An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

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2009 JULY-AUGUST

Our cover picture this month shows Bob, **G8DTF**, portable at Matchmoor Lane, Winter Hill (IO83RO) during July's 10GHz/5.7GHz/24GHz Cumulative Contest, which ran in tandem with the BATC West Coast ATV Marathon. What you don't get from this photo, unless you are "in the know", is that the wind is blowing furiously and the rain is really pelting down! The weather forecasters have certainly got it wrong this summer! Many congrats to Bob and all the other UK portables who ventured out on that horrendous weekend. One activity report (GW3ZME/P) appears in this edition but more are expected for next month's Scatterpoint.

Apparently the ATV lads had it even worse than Bob!

Photo by Dennis G6YBC

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Latest News ...

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BUMPER EDITION

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28 PAGES !

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

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From the Editor's Desk

WHAT A FANTASTIC MONTH FOR READER INPUT!

Many thanks to our featured article contributors — G4JNT, G3UKV, G3LTF, G4NNS, G0API, G6GXK, G4BAO and M0EYT. This has been the best month for articles that I can remember (and I go back to 1985 as editor of Scatterpoint and its predecessor the RSGB Microwave newsletter) ! As a result, I've been able to produce this extra large edition for this month only. Don't get used to it though as it will be back to 20 pages next time! I also have material for next month still in the file. Robin, the Activity News Editor also reports another very good month for reader input. Please keep this up folks as it's YOUR newsletter. As the saying goes, 'You only get out what you put in ... ' (a bit like the UK banking system at the moment !)

BY THE WAY …Those of you who still get the black and white postal and/or email version may like to access the Hi-Res Colour edition available at the Scatterpoint Yahoo Group. You can have this in addition to what you already get or change over to it ... for free! Go to the following URL and sign up:

http://uk.groups.yahoo.com/group/scatterpoint

and click on [Join this Group] above the UKuG logo.

This edition look VFB in colour!

73 from Peter G3PHO, Editor

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

Crawley Microwave Round Table Program

Sunday 13th September 2009

As usual, we will be running the UK Microwave Group annual construction contest for the G3VVB trophy. Please do bring along your constructed equipment and enter the contest. Entries do not necessarily need to have been constructed during the last year. Last years winner was Mike G3LYP – this year it might be you that carries away the trophy! The program this year offers the microwaver something different – come along and support the construction contest and hear the talks.

Below is the finalised timetable:

10:00 **Venue opens**

12:00 **Construction contest** judging commences

13:00 **Lunch** (rolls, sandwiches etc and tea/coffee available)

14:00 **Opening address** by Derek G3GRO and the results of the construction contest

14:15 **The Goubau single wire RF transmission line revisited**
– find out all about the famous G-Line by Prof. Mike Underhill G3LHZ

15:00 **The Type 85 Multi-Megawatt Air Defence Radar – A Cold War Monster!**
- by Derek Atter G3GRO

15:45 **Break**

16:00 **A 5840MHz receive converter for use with the C band beacon being constructed for the new ESEO satellite**
-by David Bowman G0MRF
-The dual conversion down-converter uses a sub-harmonic mixer and a Hittite passive frequency doubler to simplify the design.

16:30 **End of meeting**

The venue is the Crawley Amateur Radio Club's hut and directions can be found at:

www.carc.org.uk/find_us/directions.shtml

UK MICROWAVE GROUP SUBSCRIPTION INFORMATION

The following subscription rates now apply. **Please make sure that you pay the stated amounts** when you renew your subs next time. If the amount is not correct your subs will be allocated on a pro-rata basis and you could miss out on a newsletter or two!

Your personal renewal date is shown at the foot of your address label if you receive Scatterpoint in paper format. If you are an email subscriber then you will have to make a quick check with the membership secretary if you have forgotten the renewal date. From now please try to renew in good time so that continuity of newsletter issues is maintained. Put a **renewal date reminder** somewhere prominent in your shack (the editor suggests having it tattooed on your forearm!).
Please also note the payment methods and be meticulous with Paypal and cheque details.

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

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

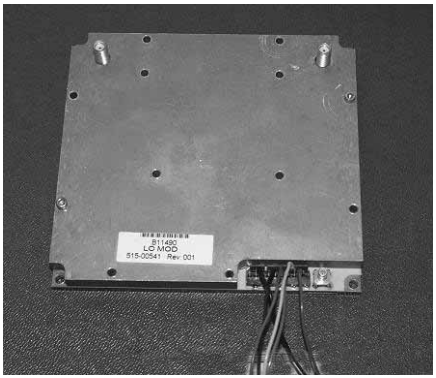
or

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

The standard membership rate for 2009 is:

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

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



Controlling the Bridgewave Communications type Microwave Synthesisers

… by Andy Talbot, G4JNT

At the RAL Roundtable, Paul M0EYT handed me a flat grey module, saying it was a 12GHz synthesiser and "could I do anything with it".

On opening it up, I found it to contain a synthesiser based around an LMX2326 chip and a Zcom CLV1525E VCO, followed by a conventional times 8 multiplier chain and splitter for two 12GHz outputs. The (several) internal regulator chips were found to be 5V out devices and the Power In was stated by Paul as being +8V.

There was no inbuilt micro or any logic for control and the three Microwire programming pins from the synthesiser chip were brought to the outside world on a 10 way connector. Connections for this were traced out and are shown in ***Figure 1*** below:

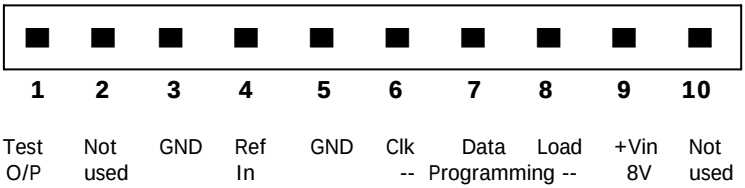


Figure 1: ***Bridgewave Communications Synthesiser interface***

There is no internal reference source … this has to be supplied externally. The pin for this has a track leading to pads for a PCB mounted coax connector adjacent to the 10 way connector so an SMC socket was installed here for convenience. Applying +8V power (350mA drawn) resulted in an unlocked 12GHz signal appearing on the two output SMA connectors. So all appeared to be working.

Programming:

I already had a PIC utility for controlling LMX1501 devices from a serial RS232 interface. (See http://www.g4jnt.com/synthblb.asm) This was built around the tiny 8 pin PIC 12F629 . The firmware was modified to send the commands in the format needed by the LMX2326 which wants 21 bit words consisting of 19 bits of Data (**R**eference and **N** divider values and the **F**unction or control register) and two address bits to define the register being programmed.

The connections for the interface are shown in ***Figure 2***. The four pin connector serves a dual purpose. It serves as the in-circuit programmer for the PIC and also as a direct interface to a serial or RS232 port (with an additional resistor). This allows a simple external interface for routine programming of frequency and setup information, as well as being able to update the PIC code as the need arises. The serial control allows values to be programmed into non volatile memory so it will boot up with the correct frequency at turn-on. See Appendix A for the serial command protocol.

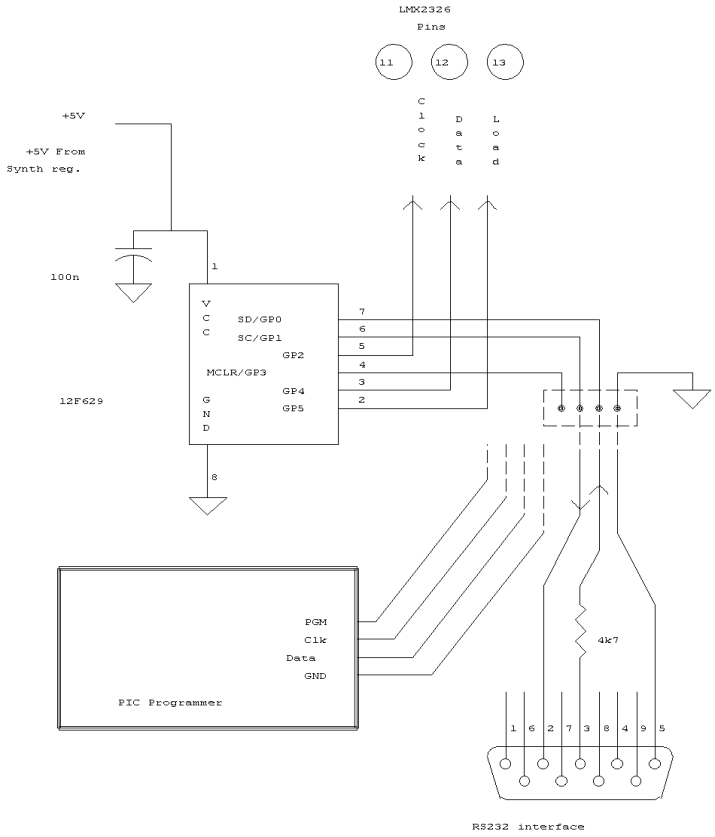


Figure 2 *PIC Controller Interface for LMX Synthesiser chips*

Synth Control

Close examination of the LMX23x6 data sheet available from http://www.national.com/mpf/LM/LMX2326.html gave the minimum requirements for the Function register – the only bit that actually mattered to the PLL operation was the VCO polarity bit which has to be set to 1 for positive tuning direction. All other bits can be zero. There is a convenient test-pin on the LMX2326 Pin 14, *Fo/LD*, which outputs one of several internal signals from the PLL depending on Function register programming. For initial testing this was programmed to give the divided-down N divider output. When looked-at on a scope it should consist of reference spikes at the comparison frequency and will show whether there is any PLL instability, or if it is even locked!

