bigger (and hopefully better) than anything done before "up North". Details are on page 15. Make a holiday weekend of it! It's just 15 minutes from the Peak District National Park.

Don't forget the **microwave contest** season is just about upon us. Some imminent dates are shown on page 16. More information and rules can be found at the UKuG website at: **www.microwavers.org**

Finally, there's a reminder that important **Ofcom and IARU** business is always being undertaken on your behalf by our very hardworking Microwave Manager, Murray G6JYB. You really need to check the Group's website at on a regular basis and follow Murray's links to the appropriate information.

73 from Peter, G3PHO
Editor

G3PHO: editor@microwavers.org

G3PHO: Peter Day ++44 (0)114 2816701

G3PHO, Peter Day,
146 Springvale Road,
Sheffield, S6 3NU, UK

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

MANY THANKS FOR YOUR INPUT THIS MONTH ....

The editor would like to offer his thanks to all those who have sent in activity news to Robin G8APZ, our assistant editor and, in particular, thanks go to G4JNT, F6DRO, G8KQW, WA5VJB, G3GNR for their articles.

The editorial desk always has room for **your** article or small item... please email them and any general news items to:

editor@microwavers.org

All Activity News must go to:

scatterpoint@microwavers.org

- Not to G3PHO's personal email address !

EDITORIAL TEAM:

Peter G3PHO: Newsletter Editor
Robin G8APZ: Activity News
John G4BAO: Technical editorial assistant

SUBSCRIPTION ENQUIRIES SHOULD BE SENT TO THE UKuG GROUP SECRETARY AT THE ADDRESS SHOWN AT THE TOP OF THIS PAGE

UK Microwave Round Table News

Dates for your diary ...

BATH ROUND TABLE: 21 APRIL 2008: Visit www.microwavers.org and **register now!**

SHEFFIELD ROUNDTABLE & WORKSHOP: 12-13 JULY 2008: Details on page 15 this issue.

CRAWLEY ROUNDTABLE: 14 SEPTEMBER 2008: More details later here and at www.microwavers.org

MARTLESHAM ROUNDTABLE: 8-9 NOVEMBER 2008: Watch www.microwavers.org for updates.

UK Beacon Liability Insurance

Under the old RA regime, all GB3 beacon licences were technically held by RSGB and centrally insured. In the modern era any new beacons or changes to beacons are implemented by Ofcom via NoVs against a keeper's personal licence, in much the same way as repeaters are. As a consequence those Beacon keepers with new NoV based licences are not covered by the original insurance scheme.

Under an early plan, all remaining beacon clearances were expected to be migrated en-masse to NoVs by Ofcom in April-2007. This has been delayed but Ofcom are currently considering an RSGB proposal on how to manage this from HF-Microwave during 2008.

As an interim measure RSGB has covered GB3 beacons receiving NoVs due to changes (eg frequency or site moves) during 2007 but that favour will expire when the annual insurance cycle come up for renewal in April 2008. As per repeaters, on request, RSGB can offer a low cost liability cover for just over £10 per year per unit. If you are interested then please contact Sylvia Manco at RSGB HQ who can arrange this in time for the March 2008-9 timeframe. Keepers need to consider this very carefully. For example Arqiva (formerly NTL) insist on at least £5m indemnity cover (which RSGB and similar schemes will provide).

In conjunction with this, it is imperative that up to date shutdown lists are maintained so that there is no doubt that those closing beacons down under instruction are fully covered when visiting sites, etc.

Galileo given the go ahead for full deployment

After a period of uncertainty over the summer of 2007, the EU has now agreed to publicly fund the construction of the entire satellite constellation and associated control ground stations to the tune of €3.4bn for a 2013 in-service date. RSGB maintains a watchful eye on this for well known reasons in the 23cm band.

BBC News item:
http://news.bbc.co.uk/1/hi/sci/tech/7120041.stm

GB3CAM CAMBRIDGE 24GHz BEACON

From: "John Worsnop" <g4bao@ntlworld.com>

As you probably all now know, we've received the NoV for the GB3CAM beacon cluster (can you have a cluster of 2 beacons?) well 3cm and 24GHz anyway. The 3cm beacon continues on test as G4AKD/B from Dry Drayton, on 10368.749 and has received a few reports. At the time of writing, the 24GHz beacon is still a (complete) collection of parts but the outdoor unit should be together and on test by the time you read this. The oscillator will depend on when Sam an extricate himself from underneath the massive load of other "stuff" he's currently signed up to do! Thanks to Dave, G4FRE/WW2R, we now have a keyer board. The liaison with the site owners is under way and we have located the feeders. We are still on track for a late April install if all goes according to plan.

This is the first beacon project I've worked on since I built the Crowborough 4m TX back in the late 70s and I have to admit that this has been a most satisfyingly collaborative! The list of contributors so far is:

Bernie G4HJW for the complete 3cm beacon (we are not worthy!)
Ian G4AKD for use of his shed for G4AKD/B
Jenny G0VQH at J-Squared for PCB making facilities
Ian G8KQW / Brian G4NNS for the 24GHz antenna
Sam G4DDK for the 125MHz Oscillator
Tom G4TWJ for the 24GHz PA
Murray G6JYB Licence liaison
Rob G1ZPU Cambs repeater group liaison
Phil G4BIK rigger
Dave G4FRE keyer

When you look at the list of collaborators on the 24GHz beacon you'll see I really mean my comment about Bernie!

There will be a further update at the end of next month when hopefully, the 24GHz beacon will be on test somewhere. **73 from John, G4BAO**

250MHz Phase-Locked Source

Andy Talbot G4JNT Dec 2007

The Vectron 250MHz oscillator module shown in **Photo 1** below appears to be reasonably popular on the surplus market: several have been seen on the stands at rallies and roundtables. It can be identified by having an SMA output connection and three pins for voltage supplies and tuning. There are also plenty of similar-looking ones around with other obscure frequencies, so buy with care!

The unit is completely sealed in a casing of 50mm square and 20mm high plus connections, and cannot be opened without a hot plate or hot-air gun. It appears to have an internal regulator which allows it to work properly with anything over 9 Volts supply. An examination of the output spectrum and frequency stability suggest that internally the module starts off with a 62.5MHz oscillator (sub harmonics are just detectable at -60dBc or thereabouts) and has a tuning range of a few hundred Hz centred on 2 - 3V on the tuning pin. There is a frequency adjustment trimmer accessed by removing a screw on the side of the module. This appears to be a quite critical adjustment and it is easy to shift the frequency by several kHz if it is moved too far. The oscillator module is not ovened and stability readings suggest it *may* be temperature compensated. It gives quite a clean low phase-noise signal and so will make an excellent clock for an AD9852 DDS, which can then be used to directly generate any arbitrary frequency up to around 110MHz. When fed with a low phase noise clock and its own internal PLL multiplier is not used, this DDS chip can give a signal suitable for multiplying up to microwave frequencies.

Photo 1:
Vectron Crystal Oscillator Module

Mike G0MJW used an identical module as a master clock for the DDS sources forming the GB3RAL 40/50/60/70MHz beacons, where it was phase locked to a 10MHz reference from a GPS locked source. Mike used the Reflock 2 board by CT1DMK [1] to do the phase locking and, as this had an upper input frequency limit of around 120MHz, needed a divide-by-two prescaler to bring the oscillator frequency down to a useable value. As the Reflock employs a large division ratio resulting in a low comparison frequency, the loop bandwidth becomes very low, lock up time increases, and loop filter becomes more critical.

