An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

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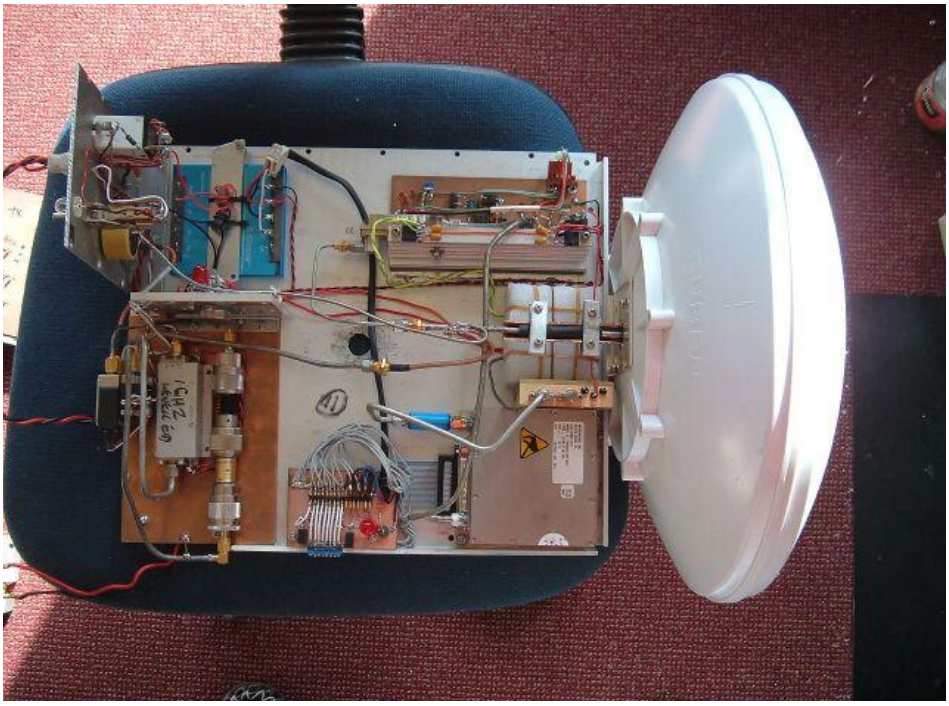
76 GHz and 122 GHz in a single Transverter

By Alan VK3XPD



In this Issue

Many thanks to all our contributors this month, without whom there would be no Scatterpoint!

Latest News

- 25 Sept More of Alan VK3XPD's work on harmonic mixers (pdf download)

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Editor's bit

Bit of a light month this time (don't get excited, Nanowavers!) in terms of the number of articles but we do have two 7-page technical articles for you to mull over, ready for the cooler "constructing" months.

Hope you all had a good summer.

Readers, please let me have your ideas for topics, even if you don't feel able to write an article yourself.

Downloading Scatterpoint

I have taken to placing the latest edition (A4 and A5 booklet formats) in a Dropbox and will post the link via the Yahoo message when I publish. I'd prefer you to use the Yahoo files facility and only use the Dropbox as a last resort as it could bust my download allowance. The files will remain in the Dropbox for 2 months but 3 months in the Yahoo files.

The 2010 volume will become available vie the microwavers.org site at the end of December.

Of course, if you'd like to receive recent editions (prior to your membership start date) you can always pay for a back-dated subscription...

73 de Martin G8BHC

Articles for Scatterpoint

News, views and articles for this newsletter are always welcome.

Please send them to

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The CLOSING date is the FIRST day of the month

if you want your material to be published in the next issue.

Please submit your articles in any of the following formats:–

Text: txt, rtf, rtfd, doc, docx, odt, Pages

Spreadsheets: Excel, OpenOffice, Numbers

Images: tiff, png, jpg

Schematics: sch (Eagle preferred)

I can extract text and pictures from pdf files but tables can be a bit of a problem so please send these as separate files in one of the above formats.

Thank you for you co-operation.

Martin G8BHC

UK MICROWAVE GROUP

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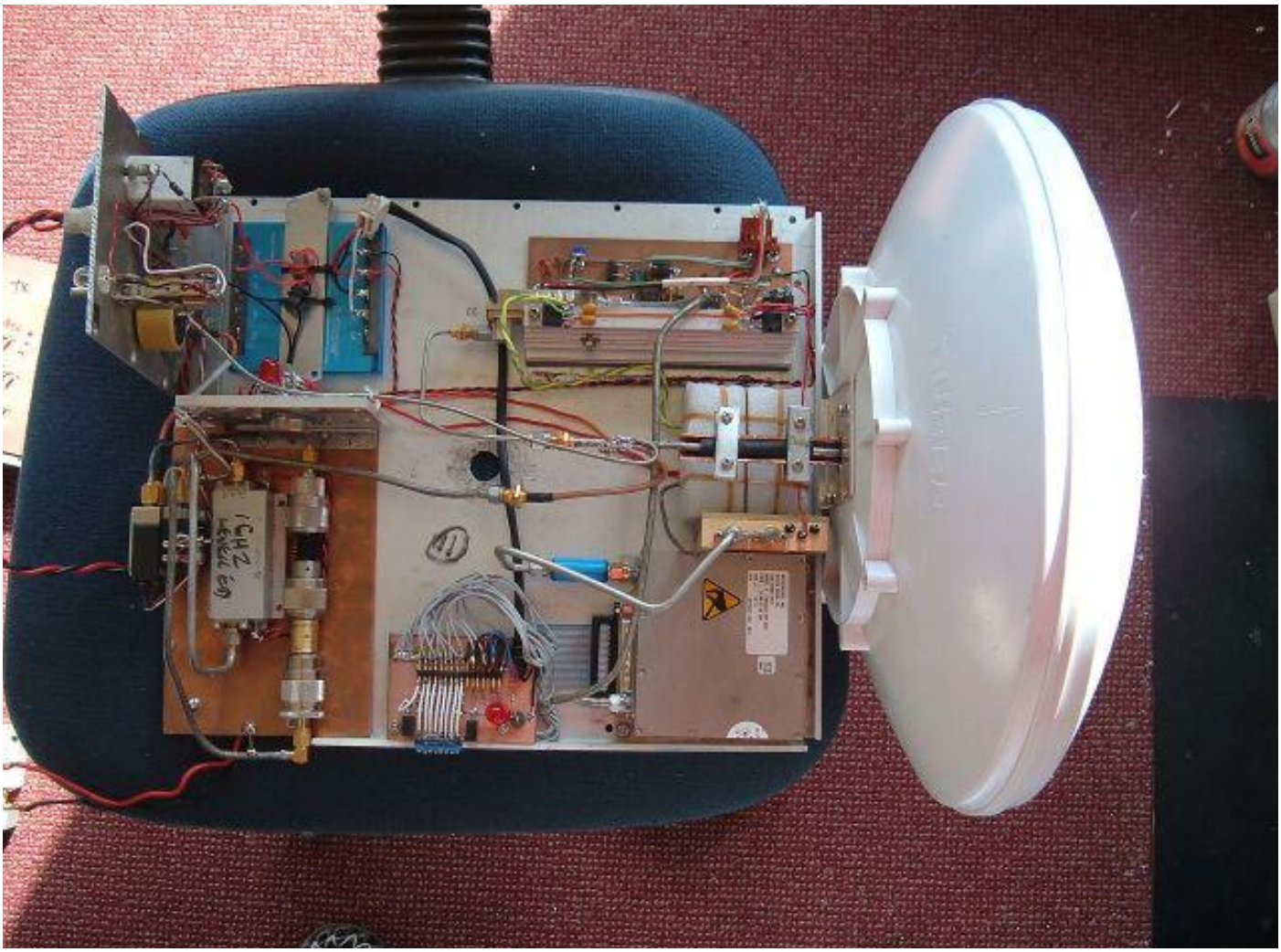
76 GHz and 122 GHz in a single Transverter

By Alan VK3XPD (Source http://www.vk9na.com/)



After reading an Article (1) written by Kerry Banke – N6IZW, I became enthused with building gear for 47 GHz. It was not long however before I realised I had all the parts needed to build a 76/78GHz transverter instead. This home-brew, prototype transverter is with just one exception - ALL coaxial.

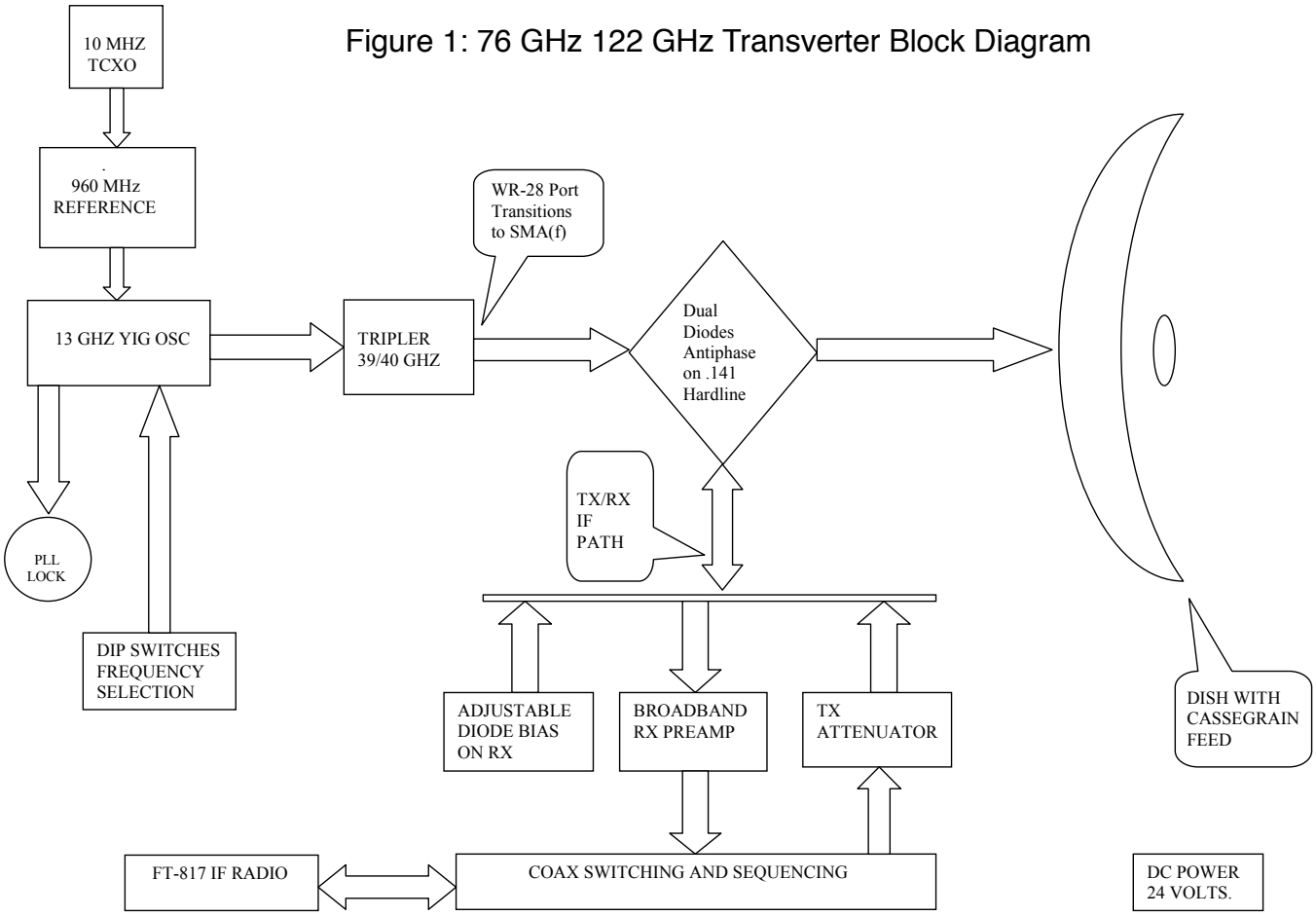
Two prototype transverters in Figure 1 were designed and built all within the space of 4 weeks. They still look a bit rough but of greater importance to me is that they “work” amazing well!