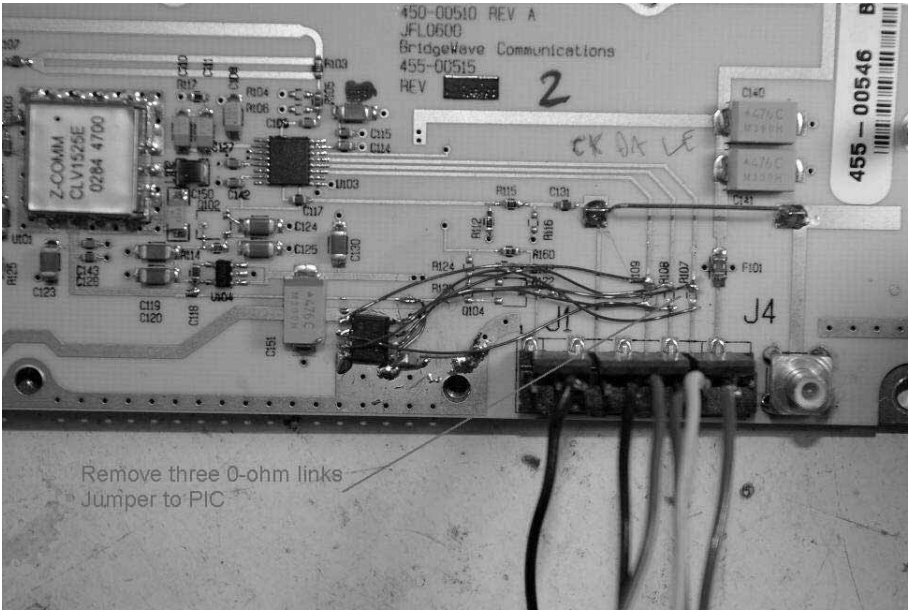
I used a 10MHz reference input and initially guessed the PLL might be set up for a comparison frequency in the region of 200kHz. So I programmed in values of R = 0x32 which is decimal 50 for the hexadecimal-challenged J and N = 0x1DC9 - (go on work it out) for the middle of the VCO's specified range. The spectrum analyser showed a nice clean signal at 12GHz. Then a brainwave struck .... a comparison frequency of 125kHz results in 1MHz steps at the output and N = output Frequency in MHz . (R = 0x50 and N = 0x2EF8 gives 12024MHz = 24048 / 2)

Although the VCO is only specified for 1500 – 1550MHz it locked happily down to at least 1450MHz which is good! This gives 11600MHz output, and when used as an LO for 24GHz, is 23200MHz, meaning that for a 24048 receiver it will allow any IF below 800MHz. It may even go lower but I suspect 11376MHz for a 23cm IF is a bit too much.

Shoehorning it in

As there is plenty of space on the Synthesizers PCB, it was decided to mount the PIC inside the case and apply the serial programming to pins on the existing 10 way connector. There are not enough spare pins for a complete interface as three are needed if PIC device programming is to be available as well as the RS232 interface. Fortunately, the LMX programming pins have zero-ohm links in their tracks to the 10-way connector so these were removed and the three external pins now became my interface.

The 8 pin PIC was glued onto the PCB adjacent to the nearest ground track I could find that wouldn't have part of the upper casing lying on top of it when assembled. Refer to the photograph ***Figure 3.*** A dab of superglue was used to firmly fix the chip in place which was installed the right way up with the pins lifted to clear. I've had unpleasant experiences with wrong pin connections and blown chips using upside-down dead-bug construction - perhaps this ought to be called live bug construction. The location shown is not the neatest place for it, but was the only place I could find where a direct connection to ground was available and resulted in six relatively long signal links going to the pads of the now-removed zero ohm links. Note the 100nF decoupling cap on the Vdd pin, also connected directly to ground. All totally OTT, and a much nicer job could have been made by installing the chip straddling the three signal lines, resulting in six short signal links and two longer PSU / ground ones. If the decoupling cap was connected directly across the PIC pins 1 and 8 it would still have been more than adequate.



The PIC Code as well as copies of the figures can be found at http://g4jnt.com/BridgeWave.zip

APPENDIX A: Serial Interface Programming Instructions

Commands are sent to the Synth Controller with ASCII commands. All commands must be terminated with a Carriage Return , shown as [cr]

In the examples below, data you type is shown underlined such as **N12345[cr]** and responses from the controller shown in italic ***N – 12345*** . Upper or lower case letters are accepted and typed characters are not echoed back

Do not put any extraneous spaces into commands – in the examples below a space is shown before the [cr] purely for clarity. If a command has the wrong syntax, no response will be received from the controller.

Make up an interface lead with a 9 Way D Female connector and 4k7 resistor as shown in Figure 2, and connect to your computer's COM port. Run ***Hyperterminal***, or ant similar serial driver programme with the parameters set to 1200 Baud, 8 Bit data, No parity, 2 stop bits and no handshaking : *1200 N81*

Connect the interface and turn on the synthesizer. A display similar to that shown should appear and shows the values stored in non-volatile memory with a brief description of the command protocol to change them.

LMX23x6 Control G4JNT
Commands:
Rxxxx
Nxxxxx
Fxxxxx
[U]pdate
[W]rite EE

R 0050
N 02EB0
F 00030

The three registers are updated by entering the letter R, N or F followed by four or five hexadecimal characters then [cr]. To set a new value of N, work out the value needed for the programmable divider, convert to a five digit hexadecimal number and type, for example **N02EB1 [cr]** If the data has been accepted the controller will respond with ***N-02EB1***

Do the same for R if desired, but note that this only takes a four digit value, for example **R0050 [cr]** will respond with ***R-0050***

Unless you really need to, and have studied the data sheet, leave the F value alone.

The values are not immediately written to the synthesizer, so all R, N and F can be set and all sent together. When all three have been succesfully entered, press **U [cr]** to send these values to the LMX2326 chip. If everything is OK, the frequency will jump to its new correct value and the controller will respond with :

R 0050
N 02EB1
F 00030
Updated

Pressing **W [cr]** instead causes the values to be written to non-volatile memory as well as updating the device, and will be loaded next time the unit is turned on.
The response in this case is :

R 0050
N 02EB1
F 00030
Written

Note that as it stands, there is no scope for setting the LD Precision bit – the MSB of the R register - via the serial interface. If you need to set this it will have to be changed in the PIC firmware.

The West Coast ATV Microwave Marathon Experience 26 July 2009.

By Martyn Vincent G3UKV (for GW3ZME/P)

This event was quite widely publicised early in 2009 and caught both mine (G3UKV) and Dave's (G8VZT) interest as we have both undertaken some microwave TV in the past, based initially on modified LNBs for receive and modulated Solfan (movement detector burglar alarm) systems for transmit. Dave had extended his experience through modified LNBs for transmit, building a complete 3cm ATV repeater (GB3DJ, Telford) and extending his station for ATV to operate on both 3cm and 24cm, both simplex and via repeaters. This event sounded like 'something different' after umpteen NB contest entries over many years from most corners of the UK and Eire.

We both had to sort through stacks of gear to sort out what may, or may not, be useful on the proposed activity day. Eventually we put together two complete 3cm stations, and also a 24cm ATV station. A re-programmed caption generator plus a couple of cameras were the sources of video, and it was decided that 2 metre FM plus HB9CV would provide the principal talkback facility around 144.750MHz (the national ATV talkback calling frequency). Both the BATC website and UK microwave reflector were used for some publicity prior to the event. Feedback from the former was zilch, and minimal from the latter. Never mind, press on...

Sunday arrived, with an appalling weather forecast promised and fulfilled! We left Shropshire promptly at 7:30 am and travelled the ninety odd miles to Cefn Du, IO83DF, a few miles south of Llandudno. It's 1140' (347m) ASL with a good take off, at least locally, in all directions. I was trying out a Caranex awning I had never used before, which attaches to the back of any hatchback car – and found it absolutely great, keeping the driving rain and wind at bay. It took under 10 minutes to erect, and I would have been relatively dry all day, if the two masts and tripod could have been put up as quickly. As it was, we both ended up with cold and soggy feet (too idle to put on the wellies I had brought...) for the rest of the day.

We started on 3cm ATV. Both our systems worked and Peter GW3PYB/P was very patient in finally completing a 2-way with us on that band, P5 both ways from his QTH near Amlwch, Anglesey, 40Km away. He even fleetingly spotted my own 10mW 3cm video signal, emanating from a smallish elliptical horn. In fairness to all, Peter was a bit at sixes & sevens too, with mislaid patch leads, etc. After that, apart from working each other at an estimated DX of 3 metres, we only had one further QSO (one-way) on 3cm, with Brian G3SMU on the edge of Winter Hill (94 Km).

As the rain moved away after lunch, we decided to move some gear slightly to avoid a possible local obstruction. It also paved the way for a particularly vicious squall of wind to blow over Dave's previously wind-proof tripod (actually, we believe the HB9CV + pole attached to the tripod, was the final straw – law of leverage etc). The superbly machined cassegrain feed plus elevation mechanism were both badly damaged and so we concentrated thereafter on 24cm ATV. The Anglesey TV repeater GB3TM was easily accessible but few other users seemed at all interested in having a QSO with us, even though we saw their test cards from time to time and sent our own back as a sort of bush-telegraph means of communication. Unfortunately, the mike for the inter-carrier audio had been left at home, so we could not make sound contact via the repeater, and calling or talkback on 2 metres seemed to be forgotten by several users. We both felt rather let-down by this myopic approach to what was supposed to be an ATV activity session.