Although the Reflock set-up worked well, 250MHz is a direct multiple of the 10MHz reference and I knew there had to be an easier way, so looked for a way to lock the VCXO module to the master reference directly. Reference [2] describes how harmonics of a divided down reference in a sampling mixer can be used to lock a 100MHz VCXO for a microwave Local Oscillator but how well could an even simpler version be made to work with 10MHz input instead of the few 100kHz comb spectrum used previously? All diode-ring mixers work to some extent at odd harmonics of their LO signal, albeit with increasing mixer loss as the harmonic level rises [3]. So, I tried an SRA-1 mixer and directly fed the output from a 10MHz reference at around +6dBm to one port. The VCXO signal at +3dBm was connected to the other RF port, and a scope on the IF connections was used to see what came out. After adding a bit of filtering (a 47nF capacitor

across the scope input) to remove the 250MHz and 10MHz components leaking through, the result was a 5mV peak-peak sine wave at the difference frequency of a few hundred Hertz. Useable, but a bit too low a voltage for comfort. I then added a reference input buffer made from 74AC00 CMOS gates to drive the mixer with a square wave at 10MHz at about +13dBm. This raised the mixer output to 30mV Pk-Pk - Perfect!

The circuit in **Figure 1** (see page 7) shows how this leads to a finished design. The 30mV IF is raised in level by a low noise NE5532 op-amp in a quasi-differential circuit configuration. The SRA-1 mixer has both sides of its IF port accessible and using a differential amplifier-type architecture removes any need for the op-amp to handle negative input voltages, so no negative rail is needed. It also allows the output to be centred on a reference voltage, which here is conveniently taken from the 5V supply needed for the input buffer. The amplifier gain is set at around times 300 and can be changed by altering the single feedback resistor. This particular Vectron VCXO requires a lower tuning voltage at its centre frequency, so the op-amp centre-voltage output is reduced to about 2.3V with two further resistors.

Phase Locked Loops using crystal oscillators inherently have a low loop bandwidth due to the restricted frequency pulling range of the crystal, and when a high comparison frequency is used the PLL becomes very benign to set up. The inherent maximum bandwidth possible is given by the product of the tuning sensitivity in Hz/Volt of the VCO and the phase detector Volts/radian. The oscillator module gives about 200Hz /Volt frequency shift, and the phase detector/differential amplifier combination results in about 2 Volts / radian leading to a PLL bandwidth in the region of 500Hz.

A capacitor in the feedback loop limits the PLL bandwidth to around 300Hz which kills any 10MHz component that may try to get through, but otherwise has little effect on the PLL functioning. In fact, it proved more important to properly decouple supply rails and control leakage around the mixer than it was to worry about loop filtering.

Initially as the output level from the VCXO module was more than adequate to drive both the SRA-1 and the DDS clock input, I just used a passive splitter to provide the 250MHz signals to both. When locked, 10MHz sidebands were present at about -40dBc on the output port, making it unsuitable for a DDS clock without further filtering. Clearly these weren't due to the PLL, so it had to be direct leakage around the mixer and splitter. A few dB of attenuation before the SRA-1 input helped, but not enough to reduce spurii to acceptable levels before the drive level became too low for the PLL to function. By doing-away with the splitter, and adding around 25dB attenuation, followed by a modamp buffer giving an additional 20dB of reverse isolation, these sidebands were reduced to better than -70dBc. The modamp used for the buffer was intended to be a MAR-6 (20dB gain, Pout max = +6dBm) but, in error *****, I picked a MAR-8 out of the spares drawer and soldered into the breadboard. The device functioned perfectly well in this position even with the sub-optimum biasing, so rather than replacing after noticing the mistake, I just left well-alone! Presumably it is acting as a quite effective limiter when incorrectly biased like this.

With 10MHz reference applied, the PLL locks up immediately it is turned on and the pull-in range of the VCXO appears to be of the order of several hundred Hz. Certainly well beyond the VCXOs amount of day-to-day drift. As an experiment, a 5MHz reference input was then tried. Even order harmonics are normally cancelled out in the mixer, so this design ought not to work when a reference of 5MHz is used. However, to my surprise it did lock up although the PLL did appear to be a bit 'twitchy' and had poor lockup performance. Looking at the output of the 74AC00 buffer showed that it was not a perfect square-wave and actually had a 40% duty cycle. This meant a level of even harmonics were therefore present on the mixer input and allowed a limited lock-up to the 50th harmonic. However, this is not an ideal situation. If it really is necessary to use an even harmonics of the reference, it would be better to pre-multiply to a higher frequency, for example to 10MHz with a simple push-pull doubler, before applying to the mixer. (In fact my normal lab frequency standard is generated by a 5MHz source which passes thorough a diode 'full-wave rectifier doubler' before being buffered and distributed).

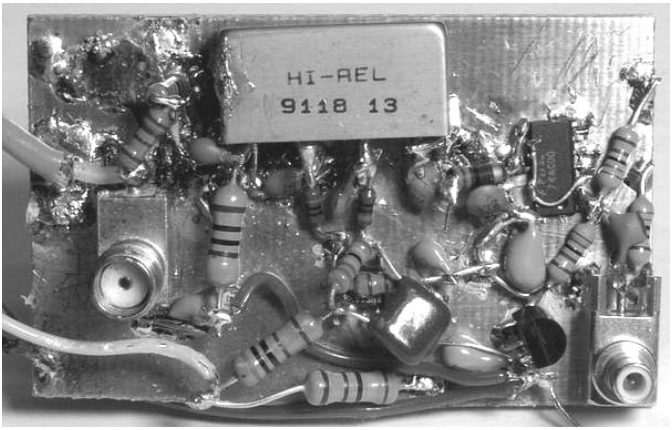


Photo 2, left, shows the breadboard phase locked source, built birds-nest style. I don't intend producing a PCB for this and the circuit is so simple and uncritical than any build method can be used. Just pay attention to supply voltage decoupling and layout, keeping 10MHz harmonics away from the 250MHz path to the output.

Photo 2 Breadboard PLL

* **The colour coding spot on MAR series modamps starts off sensibly – Brown for the MAR-1, Red for the MAR-2, Orange, Yellow etc. But, for some perverse reason, MAR-6 devices have a White spot (which looks Grey) and MAR-8 devices have a Blue spot.** ***Why ???***

References:

1. Reflock 2 http://www.tapr.org/kits_reflock_ii.html
2. A Simple Way of Phase Locking Microwave Local Oscillators. Scatterpoint April 2004. Can also be found at http://www.scrbg.org/g4jnt
3. Minicircuits catalogue http://www.minicircuits.com/pages/s-params/SRA-1+_VIEW.pdf

FRENCH MICROWAVE NEWSLETTER

Great news ... the French microwave newsletter, "HYPER", from editions 1 to 132 (ie to December 2007), is now freely available online. You'll find also some special editions (G8ACE amps, F1OPA 6cm transverter, 1W qualcom surplus adaptation, EME, etc).

Our thanks go to F6ABX , F4CWN,F1CHF and F6HYE for the hard work

You can find the Hyper archive at:

http://dpmc.unige.ch/hyper/

FOR THE EME FRATERNITY ...

Graham F5VHX / G8MBI writes ...
I am indebted to Dick K6HIJ for posting this link on the U.S. Microwave Reflector.....

http://descanso.jpl.nasa.gov/Monograph/mono.cfm

The last item (book) on this page covers LNAs and all associated subjects. I have only had a short time to skim it.

No matter what you really know about Noise and LNAs , or think you know, this document will be invaluable to you, it should be mandatory reading for anyone into EME. It contains every formula and every measurement/ analysis you are ever going to need, all in one PDF.

Some of it is heavy going, some of it could not be easily/ practically applied in 'amateur' systems but ALL of it is compulsive reading. Even if you just go 'oooh' and 'ahhhh' at some of the pictures and concepts .....