Referring to the block diagram, each transverter consists of a DIP-settable, Microsource 26GHz YIG oscillator. This brick requires a 960MHz reference which is then TCXO locked back to 10MHz. By removing the internal passive doubler, this now 13GHz brick delivers up to +16dBm to drive a X3 or X4, 39/40GHz multiplier (CMA382400AUP) delivering circa 100mW or +20dBm. This multiplier with its WR-28 transition is mounted upper right on the heat-sink.

Some of you will recognise this part number as the same as Philipp DL2AM has used in his 76/122/241GHz hardware.

After tripling, this 39/40GHz signal exits through a WR-28 to SMA(m) transition on the output port. Apart from this WR-28 transition, on the CMA 39/40GHz multiplier, I have NOT used any waveguide in my design. The RF is then fed coaxially to pump a pair of anti-phase diodes

Figure 1: 76 GHz 122 GHz Transverter Block Diagram



(surplus 14GHz mixers) mounted/soldered on the end of a piece of .141 hardline. A photo of some prototype mixers can be found later in this document. A small flared horn is fitted over these diodes and this “feed” is then slide through a rear dish mount and aimed at an integrated Cassegrain reflector in the radome of a 300mm dish. The positioning of this horn relative to the diodes is VERY critical. Correctly positioned, a performance improvement of more than 15-20dB can be expected. Signal polarisation is still an issue, so rotating one “feed” for optimum performance is necessary. I have no idea what polarisation I set my feeds for – horizontal or vertical or offset? I would welcome comments on how can I determine this.

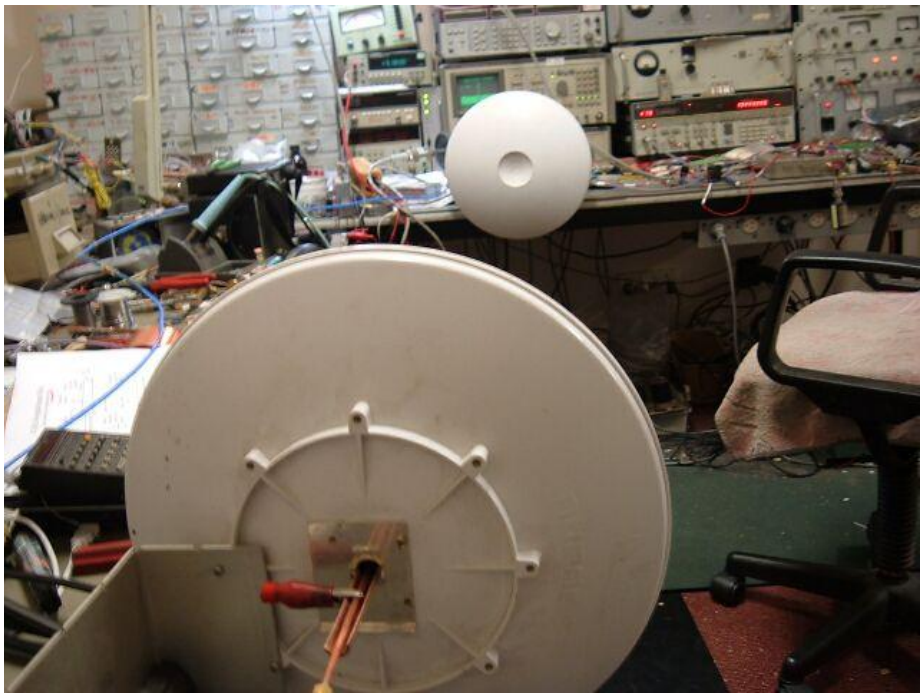
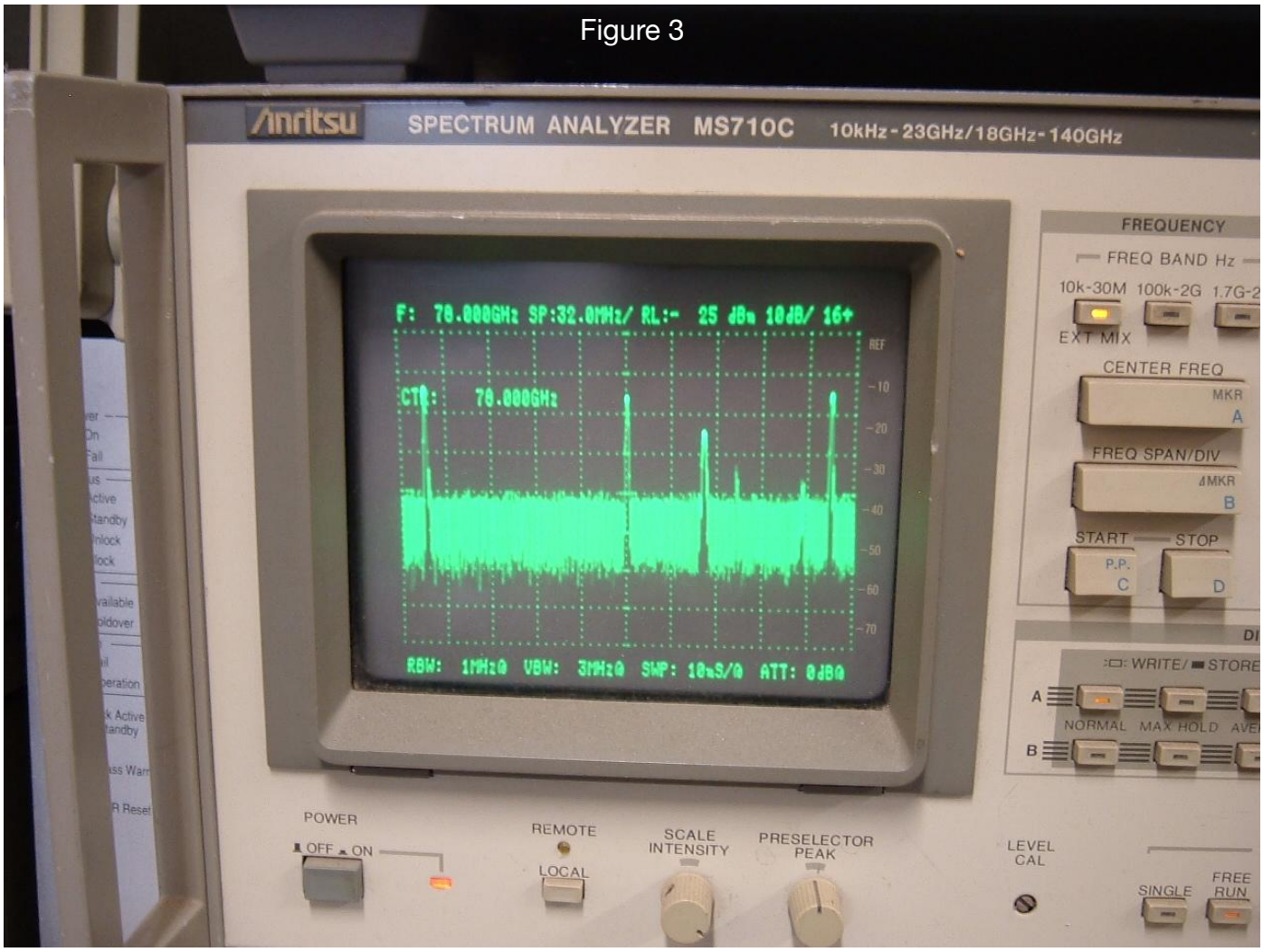


Figure 2 shows the Cassegrain dishes during my early testing.

The second harmonic of 39GHz is of course 78GHz! Figure 3 shows the unfiltered, double sideband signal. So, the 78GHz Centre frequency with its 2 sidebands, 144MHz either side. The other signals to the right of the 78GHz centre are “mixer” products. They are NOT real!! There are no constraints on the choice of IF frequency or operating mode. HF through to UHF IF frequencies can be used within the constraints of the mixing processes to create our LSB or USB. So, oscillator plus IF when “mixed” must still be within our band allocation.

NOTE: I deliberately chose to use our VK 78GHz segment because although the Microsource brick will function (lock) down to 12.65GHz, I found the output of the X3 CMA382400AUP multiplier block was dropping away because it is operating towards its lower frequency limit.

Figure 3



The IF connection for TX and RX is quite simple.

Referring to Fig 4, I cut a small hole in the .141 hardline to expose the inner conductor near the SMA connector that couples to the x3 multiplier. I then soldered the braid of a thin flexible Teflon coax (RG-174 or similar) along the side of the .141 copper jacket with the inner conductor in line/ near this “hole”. This is the IF cable. I then solder a short but very fine piece of wire from the centre conductor of the .141 to the junction of a 1nF capacitor and a 470Ω. The 1nF connects to the inner of the IF cable. DC isolation is necessary because the RX DC Bias (see below) via the 470Ω would be shunted. This thin IF connection forms an RF Choke at 39GHz but it allows 144 or 432MHz to pass with minimal attenuation. For picture clarity, I’ve unsoldered the 470Ω and the bypass capacitor from the .085 semi rigid hardline supplying the RX DC bias.

Rx DC Bias for the Diodes

The multiplier diodes I have used to date are ordinary “leaded” Schottky units. transverter RX sensitivity can be optimised considerably by setting/adjusting some nominal DC bias to these diodes. In my testing, I noticed that the optimum bias voltage is somewhat temperature dependent and the diodes may also give greater efficiency (less loss) with either + or – biasing. To achieve this, I used a 5kΩ potentiometer with both +/-5V w.r.t. earth on either end. The lever with the series current limiting resistor (470Ω) connects to the centre of the anti-phase diodes. Varying the pot varies the voltage plus and minus. I also found a small value decoupling capacitor on this bias line at the IF connection point to earth improves the RX signal to noise performance.