However, we achieved an excellent 2-way ATV QSO with Phil, GD1HIA/P on the Is of Man (IO74OB, 114 Km), plus Peter GW3PYB/P and Brian G3SMU. We know-not what happened to the other stations listed as active that day but would offer the following suggestions "to whom it may concern" :-

- Monitor the 2 metre talkback frequency (eg 144.750 MHz) frequently - all day if possible; definitely don't sit on 144.750 for long periods, nattering;
- How about replacing one of the over-frequent summer series of microwave sessions by a wide-band event to encourage ATV and other simpler systems to be used (eg WBFM solfan/LNB systems or Bernie's G4HJW LNB receivers) by newcomers to this part of the spectrum ?
- If a future ATV and/or WB activity session is planned, for goodness sake, publicise the parameters and get it coherently organised. Four stations at one site, close to an ATV repeater, does not seem very sensible !

Anyway, we both enjoyed the experience and would welcome a repeat next year (with some changes HI !). ATV can be very interesting, although one operator revealed (if that's the appropriate word) that he would

not turn the camera on himself as he was not wearing any clothes !! If you've never tried ATV, or left the gear unused for years, just let your mind boggle and think of the possibilities.....

73 and happy viewing ... Martyn G3UKV

Dave G8VZT's bent 10 GHz antenna Cassegrain dish feed (now fixed!)

General view of both vehicles, QTH and some gear

3cm ATV pic received from Peter GW3PYB/P in Anglesey.

General view: Shows G8VZT 10GHz dish on tripod (before disaster!), 23cm antenna (38 ele from Severnside ATV group), plus elliptical TX horn and RX squarial for QRPP 3cm (G3UKV).

SOUTH YORKSHIRE MICROWAVES JULY 2009

This, the second event of its type was, according to all who attended, a huge success. What follows is a brief account and photographic record of the weekend in the hope that it may encourage more of you to attend in future. We have now made this event a regular annual meeting place for microwavers in the North of England and expect it to be as popular as the more established microwave roundtables held at RAL, Crawley and Martlesham. For those of you who have already been to these three latter events, South Yorkshire Microwaves probably sits between Crawley and RAL from in attendance figures and unique character.

The whole weekend's programme was videoed and will be soon be archived at www.batc.tv for reference purposes.

Saturday saw an attendance of around 25 or so budding ATVers at the ATV Workshop run by Peter Blakeborough G3PYB and Bryan Harber G8DKK. Ways of getting into microwave ATV were discussed and demonstated in a practical manner while Bryan explained the basics of making measurements (especially power measurements) at microwave frequencies.

When Saturday evening came along, a group of around a dozen met at a local pub for a very nice carvery meal (at only £3.50 a head!) and lots of 'chin wagging'.

On Sunday, the 50 or more visitors had the whole morning to mix socially and enjoy the very large and varied amount of fleamarket "goodies". These were housed in a large outbuilding to the side of the main club rooms which, by the way, caused many attendees to express their surprise and envy at the excellent facilities enjoyed by Finningley Amateur Radio Society members. FARS had gone out of its way to make everyone welcome. The organising group included a couple of lady members who arranged the provision of a superb array of sandwiches, homemade cakes, tea and coffee, throughout the weekend.

Several visitors brought fleamarket items to sell but FARS already had an enormous amount of their own on sale! This feature alone should attract more attendees next year.

The programme of talks during the afternoon was preceded by a welcome given by Eric G3KNU, the President of the Finningley Amateur Radio Society, followed by the chief organiser of the venue (and UKuG member) Kevin Avery G3AAF. Peter G3PHO (who organised the lecture programme) made a brief announcement of behalf of the UK Microwave Group, thanking FARS on the Group's behalf for the excellent organisation and the good weather that they had obviously arranged for us all!

Three most interesting talks then followed... Dave G4HUP described the Bawdsey Manor Project that he and a small group of Suffolk microwavers have just embarked upon. It will be based around the microwave beacon network as well as having a facility to actually have your own signal automatically received at Bawdsey and a reception report put up on the internet! Watch this space!

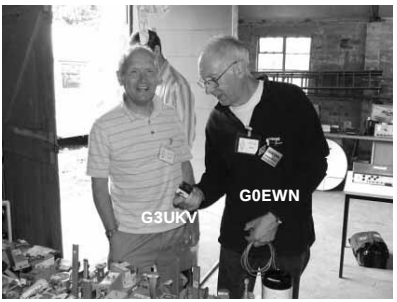
Bernie, G4HJW, then followed up Dave's talk with his, now classic, description of how to use an unmodified satellite LNB as a narrowband 10GHz receiver. He had one in the lecture room working all weekend, receiving a beacon which he had brought up and which he afterwards most kindly left for FARS to use as an attended beacon, G0GHK/B, on 10368.746MHz. Since that weekend, the beacon has been heard all over England, as far as Cornwall, and is providing a very useful replacement (albeit intermittent) for the now defunct GB3MLE. It's hoped that FARS will apply for a full GB3 licence and rehouse the Emley Moor beacons (23cm and 10GHz at least) on a permanent basis as the coverage seems really good.

The final talk was by Barry, G8AGN and was entitled Reflections on Reflections. After a brief look back at the history of radar, he described some of the experimental observations he has been making using readily available software and real time aircraft positioning monitoring equipment, along with an SD receiving setup. He's made some interesting and thought provoking observations of VHF beacons heard via aircraft scatter and moon bounce signals from the powerful French radar at Graves that transmits just below the 144MHz amateur band. He had some impressive Spectran waterfall displays to illustrate his talk.

All in all, this was a most excellent weekend, well attended and appreciated by all who were there. You too must come next July!

Above Right: Eric G3KNU welcomes everyone to FARS

Left and Below: At the fleamarket



Below: Just one corner of the FARS amateur radio museum

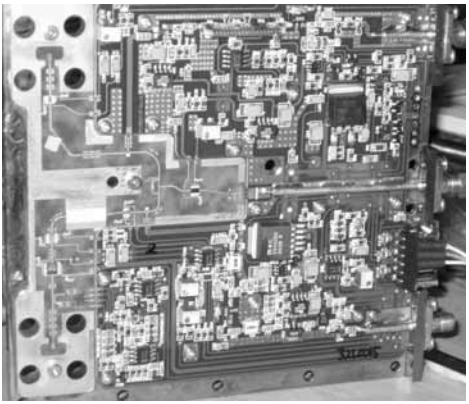
Below: G3PYB explains ATV to a couple of the visitors to the Saturday workshop

Below: The FARS club kitchen and dining room !

32GHz down converter for DSN reception

By Paul M0EYT

The Kepler mission was launched by NASA on the 6th of March 2009 with the aim of searching for habitable planets. The interesting thing about this mission in comparison to many others is that it will use Ka band for its primary science data down link and X band only for TT&C. I had copied the X band signal on the 8th of March, albeit not particularly strong but this is primarily due to the low antenna gain aboard the space craft. At this point I was fairly pleased to have logged another DSN space probe, although the thought had crossed my mind about the 32GHz signal, I had no suitable equipment to receive this signal.



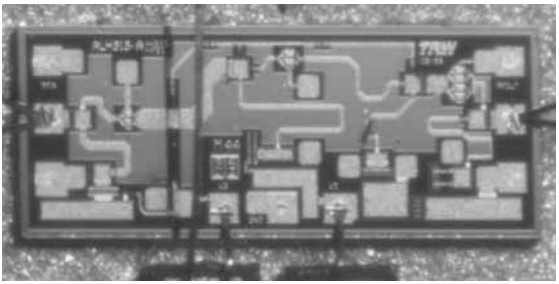
An email arrived a few after the launch from fellow Amateur-DSN enthusiast, Bertrand F5PL who lives in the south of France. He pointed me at an ex-microwave link part that was for sale on eBay covering the 32GHz band. The units certainly seemed to operate around the frequencies in question, but the seller knew nothing of the condition of them. Needless to say, one was ordered and it arrived a few days later. The up / down converter unit is made by a Korean company called Broaden. No details have been located as to the actual specification of the unit; it probably came as an integrated assembly for which specifications are available. The **photo right** shows the modified PCB inside the converter, the receive strip is at the top left, and transmit at bottom left.

Building the down converter

Since nothing was known about the unit, the first step was to guess the supply voltages; this was mostly based on the regulators that were present for the positive and negative supply rails (F5PL later confirmed the correct voltages).

This was done with no magic smoke being emitted and IF noise around 2GHz was noted on the output. The IF stages consist of a gain block, digital step attenuator and a driver stage. The step attenuator was removed from the PCB, as were the other matching pads and this was bypassed with a short length of coax, resulting in an additional 6dB of IF noise. The signal path therefore excited the mixer, had a few stages of amplification and was then output to the receiver.

Having got this far, the next phase was to determine the local oscillator input frequency. I checked out the multiplier chip but, again, no information could be found on line as to what its specifications were but the output had to be around 30GHz to 35GHz. There was only one way for me to work this out; generate a signal at 32GHz, connect the IF output to a spectrum analyser, sweep the LO input from 2GHz to 16GHz whilst watching for a signal. I'd made a chart of input frequency/power and LO output frequency/power. Following an hour of testing, I came to the conclusion that the LO must be 4885.714284MHz at 10dBm in order to produce a Ka band LO of 34.2GHz – there is an on-board multiplier that does this; unfortunately the text printed on the module is just too small to read.



The 4885.714284MHz was obtained with a brick oscillator locked to a 111.0389610MHz source which is GPS locked by a VE2ZAZ unit.

The TRW LNA (HMC-ALH313) is shown in the **photo left**. This is actually quite small, measuring around 0.7mm X 1.8mm. The LNA's specification mentions a noise figure of 3dB with an associated gain of 20dB over the 27GHz to 33GHz range.