Many thanks to Peter, G3LTF, for forwarding this interesting item ...editor

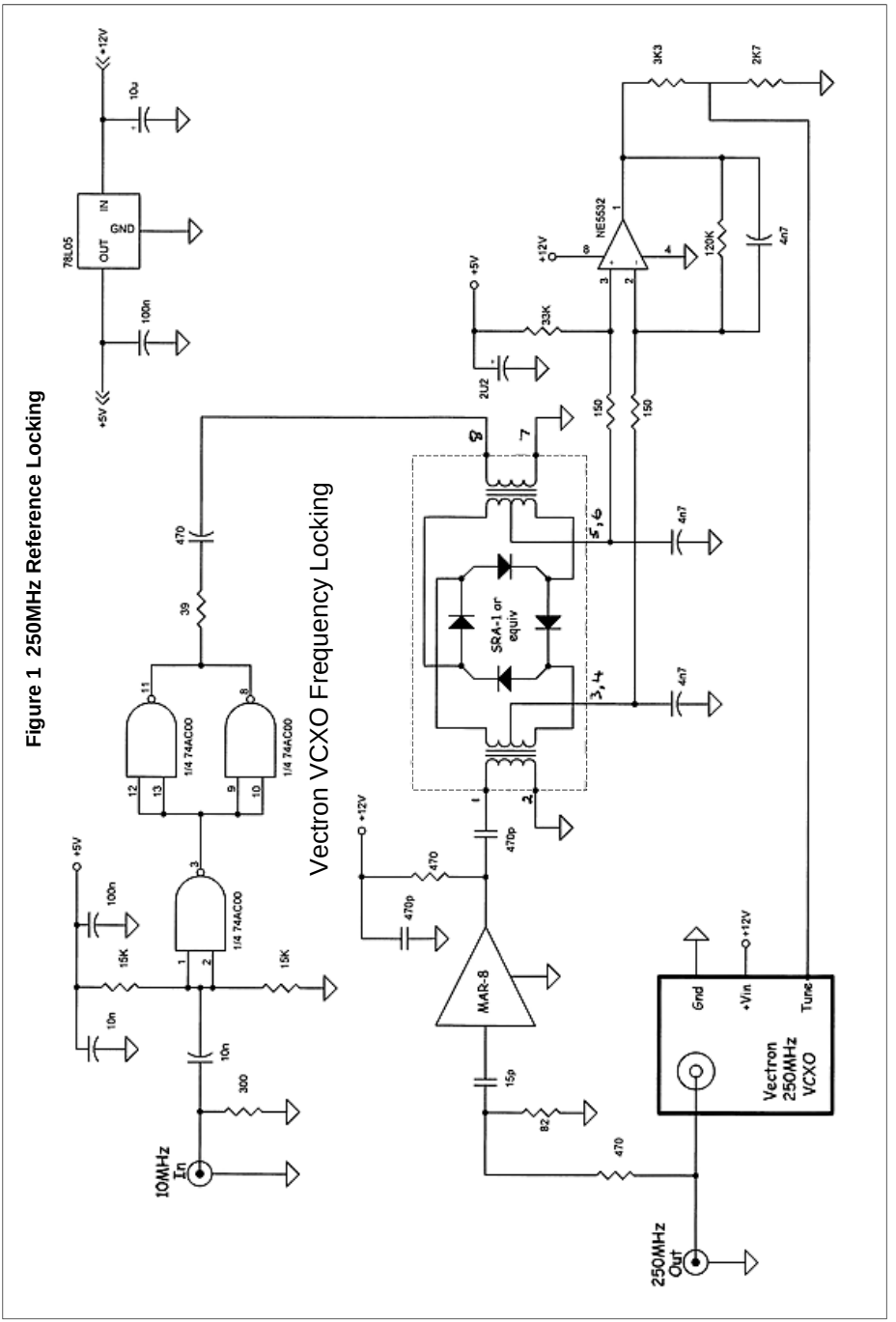
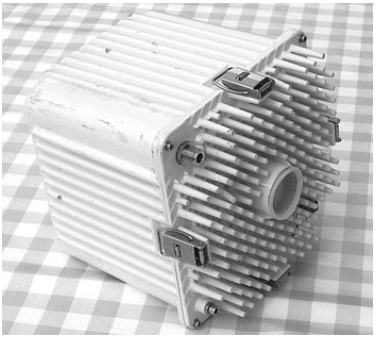


Figure 1 250MHz Reference Locking

24GHz WHITEBOXES

- Dom Dehays, F6DRO

Using the RX converter on the 24.048MHz amateur band



Many of us can now buy, at low cost, the 23GHz microwave links called “boîte blanche” (white box) by Alcatel.
I have been checking the RX converter....

Several types are available , all very similar :

- -GBX124 : 23GHz RX converter with LSB mixer (LO frequency lower than RX frequency)
- -GBX125 : 23GHz RX converter with USB mixer (LO frequency higher than RX frequency)
- -GBY111 like 125.

Much information (pictures, schematics, etc) can be found on:

http://f1chf.free.fr/boite%20blanche/forum.htm).

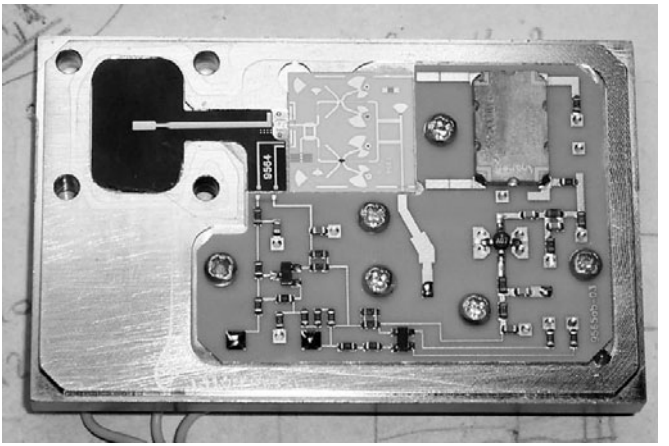
If your converter is an LSB type there is no problem, you can use it without modification. (There is generally an INF sticker on the synthesizer box) . Mine was a GBY111 (SUP sticker) so, without modification, the LO had to be on 12240MHz (harmonic mixer and 432MHz IF) otherwise, if I had used the LSB LO (23616MHz), the 24048 would be rejected (image reject mixer) !

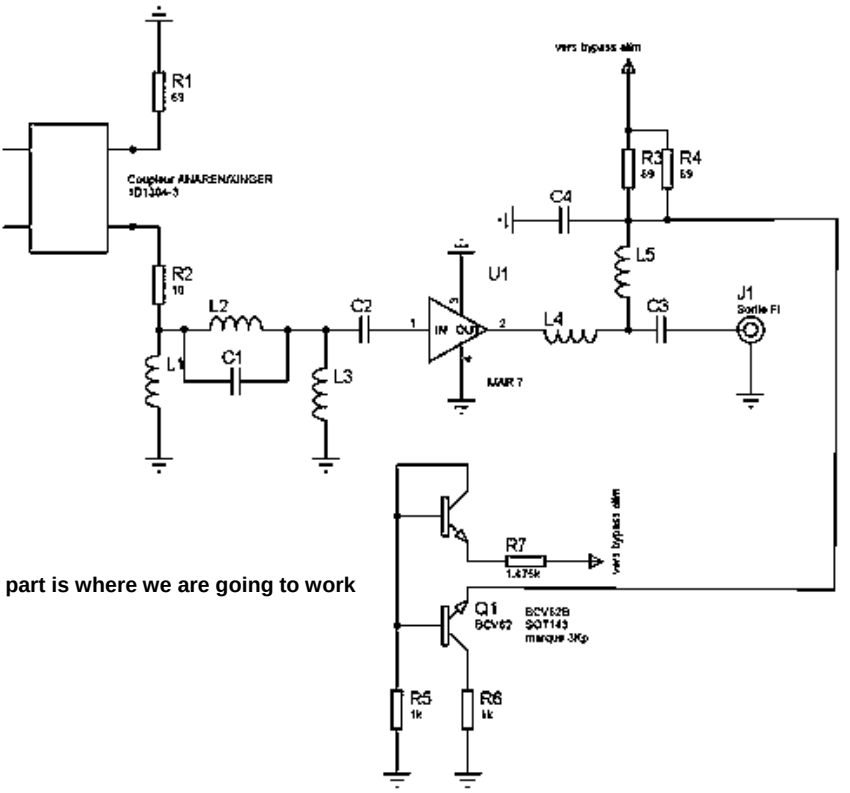
RX converter modification to use the LSB LO on an original USB converter:

The mixer used in the white box converter is an image reject type. On the output 3dB coupler, we find two mixing products. On one of the outputs, there is the LSB product, on the other the USB product. So all we have to do is to use the other output.