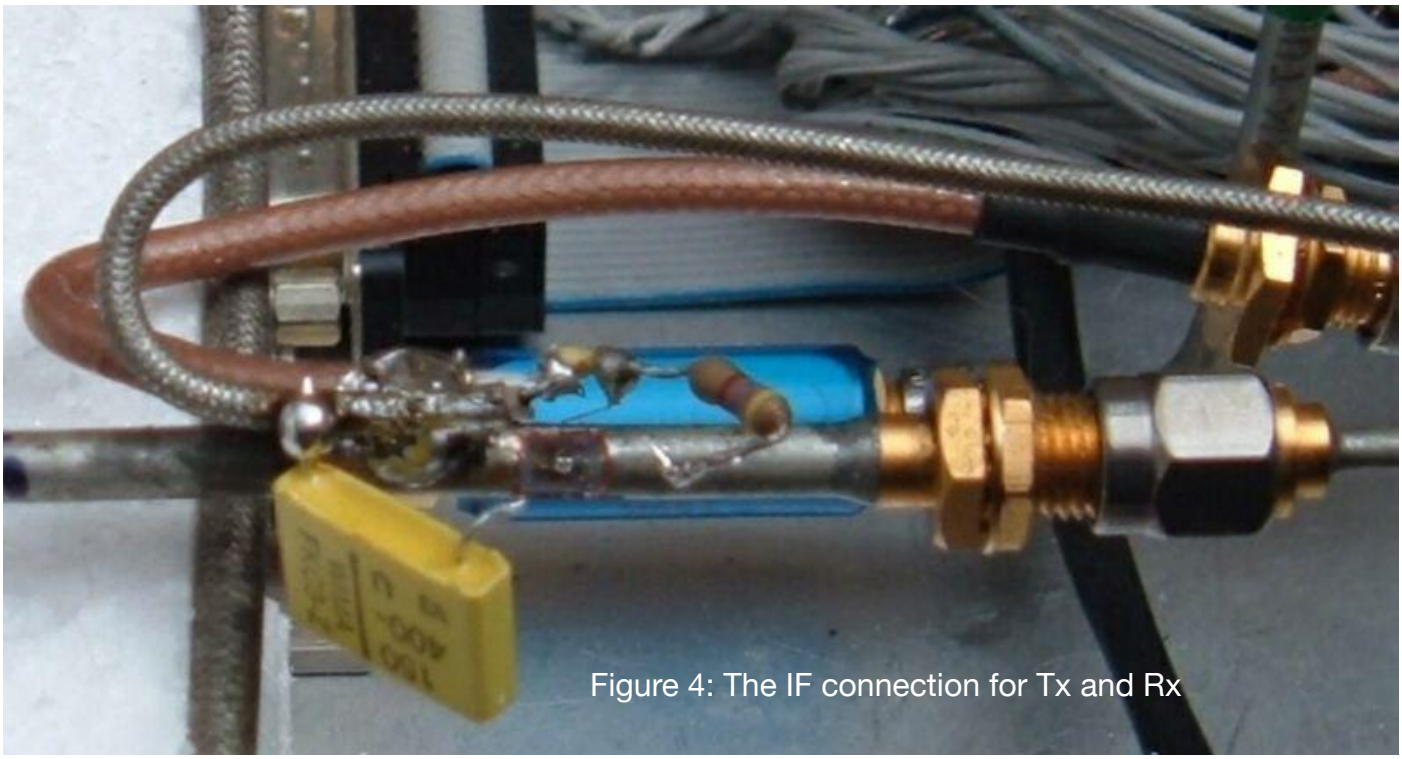


Figure 4: The IF connection for Tx and Rx

Standard Coaxial Relay switching is necessary.

On TX, the SSB modulation from the FT-817 is switched and attenuated down to a few milliwatts. Between 0dBm and +7dBm works fine. I found if too much IF injection is applied, sensitivity (diode response?) is degraded giving reduced output. On RX, a broadband RF amplifier is fitted in the RX path to improve the overall sensitivity. Figure 5 refers.

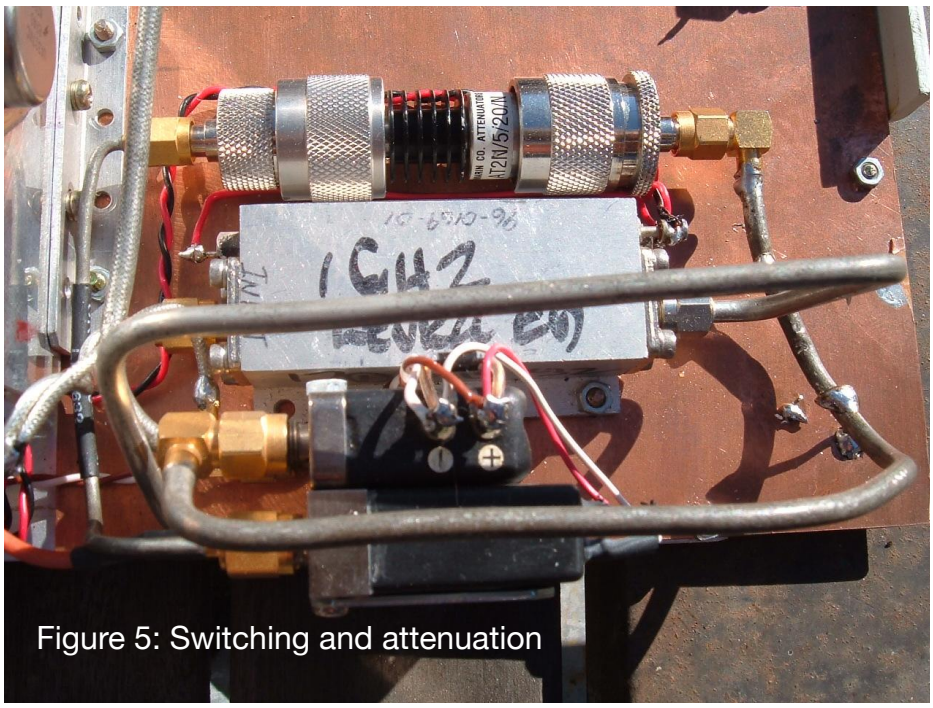


Figure 5: Switching and attenuation

Output Power on 78 GHz.

The absolute power level on 78GHz is difficult to quantify. I don't think it can be measured easily. The "pumped" anti-phase diodes are mounted on the end of the .141 hardline and pushed into the dish at/near the focal point. Therefore, there are no coaxial or waveguide connections available. However, with both dishes pointing at each other and separated by 2m, using my home-brew, uncalibrated harmonic mixers; I have measured (at best, on the spectrum analyser) a level of -25dBm on 78GHz. Suffice to say that it is a whole lot less than ONE mW.

The first ever VK, 78GHz QSO was conducted over a 1.5km suburban path on August 3rd, 2011. The Operators were Alan – VK3XPD and Michael – VK3KH. This record was extended a few days later to circa 12km. Signal reports over this longer path were 5+1 both ways. One significant observation was quickly identified. The "pointing" of our small 300mm Dishes is extremely sharp on these higher frequencies. As an investigative exercise, on the shorter path, we tuned up the band to the 3rd harmonic of 117GHz signal. Although it was a very weak signal, it was quite audible. This clearly showed good prospects for operation on 122GHz.

Now, being the "Devil's Advocate", perhaps some of you may be thinking that this could have been a 39GHz QSO and not 78GHz?

In the course of developing this simple transverter, I built up multiple sets/versions of home-brew harmonic mixers to test on my spectrum analyser. A sample of my prototypes can be seen below. All these units worked well/OK with some variability. I found the "leaded" anti-phase diodes in the lower photo make excellent harmonic mixers. For many of us, the likelihood of owning the rather expensive HP 1197X series of waveguide harmonic mixers for V, E or W bands is a "dream". The techniques I have described here make it VERY easy for almost anyone to build their own harmonic mixers that are usable well beyond 100GHz. With my home-brew mixers, I can now easily see these 78 and 122GHz signals. In Bench testing, I have actually seen signals up to 140GHz, the upper frequency limit of my Anritsu MS710E spectrum analyser. Not bad for 14GHz diodes!!

The absolute conversion loss may be unknown – but who cares!! It's the ability to actually "see" and quantify these frequencies. Best of all, these 100+GHz harmonic mixers only cost a few $$$ to make.

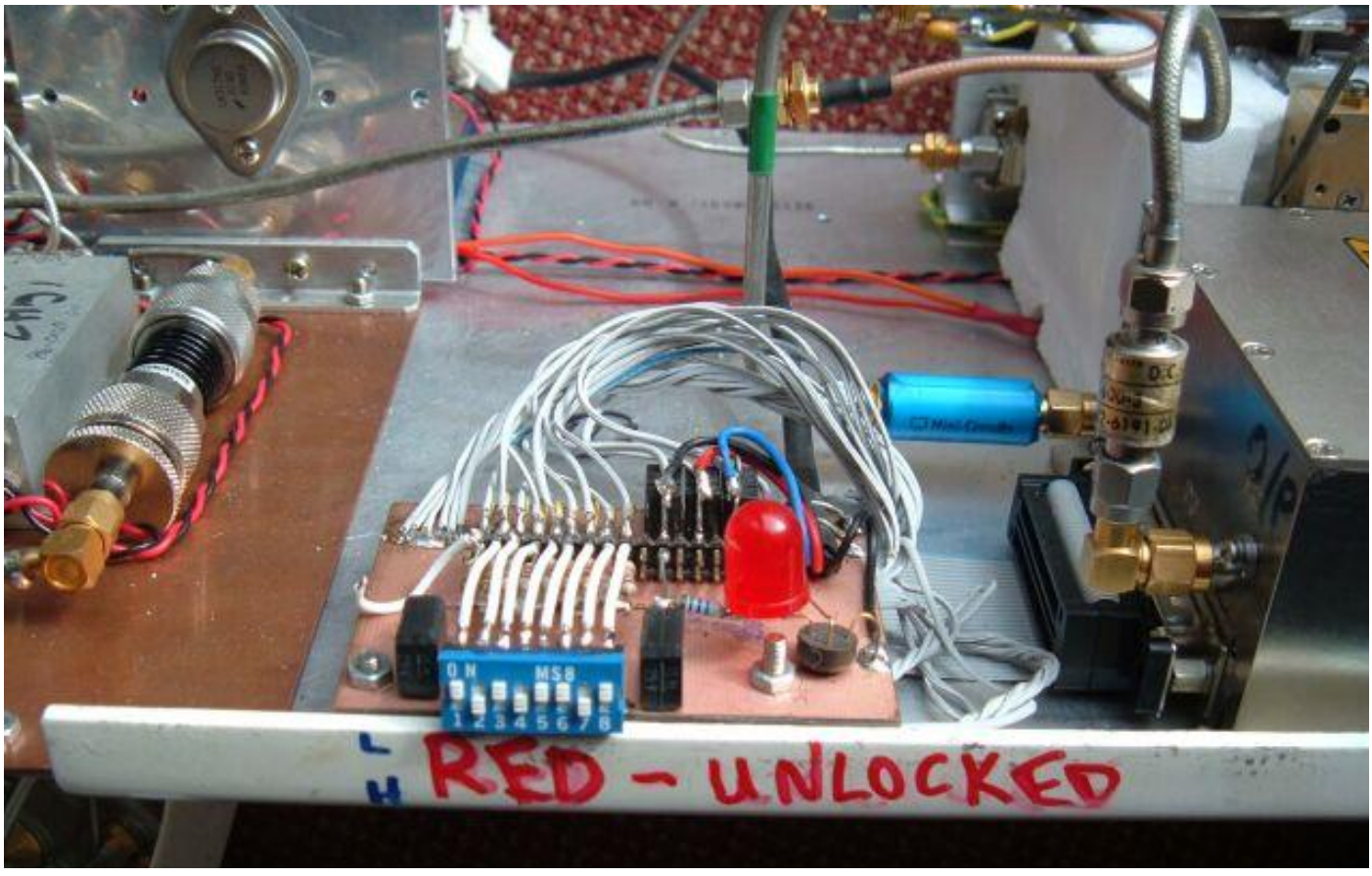
Frequency determination.