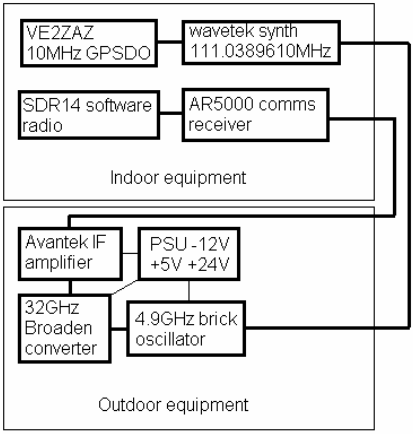
At this point, the board could be powered up, and signals received – the only problem

was that I had no source of a 32GHz signal to test it with. To fix this, I set up another GPSDO, a synth and an 8GHz brick oscillator. The brick had a short length of semi rigid on the output which has a mixer diode soldered across the end as a crude multiplier. Amazingly this worked fairly well, and gave me a signal on 32GHz which I could use for tuning. One task which was completed successfully was the retuning of the internal band pass filter, it was slightly too high in frequency. Adding tape made a measurable difference to the output signal, so the filter was peaked at 31.75GHz in order to make sure the band is covered sufficiently.

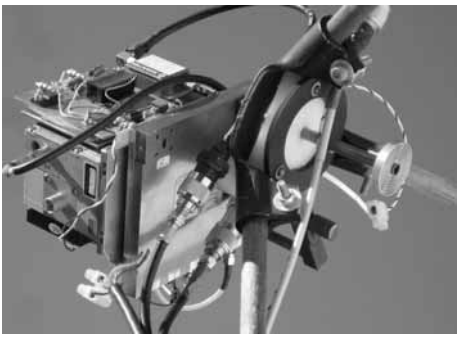
Once I was happy with the general performance, it was time to build the system and mount the converter on the dish. Initially, I'd used my 1.8m prime focus dish and suitable scalar feed. The sun noise response was very poor, only an increase of 0.3dB could be detected – the problem here turned out to be the rather poor surface accuracy of the dish; it's a nice performer at 8.4GHz but lousy at 32GHz! Plan B was put into action … this involved mounting a Prodelin fibreglass offset on the same AZ/EL mount as the 1.8m dish. Having done this, a sun noise check revealed about a 2dB increase over the 1.8m dish – this was satisfactory.

One of the main problems was optimising the feed, so some guess work was done, and the feed positioned in about the right place. Using the JPL Horizons ephemeris software, the position of the Kepler space craft was computed, and over 3 ½ weeks, one hour a night was dedicated to tracking the space craft and looking for the signal.

The general layout of the Ka-Band receive system is shown in the **block diagram right**:



As with a satellite TV LNB, all the microwave equipment is mounted right at the focal point of the dish as shown in the picture below, with only low frequency IF and reference signals being fed to it.



The scalar feed was milled out according to the CT1DMK scalar ring design spreadsheet.

On the Air

No signals at all, nothing!! – This was indeed very frustrating. I was convinced that the receiver was working in a reasonably good manner, but I knew nothing of the transmission schedule from Kepler, and NASA didn't answer any emails on the subject, I was working in the dark. John G0API popped round for a cuppa, and in the resulting discussion about the system, he mentioned that the sun noise showed that the system was indeed in the right ball park to be able to detect at least something from the space craft. I'd intended taking the 32GHz system off the dish, in order to make room for the 20GHz down converter, where there are actually signals to receive! Luckily I kept the 32GHz system in place 'just for another week'.

The procedure I used to tune to the correct downlink frequency was to set my local 'test' source 10KHz below the computed space craft downlink frequency. This gave me a sanity check signal to ensure the system was working properly end to end, and an idea that it was actually on the right frequency.

The DSN frequency spreadsheet (available online at http://www.uhf-satcom.com/DSN.xls) was modified to cater for Ka band downlinks, and to calculate the local test source synthesiser frequency.

Success at last!

Following the 3 ½ weeks of nothing, on the evening of 29th April 2009, I finally struck lucky and copied the

Spacecraft TX frequency	Velocity	Doppler corrected	Doppler shift	IF Tuning Freq	Local test sig
(MHz)	(KM/s)	(MHz)	(KHz)	(MHz)	Synth freq
8424.506100	1.200508	8424.472364	-33.735617	424.506100	
32166.290000	1.200508	32166.161191	-128.808696	2033.838809	100.519254

signal from Kepler, witnessed by fellow tea-drinker Carl G6NLC. Initially I'd assumed the signal was in fact something local, it was only on closer examination with Spectran, that the Doppler shift could in fact be seen. This means that it was in the right place, on the right frequency so therefore it had to be Kepler! At the time, the distance to Kepler from my dish was 5173000 Km or 3214000 miles - 0.035 AU, 13.46 times the distance to the Moon. Not bad DX!

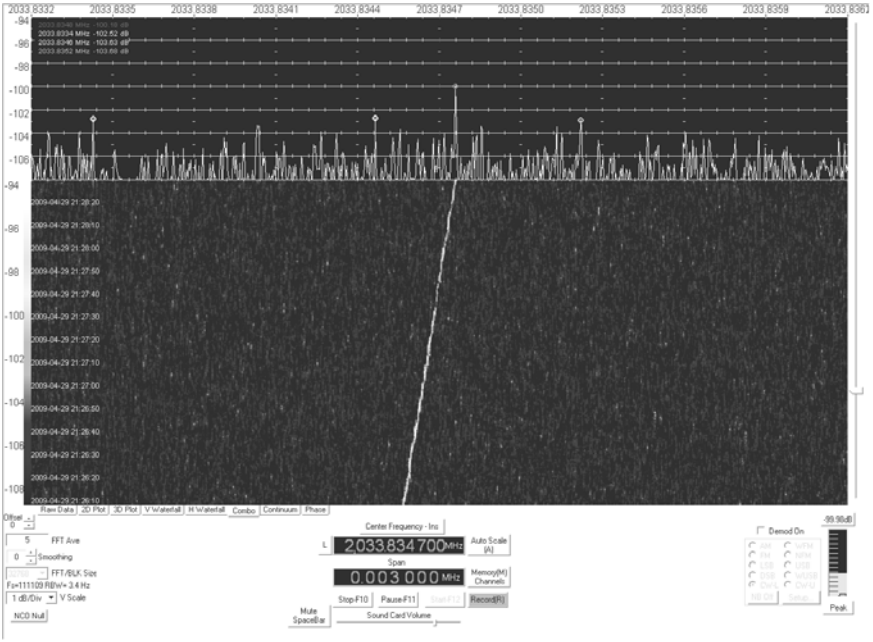
The **FFT screenshot below** shows the captured signal. As usual, it is made with the RF-Space SDR-14 software defined receiver. This is coupled to the IF output of the AOR receiver, allowing the correct frequency to be displayed in the SpectraVue control software. The carrier from the space craft peaked at 8 to 10dB above the noise – one of the interesting observations I made is, that during periods of light rain, the signal visibly 'fuzzed' in the FFT, only to return to a consistent thin line during periods of clear weather.

The next task for the 32GHz system will be to try to copy a signal from the Mars Reconnaissance Orbiter – this is indeed a big task as the space craft is in orbit around Mars, so I'll have to wait until it's a little nearer to Earth. Also in the pipeline is a 26GHz receive converter which is to be used for the NASA Lunar Reconnaissance Orbiter mission, due to be launched no earlier than the 5th of June 2009. This receive converter has been tested on the bench and can easily hear the GB3SCK 24GHz amateur beacon just on open waveguide.

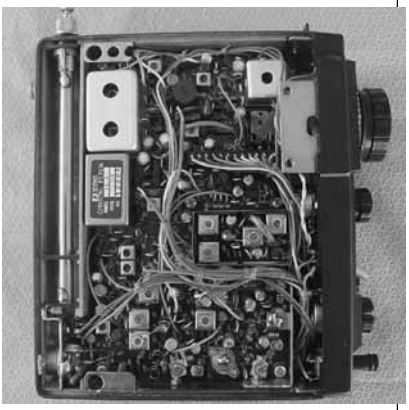
There is further information on my website at http://www.uhf-satcom.com where you can find up to date info on some of my satellite based projects.

(Note: this is why you never hear me on the air, I'm too busy listening to noise!)

If you have any questions on Amateur Deep Space reception, please either email me at pjm@uhf-satcom.com or join the yahoo group http://groups.yahoo.com/group/amateur-DSN



FOR SALE



IC-202E 2M SSB TRANSCEIVER

In excellent unmodified condition - with microphone, CW shorting plug, and original English language handbook (plus circuit). Crystals installed allow coverage of the four 200 KHz wide tuning segments centred around 144.100 MHz, 144.300 MHz, 144.900 MHz and 145.900 MHz. This is definitely the cleanest IC-202 for its age that I have seen in recent years (see pics) and it's working perfectly! The only sign of its age is that the paint on the top has become a little wrinkled. Asking **£100 or near offer. I CAN ARRANGE DELIVERY IN THE UK when I come over in mid-September this year. Contact: Doug Friend, VK4OE, friends@squirrel.com.au**

ANTENNA TEST RANGE RESULTS … RAL APRIL 2009

47GHz :

Antenna	Range	Reading	Total	Gain (dBi)	Comment
Dubus early design Horn, DF6NA	-50	-3.0	-53.0	20.3	used as reference
35cm BSB dish, G6GXK	-40	-0.6	-40.6	32.7	
Andrew VHP1-370AD23, G8ACE	-30	-5.0	-35.0	38.3	38GHz commercial
S8 2-300NEC1 RFS, DF6NA	-30	-4.0	-34.0	39.3	
MRC 40cm dish, DF6NA	-40	-4.5	-44.5	28.8	
Procom 250 New version, DF6NA	-30	-9.0	-39.0	34.3	
Horn, G6GXK"	-50	-2.0	-52.0	21.3	pattern problems?