To open the converter box, you only need to insert a small screwdriver tip between the two covers, both of which are only silver pasted.

Nice electronics can be seen once the box is open (see photo right):



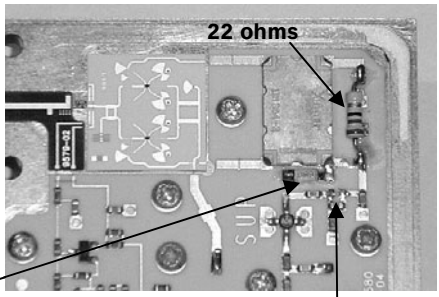


IF part is where we are going to work

On the left side, the WR42 access and its microstrip adapter, the hybrid module is the 23GHz low noise preamplifier. On the preamp output, there is a 3dB coupler driving two harmonic mixers (so the LO is 12GHz). Both mixers are summed in the 3dB output quadrature coupler. One of the two outputs is loaded by R1. The other output is connected to the IF amplifier via R2 (in my case it was a 22 ohms, and not 18 ohms like it is shown on the schematic). All the rest is polarisation and LO access components

What we need to do now (if our converter is not the right one), is to reverse the two Anaren coupler outputs. The output originally connected on the IF amplifier, will go to the ground via 68 ohms (SMD resistor in my case) and the other one will go to the IF amp via 22 ohms.

So, carefully unsolder the two resistors, then solder an SMD 68 ohms between the 3dB coupler output and the closest via to the ground and solder the 22 ohms on the other side to the IF amplifier input and all is done.....



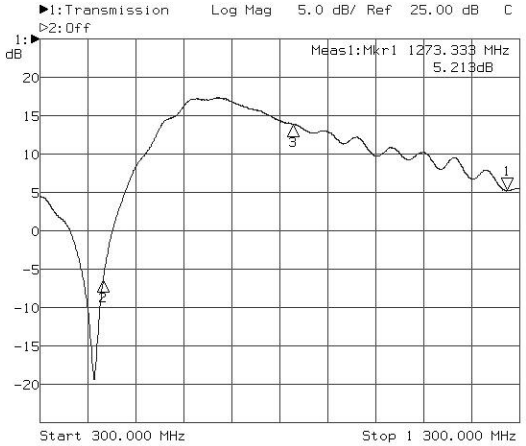
IF Passband:

Originally the white box IF was around 600/800 MHz. In my case, I wanted to use 432MHz for an IF. The question was: Was this possible?

Two possible problems arise:

- The 3db Anaren coupler is not designed to be used at 432MHz, what will be the image
- rejection if the same coupler is kept , but with a 432 IF ?
- Is the IF amp possible to use at 432MHz?

First of all, I ran a network analyser measurement of the IF amplifier:



We can see than the IF amp gain is not OK at 432MHz, where the gain is –7dB ! I decided to take the L2 inductor away, as it creates a rejection pole with C1.

17dB gain at 432 ... better !

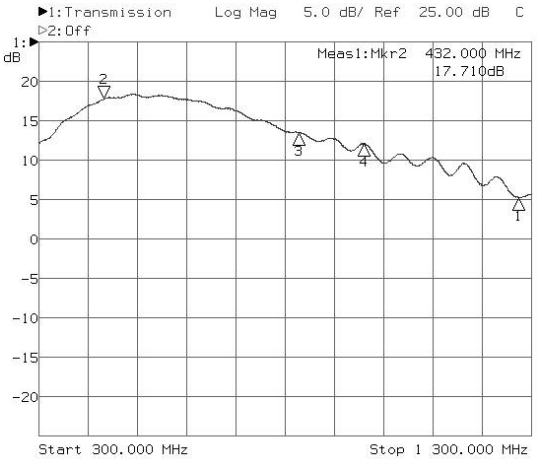
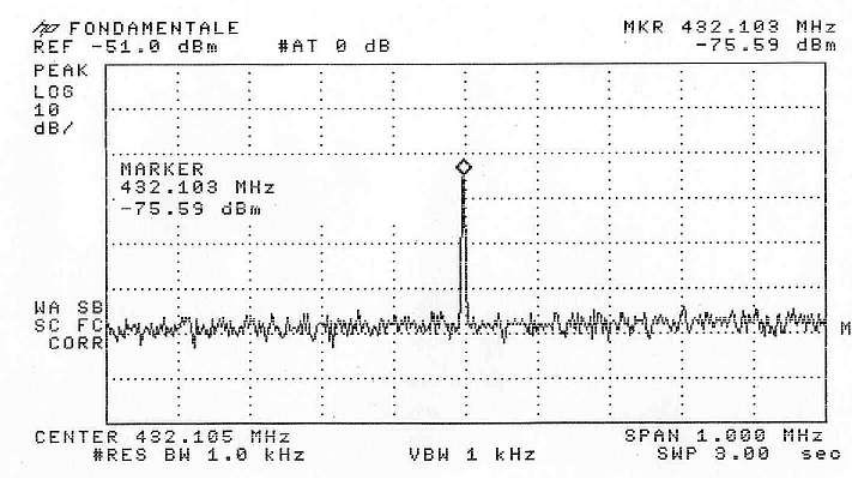


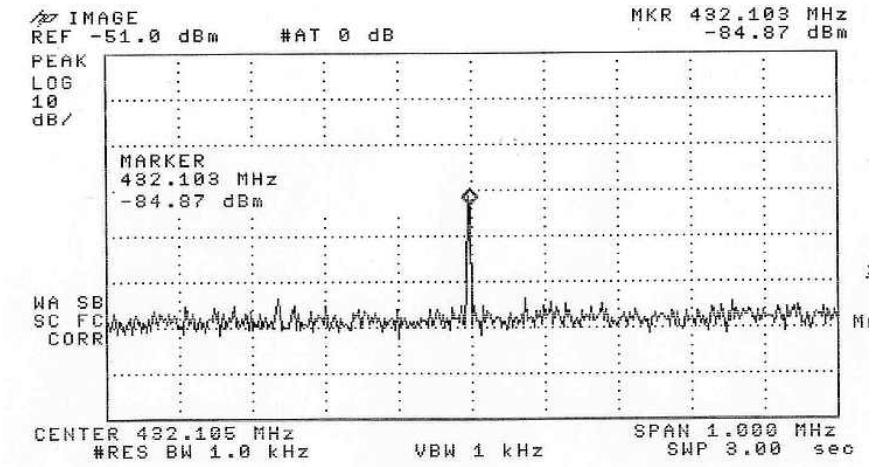
Image rejection

A good idea would be to replace the 800MHz Anaren with the same model but designed at 432MHz. Unfortunately I had only one converter available. Taking the original coupler away is a risky operation, as I had no spare converter. So I decided not to try it. A question remained : how much image rejection?

With 24048MHz at the input the 432 output is –75.6dBm



With the image frequency at the input (same level) , the 432MHz IF level is –84dBm



So we can state that the image rejection is 9dB .... not extraordinary but acceptable.

Noise figure :
I ran some cold sky/ground measurements to do some NF evaluations. I did an average of several measurements. The converter noise temperature found is about 270°K but there is some image noise contribution to take in account. What we measure here is the DSB noise figure. What we need is the SSB noise figure, so we have to correct our measurement. Usually we don't need to do this as the image rejection on the systems we run CS/GND have enough image rejection to neglect it. If we do the correction, the SSB noise temperature is about 300°K equivalent to about 3dB NF.