There is another method of determining the transverter operating frequency.

I'm using 10MHz TCXOs to "lock" the 13GHz oscillators. There are, however, slight frequency differences in the TCXO frequencies. Therefore, the "locked" 13GHz sources are not identical in their output frequencies. Consequently, the transverters have a frequency "offset" or difference due to these very small TCXO frequency differences. The result, my transverters have a circa 22kHz difference between each 13GHz oscillator. After the x3 multiplication of these "circa" 13GHz signals, the frequency difference between the transverters now equates to 66kHz for the 39GHz signal, 132kHz for the doubled 78GHz signal and finally 198kHz for the 3rd harmonic on 117GHz.

For our 78GHz QSO, one of our FT-817 IFs on 2m was simply tuned 132kHz higher (or lower for LSB) in frequency. So, with one IF rig running a CW "Ident" on 144.150MHz, the other IF rig was tuned up to 144.282MHz where the 2nd harmonic 78GHz signal should be. Controversially, this also means that an IF to IF contact is NOT possible! Interestingly, this frequency difference is an advantageous situation because if I had used GPS locking on both transverters there would have been zero frequency offset/error. For this scenario, a 39GHz contact (strongest signal) or worse, an IF to IF contact would have been unavoidable.

The "multiplication" technique I have used means that the fundamental 39/40 GHz "pump" signal is also radiated because RF filtering is not possible. There is, however, an obvious benefit with this situation. Being much louder than the desirable 2nd Harmonic, this 39/40 GHz signal can be



used for initial dish alignment/sighting and then we tune up the band to the desired 2nd or 3rd harmonic for 78/122GHz, defined by the TCXO differences between the transverters.

For shorter close in distances when initially testing the gear in the field, using the 39/40GHz signal is not really necessary because the 78/122GHz signals are so much stronger closer in. However, over the longer distances, this technique of initially optimising our dish pointing using the stronger 39/40GHz Injection signal worked VERY well for us.

After the success we had on 78GHz, I started looking at the possibilities for 122GHz. Since there is no frequency limiting waveguide used in my transverter design, both bands - 78GHz (39GHz x2) and 122GHz (40.6GHz x3) are potentially achievable with ONE transverter by simply changing the 13GHz oscillator frequency. This is easily done by setting the DIP switches. There was one proviso – would the 14GHz anti-phase diodes generate enough 3rd harmonic RF on circa 122GHz?

In VK, the 122GHz allocation has a lower band edge of 122.250GHz. Using a 144 MHz IF, the multiplier needs to deliver circa 40.75GHz to the anti-phase diodes. This frequency is towards the upper performance limit of the CMA382400AUP multiplier. So, I decided to use a 435.15MHz IF which pulls the “drive” frequency down to a more efficient operating point of 40.605GHz. This equates to 13.535GHz from the brick.

Bench testing with my home-brew harmonic mixers on the spectrum analyser showed I had a 122.25015GHz signal but it was quite weak. I had also found the CTR960459102R01 X3 multiplier performed better delivering more RF at the higher end at 40.6GHz than the CMA382400AUP multiplier. It also needs less RF drive than the CMA unit. Swapping the CTR unit in, I found a noticeable improvement in the 122GHz signal strength.

In further testing on 122GHz, I found that altering the RX DC bias on the TX unit (normally used for RX optimisation), delivered a slight improvement in the RX signal strength on the other unit. I’m not entirely sure why this bias adjustment was beneficial/necessary. It would seem to indicate that I’m suffering from insufficient RF drive at 40.6GHz. This still needs further investigation.

My initial observation on 122GHz was the faster frequency drift due thermal changes affecting the TCXO’s. IF signal “wobbling” (quiver) on the audible tone was also much more noticeable on this 3rd harmonic signal. I was able to reduce the frequency drift somewhat by fitting a heater and more insulation around the TCXOs. The Signal “wobbling” is an interesting phenomenon. On the Test Bench, once the TCXOs are up to internal temperature and therefore relatively stable, the “wobbling” of a GPS-locked IF signal (435.15MHz CW Carrier) from the TX unit is quite noticeable on the 3rd harmonic of 122GHz. It became even more noticeable when I tuned up to the 4th harmonic of 162GHz. Not surprisingly, I could not find a signal at the 5th harmonic of 203GHz.

The first ever VK, 122GHz QSO was conducted over a 1.5km suburban path. Signal reports were 5+1 both ways with some QSB. So there you have it – a description of the techniques I used to develop ONE transverter that will cover BOTH 78GHz and the 122GHz Bands. In concluding this article - I hope the contents inspire a few of you to have a go at building home-brew 78/122GHz gear!!!

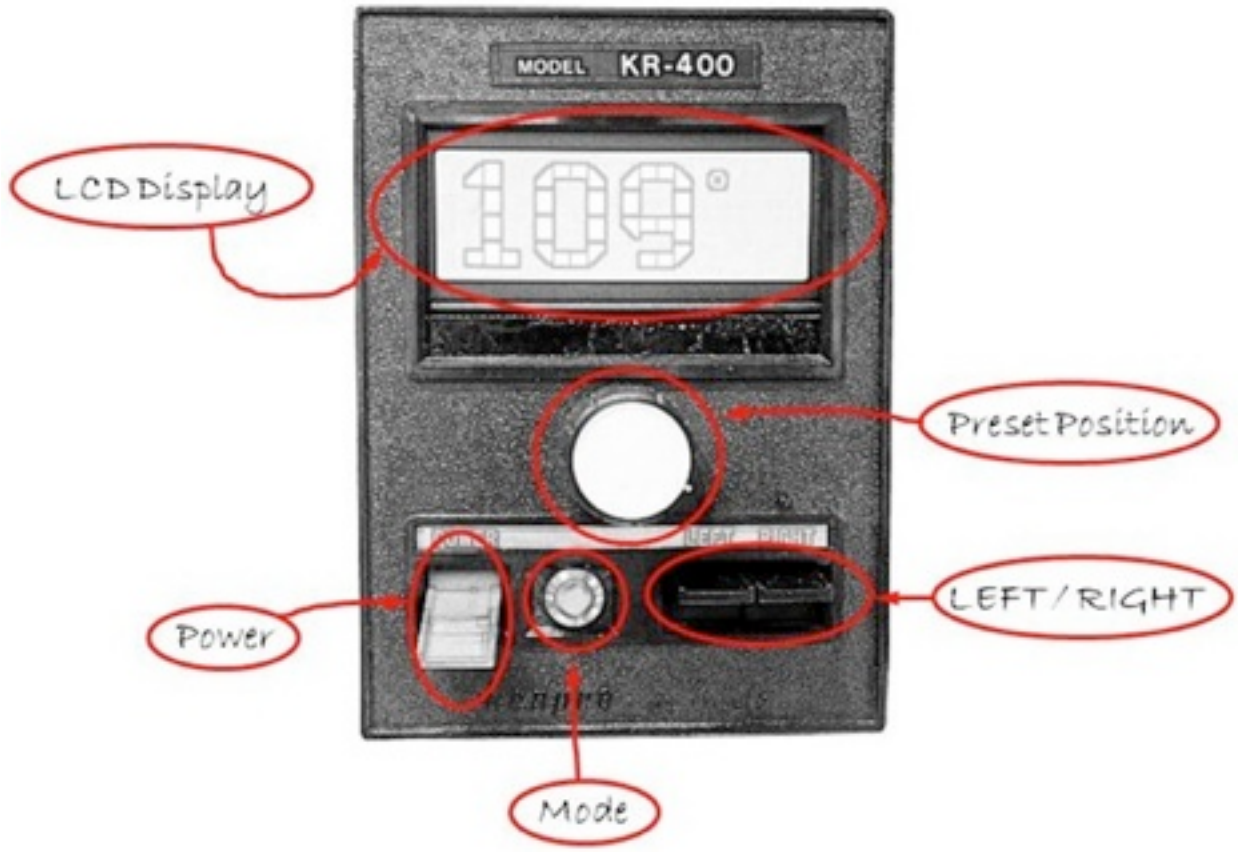
Cheers, Alan – VK3XPD

My Thank-yous.

1. Kerry Banke N6IZW, San Diego Microwave Group for his technical article – *A Simple Harmonic Mixer/Antenna Feed for 47 and 76 GHz Experiments*. For more information, check out this website
2. Will Jensby W0EOM for supplying the 39/40 GHz multipliers.

BXF Azimuth Rotator Controller

By Gavin Nesbitt M1BXF



I decided to build a new rotator controller to replace my Yaesu G400RC controller (but my design was made to work with virtually any rotator) to give me additional features beyond the sole analogue position feedback of the G-400RC. I wanted the new design to be digital, have integrated PC control, hands off operation (pick your direction and then sit back) and have additional features such as memory and PARK directions. I had previously built a rotator PC interface but not a full blown rotator controller, however my original code covered most of what I wanted to do except the LCD hardware and user inputs. This is a development in progress, since making it I've found I use the rotator controller differently from how I envisaged but I'll cover that at the end.

I built the rotator controller around the PICAXE-20X2 chip which is far the best chip in Revolution Education's range and can be used in almost any design. It supports almost all PICAXE BASIC commands and has 16 hardware inputs/outputs, it also has loads of registers and code space. After using the

PICAXE-20X2 chip on other projects, I got my head round some of the advanced commands and my own limitations from when I did my original rotator PC interface on the PICAXE-28X1 chip.