76GHz

Range had to be abandoned due to what was later discovered to be a detector problem

.. Lessons have been learned...

24GHz:

Antenna	Range	Reading	Total	Gain (dBi)	Comment
Reference Horn, G6GXK	-40	-4.0	-44.0	13.0	used as reference
Procom 25cm, G4FSG	-30	-4.0	-34.0	23.0	
EMS 26H-90, DF6NA	-40	-4.0	-44.0	13.0	90 deg sectorial horn
RFS-SB2-190 60cms, DF6NA	-20	-7.0	-27.0	30.0	
Precision Antennas 35cm	-30	-1.0	-31.0	26.0	

Some doubt was being cast on the previously measured gain of the reference antenna.

This will be checked at the next opportunity and the results updated if required

Tests on a 10GHz slotted waveguide antenna for the GI beacon

John Worsnop G4BAO

Introduction

Recently, Sam G4DDK asked me to make him a 16 slot, WG16 slotted waveguide antenna to use in the proposed 3cm beacon for Northern Ireland. The design is neither original nor novel. This paper describes the results we measured on Sam's homemade "ground reflection" antenna range.

The Range

Much has been written about the "ground reflection" method of testing antenna polar patterns, so I refer you to the references for details (1), (2)

Design

The design is a 16 slot (8 per side) version of that proposed in the excellent W1GHz online antenna book (3).

The top slot is one quarter wavelength from the closed end, and the antenna is matched with a 2 screw tuner at the waveguide flange (feed) end.

It was cut "by hand" using a 1.6mm slot drill on a Proxxon MF 70 micro-mill from Axminster Tool centre (4).

Testing

The antenna was tested in three different configurations on the test range.

- With the detector at right angles to the slot (Fig 2)
- With the detector running parallel to the pole (Fig 3)
- Raised clear of the pole with a length of Waveguide 16 (Fig 1).

Fig. 1: The slot antenna on top of a waveguide extension

The antenna was rotated at 20 degree intervals and the gain compared to that of a 20dBi Horn.

With the first configuration there appeared to be a difference between the gains "front to back" so this prompted us to try changing the configuration to see if the detector position was affecting the results.

Results

The resulting polar patterns measured for the three configurations are shown in Figure 4.

A maximum gain of around 13dBi was measured in the main lobe. We estimate the range error to be in the region of 1-2 dB depending on direction.

Observations on results

The first thing to notice is that the pattern is far from omni directional. This ties in well with what is known already, as the antenna does not have "wings" fitted. The pattern shows a classic "cross" shape with maximum gain on the broad sides of the guide where the slots are cut.

Effect of mounting hardware and range

It is clear from the black and red plots with the antenna feed close to the pole, that the detector and or pole are affecting the front to back ratio. (which in theory should be unity).

Putting the detector parallel to the pole, improves things by about 2dB, but elevating the slot on a length of waveguide has dramatic results of around 5dB (green plot) making the front to back ratio unity again.

This has repercussions as to the mounting of these antennas on a beacon site. It is advised that they are cut from a piece of waveguide that is at least twice the length required by the slots to enable the active part of the antenna to be well clear of the feed point and mounting hardware.

I think the sharper null at 120 degrees may be an artefact of the range, as a second slot antenna was measured and this showed a similar larger null. Interestingly, Sam's HF vertical was exactly in that direction about 5 metres away from the antenna.

If true omni directional performance is required, the antenna needs to be fitted with "wings" .

Fig. 2: The slot antenna with detector

Fig. 3: The slot antenna with detector vertical

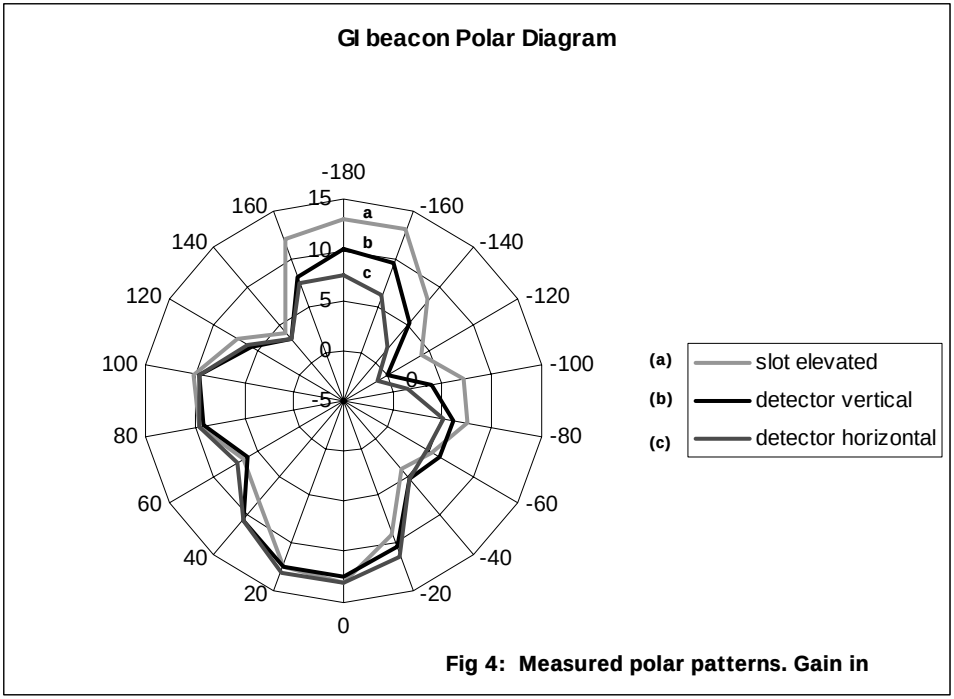


Fig 4: Measured polar patterns. Gain in

Acknowledgements

Sam, G4DDK for the use of his back garden for the afternoon.

Dave, G4HUP for the photos

References

(1) Paul Wade, "Antenna range measurements" http://www.w1ghz.org/antbook/chap9.pdf

(2) An Introduction to Antenna Test Ranges, Measurements and Instrumentation http://www.lehman-inc.com/pdf/mag.pdf

(3) W1GHz online antenna book: http://www.w1ghz.org/antbook/preface.htm

(4) Axminster power tools: http:// www.axminster.co.uk

SILENT KEYS

It is with deep regret that we record the recent passing of John Tye, G4BYV, and Ken Willis, G8VR, both of whom were well known and influential UK operators on the VHF, UHF and microwave bands for several decades. Some of the many tributes received are shown below ...

John Tye G4BYV SK

The photo left shows John and the reproduction pre WW2 wireless set he built himself some years ago

From: G4DDK <jewell@btinternet.com>
Tuesday, July 07 2009

Many of you will remember John, the voice of East Anglia and well known microwave DXer. Simon, G3LQR, has just informed me of his passing and asked me to let the group know. John was taken ill last week and I guess succumbed. Vale John

From: G3XDY <g3xdy@btinternet.com>

I am very sorry to hear of John's passing. G4BYV was one of the real microwave pioneers in East Anglia and his results provided inspiration to those of us working towards getting on the microwaves in the 1970s and 80s.

73 & Vale
John G3XDY

From: G3PHO <microwaves@blueyonder.co.uk>

I'm very saddening at this news. John was an old friend. He often sent me snippets of information for the newsletter and was firm supporter of the UK Microwave Group. He is well known for the many UHF and microwave "Firsts" that he achieved long before DB6NT kitsets and Ebay amplifiers allowed many of us to catch up! Always a friendly face at the Martlesham Roundtable, I shall miss the conversations I had with him but the contributions he made to our hobby will last for many years to come.

Rest in peace John and 73 ... from Peter G3PHO

Ken Willis G8VR SK

The photo right shows Ken on the air in 1939. For more go to:

http://www.uksmg.org/content/50yrsof50megspt6.htm

From: GM4CXM 26 June 09
It's sad to read the message from M0ELS on 'KST this morning to inform that Ken G8VR has passed away.
I rarely met Ken in person (Sandown Park VHF Conventions) but we had communicated over many years on the air or in his capacity as a columnist. Most recently our contacts have taken place on 23cm where he kept on reminding me that he'd only ever worked GM twice over many years of activity yet via aircraft scatter we were completing contacts in the morning with almost 100% success, something that gave him a lot of pleasure and the desire to improve his station further.

RIP. 73 Ray GM4CXM

From: John G4BAO
I'm so sad to hear this news.....
While I never met Ken in person I felt a close connection to him through our email and 23cm correspondence.
Ken was the same age that my late father would have been, and suffered from the same disease (diverticulitis) that, a couple of years ago, finally saw off my old man . Ken was very considerate to me during that time.

We not only shared that, but we also shared a passion for "unpopular" football teams that had fallen on hard times, me Leeds United and Ken, Charlton Athletic. We used to come on either KST or 23cm and sympathise with each other! As far as I know only until the last couple of years, Ken was going, by coach, to all the Addicks home matches but told me a year or so back that it was just getting too much for him to get from the coach park to the ground. He told a similar tale about erecting his antennas as well I'm afraid! Despite that he was active until very recently. Right up to the end, Ken was interested in microwaves and I last saw him on KST earlier this year, still looking for the DX .

When I was starting up on 23cms in earnest, he sent me, completely unprompted, a 2C39A PA and all the bits to make a PSU for it. His comment then was along the lines of "well someone's only going to have to clear it out of my loft in a few years time anyway!"

A fascinating fact that some of you might not know, he told me a little about his post-war activities, which included setting up the comms links for the first British Atom bomb tests. I'd love to have spent more time talking to him about this.