Conclusion:
So the white box converter gives a good performance. For a top notch 24GHz RX (1.5db NF), a preamp will be used, with enough gain to be able to add an OE9PMJ filter between the converter and the preamp so that the image frequency will be well down.

Notes and References:

- Principe de la mesure du facteur Y et calcul du NF par F5CAU.
- Image reject mixers by Aksel Kiis in Applied Microwave winter 91/92

Acknowledgments:

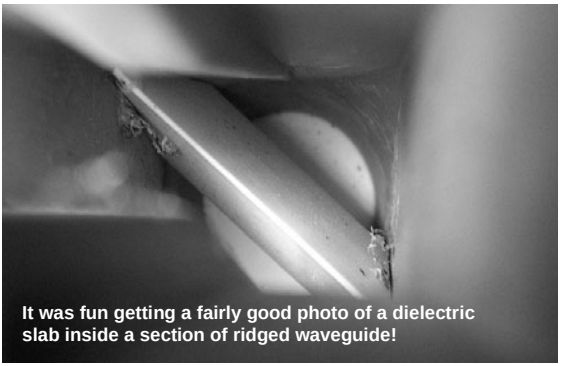
F1VL,F1BOH,F1CHF,F6BVA,F9HX and G4ALY.

Circular Polarization

by WA5VJB

One common way to generate Circular Polarization is to put a slab of dielectric/plastic at a 45 deg angle to the wave. As many of you know, I have a very large library of antenna textbooks and, while many talked about this CP technique, NOT ONE OF THEM said if you got Right or Left Hand Circular Polarization!

So I asked Dick, K2RIW, who is not known for short answers! Here's his reply:



It was fun getting a fairly good photo of a dielectric slab inside a section of ridged waveguide!

Kent,

In the way you worded the question you have a triple ambiguity.

1. Is the probe at 3, 6, 9, or 12 o'clock (rear view)?
2. Is the plastic slab tilted 45 degrees to the right or left?
3. Is CW or CCW defined by the IEEE or Classic Physics?

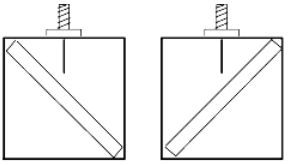
The IEEE says that if the back of the antenna is touching your chest, and if the instantaneous E-filed that is being launched is rotating in a CW manner (when viewed from the rear at a constant Z-plane location), than the wave is CW.

The plastic sheet slows down the propagation of the wave that is parallel to it.

If your probe is at 12 o'clock, and the plastic sheet is tilted 45 degrees to the right (all from the rear view), the horn is launching a CW wave (by IEEE definition) if the plastic is the minimum length to do the job (90 degrees of delay), in the Z direction.

If the plastic is 3 times as long (270 degrees of delay), the wave would be CCW.

The 12 o'clock probe launches a Vertically Polarized wave. By Vector Decomposition you could say half of the wave is slanted 45 degrees to the right (at 1:30 o'clock), and half of the wave is slanted 45 degrees to the left (at 10:30 o'clock). Add those two waves together and you re-get a purely Vertically Polarized wave (at 12:00 o'clock).



The plastic sheet delays (by 90 degrees in time) the de-composed part of the wave that's 45 degrees to the right (at 1:30 o'clock), when compared to the de-composed part of the wave that's 45 degrees to the left (at 10:30 o'clock). The 10:30 wave comes out first, and the 1:30 wave comes out 1/4 of a cycle later. That means you're generating a Polarization Arrow that sweeps from 10:30 to 1:30, which is a CW sweep.

Lots of smart people have a lot of trouble figuring out Circular Polarization senses.

73 and Good DX, Dick, K2RIW

REMINISCENCES OF AN OLD TIMER …...

I am saddened by the passing of Bill James, G6XM. Perhaps we can go back a few years when there were only 3 active microwavers in the West of Devon, namely, Bill, Cliff G8SHF and myself, although no doubt many will claimed to have been around.!

For some 28years I had a 45 acre Back 'Garden' and this was eminently suitable for the many tests we carried out. Bill lived about 12miles away (by road) and was able to drive up to Okehampton Camp, to a site just about 1000ft ASL This was ideal as it was line-of-site to my Front Garden and many hours were spent testing our equipment, not always with success!!

Charlie, G3WDG, wanted a contact with IO70 on 3cm and I agreed to put up a receiving system, saying that, if I heard him, I would go for transmit. It was no problem hearing him, so a MA/COM 'White Box' was quickly modified and contact was made. In the meantime, Bill was playing 'Wideband' both on 10GHz and latterly 24GHz having obtained some 'Doppler Modules.

About this time, there was interest from Wales by husband and wife team GW4JJW and GW4JJV, who came along to my QTH and tests were carried out across various fields.

Probably the best QSO then and still today was on 24GHz WBFM from Dartmoor to Prescelly where Steve, G4KNZ, carried all his gear up the mountain! Signals were exchanged over the 150plus km distance .... not bad even by today's standards!

There was much help amongst quite a few, namely G8SHF, G8ACE and Eric F1GHB to name a few. John G8ACE came several times to my QTH, with his partner, en-route to Tintagel from where signals on 24GHz Narrow band were always S9! Much of the pre-arrangements with John were by letter. I still have quite a few of his letters written using a fountain pen (you remember them?).

We used to have Microwave Outings in our Yard with probably something like half a dozen different rigs on both bands.

Maybe at some later date I will try to find some of the photographs that should show our efforts in those early days!

Cliff G8SHF was very helpful also most particularly on the constructional side and I well remember one microwave meeting at Wimborne where a VK, (can't remember the call, Dr Howes??) was most interested in our efforts.

Much help was also given by Les G3BNL who, sometime earlier with Roy G3FYX, developed a phase locked system for 24GHz! This was a good effort for those days. We didn't have DB6NT made up modules but did have PCBs, mostly to play 24GHz ... in particular, the anti-parallel diode mixer!

We had virtually no test gear that went up to 24GHz and power output was only ever an indication on a diode plus meter combination!

I could go for ever but, suffice to say, it was groundbreaking stuff and, for me personally, will never be the same again ... but then is it ever?.

Oh, another thing! I well remember the very first 10GHz QSO I had with Don, G3JHM in the 1950s! .... but that would make me seem Old!

Regards from Bob, G3GNR

Polish Antennas for 24GHz

I have recently installed 24GHz on my mast at home for the winter months. As I have continued planning problems I am forced to use a "temporary" 12m Clark Scam pump-up mast from my home QTH until such time has elapsed that I can obtain permanent planning permission for a tower.

There are many problems which I have had to overcome in using the Clark mast for microwaves and one issue remains that I am very limited to the weight/headload I am able to install ,even using steel stability guys.

I use yagis on 23, 13 and 9cm, a 1m grid dish on 6cm and a Procom 0.48m dish on 3cm. However, to able to install the 24GHz outdoor unit and 0.48 Procom dish, I had to reduce the size and weight of the existing antenna installation.

These days, we are blessed with a large number of internet shops selling PTP, PTMP and WLAN antennas for the 2 and 5GHz microwave bands. One such shop caught my eye on an internet search ... http://yagi.pl

This shop sells loads of goodies, including cables, panel antennas, dishes, brackets, etc, at what I consider to be really cheap prices. I purchased an "Antena Panelowa GIBEON 24dBi HV 5 GHz" from the "Anteny lierunkowe 5GHz" page (http://yagi.pl/index.php/cPath/51) for 101 Zloty (~£20).

The antenna is 1.5kg and is 325mm square, has a power handling of 50W and a claimed gain of 24dBi.