My original premise was to split the rotator controller into modes, mainly to test how I would use each one and after using it I redesigned the code to make it an all in one but the modes were:

Manual — **Standard control where the buttons change direction LEFT or RIGHT.**

Fast — **This is like manual but the LEFT and RIGHT buttons move the desired heading faster than the physical rate of rotation and the antenna catches up.**

Preset — **Uses a dial (potentiometer) on the front panel to set a desired heading and the antennas track to that heading.**

PC Control — **Heading feedback to the PC works on all modes but setting the heading only works in Manual mode. PC control also supports L for LEFT, R for RIGHT and S for STOP – this can be used also to interface to additional non PC [other BXF project] controllers.**

The PC protocol is based on Yaesu GS-232 and I've included support for AZ only (GS-232A) and AZ+EL (GS-232B), in the GS-232B all EL commands are ignored or answered with 0 degrees.

After deciding what I wanted from the new code I set about looking for a suitable rotator controller, or box, to house it into which I found in Friedrichshafen in the guise of a KR-400 control box for €30. It had a nice big south stop analogue meter in it but that didn't worry me as I planned to use a 4×20 LCD (which I had bought off eBay). I cheated slightly by using a Wulfgang K107 LCD interface board (tech doc .pdf) to drive the LCD, this was for 2 reasons;

1. It allows me to use serial to update the LCD instead of connecting all the parallel pins to the PIC so simplified the design,
2. The K107 LCD interface supports large character mode (as seen in the pictures) so allows me to use the full height of the LCD better (easier).

The final code doesn't have modes but instead allows any input to move the rotator, I did drop the FAST mode as it was redundant and I didn't use it much. The use now is you press LEFT or RIGHT to move in the desired direction, spin the preset to take you to the preset direction or press PARK* to take you to a pre-defined heading. Pressing LEFT, RIGHT or PARK at any point cancels the current movement and starts the new one, so if I set the preset to 200º and pressed

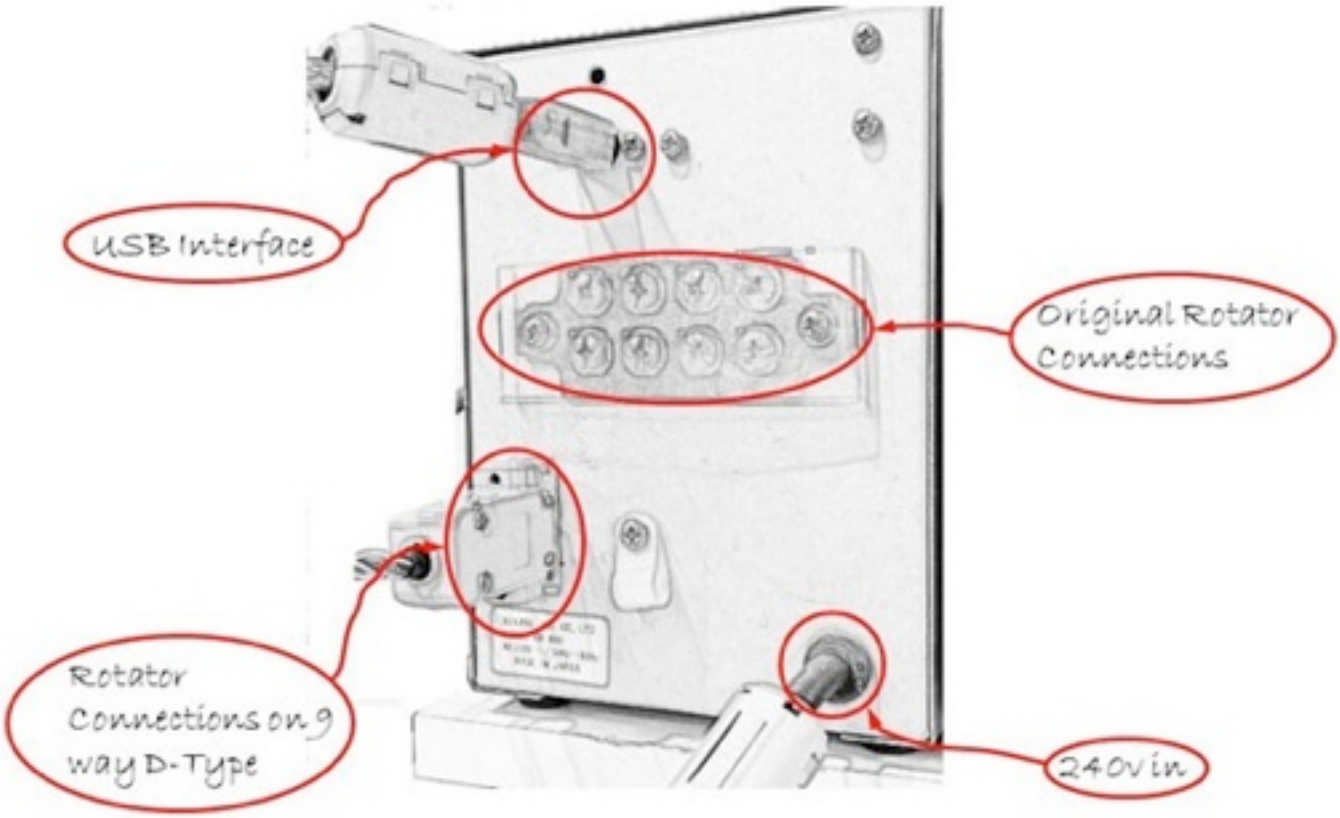
---

* At present there is only one input used as a predefined heading, which I call PARK and have set to 120º, Europe from my QTH. The PICAXE-20X2 has 5 additional spare inputs in this project so it's more than capable of having extra switches attached to these inputs and assigning them to additional presets in the code.

PARK (which say was set to 120º) then the rotator would cancel heading to 200º and head to 120º. The same is for the PC input, any PC input to goto a direction would override any current movement and head to the new heading set by the PC input. The PC can read the antenna direction at any time which does not effect the antenna movement.

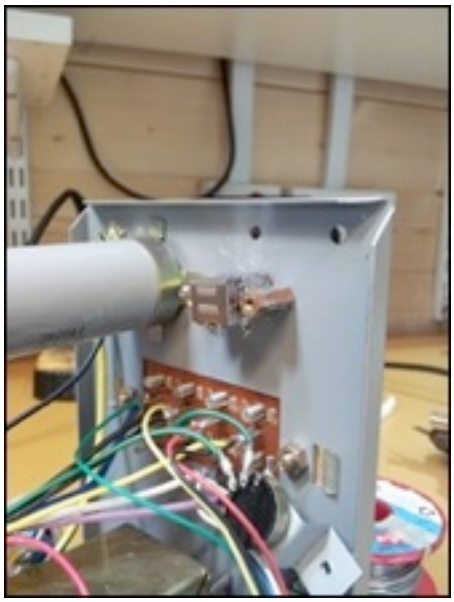
Outside The Case

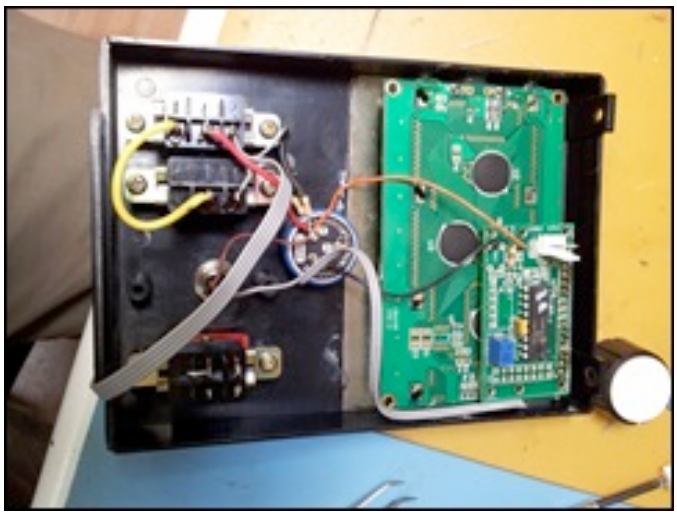
There was not much modification required to the KR-400 box. I added an extra button on the front for PARK, originally for changing mode and on the back a 9-way D-type connector which I use for my rotator wiring as it's much easier to disconnect, also all my other rotators use the same plug so they are all interchangeable. I also added a USB-B port on the back for PC interfacing, internally this goes to a USB<>Serial interface. Inside is where the main changes are.



Inside The Case

The original circuit and meter in the box was of little use so the first thing I did was to remove both. I left the transformer in along with the capacitor over the motor outputs which was also original, after that it was a new PCB with all the required circuitry and that was about it!





Calibration

The rotator controller needs to be calibrated. This is done in a simple way by either powering on the rotator controller holding the PARK button or if the MINOffset or DirCorrect EEPROM values are 0 (no values stored in EEPROM would be the case after programming). When in calibration mode, the user is presented with step-by-step, text-based commands on the LCD to follow for calibration. You only need to do the calibration once, after which MINOffset and DirCorrect values are stored on EEPROM and recalled on each power up.

The steps for calibration require the rotator to be moved fully LEFT (CCW) to 0 degrees (north) so the feedback pot in the bell housing reports its minimum value (MINOffset).

Pressing the PARK button saves this ADC value in EEPROM (MINOffset) which is then subtracted from ADC reads in the main code.

We then go RIGHT to 360 degrees (north) and save this ADC value (DirCorrect) which is used for the correction factor.

The ADC value is again saved in EEPROM when the PARK button is pressed.

Let me explain using my values. On my rotator 0º (north) returns an ADC value of 22, this ADC value is subtracted from all other ADC reads in the code, the reason is 22 is 0º so an ADC value of 32 would be 10º (it's not quite that linear but you get the idea). We then goto 360º (north) which in my case is ADC 953. ADC 953 is actually not yet right as we need to subtract the MINOffset value for the correct ADC for 0 to 360, we then need to convert to a correction factor.

To get the most accurate heading I sample the ADC value in the code 64 times. I use 64 [times] as this then fills a 16 bit register when sampling the ADC at 10 bits without the chance of it overflowing. The maximum ADC value at 10 bits is 1024 so 1024 * 64 = 65636.

As my max ADC value is 953 (remember my minimum value of 22) I need to subtracted this off so the real ADC value is 953 minus MINOffset or 931. It's the value of 931 which is loaded into the register 64 times meaning the register value is stored as 931 * 64 = 59584. I then divide this by 360 to get the correction factor. 59584/360 = 165.5. In PIC code we can only divide by full numbers so I take into account if the decimal is greater than 0.5 and if so I add a number to the correction factor to make it closer to the real value, if my result was 165.4 I would then use 165 but as it is 165.5 I instead use 166.