Well, Godspeed Ken Willis, 23cm won't be quite the same without you.

From John G4BAO

By Robin Lucas, G8APZ

Another bumper crop of reports this month, and for the second month in a row, I've had to requisition the back page. I'd be very pleased if this level of input could continue!

With the rainscatter season now well under way, there are more than the usual level of RS reports. The UK doesn't always get into the very high rain cells which occur in summer over mainland Europe, but nevertheless, some inter UK activity can still benefit from the lower level blanket rain which seems to be so abundant this summer!

CONTEST and ACTIVITY REMINDER

August

18-Aug 1900 - 2130 1.3/2.3GHz Activity Contest Arranged by VHFCC (RSGB Contest)
23-Aug 0900 - 2000 4th 5.7GHz Cumulative
23-Aug 0900 - 2000 4th 10GHz Cumulative
23-Aug 0900 - 2000 4th 24GHz Cumulative ******

September

27-Sep 0900 - 2000 5th 5.7GHz Cumulative
27-Sep 0900 - 2000 5th 10GHz Cumulative
27-Sep 0900 - 2000 5th 24GHz Cumulative ******

**** G0RRJ Memorial Trophy**

FRENCH JOURNEES d'ACTIVITE (JA)

29th-30th August - 1296MHz and up
26th-27th September - 1296MHz and up
24th-25th October - 1296MHz and up

Duration of all the JAs (except for 12th July) is from 17:00 Saturday to 17:00 Sunday

UKuG LOW BANDS CONTEST

From: Mike, G0JMI/p
On Sunday 7th June, I took part on all three bands, from Holybourne Down, Alton, Hants (IO91ME), helped by Nigel, **2E0BUF**, who made the change over between bands.

On **9cm**, we heard the **GB3OHM** and **GB3SCS** beacons, and on **23cm GB3MHL**, **GB3IOW**, **GB3USK** and **GB3FM** (repeater). I think we heard **GB3FRS** on **1296.850MHz** but there seems to be no keying working on this beacon to identify it.

The following ended up in the log on **23cm**: **G8AIM** (IO92FH) 131km, **G3TCT/P** (IO91GI) 39km, and **G4RFR** (IO90AS) at 84km. On **13cm: G3TCT/P** (IO91GI) 39km and **G4RFR** (IO90AS) at 84km, and on **9cm**, **G8AIM** (IO92FH) 131km, and **G3TCT/P** (IO91GI) 39km.

I run QRP on these bands: **23cm** 2W, **13cm** 0.5w and **9cm** 200mW to a 2.5ft dish, so I was really pleased.
73, Mike, G0JMI

RSGB UK ACTIVITY CONTEST

The session on 16th June seemed quite well supported. Pete **GM4BYF** (IO85JV) in Edinburgh now has a masthead preamp. On only his second attempt on **23cm** he found some surprisingly strong signals. Pete said that signals were definitely best at the start of the contest. He worked three **GM** stations, in addition to **G4BRK** (IO91), and **G8ATB** (IO83).

G4BRK was troposcatter and readable for 80% of the time, whereas **G8ATB** was 59 at times down to 53.

John, **G0API** was with **G4RFR** and they managed to work 14 stations on **23cm** and 6 on **13cm**. The strongest station they heard was **F4BRK** in IN99VF, who called in off the side of their beam. He was a massive tropo signal, probably due to a duct across the channel.

Best DX was to JO02 with 3 stations, and on **13cm**, John **G3XDY** was an easy 529.
Most of their contacts were the result of direct CQ calls on **23cms.**

Ray **GM4CXM**, managed 20 contacts on **23cm** in the June session, beating his 18 contacts in the May session. Ray was very busy throughout the evening, with contacts being made right up to the end. He found conditions to be quite variable, with signals from the north of England and Wales up on normal whereas it was variable for signals from much further south.

The final log contained four **GM**s and two **GW**s, and ODX this time was John **G4EAT**, in JO01 at 572km. The contact appeared to be a

combination of troposcatter combined with aircraft enhancement.

RAINSCATTER

During the late afternoon of 15th June, some very intense storms developed over the UK, mainly in the East. One of these was centred in Essex, right above **G4EAT** and **G8APZ**. The thunder and lightning was incredible, and the torrential rain and hail caused local flooding.

John's SKY digibox and his telephone system were frazzled as a result of a very near strike, but luckily there was no damage to the radio gear!

There were at least seven UK **3cm** beacons spotted during this deluge, but there didn't seem to be much traffic on the bands.

On 17th June, a rather large rain bank moved across the UK giving some localised scatter opportunities. Around lunchtime, Dave, **G0DJA** heard the **GB3XGH** beacon on **3cm** for the first time from home, whilst pointing his small horn out of one of the windows!

Gordon, **G0EWN** found that rainscatter has yielded a couple of good sessions on **3cm** from IO93. One inter UK event when he was hearing **GB3XGH** on a number of days, and one event to the EU with Gerd, **DJ5BV** in JO30KI and a number of French stations worked out to 750km or so.

From: Bob, G8DTF

On Tuesday 23rd June I noticed that a warning for heavy rain had been issued by the Met office, so when I got home I switched the **3cm** gear on to warm up and got 'KST going. The dish was at 4 feet AGL as I had not extended the legs of the tripod.

GB3XGH was very strong on RS with multiple rain showers providing scatter. I peaked the dish on the strongest scatter from **GB3XGH** and turned on my beacon. **G3CWI** was on 'KST but was not getting scatter. **G3VKV** (183km) was also about and we very soon had a contact. A contact with Martyn **G3UKV** (88km) followed shortly after with good signal strengths on RS.

This was my first experience of RS other than hearing **GB3XGH** via RS. A very interesting mode of propagation. Regards, Bob, **G8DTF**

DIGITAL MODES - MICROWAVES

In late 2007, Joe Taylor **W1JT** released some experimental modes for use on the microwave bands. One of these is JT4, which has a number of variants ranging from JT4A to JT4G.

JT4 uses 4-tone FSK, so it can also include both a sync bit and a data bit in each symbol. The keying rate is 4.375 baud, and seven different tone spacings are offered.

Each sub mode of JT4 increases the occupied bandwidth of the generated signal, from JT4A (4.375Hz tone spacing and 17.5Hz total bandwidth) to JT4G which uses 315Hz tone spacing and a total bandwidth of 1260Hz, which is more suited to EME on the higher microwave bands, and for rain scatter at **10GHz**.

Multi-path, QSB, aircraft and rain scatter have made previous WSJT modes unusable at these frequencies, due to the spectral spread of the tones.

On 17th June, I asked Sam, **G4DDK** to do some tests with me on **10GHz** using the JT4G mode. The user interface is identical to that of JT65 which is already familiar to many.

Early in the tests, it was noted that drift can be a problem when the local oscillator is not locked to a reference. This was easily overcome by slowly following the drift with the RIT, but a better solution would be to use a phase locked oscillator.

The results so far have been encouraging, with JT4G proving itself to be resilient to drift, fading and scatter. The width of the tones due to scatter was up to 100Hz but 100% copy was still possible.

Further tests are needed, at longer distances and much weaker signal levels, but the first impression on **10GHz** was that it works well over an 83km obstructed path.

A few days later and Sam was testing on **23cm** with **G0EWN** and **GM4CXM**. A solid contact on **23cm** ensued with Ray despite Sam hardly being able to hear the signal.

In further **3cm** tests with Andy, **G4JNT** (IO90IV), Sam reported 100% copy with both stations locked and spot on frequency. Sam says they could see the difference in calibration of their IF rigs!

6cm/3cm/24GHz CUMULATIVES

The second leg took place on 21st June.

From: Richard, G3CWI

A very enjoyable day. The first site was Hope Mountain, near Wrexham in Flintshire. This was a good site with access on foot. 17 contacts with best DX being G4ZXO/p two way SSB (316km). Initials were **GW3TKH/p**, **G4BLH/p**, **G3THW/p** and **G8JVM**. Light showers were annoying rather than helpful. A tent made operating very cosy. I walked 2.5km and ascended 180m (mainly because several trips were needed to get everything to the summit and back).

This was followed by 2.5 hrs down-time during which I drove 50+ miles to Axe Edge. There a further 11 contacts were made. Best DX was **G4ZXO/p** again (288km 2xSSB). I was especially pleased to work Dave **G0DJA/p** in his first Cumulative. The weather was improving and I finished in sunshine.

All the usual **10GHz** fun was had; "I thought you were calling first", "I don't have a compass", "we don't know where the dish is pointing" but this time most contacts worked out - eventually. One notable failure was a test with **G4LDR/p** (IN79jx) but he was up to 4 contacts (**ALY**, **NNS**, **ZXO**, **WYJ**) so he was doing well from a very remote spot.

73 and thanks to everyone, Richard, **G3CWI**

From: Peter, G3PHO (IO93AD)
Not a bad day out at Merryton Low Triangle.... 38 QSOs (27 on **10GHz** and 11 on **5.7GHz**). It was good to see more portables out again (things are looking up in this direction!). Best DX was **G4ALY** (IO70VL) on both bands.

Strongest signals over 300km were from **G4ZXO/p** on **10GHz**. **GW3TKH/p** was also a very big signal with me. Many thanks to Richard **G3CWI** and Keith **GW3TKH** for activating Wales this weekend, but where were the **GI**s and **GM**s??

My roadside location showed itself to be quite poor to the SE when Richard **G3CWI/p** worked one or two from his Axe Edge location, just a few km north of me. He easily copied **G4EAT** on SSB when I was struggling on CW with my bigger dish and higher power. I had immediate rising ground in John's direction whereas Richard had a rapidly falling take off proving the importance of location, location, location! In view of this I probably won't use the site again for these 2 bands. **IO93PW** in East Yorkshire is now my preferred location.