I measured the return loss at 5.7GHz as 15dB and, having replaced the 1m grid dish with the Polish panel, have to admit that the perceived difference in received signals from GB3SCF and GB3ZME is not really noticeable. Therefore I conclude that the gain is probably 24dBi as claimed. The azimuth and elevation beamwidth is fairly broad at 10.5 degrees and for me this means that I can't null out GB3FNM as well as I can using my grid dish. This is a problem for me when I am listening, for GB3OHM as GB3FNM is on the same heading and is extremely strong but I've only ever heard GB3OHM on RS so its not a huge problem.

I then worked Ralph, G4ALY, on a typical "normal" conditions evening, over our 250km path, using 5W. The signals were very much as normal and as expected. Of course it will be interesting to make some antenna range measurements in future.

So, my conclusion is that this is an excellent quality, cheap, lightweight antenna that is very easy to point and it works very well. Its possibly also worth pointing out that this shop sells a 70cm offset dish for 80 Zloty (~ £15)!

As a starter on 5.7GHz, it would be very easy to mount a DB6NT transverter and relay directly on the rear of this antenna giving a lightweight, small masthead system for home or portable use.

See more of you on 6cm then?

73 .. Ian - G8KQW

ps: excuse the length of heliax feeding the panel! It was the original length used to feed the grid dish and has been replaced with a smaller length - the grid dish used to sit where the lower masthead box containing 24GHz sits now.

SHEFFIELD MICROWAVE ROUND TABLE

12-13 July 2008

Sheffield Amateur Radio Club is delighted to host the UK Microwave Group's Summer Microwave Round Table and Workshop this year.

The club premises are ideally located for such an event, with ample parking on site, proximity to overnight accommodation and on site catering during the day. Location details are as follows:

Sheffield Transport Sports Club, Greenhill Main Road, Sheffield, S8 7RH

The Sheffield Transport Sports Club is located 100 metres from Meadowhead roundabout and is an ideal location for radio at 691ft ASL. The Club has excellent disabled access and several rooms that are available for training and radio operating. Off-street parking is available and the Club can be reached by public transport - the First nos. 53, 75 or 76 buses and the Yorkshire Terrier No. 72 bus all stop near to the Sports Club. Precise location details can be found online by visiting the club's website at **http://www.sheffieldarc.org.uk** and following the "Finding Us" link from the homepage. Maps and other details will also be sent to all who register for the event.

You may wish to make a long weekend of this visit. The beautiful PEAK NATIONAL PARK is just 15 minutes drive west of the club venue. Chatsworth House (a stately home) is 30 minutes away. Sheffield and Chesterfield offer good shopping and interesting sightseeing. So bring your wife or partner and have a mini holiday!

The weekend will consist of two separate but linked activities... a **workshop** on the Saturday and a **conference** style meeting on Sunday. The **Intermediate Workshop** is aimed at those amateurs who have recently entered into the microwave region and wish to learn more about home construction, operating, setting up a station and propagation, etc. It is designed as a follow up to the UK Microwave Group's 2006-2007 series of Beginners' Workshops, the first of which was held in Sheffield in May 2006.

The conference or "Round Table" will be on the lines of UKuG's other annual events held at Martlesham, Crawley and the Rutherford Appleton Laboratories. It will include up to four lectures, an antenna test range, an all day Bring and Buy and plenty of time for meeting friends and socialising. An informal **Saturday evening dinner** may also be arranged in a local hotel, again only if there is sufficient interest.

It is essential to register for both events so that catering and overnight accommodation can be organised accordingly. Once the organiser has your details he will supply details of overnight accommodation if you require it.

Catering during the day will consist of sandwiches, tea and coffee on sale at the Sports Club. The Club also has a licensed bar on site.

Sheffield Amateur Radio Club is also planning to hold an **Amateur Radio Boot Sale** on either Saturday or Sunday morning. This may appeal to microwavers, some of whom may like to bring surplus equipment for sale at that event. A section of the sports grounds has already been allocated for the boot sale. Full details of this will be made available as soon as the event is finalised.

At this stage **please register** your interest with the organiser, **Peter Day, G3PHO** (QTHR) at: sheffieldmicrowaves@g3pho.org.uk. Peter would be grateful if you could give him a definite yes or no, to attending either or both events, **as soon as possible**. On receipt of your enquiry, he will send you a PDF document giving more details of the activities and access to the site.

By Robin Lucas, G8APZ

Widespread high pressure areas and cold night time temperatures across the UK and continental Europe during February have once again produced some excellent conditions on the microwave bands.

Various beacons have been spotted at long distances (for the first time by some), and the 24GHz band saw some excellent contacts, resulting in a new UK record by G4EAT of 408km. There are quite a number of 24GHz reports in the column this month, which makes a good start to 2008.

With the apparent onset of Spring in the UK, some operators took the opportunity to go out portable, and there were also quite a few short forays into the hills for SOTA activations by G3CWI.

The contest season is under way, with the first major event having taken place at the beginning of March. The calendar for the next few months appears below. Of particular note, the activity day at the end of April coincides with a French activity period, so do make an effort to join in that one.

CONTEST and ACTIVITY REMINDER

March

18-Mar 2000 - 2230 1.3/2.3GHz Activity RSGB Contest
23-Mar French Activity day - 24GHz and up
30-Mar 0900 - 2000 All-band Activity Day
Non competitive - Last Sunday in month

April

6-Apr 0900 - 2000 Low band 1.3/2.3/3.4GHz
15-Apr 1900 - 2130 1.3/2.3GHz RSGB Activity Contest
26/27-Apr French Activity day (JA)
27-Apr 0900 - 2000 All-band Activity Day
Non competitive - Last Sunday in month

24GHz NEW UK RECORD

The **24GHz** band has been quite active during February, and it is a great pleasure to be able to report a new UK record by **G4EAT** for a contact with **PA0BAT.** Our congratulations to both John and Gerard.

From: G4EAT, Danbury, Essex,

24GHz QSOs - 17th FEBRUARY 2008
The weekend weather was forecast to be cold with temperatures of -5C overnight, so I was expecting to see a big reduction in water vapour losses at **24GHz**. These losses are usually very high in the summer and an extra 0.25dB/km loss is typical so the winter months are normally best for **24GHz** DX.

Also seen in the weather forecast was an unusually high anti-cyclone 1045mb over the UK which was expected to decline and therefore also likely to provide some tropo enhancement. It is always good to test **3cm** first to see if there is any tropo enhancement on the higher microwave bands.

On Sunday morning (17th) **G0EWN**, (IO93fk) at 241km was 59+++ on **3cm**. Unfortunately Gordon did not have time to install his equipment for a **24GHz** test but a QSO would have been possible based on previous successful tests.

In the evening several **3cm** beacons were well above normal: **GB3MLE** (IO93), **GB3CEM** (IO82), **GB3LEX** (IO92), **G4AKD** (JO02) and **DB0JO** (JO31). Only **GB3FNM** (IO91) and **GB3SCK** (IO80) were found on **24GHz**.

I tested 3cms with **G4BAO** (JO02) and signals were above average. After about the 20th attempt over the last year, we finally had a solid QSO on **24GHz** over the very obstructed path. Who says perseverance doesn't pay off?

Then I tested **3cm** with **G4PBP** (IO82), who was end stop. Lucky my meter is LCD!

Having heard **DB0JO/B** in JO31 at 599, I raised Gerard, **PA0BAT** (JO31fx) via the **ON4KST** microwave chat site. At first Gerard could not hear me on **3cm**

but after raising his tower another 12m he was 59+10. We QSYd up to **24GHz** and he copied my reports on CW almost straight away. After a small adjustment to his 80cms dish he then gave me 57 on SSB. QRB was **408**km, a new UK record for the **24048MHz** band.

Gerard's previous tropo DX was 195km but he has worked 411km on rainscatter. Conversely, I have yet to work any stations on RS!

Arie, **PA0EZ** (JO22of) then requested a test but had no **3cm** operational. We tried directly on **24GHz** and had a solid CW QSO over a 319km path.