This means if I have an ADC value from the rotator of 546, I first subtract 22 (MINOffset) from it, leaving me with 524 which is sampled 64 times giving a register value of 33536 (in reality the ADC value of 546 could vary slightly on each of the 64 reads, one of the reason we average so many). I then divide 33536 by 166 (DirCorrect) and I get a heading of 202º.

Did you follow?

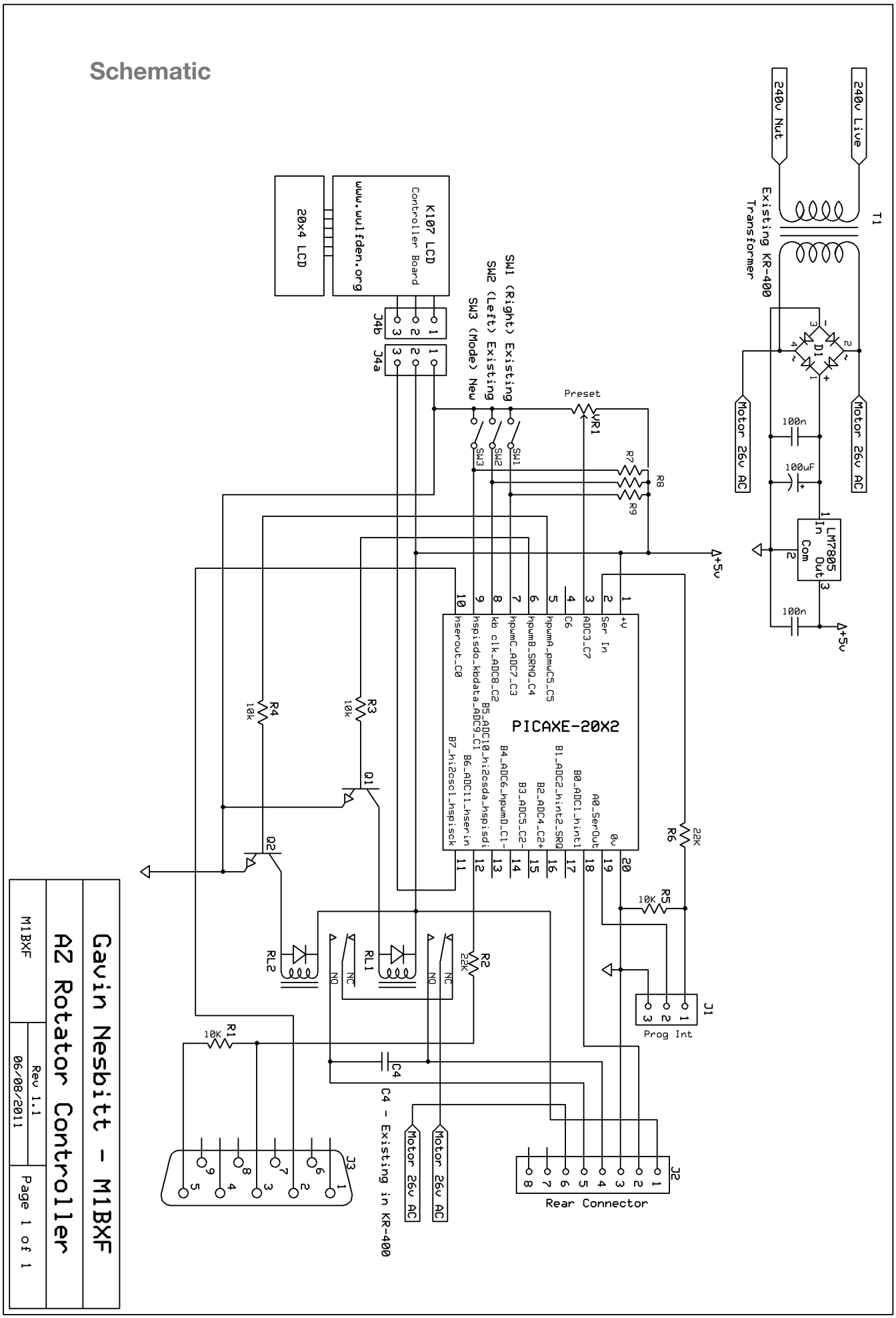
The schematic diagram is on the next page.

[NB the sch file won't open in Eagle but requires ExpressSCH. Ed.]

Code

Download the code

Schematic


240v Live
240v Nut
T1
Existing KR-400 Transformer
D1
Motor 26v AC
Motor 26v AC
100n
100uF
LM7805
In
Com
Out
+5v
100n
20x4 LCD
K107 LCD
Controller Board
www.wulfden.org
J4b
J4a
SW1 (Right) Existing
SW2 (Left) Existing
SW3 (Mode) New
Preset
VR1
R7
R8
R9
PICAXE-20X2
R4
10k
R3
10k
Q1
Q2
R6
22K
R5
10K
R2
22K
RL1
RL2
NC
NO
J1
Prog Int
R1
10K
C4
C4 - Existing in KR-400
J3
J2
Rear Connector
Gavin Nesbitt - M1BXF
AZ Rotator Controller
M1BXF
Rev 1.1
06/08/2011
Page 1 of 1

Old Design (PICAXE-28X1)

A long time back I decided I wanted PC control of my antennas, mainly for point and shoot, click on a heading in some PC software and start CQ'ing so that I wouldn't have to think both about calling and antenna direction. For this I ordered an LVB Tracker from AMSAT UK but before it arrived I thought I'd have a go at making one myself using PICAXE, it worked but it was crude!

I have a Yaesu G-400RC rotator which is the one with a round controller for the display and uses a comparator circuit to 'match' the heading of the controller display with that of the rotator itself, the problem is the comparator swings from –15v to +15v and is non-linear. This meant interfacing to a PIC chip was possible (using an opamp) but as the voltage was non-linear it would not work so well.

My first attempt was using a PICAXE-28X1 chip which as good as a design it was I didn't know PICAXE programming as much back then so didn't fully utilise the chip, or code. Instead of using the hardware serial (hserin) inputs, which allows serial reception in the background while the code executes, I used the normal ones and had to set a serial buffer timeout which would expire if no serial data was received, during this time all the code execution stopped. Also due to my lack of familiarity of PICAXE code back then the code wasn't really optimised, an example was lack of subroutines (Gosub) meaning there was lots of code repeated. There was no calibration routine so working out the actual heading was left to the user to calculate and enter the correction values for the ADC value directly into the code. I've not reproduced the code here as it is, in my mind, redundant and outdated. But some of it was salvaged for this project.

What I did end up doing, though, was to take some of the ideas and features from this code and turned it into my LVB Extender design, an add-on for the LVB Tracker, which could send serial commands to the LVB Tracker, giving added extra features and automation to the rotator system without the need for a PC.

Gavin Nesbitt M1BXF

http://www.geekshed.co.uk/bxf-azimuth-rotator-controller/

ARRL EME Contest

By Peter Blair, G3LTF, Andover

I was active in the first leg (microwaves, 13cm and up) of the ARRL EME contest on September 24th/ 25th. Fortunately the winds stayed low and, given the complexity of 3 microwave band operation, it was relatively trouble-free considering five changes of feed systems and PSUs at the dish.

This picture shows all the feeds and transmitters that, separately, go at the feed point or, in the case of 13cm PA, just below the dish. Powers at the feeds are 13cm 250W, 9cm, 30W and 6cm 22W.

On 13cm I worked 31 stations, (*means crossband.) LZ1DX, OH2DG, DL1YMK, JA8ERE*, F2TU, SP6OPN, CT1DMK, G4CCH, ON5TA, ES5PC, S50C, IZ2DZP, SM3BYA, SD3F, RK3WWF, SM4DHN, SV1BTR, PA0BAT, K5GW, LA9NEA, G3LQR, WD5AGO*, K1JT*, PA7JB, OZ4MM, LX1DB ssb, SM4IVE, G4DDK, VE6TA, PY2BS, and WA6PY*.

On 9cm I worked 3, ES5PC, W5LUA and K5GW. On 6cm I worked 6, F2TU, OH2DG, K5GW, SV1BTR, ES5PC, and W5LUA.

73
Peter G3LTF

23cm UKAC 20th September from Scotland

By Ray James GM4CXM

Conditions during Tuesday evening's contest were pretty average. With a few regulars away on holiday, multiplier numbers were down a bit. Activity levels continue to be high on this band. Ten stations were active from GM though none north of the central belt.

Aircraft reflection results were very productive despite fewer jets being around following the peak of holiday traffic during the summer months. In particular, Kjeld OZ1FF was audible calling CQ for at least 2 minutes following our contact thanks to a Ryanair Riga to Dublin flight.

Hans PA0EHG was a bit more difficult to complete as the aircraft used just skirted inside our mid-point area and no more.

Changes to interconnection cables around the PA and sequencer changeover relay system to reduce losses appear to have paid dividends with a number of known low power stations worked on SSB much easier and with improved reception.

My 1.3GHz QSO map can be viewed here.

73 Ray GM4CXM

Scottish Microwave Round Table

Saturday 5th November 2011

You are invited to attend the first Scottish Microwave Round Table.

A full programme of talks will be published in due course and will include technical and operational subjects of interest to all microwave operators.

There will be plenty time for socialising during the day, meeting friends old and new as well as putting faces to a lot of callsigns. This will continue later in the nearby Burntisland Sands Hotel for evening dinner.

The Museum of Communication venue will also be well worth a good look around.

There will be a small admission charge of £8 for the day event to cover the room hire, refreshments and a sandwich and finger buffet lunch.

Provisional programme

Talk & refreshment times subject to change

10:00	Doors open
10:30	Introduction and welcome
	Guest speakers, lunch and refreshments
16:00	Close RT
18:00	Pre-dinner drinks at the Burntisland Sands Hotel
19:00	Evening Dinner at the Burntisland Sands Hotel

Keep en eye on the web site for updates

The venue has a limit on numbers, so PLEASE REGISTER NOW to avoid disappointment!

www.rayjames.biz/microwavert/index.html

Nanowaves Diary

From Gordon, G0EWN and Barry G8AGN

26 Sept

Monday evening, 26th September saw members of the two Northern nanowave groups join forces for the first combined tests. Rob M0DTS was active from the North York Moors, IO94MI65 and Barry G8AGN and Gordon G0EWN out on the moors above Sheffield. Barry was located at Edgemount and Gordon at Stanage End, IO93EI52. Despite predictions which suggested excellent visibility, conditions were actually poor in terms of visibility – perhaps 40-50km tops. Despite this the tests continued. Barry was using a new TX LED a 20W Phlatlight (Photonic Lattice) and Rob spotted it almost as soon as Barry turned it on. These are very much brighter/more powerful than Luxeons or Golden Dragons with a similar beam width. It was quite amazing how well the red light cut through murk. Rob and Barry exchanged 56 signal reports both ways over a path of around 110km – the same path used by G8AGN and G0EWN for the first 100km plus light contact in the UK. in January.