I notice that the Grand Prix seems to syphon off some microwavers from their more important duties of operating! Personally I think that motor racing is like watching paint dry compared to working on the microwave bands ;-)
73 Peter G3PHO

Over in Cornwall, Ralph, **G4ALY** found it rather hard going. For reasons best known to the other contestants, they seem only to call **G4ALY** towards the end, despite Ralph having spent maybe 8 hours listening to them all off the back of their beams!

Don't leave it until the end, since Ralph may decide to QRT early next time! Ralph worked just five (yes five!) on **3cm** and six on **6cm.**

Dave, **G6KIE/p** and Steve, **G1MPW/p** worked from Firle Beacon (JO00AU) for the June event, and the day didn't get off to a good start. One section of their talkback mast failed at the swaged joint which left it a bit shorter than usual. At least it failed before it was even off the ground and not when it was up !

After a slow start, using a mixture of 2m and KST the pair went on to make 13 two ways - and Dave managed a one way to **GW**. The long grass caused problems with hay-fever , so they had to make a fairly early finish, with the best DX of the day being **F1NPX/p** (JN28JW) at 401 km. By the end of the day, Dave had worked five countries (**G**, **GW**, **PA**, **ON**, and **F**) - he hasn't had such a good haul before.

Dave and Steve both found **24GHz** disappointing, the only QSO was with Peter **G4ZXO/p** at 12km - a test with John **G4EAT** (JO01hr) produced no signals either way - but it was 105km - so it wasn't too much of a surprise.

From: Bob, G8DTF
A quick report on my recent activity since I have rebuilt my **3cm** system. In the June Cumulative (21st June) I operated from Matchmoor Lane on Winter Hill (IO83RO), and in a 2 hour period I worked **G3CWI/p** (64km), **G4BLH/p**(27km), **G3PHO/p**(64km), **G3VKV** (193km) and **MW1FGQ**(62km). All of them were relatively strong signals. I was only using 144MHz talkback until the last 20 minutes as the batteries in my laptop were almost flat. I did try with **G4EAT** and **G3XDY** but with no success.

From: John, G8ACE, Winchester
There seems to have been some positive comments about this last **3cm**, **6cm** and **24GHz** activity on the reflector.

However I was most disappointed up on Walbury Hill (IO91GI) as the most different stations I ever heard on 144.175 talkback was around eight between 11.00 and 16.00 BST. I know contacts were set up using 'KST so there is no doubt in my mind now that 'KST is killing off calling CQ on .175 If you use 'KST then you're not being heard on 2m.

I'm doubtful its worth making treks beyond one's local hilltop if this is the continued way forward. Perhaps a rule that says you can only claim points with /p stations if contacted initially by radio would help this matter? I don't mean 'KST by phone or laptop dongle would qualify as by radio either.

On the positive side I was pleased with the results using a roughly 5" square horn integral to the rig on **6cms**. **73s John, G8ACE**

[Note that there is "Section R" in UKuG contests for "Amateur radio only talkback (no KST or telephone)"]

Chris, **GM4YLN** took the opportunity of doing a **10GHz** test during the contest. He made contact with **GM3SBC** for his first ever **10GHz** narrow band QSO. Chris says it was "only" 37 miles (60km) but it was from his shack window!

Chris hopes to go portable when he gets a bracket made to fit his transverter to the tripod.

It is refreshing to hear about newcomers to **3cm**... and especially in **GM** land. There is a good core of stations becoming equipped for the band, and this can only be good news. Well done Chris.

I can still remember my first 70cm QSO in the late 60s and it was a lesser distance than that! I also remember that **G8AZU** was my third contact on that evening (now **G4NNS** - UKuG Chairman). It is always a thrill to make that first contact on a new band.

Roger, **G8CUB/p** operated from Mountnessing (JO01EP) for the first couple of hours, and worked **G6KIE/p** and **G1MPW/p** (JO00AU), then the short hop to **G4EAT** on all 3 bands. A **10GHz** attempt with **G3ZEZ** failed, as did **5.7GHz** with **G4BRK.**

After that it was Therfield (IO92XA). The first contact was with **M0DTS/p** (IO94LI) direct on **10GHz** 58/57, followed by **G0EHV/p, G3CWI/p** at his second site, **G4EAT, G4ZXO/p**, **G3XDY**, **G8DKK**. On **24GHz** **G4EAT** and **G4BAO** were worked.

Roger says it was a good day out, but it nearly didn't end so well. When taking the kit down, the ladder gave way (very little room for it), and he very nearly fell off the Transit roof with dish, transverters and all!

STEAM POWER ON 10GHz

From: Mike Wade M0EDU

Some time ago, I built a Bob Platts designed kit for a **3cm** ATV TX using a Gunn diode, together with the matching receiver. This year it was used at a school radio day for the pupils at Charters Ancaster primary/prep school in Bexhill. Members of Hastings Electronics and Radio Club set up an HF station and the pupils were able to ask questions of the operator at the Norman Lockyer Observatory, which this year celebrated the 400th anniversary of astronomy.

I reported a while ago that I intended to operate some **3cm** ATV from steam generated power. The breakthrough only came recently when I got round to making a steam generator which now provides 12 volts, opening up a choice of projects that can now be powered. On the 6th June BSES open day, it powered the **3cm** ATV TX. The matching **3cm** ATV receiver was used in the radio room and showed a good picture of the Steam Engine buildings outside where the ATV TX was operating from the steam powered generator which was using a Primus stove for the steam.

On Sunday 7th June, the same set up was used during a Brede village fete when the public visited the 1st Brede Scouts camping ground. Here a camp fire provided the steam for the generator and the **3cm** ATV TX transmitted a picture of the BSARS radio hut in the scout ground to the ATV receiver and monitor showing the picture at the radio hut.

Explanations were also given about the ten Peltier units sandwiched between steel plates which were steam heated and water cooled, each producing about 1.2 volts making the 12 volt output.

73, Mike Wade **M0EDU**

PS It has occurred to me that the next step could be a digital microwave link powered by steam - the risk is, I suspect, it might easily get me put away!

BEACON NEWS

G0GHK is a new, attended **3cm** beacon located at Finningley ARC (IO93NN). It is currently operational on Tuesday evenings, and at weekends.

The hardware consists of the spare **GB3CAM** unit, which is why it's so close in frequency! The beacon produces 1W, followed by 30dB of cable loss up to an antenna mounted PA to bring the level back to 1W. This is fed through an isolator into a slot antenna consisting of 8 slot pairs (but no wings).

The beacon has been widely received in the first few weeks of operation, and interestingly, it is getting far more spots than the late **GB3MLE** beacon used to get! Ruud, **PE1BTV** wrote with news of more **PI7ALK** beacons within the next year. The group are building six beacons in total, covering **23cm**, **13cm**, **9cm**, **6cm**, **3cm**, and **1.2cm** and all will be on ****.920**

The **13cm** and **3cm** units are finished and **23cm** is nearly complete. The other beacons are still under construction. Ruud has recently applied for the licence.

LONG DISTANCE 10GHz TESTS

During the last week of June, a number of teams were on various expeditions for some planned **3cm** tests from Portugal, the Canary Islands, and the Cape Verde Islands. There were several objectives - to make QSOs between **CT7-EA8**, **D44-EA8**, and finally **CT7-D44**.

On 19th June, Jean Claude


Jean Claude, F5BUU

CT7/F5BUU (IM57NH) set up a beacon on **10GHz** aimed towards **EA8**. At the **EA8** end was Peter, **EA8BFK** (IL28XR). Another team was on their way to the Cape Verde Islands (**D4**).

On Saturday 20th, the first **3cm** QSOs were made at 18:05 with 59+++ signals at a distance of 1068km with **EA8BFK** operating his station on the beach. In Portugal, two stations were QRV operating 1.5km apart with **CT7/F5BUU** (85m asl) and Philippe **CT7/F6DPH** (40m asl).

A few hours later, Jean Claude was in QSO with the **D44** team on 2m at 59, and they reported receiving the **10GHz** beacon which had been set up in southern **EA8**. However, despite the teams spending almost a week of testing, it was not possible to make that very elusive QSO with **D44**.

The team at the **CT7** end consisted of **F6DPH**, **F1URI**, **F1AAM**, **CT1HZE** and **F5BUU**.

EME

From: Dave Robinson, WW2R/G4FRE

It was nice to hear 4 UK stations off the moon on **3400MHz** during the activity weekend organised by **G3LTF**. I worked two, **G3LTF**and **G4NNS, -** the escapees were **G4RFR** and **G3LQR**. **G4RFR** was up on 3400.450 due to QRM , so it was hard to keep an eye on with the panadaptor! Although IO91 had 2 active stations, EM13 had three, all within a 10 mile

TROPO

On 23rd June, Gordon, **G0EWN** caught a good tropo opening - lots of beacons were showing on all bands from **23cm** to **3cm**. On **23cm**, **DC6UW** was a huge signal with 75w to a 2m dish. Gordon also heard many **3cm** beacons including **DB0GHZ**, **ON0RUG**, **DB0VC** and **DB0HRO** (JO64AD).

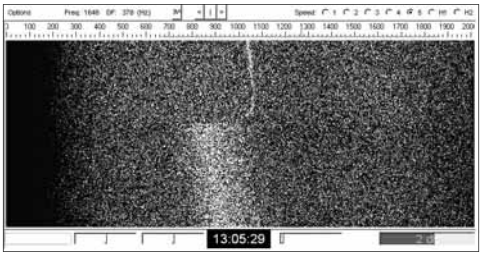
The event did not appear to favour stations in the southeast, where conditions seemed to be normal. However, late the following evening a duct across the North Sea developed, and the **23cm** and **13cm LA4SHF** beacons near Stavanger (JO28UO) were reported by stations further south.