My local weather station reported a temperature of 0C, RH 79%, pressure 1038mb falling. The calculated water vapour losses were 0.07dB/km. Just as hoped for. However, the Radiosonde data suggests a duct below 800m with a very sharp drop off in RH providing even drier air, so it's possible at least some of the path had even lower losses.

I called Heino, **DJ6JJ** (JO31), by phone for a **24GHz** test, only to discover he had taken his system down for upgrade 3 days before! What a shame - a missed opportunity, but there's always next time!

On the next day (Monday 18th) the morning conditions were still very good on the higher microwave bands but activity levels were down. I managed to work several **24GHz** home stations: John **G8ACE** (IO91ib) 153km on SSB from his back doorstep! Also worked **G8KQW** (IO91) 121km and **G0EWN** (IO93) 241km.

73, John Wood, G4EAT, JO01hr. (or more accurately JO01gr91).

Station details: 110masl. Antennas 15magl. **24GHz** stations: **G4EAT** 2.5W, NF circa 2dB, 60cm perforated offset antenna. **PA0BAT** 2.5W, 80cms antenna.

24GHz FROM EAST ANGLIA

Sam, **G4DDK** posted an enthusiastic note on the UKmicrowaves reflector relating to the activity on Monday 18th February. Whilst some of this is covered elsewhere in this column, it is worth seeing it verbatim. Sam takes over...

...If ever there was any question about the effectiveness (or otherwise) of home to home on **24GHz**, last night's burst of activity on the band should have put any doubts to rest.

Humidity levels were higher (in this area anyway) than the previous evening, with wet dripping off the trees and a damp feeling in the air. My RH meter showed ~60 - 70% RH.

I heard **GB3FNM/B** on **24048.906MHz** for the first time (147km) at levels increasing to 57. **G8KQW** (179km) and I tried several times during the evening but apart from a few brief bursts of signal, no QSO. This path will go at some stage.

Signals over the 79km path to **G4BAO** in Cambridge produced only a weak, but workable, signal. **G0EWN** (IO93fk) in Sheffield was a huge signal at 247km with an easy SSB QSO at up to 58 - 59 at times from Gordon's 500mW!

G8APZ (JO01do) also worked Gordon for his ODX and Robin reported my signals as strong when trying with **G8KQW** and when working **G0EWN**. The path offset was over 30 degrees at this time. When beaming at each other the signals were also colossal.

I can only assume that although the lower levels of the atmosphere were nearly saturated, once the signal cleared those levels the air was much drier above and propagated the signals extremely well. At least in some directions.

Ducting on **24GHz** seems to be confined a great deal more than on **10GHz**, leading to very selective openings in certain directions.

I know there were a number of other contacts on **24GHz** last night, but I'll let the participants comment for themselves. A great evening on **24GHz**!...

...Congratulations to John, **G4EAT**, for his QSO with Gerard, **PA0BAT**. I think this is a new UK **24GHz** record, beating the long-held 394km record by **G3WDG/PA0EZ** and that old record was on **24192MHz**, as I recall.

I tried twice with Gerard, but no signals either way. I did, however, work Gordon, **G0EWN**, on **24GHz** at 247km for a new square and "initial" on the band. Thanks for taking the time to put the **24GHz** back on the mast, Gordon. It must have been cold out there last night.

I also worked John, **G4BAO** on **24GHz**, at 79km, for the first time in many months. John has reported hearing the Farnham **24GHz** beacon this morning.

The very low RH certainly contributed to the success of the **24GHz** contacts. **73, Sam**

From : **Robin Lucas, G8APZ, Brentwood, JO01do**

I had not put the **24GHz** gear back on the mast after the contest last October, but after watching 'KST on Sunday 17th Feb, and seeing the success that **G4EAT** was having into PA land, I felt I ought to get the kit back on the mast, and I was persuaded on Monday morning (18th) by **G8KQW**. Two hours later, the mast was back to vertical with **24GHz** on it.

In the evening, I found the **GB3MHK** beacon, and was surprised how strong it was (s5 - s7). It has a small indoor horn antenna (3 - 4cm square aperture) on a window ledge on the 10th floor of the BT radio tower, firing through a double glazed pane of glass!

G4DDK, (JO02pa) was an enormous signal on SSB at 83km. A test with **G0EWN** (IO93fk) only produced a few dots in the noise, but an hour later at 22:54 Gordon's signal came up strong enough for SSB, and 5/3 reports were exchanged both ways. That's my best DX on **24GHz** at 239km, and I'm now looking at breaking the 300km barrier!

My station consists of **DB6NT** modules and a 2.5W PA into a Flann 33dBi lens horn mounted at 17m AGL.

From: **Dave Cox, G4RRJ, Andover, IO91GE**
On the 11th of February 2008 I worked **G4NNS/P** 59/59 (FM) and **G8ACE/P** 59/59 (FM) on **24GHz** they were both located in IO81XD (41km) at 1145.

Approximately 1 hour later I worked **G4NNS/P** 53/55 (SSB) and **G8ACE/P** 52/53 (SSB) on **24GHz** this time they were located in IO80WX (52km) for a new locator square making a total of four different locators since August 2007.

On the 18th February I worked Ian **G8KQW** from his home location at IO91OC on **24GHz** where we exchanged 55/57 reports. I have worked Ian twice more since then over an obstructed 47Km path.

OTHER ACTIVITY

From: **Gordon Fiander, G0EWN, Sheffield**

Following the large opening in December 2007, January was a quiet month for activity. Richard **G3CWI** stirred some activity up on 6th Feb by going portable, combining SOTA with **10GHz** and this spurred me to go out portable in order to provide a contact. Whilst relatively short in distance the morning was enjoyable and encouraged other stations to be active including **G4PBP** and **M0DTS**.

The weather started to improve towards the weekend of the 9th February and I took the opportunity to go walking in N. Wales. It was fantastic, just like early summer.

On my return the bands looked in better shape and I worked John **G4EAT** at 59 on **3cm** and Uffe, **PA5DD** on **23cm**. Beacons from the UK were strong on most bands but nothing, beacons included, from EU until the 13th when **DB0JO/b** and **PI7QHN** put in an appearance.

The extent of the opening was limited mainly to **23cms**. Stations worked included **DL9EAJ,** (JO31) **DK7QX**,(JO42), **DK7BT**,(JO43) (new #) and **PE1IWT**, (JO32).

I continue to hear **G3AUS** (IO70) now occasionally quite strong and on SSB since he has started using a 3m dish for tropo skeds with his qso partner **G0FNP**. 73, Gordon, **G0EWN**

10GHz - SOTA ACTIVATIONS

Richard, **G3CWI** has been truly bitten by the **10GHz** bug, as he launched into a flurry of summit activations during February. Most of these took place at very short notice, during weekdays. They were announced either

From: Brian Coleman, G4NNS, Andover,

The **G8ACE/p** and **G4NNS/p** systems located a few km SE of Shaftesbury at IO80WX.

A portable outing on 11th Feb for a **24GHz** test with Dave, **G0RRJ** gave him his fourth square on **24GHz** from his home station.

The temperature inversion didn't seem to be much help but 52/55 SSB reports were exchanged on this doubly obstructed path of 52km.

(I'm the one behind the camera!) **73 from Brian**

Photo: **G4NNS**

via the 'KST chat' or the UK Microwaves reflector. The following is a summary of his activities.