After that Rob re aligned his TX on Gordon. Despite only a further 11km or so further than Barry, visual observations confirmed that things would be much weaker. Rob received Gordon at 52 peaks, over the 122km path but Gordon had a problem with his RX which stopped this becoming a two way exchange.

However the evening was deemed a success – first liaison between the Northern groups, Barry tested a new TX, whilst Gordon walked up to the high point – well away from the road – to test newly developed lightweight equipment. It was also interesting for its cross mode nature – Barry and Gordon were using baseband equipment whilst Rob was using sub carrier/transverter tuned to as close to the LO as possible. It had been discovered, during the Finningley RT, that it was possible to mix mode/ equipment in this way, AM baseband, SSB sub-carrier with little if any penalty. At 122km it is also the longest distance so far across which a signal has been sent via red light in the UK. When we next get some clear conditions it is hoped that this or a longer path can be repeated as a two way exchange between the two groups.

Gordon, G0EWN

27 Sept

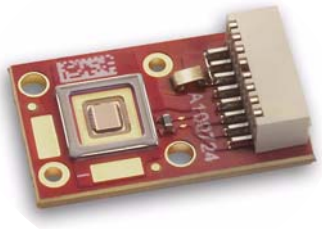
Rob, M0DTS, and I had a lightwave contact over a path of approx 111km this evening just before 2000 clock-time. Rob was on Blakey Ridge, NYM and I was at Bradfield, on the north side of Sheffield. Conditions were not ideal and visibility was only about 50-60km as estimated from lights in the distance. Nevertheless, we both spotted each others Tx as soon as they were switched on and signal reports were exchanged at 5/6 both ways.

I then passed the baton to Gordon G0EWN who was situated about 11km further away from Rob but on more or less the same beam heading. Certainly a one-way contact was made before I quit the scene of battle at about 20.30 clock-time but I'm sure a full account will be posted soon.

A good start to the "season".

73 Barry, G8AGN

PS I used my separate baseband rig with an upgraded TX which uses a 20W LED – the Luminus CBT-40. Rob was using his normal rig.



28 Sept

This evening Barry and I went out to test a JT4A generator – Andy's design – over a 10km test path. The generator feeds 4 Luxeons each with small 'torch' lenses. beam width is fairly broad compared to Fresnel.

On starting the test a broad stripe was seen in the waterfall at the correct frequency and we had 100% decodes. Barry then moved the beacon off heading until it was around 45 degrees off – I could just detect the merest hint of red – the programme decoded down to -15dB JT but although it seemed to recognise something was still there at -20+ dB (hint of signal on waterfall) it wouldn't decode below -15dB. Barry and I have little experience of this JT mode. We wonder if the very marked scintillation this evening caused the programme to struggle with decode below -15db in the same way signal spreading/ scatter causes problems with some modes? (Tones are closely spaced.)

Looking at the same signal with Spectrum Labs, the signal was perhaps 5db/N – certainly I couldn't detect the tones by ear. Somewhere I should have a screen dump – shift + PRT SCR, but as I don't use this I can't find it at the moment.

The tone generator worked very well – we hope to do some non LOS and scatter tests in the months ahead,

Best wishes all, Gordon G0EWN

Some links

1. *PhlatLight: The most powerful LED in the world,* Alexei Erchak, CTO and Founder, Luminus Devices, Inc. September 2006 is downloadable from here.
2. Nanowaves Yahoo Group

RSGB Convention

By Graham Murchie G4FSG

The UKµG was very well represented at the RSGB Convention at Horwood House on 8 and 9 October. Six full and three corresponding members of the committee were present and the stand attracted much interest with various positive comments about the construction projects being displayed.

With over 60 presentations to choose from I am only able to comment on a few relevant ones! Simon, HB9DRV gave an update on his SDR software and demonstrated the capabilities. He also indicated that during 2012 a 1mW 0–30MHz SDR transceiver will be available with a 0–3GHz version to follow in due course! Soon all we will need is an Ethernet and power lead up the mast – everything else will be at the top! Brian, G4NNS, presented on 10 & 24GHz EME explaining that DX was really all about frequencies 1000x greater and distances 40x greater than the HF DXers are used to! The talk was well attended and several questions in and after the session indicated that it had made a number of people think somewhat differently about microwaves.

The two presentations on plasma in space were very contrasting and thought-provoking. The UCL presentation by Dr Colin Forsyth helped explain some of the relationships between radio propagation and the earth–sun electric environment, and that was very brave of the RSGB to invite Tom Findlay, GM4DOZ to introduce the very controversial concept of *The Electric Universe* to radio amateurs.

Murray, G6JYB, updated the attendees on what the implications of the Olympics will, or might be (Ofcom still have to decide!). Certainly 70cms will be severely impacted for a while with other bands also suffering. He will continue to update us via Scatterpoint. Bo, OZ2M, gave the most interactive talk that I attended all weekend on Next Generation Beacons. Virtually everyone seriously involved in beacons in the UK was there and contributed. Not quite Microwaves but still very thought provoking was the New VHF Antenna presentation by John, G4SWX. He presented this at the Martlesham Round Table earlier this year and updated people on his latest work and touched briefly on implications for 23cm antennas. Last, but not least, was a strong microwave presence at the RSGB Contest Committee Forum where the (infamous) M5 rule was the subject of 'lively' but, hopefully, productive debate!

As Chairman of the EME2012 organising committee, I was able to talk to a number of potential presenters and exhibitors as well as publicising, with the others present, the wider appeal of the event. A number of non-microwavers have expressed a serious intent to attend next August.

For the first time since the event was changed from 'The HF Convention' three years ago, I felt that the VHF and microwave community was making a significant impact.

Graham Murchie – G4FSG

Activity News

from the world above 1000MHz

By Robin Lucas G8APZ

I decided to spend my last three weeks in France doing some single yagi EME on 2m. I kept an eye on the Microwave conditions, of course, but the amount of enhanced tropo during the summer months was minimal. In France, the distances covered on the microwave bands during the summer is truly impressive, with 10GHz contacts up to 700-800km being quite commonplace.

There are several reasons why this sort of distance is not seen in the UK very much, the main one being the topography. France has many more mountains than the UK, and many of the summits are accessible by road, whereas the highest mountains in the UK, are generally inaccessible by road, and not as high as those in France.

Another reason is the predominance of portable operation. French stations will often announce a portable foray to their local high ground at a few hours notice. Such operation doesn't seem to occur in the UK. It seems to me that there are far more French microwavers who operate portable compared with those who operate home stations.

The third reason is that summer temperatures over the European land mass are more conducive to storms, where rising air masses on occasion can reach 10-15km above the ground before ice crystals start to fall, and then turn to heavy rain at a great height. This gives rise to rainscatter conditions and paths of up to 900km, and it is these paths that simply do not occur in the UK.

Maritime propagation

I mentioned last month that EA3XU (JN11ck) worked IW5BSF/5 (JN53ev) on 10GHz with 59+ signals, at a distance of 722km. Since then, I asked EA3XU for some information about his activities, which he kindly supplied.

From: Benjamin Piñol, EA3XU

I was active on 3cm (Wideband FM) from 1979 to 1984, and then stopped. I came back to microwaves in 2003, and now I'm QRV on VHF/UHF and the higher bands 1296/2320/5720/10GHz and 24GHz (from 2011). My QTH is the city of Barcelona 170m asl, where I am QRV on 3cm both Tropo and RS.

My 10GHz ODX (July 2005) was from a portable location at JN00ET 1444m asl, with two stations in Malta, 9H1ES and 9H1VW at a distance of 1344km.

I have made 10GHz QSOs with many stations from France, Italy, TK, IS0, 9H1, EA2, EA3, EA5, EA6, and EA9.

Two years ago I retired from my job and I now cover microwave activities in Spain for the Spanish Association URE, (Union Radioaficionados Españoles). I write for "Radioaficionados" the magazine of the URE, and I have also presented papers at the Congress of URE in Spain.

This year the number of EA microwave stations has doubled, and I am very pleased about this. The following stations are on 3cm: EA1BLA, EA2BCJ, EA3PL, EA3LA, EA3BSG,

EA3TA, EA3FVI, EA3FLX, EA3BHM, EA5YB, EA5JF, EB5EA, EA6FB, EA6QB, EB6AOK, EA7BMV, and EA8BFK with more stations working on becoming QRV.

Benjamin's website (in Spanish) shows some interesting paths marked on the map of the Mediterranean and a number of sound recordings of his 3cm DX

The 3cm dish at EA3XU, with a few degrees of elevation by the look of it!

The serious antennas for the VHF/UHF and lower microwave bands, including 8 x 35 element yagis for 23cm consisting of two bayed boxes of four.

First Spain to Italy on 5.7GHz

Benjamin, EA3XU reported the first contact between Spain and Italy, with both stations using just 200mW.

On 18th August, at 18:20 contact was established from EA3XU to IW5ADB/5 (JN53ev) across the 722km path. Signals varied on SSB from 52 to 54.

On 19th August, a second QSO to the same locator, this time IW5BSF/5. The signals were 59+20dB both ways.

On 20th August, another QSO with IW5ADB/5 brought reports of 59+40dB both ways.

Maritime tropo on 10GHz

During August, the tropo conditions across the Mediterranean produced 59 or better signal levels on many occasions. EA3XU worked I4TTZ/5, IW5ADB/5, and IW5BSF/5 on SSB (all in JN53) over the 722km path.

On 20th August, IW5ADB/5 (JN53ev) made an exceptional contact with EB5EA/P (IM99ev) at a distance of 1024km.

Most of the contacts reported here took place in the late afternoon and early evening, but no doubt there exist opportunities at other times of the day. My thanks to EA3XU for the information.

10GHz in the USA

From: Scott Littfin, N0EDV, EN45fa

We're in between the two weekend runs of the ARRL 10GHz and Up contest and I got to make a nice rainscatter QSO with K2YAZ in EN74av on 3rd September 2011 at a distance of 440km. My location at home is far from ideal, being in a valley with lots of trees and hills in most directions. This is my best DX to date.

K2YAZ runs 18W and I run about 1.5W. My antenna is a converted offset feed satellite TV dish about 18 inches in diameter (45cm).

During the second weekend (17th/18th September ARRL 10 GHz and Up contest) the weather was a little wet.

That's Charlie, N0AKC under there. My operating position was just to his right. It wasn't entirely successful at keeping us dry, but did keep the radios dry.

We took the tarpaulin off each time the rain stopped. Once, whilst the gear was uncovered, it started to mist lightly, but we didn't think it was heavy enough to put it back over until N0AKC's keyer started sending a solid string of dashes when moisture closed the gap in the bencher paddles. Hilarious!!

23cm UKAC 20th September

John Quarmby, G3XDY (near Ipswich) had 33 QSOs with 18 different locator squares. DF9IC (JN48) was his best DX. Other good DX included DC6UW (JO44) and OZ1FF (JO45).

[see p19 for the Scottish report, Ed.]

SHF UKAC 27th September

G3XDY reported enhanced tropo conditions during this short contest session. His 12 QSOs on 13cm were spread across 9 locator squares, with his best DX being with SM6AFV at 955km.

On 9cm, five QSOs in 4 squares were made, with DF9IC the best at 635km.

6cm produced two contacts, the best of which was with OZ1FF (JO45), the other being M0GHz.

On 10GHz John had one contact with DJ6JJ (JO32) at 416km.

September Tropo

From: John Quarmby, G3XDY, JO02

On 25th, early in the day I looked for French stations during their activity day. F9ZG (IN98) was worked on 13cm, 6cm and 3cm, with the contact on 6cm providing a new square.

F1NPX/p (JN29) was worked on 23cm and 3cm, and F1DBE/p (JN19) was worked on four bands, 23cm, 13cm, 6cm and 3cm.

On 28th September, just one contact on 23cm with OZ3ZW (JO54). A test on 13cm failed to produce a QSO.

The next day (29th), a very odd opening. Some very good DX from SM, but no SM beacons. The first contact was with SM7GVF (JO77ga) on 23cm at 55 both ways, then SM4DHN (JP60va) 559/579. SM7GEP (JO77ip) was only 419 on 23cm, but also 519 on 13cm and 9cm, and back to 419 on 6cm. Once again a 10GHz contact eluded us.

An early morning beacon check on 30th revealed the SK1UHG beacon on 23cm from JO97 at a distance of 1237km, plus SK6MHI (JO67) on 23cm/13cm, but no stations were around to work. The evening produced contacts with F5EJZ in IN99 on 23cm and 13cm, SM6ESG (JO67) and OZ1FF (JO45) on 23cm, and OZ9ZZ (JO46) on 23cm and 13cm.

IARU Contest weekend

On 1st September, the good tropo looked like extending through the contest weekend. Stations in the South East of England, at least, were not to be disappointed.

From: John Quarmby, G3XDY, JO02

Amongst the stations worked on 23cm were: DK7QX (JO42), DR9A (JN48), DK6AS (JO52), OZ1FF (JO45), GW8IZR (IO73), GM4JR (IO85), DL3IAS (JN49), SK7MW (JO65) by aircraft reflection, LA3EQ (JO28), DH9NFM (JO50), DH1TS/p (JO44), DF5GZ/p (JN47), DF4IAO (JN48), DL0GTH (JO50), DJ8MS (JO63), DM7A (JO60), OK2A (JO60), and OZ9ZZ (JO46).

13cm highlights were OZ1FF (JO45) and DL0GTH (JO50) plus several DLs in JO31/32.

9cm produced contacts with DK2MN (JO32), DF0MU (JO32), DL5EAG (JO31), PI4GN (JO33), DK1VC (JO31), whilst on 6cm the QSOs included DK2MN (JO32), DF0MU (JO32), OZ1FF (JO45), and PI4GN (JO33).

Some good contacts too on 3cm, including DF0MU (JO32), OZ1FF (JO45), PI4GN (JO33), DL5EAG (JO31), DF0HS/p (JO31), and DK2MN (JO32).

Sunday 2nd October brought in more of the same. Highlights on the various bands were:

23cm: DL5YWM (JO61), OK1KIR (JO60), DD2D (JO50), DC6UW (JO44), DB5YB (JO42), DJ3HW (JO42), DC7BQ (JO42), DF0WD (JO42), DL1SUZ (JO53), DK1ZD (JO44), DG7TG (JO43), GM4LBV (IO86), DL6DA (JO40), F6FHP (IN94), GM4CXM (IO75), and DF0YY (JO62).

13cm: OK1KIR (JO60), DC6UW (JO44), and DK1ZD (JO44), Signals were exchanged with GM4CXM but no QSO resulted.

9cm brought in DK1ZD (JO44), and on 6cm F5REF/p (JN19), DC6UW (JO44), and F6DWG/p (JN19), and on 3cm DC6UW (JO44), and F6DWG/p (JN19).

125 QSOs on 23cm was the highest 24hr total I have made since the last major tropo that coincided with this contest back in 1995.

Signal strengths were enormous from stations on the near continent, with very strong radar noise mixed in too. The noise blanker would take out the radar but produced lots of intermod splatter from all the strong signals. With the NB off it was just about possible to hear stations in the nulls of the radar pattern.

73, John G3XDY

IARU contest at M1CRO/p

I was with the Colchester Contest Group M1CRO/p (JO01pu) for the IARU contest, (DC-Daylight as it's known). The WX could not have been better. Friday 30th September had the highest temperature for the last day of September for over 100 years, above 29C, and Saturday 1st October also produced 29C for the hottest October day on record in the UK.

On 23cm, 152 contacts were made, in 44 squares, and 11 countries, the top distances being OK2A (JO60) 830km, F6FHP (IN94) 802km, OZ3ZW (JO54) 749km, OZ9ZZ (JO46) 732km, and OZ5KM (JO45) 721km.

13cm produced 45 contacts in 23 squares and 6 countries, the best were F6FHP (IN94) 802km, OZ3ZW (JO54) 749km, and OZ9ZZ (JO46) 732km.

Of the 18 contacts on 9cm, the ODX was DJ3AK/p (JO52) 646km, with DK1ZD (JO44) at 630km not far behind.

The best two on 6cm were OZ9ZZ (JO46) 732km, and OZ1FF (JO45) at 613km, from the twenty contacts.

On 10GHz conditions to stations in the UK seemed to be very poor but to Denmark, Holland and Germany were excellent, resulting in contacts with JO squares 30, 31, 32, 33, 42, 44, 45, and 46 amongst others. The 38 contacts yielded 6 countries , twenty squares, and an average points per QSO of 280km! The best DX was to OZ9ZZ in JO46qk at 732km.

Throughout the 24 hours, the beacons DB0GHZ (JO34), DB0VC (JO54), OZ5SHF

The M1CRO/p take-off at sunrise.

(JO45) were pounding in at 59+ the latter at 722km!

In conditions where the 10GHz signals were phenomenal, it was a bit of a disappointment that 24GHz didn't produce some very long DX, but the humidity above the sea made the path loss prohibitive.

Despite several attempts with OZ1FF, with 3W at each end, our hopes of success on 24GHz came to nothing, but nevertheless, we made 7 QSOs on SSB, the best being PA6NL at 195km with 55 reports both ways.

A few days after the contest, I received an email from Vøgg, OZ7DX (JO66da) to say we were 55 with him on 3cm (857km). He called us after OZ1FF, but we missed him - he would have been our best DX!

Snippets

On 12th September, Michele IZ1DYE made his first QSO on 3cm. He made contact with Francesco, IK3HHG at a distance of 338km with only 200mW.

What a lovely introduction to the band!

Congratulations, Michele.

...AND FINALLY

This month, I have been able to include a few more pictures than usual. It is always interesting to see what other people are up to and how they do it! Your photographs are always very welcome.

It is that time of year when we used to get regular “autumn lifts” on the bands. It seems to be less common these days, but watch out for the large areas of high pressure with very still air. It is many years since we have had a decent widespread tropo opening, so we should keep our fingers crossed that there will be a big one soon!

The November/December column will be my last one, and I'd like to include as many of your news and activity reports as I can. Please try to have them with me by early November.

73, Robin G8APZ/F1VJQ

Please send your activity news to:

scatterpoint@microwavers.org

Events calendar

Oct 9-14	European Microwave Week, Manchester	www.eumweek.com/
Oct 13-16	Microwave Update, Enfield, Connecticut, USA	www.microwaveupdate.org/
	Crowne Plaza Hotel, 1 Bright Meadow Boulevard, Enfield, CT 06082,. Rooms $99. Sponsored by N.E.W.S. Group. This is where the Eastern VHF/UHF Conference has been held for the past 10 years. Additional info email n2liv@arrl.net and w1ghz@arrl.net for details.	
Nov 5	Scottish Microwave Round Table	www.rayjames.biz/microwavert/
2012		
Feb 12	GHz-Tagung, Dorste	www.ghz-tagung.de/
Mar 31	CJ-2012, Seigy	cj.ref-union.org/
April 28–29	Martlesham Microwave Round Table and UKμG AGM	(mmrt.homedns.org/)
Jun 22-24	Ham Radio, Friedrichshafen	http://www.hamradio-friedrichshafen.de/
Jul 7-8	Finningley Roundtable	
Aug 16-19	15th International EME Conference, Cambridge, UK	eme2012.com
Sep 14-16	Amsat-UK Colloquium, Holiday Inn, Guildford, Surrey	www.uk.amsat.org/Colloquium/
Sep 14-16	57.UKW Tagung, Weinheim	www.ukw-tagung.de/
Sept 23 ?	Crawley Roundtable	
Sept 28-29	National Hamfest, Newark	www.nationalhamfest.org.uk/
Oct 5-7 ?	RSGB Convention, Horwood House, Milton Keynes	www.rsgb.org/rsgbconvention/
Oct 29 - Nov 2	European Microwave Week, Amsterdam	(www.eumweek.com/)
Nov 3	Scottish Roundtable	(www.rayjames.biz/microwavert)

NB (unlinked websites) are still showing their 2011 programme.

Contests & Activity Dates

October

18-Oct 1900 – 2130 1.3GHz Activity Contest
Arranged by VHFCC (RSGB Contest)

25-Oct 1900 – 2100 2.3GHz+ Activity Contest
Arranged by VHFCC (RSGB Contest)

November

15-Nov 2000 – 2230 1.3GHz Activity Contest
Arranged by VHFCC (RSGB Contest)

22-Nov 2000 – 2200 2.3GHz+ Activity Contest
Arranged by VHFCC (RSGB Contest)

27-Nov 1000 - 1600 Low band 1.3/2.3/3.4GHz

December

20-Dec 2000 – 2230 1.3GHz Activity Contest
Arranged by VHFCC (RSGB Contest)

27-Dec 2000 – 2200 2.3GHz+ Activity Contest
Arranged by VHFCC (RSGB Contest)

French Journées d'Activité (JA)

Activity dates cover all bands from **23cm** up.

29-30 Oct Activity weekend

Duration of all JA is 1700 Saturday - 1700 Sunday

EME Activity weekends

22/23-Oct ARRL EME
Arranged by ARRL

19/20 Nov ARRL EME
Arranged by ARRL

Don't forget that

Every Monday evening is Microwave Activity Evening

The RSGB 2011 VHF+ Contest Calendar is available at www.rsgbcc.org