Sunday 27th Jan - Merryton Low
I made 4 contacts, and would have stopped longer except it got very windy and I was cold. The key finding was that path profiles are largely irrelevant and are poor predictors of success for narrowband. All the paths that I worked were obstructed to some degree - some heavily. In fact I have discovered that my current system is perfectly adequate for many medium distance paths, and without carrying anything else will give me many hours of enjoyable radio.
Wed, 06 Feb - Shining Tor SP-004
Despite the very overcast and breezy conditions, I was determined to activate Shining Tor SP-004. I arrived and set up to find Russ **G4PBP** in QSO with Rob **M0DTS** on .175. I quickly finished setting up and called in. I was then surprised to be called by Gordon **G0EWN/P** who was also after a contact with me!
Wed, 06 Feb - Bosley Cloud SP-015
Russ was still standing by, so I easily made one contact. Chris **G8BKE** called in but no signals **3cm**.
Sat, 09 Feb - Foel Fenlli IO83JD 511m
The opportunity for a fast activation in good weather presented itself and I took up the challenge. We set out for Wales at 0720. We were soon at the start of the ascent of Foel Fenlli. A 500ft climb and we were at the top. First few calls on .175 yielded nothing, but then Martyn **G3UKV** called and was soon in the log on **10GHz**. A telephone call got Russ **G4PBP** on for contact number 2. An attempt with **G4DDK** failed although I could hear him weakly. Given more time it might perhaps have worked. Then Bryan **G8DKK** called in and we completed on CW for an ODX of 240km. A final bonus was **G3LRP** near Wakefield giving me the magic 4th contact we SOTA types like! A call from Rob **M0DTS** right at the end did not yield a contact but as we were rather keen to get off the hill, it was a short attempt. Good activation and my first **10GHz** qualified summit!
Tue 12th Feb - Great Whernside 704m.
Glorious sunshine. No breeze. Contacts: **G4PBP** 170km very obstructed path. Scratchy CW contact but completed quite quickly. **G0EHV/p** SSB 80km, **MW1FGQ** SSB (LoS - out of his bedroom window!). **G4EAT** tried but nothing heard.
Thu, 14 Feb - The Cheviot 815m.
Zero visibility on the ascent. Only **G4PBP** responded on 2m. Heard him occasionally on **3cm**. He could see my signal on Spectran. No QSO (QRB 340km).
16 February - Axe Edge
Freezing cold with frost and ice everywhere. Biting cold wind made it hard to stay long. QSOs **G4BRK** 2xCW 180km, **MW1FGQ** 2xssb (John running 100mW). Attempts **G4DDK** nil, **M0DTS** heard him very weakly (I was on South summit and the path runs over the higher north summit). Beacons: **GB3CEM** - loud in all directions. **GB3XGH** also loud in all directions (which was surprising). **GB3MLE** and **GB3AZA** not heard. **GB3LEX** not heard but seems it is way off freq so might have missed it.
17 February - Merryton Low
At a moment's notice I nipped up to Merryton Low this afternoon. I took the standard kit for **10GHz** 200mW on **10GHz** with 2m talkback gave the following contacts:
MW1FGQ 2xssb 90km (thanks for the 'KST spot John)
G4BAO 2xcw 176km, **G3XDY** 2xcw 246km
G4EAT 2xcw 236km, **G4DDK** 2xcw 253km ODX
G4PBP 2xssb 61km, **G4BRK** 2xcw 172km
A rather pleasing afternoon. Just over 90 minutes on the air and I eventually finished as the battery ran flat. I feel very fortunate living close to such a good site.
Beacons heard:
GB3LEX carrier just detected - no callsign heard
GB3SCX carrier just detected - no callsign heard
GB3KBQ 529 - good signal **GB3CEM** and **GB3XGH** both loud.
Thu, 28 Feb - Kinder Scout 628m
G3LRP - excellent signal on **3cm, G4DDK** heard 419. but no QSO. **MW1FGQ** - nil either way. No other takers.

Richard added "...I have yet to break the 300km barrier but I'm happy with the results so far. The gear is really quite light and now I have got used to using it, the results are starting to improve. Is anyone else thinking of joining in?"

EME on 24GHz

Al Ward, **W5LUA** posted a message on moon-net....

I was able to QSO with **DF1OI** today, Sat, 16 Feb on **24048 MHz** EME. Signals were O copy both ways even though there was slight rain today causing a small amount of moisture absorption.

EM13qc 2.4M offset fed dish and 100 watts at the feed.

...AND FINALLY

Another interesting month on microwaves, especially on the 24**GHz** front. Let's hope for many more like it!
Last month, I asked for sound clips of European microwave beacons. Many thanks to **G0DJA, G0EWN, G4NNS, GM4CXM, LA3EQ,** and **M0DTS** for their contributions. I am still looking for more, preferably in .mp3 format, but .wav is acceptable too.
The Bath University Round Table on 20th April is not far away now, so do get your registrations in if you have not already done so.

73, Robin, G8APZ

Please remember to send your activity news for this column to:
scatterpoint@microwavers.org

For Sale

Brand New and Unused DB6NT MKU 341A GaAs FET Power Amplifier:
Frequency: 3400MHz,
Power out: 4W, gain 12dB

Current price £160 + p&p
I'm looking for £100 + p&p

I never used it because I came across a 25W ex-commercial PA that runs 35W after tabbing!

Email Ian,

G8KQW :<ianlamb@btconnect.com>

For sale

13cm PA, OZ9CR type with a pair of water-cooled 3CX100A5.
Power output 120-180W.
Needs 1 to 1.2KV PSU and 28v for relays.
Mounted in 19" rack panel 5" high.
Prefer buyer collects as they can then also have the cooling reservoir and pump.
Price £50 plus postage.

Contact G3LTF at g3ltf@btinternet.com or telephone 01264 738251

Wanted

Manual or any info on a **Marconi Signal Generator Model: 801D/8/3.**
Please contact Neil Sandford VK2EI.
email: **neilsan@tpg.com.au**

TELFORD BEACONS BACK ON AIR AFTER LOCATION CHANGE

All 3 GB3ZME beacons are now back on the air.

Locator: IO82RP78 - near Telford.

Frequency: +/-: 3400.910 MHz, 5760.910 MHz and 24048.910 MHz

Initial reports VERY welcome - strength and frequency please.

73 from Martyn, G3UKV (email: ukv@ukv.me.uk)

UKUG Contest Certificate Winners : 2007

The following operators have been awarded certificates for the their achievements in last year's UKuG Contests. If they attend the Bath Round Table on the 21st April, they will be formally presented with them there by UKuG's Chairman., Brian Coleman G4NNS, otherwise they will get them via post.

10/24GHz Winter Contest: GW3TKH, G0UPU

March Low Band Contest:

1.3GHz: G3XDY, G4BRK
2.3GHz: G3XDY, G4BRK
3.4GHz: G3XDY, G4BRK
Overall: G3XDY, G4BRK

April Low Band Contest:

1.3GHz: G3XDY, GM4CXM
2.3GHz: G3XDY, G3TCU/P
3.4GHz: G3XDY, G4RFR
Overall: G3XDY, G3TCU/P

May 3.4GHz Contest: G3ZME/P, G8AIM

June Low Band Contest:

1.3GHz: G3XDY & G4SJH/P
2.3GHz: G8KQW, G3XDY, G4SJH/P
3.4GHz: G3RCM/P, G8KQW
Overall: G3XDY, G3XDY

5.7GHz Cumulative Contest:

Winner (G3KEU Memorial Trophy): G4WYJ/P
Runner Up: G3PHO/P
Leading Fixed Station: GW3TKH/P
New Entrant award: David Millard M0GHZ (/P)
Leading Single Session Award: G3ZME/P

10GHz Cumulative Contest

Open Section:
Winner (G3RPE Memorial Trophy): G4EAT
Runner Up & leading portable station: G3PHO/P

Restricted Section
Winner (G3JMB Memorial Trophy): G1MPW/P
Runner Up: G4WYJ/P
Leading Fixed Station: GW3TKH

24GHz Cumulatives:

Winner (24GHz Trophy): G8KQW/P
Runner Up: G3ZME/P

47GHz Cumulatives

Winner: G8KQW

Autumn 1.3 – 5.7GHz Cumulatives

1.3GHz: GW3TKH, GM4CXM
2.3GHz: GW3TKH, G4FSG
3.4GHz: GW3TKH, G4FSG
5.7GHz: GW3TKH