Jan, **LA3EQ** decided to go to his portable site at his local midnight! There followed a pile-up on **23cm**! **LA3EQ/m** worked **G4KIY, M0DTS, G8TOK, G3XDY, G4BAO,** and **G4EAT** at strengths up to 59+.

24GHz RAINSCATTER TESTS

At around lunchtime on 26th June, some heavy rain cells over Northern France prompted some **24GHz** tests between **G4EAT** (JO01HR) and **ON4IY** (JO20HT) Lining up the antennas on **3cm** enabled the reflections to be peaked, and then they proceeded to **24GHz**. The CW calls were for alternate minutes, with **G4EAT** taking the odd minutes. No QSO resulted this time, since Christophe had to cut short the test.

Here at **G8APZ** (JO01DO) I listened to both sides of the tests. The signal from **ON4IY** (314km) was very scattery and it was very difficult to discern the morse characters. Christophe's CW signal was at times spreading 300Hz. I took this screen shot from SpecJT of the two signals showing half a minute of each.



10GHz RAINSCATTER

At the end of June, I moved to France for the summer months, where I become **F1VJQ** (IN95OL) and for the first time, I decided to take some **3cm** gear. On 1st July, the weather map showed widespread rain in the Brittany area, and a beacon check revealed **F1XAP** (IN88HL) coming in strongly from 387km away...

A contact with Ralph, **G4ALY** (IO70vl) at 611km on CW resulted shortly afterwards. I wasn't on the key though, that was accomplished by one of my visitors!

On the 16th July, there was more rainscatter, this time in a very favourable mid path position for the South East of the UK. A test with **G4EAT** (JO01hr) at 703km resulted in a CW exchange 53s both ways, followed by an SSB contact. I'm sure that John will attest to my poor CW skills, although we did make it on CW.

ON4IY(JO20ht) was also keen to try, and had to suffer my CW in order to get the contact! It worked well with 54s/55s reports. Having made me sweat, Christophe then also went to SSB for a 55 exchange, followed by FM at 53 The distance was 716km.

Graham **G4FSG** has a VERY poor take off on **3cm** and **6cm**. His 60cm dish is 8m agl but screened by tall trees. There are a few gaps, one of which is on a bearing of 122° but only +/- 2° at most. On 21st July he tried a different approach and left the dish pointed at the gap and tracked the rain cells crossing Belgium on http://home.hccnet.nl/uffe.noucha/weurope.htm . When the rain cells were roughly in the right place he worked **F6DKW** (JN18), **F1NXP/p** (JN29) and **DJ5BV** (JO30) at 375, 376 and 434km. All three were new squares and **DJ** was a new DXCC making his total 10 squares and 5 countries. All were good strength – two on SSB and one on CW. If you have a poor location then work out where the gaps are and point there, study the weather maps and be patient.....

On 24th July, around 2.00pm local time Gordon, **G0EWN** (IO93FK) heard five beacons via RS. **G0GHK**, **GB3CAM**, **GB3XGH**, plus two he had not previously heard, **GB3CEM** and **GB3LEX**. This is the most UK beacons he has heard on the **3cm** band at any one time. **LEX** was particularly strong via backscatter from a cell over JO02, and Gordon worked **G4BAO** also via the same cell on CW, SSB, and FM. Later in the day he heard **F5ZTR** on RS for yet another 'new' beacon.

SNIPPETS

Tony, **EI4GHB** had a QSO on 19th July with Joe **EI3IX** (IO53) on **10GHz** SSB. The distance was about 5 miles, and 59++ reports were exchanged.
With some good rainscatter, these two stations should be workable from most of the UK.

John, **G4BAO** says "it's a pity I haven't got an effective station and site on **3cm**, but the price of 10W PA devices for 3cms makes my toes turn up!! If I could find a surplus source of X band GaAsFETs like the one I had for **23cm** LDMOS devices, (dream on!) I'd design a cheap PA kit for **3cms** as well. Anyone out there found a reel of 10W X band FETs in a skip recently? "

...AND FINALLY

That's all for this month, **73 Robin G8APZ/F1VJQ**

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

3.4GHz EME Activity Weekend 2009

A review by Peter Blair G3LTF

Introduction

Since the first 3.4 GHz EME Activity Weekend (AW) was held in 2007, there has been a steady increase in EME activity on that band, evident both in contest entries and in DXpeditions. The idea behind an AW is to get as many active stations on the band as possible, especially those with big signals so that smaller stations and those who are in the process of getting everything tuned up for EME are virtually guaranteed to hear some signals and probably make QSOs. When AWs first started in EME, in the early 1970s on 432 and 1296 MHz , we were often unsure of frequency and moon position but these are not really factors today and the use of the internet and loggers makes scheduling and arranging tests infinitely easier.

This years event took place on June20/21st with the moon close to perigee and at high declination and, despite the relative closeness of the sun (which might add noise into the sidelobes of small dishes), the conditions seemed to be excellent. Yes, we do experience " conditions" on microwave EME! There are days when the copy is better than others, due mainly to the level and rate of libration fading and there can also be some residual ionospheric absorbtion even at 9cm. In past years, we have had the big attraction of VK3NX on the band but this year he was not able to be on. However, most stations had an opportunity to test out their gear the previous month with the operation of MI/DL1YMK, the first microwave EME operation from GI.

Over the weekend the following stations were active, DF9QX, DL4MEA, **G3LQR, G3LTF, G4NNS, G4RFR**, JA4BLC, (swl only) K5GW*, LX1DB*, OE9ERC*, OK1CA*, OK1KIR, PA0BAT, VE4MA, VE6TA, W5LUA*, WW2R. OZ6OL was active in the following week making a total of 18. The "loud" stations, those with large dishes or high power, or both are marked with an asterisk. For example K5GW uses a 6.9m dish with a 200W TWT mounted on the rear, LX1DB has a 10m dish and 200W SSPA and W5LUA a 5m dish with 150W at the feed from a TWT in the shack with waveguide to the back of the dish and coax to the feed point. OE9ERC uses an 8m dish with about 200W. So, for much of the time, there were some big signals on the band. There were probably over 50 Qsos made in the weekend. It was very good to see four stations active from the UK, more than from any other country. The newcomer this year was G4RFR, The Flight Refuelling group, who, in a hectic four week burn by Paul M0EYT and John G0API, got their 3.4m dish operational on EME for the first time since 1994 when it was used on 3cm. See figure1.

Antennas

Dish sizes ranged from 3 to 10m and everyone used circular polarisation. The septum polariser seems to be the most widely used now on 3.4GHz with many stations now using more advanced designs, either in circular guide or the RA3AQ designs which use a square polariser with a circular transition section. Since the AWs started, a lot of feed pattern optimisation has been going on with VE4MA (or Kumar) chokes or chapparal rings now giving lower spillover and hence better receive performance. Some stations (W5LUA for instance) have a cluster of feed horns with some offset from the axis of the dish. Others use interchangeable feeds and OZ6OL has integrated his with his 1296 feed horn, see figure 2. Brian, G4NNS, has mounted his feed and the complete Tx/Rx system on a remotely controlled trolley arrangement, figure 3, so that the correct point for the feed position could be readily found. DL4MEA uses a similar system with his deep, 0.33f/d dish and a circular guide feed with chapperal rings. Detail on septum polarisers and feeds can be found at:

http://www.ok1dfc.com/EME/emeweb.htm and on optimising the feed and dish at http://www.w1ghz.org/antbook/contents.htm

Probably the most useful tool for system measurement and optimisation is the eme-calc programme available at http://www.sm2cew.com/download.htm

Power Amplifiers

The high power TWTs used by some of the US stations have already been mentioned but by far the largest number of stations used the Toshiba or Spectrian 50W SS amplifiers which will provide 50W of RF. Several stations, including G4RFR and G3LQR have combined two of these amplifiers using hybrid couplers. Unfortunately these amplifiers now seem to be in short supply. The other available module is the Ionica unit which gives 15W, G3LTF uses two of these at the feed point of his 6m dish. All of these modules need only a few mW of drive and a heat sink plus a few fans for cooling. Kuhne Electronics is now selling 9cm modules with up to 400W output which will hopefully get a few more stations on to 3.4GHz EME. There is a lot of ingenuity evident in overcoming feeder losses in 3.4GHz EME. The largest feeder that can be used without over-moding is LDF5-50 and so many

stations mounted the PAs either on the back of the dish (see fig1 for G4RFR's arrangement) or nearby as in figure 4 which shows G3LQR's dish and PA with polythene covering handy in case of rain! Several stations, G3LTF, OK1CA, OK1KIR, G4NNS, DL4MEA all mounted the PA directly at the feed point but the feed support system then has to be robust enough to carry the weight and compact so that it does not increase dish blockage.

Preamplifiers

Commercial units were in use at some stations but others used HB units based on the designs by DJ9BV (Dubus 1/95) or W5LUA. I have built several preamps using both of these designs with the ATF36077 PHEMPT with noise figures of around 0.6dB. There is also a two stage design by G4DDK using the ATF36077 but I'm unsure whether there were any in use in this AW. Using a polariser such as a septum allows separation of Tx and Rx ports but in practice everyone includes an isolation/ protection relay on the Rx port, however, keeping the cable lengths around this very short, 1-2cm, is essential to achieving a low system temperature. The loss to the next stage of down-conversion must be low as well and so some stations mounted the whole transceiver at the feed and others used a second preamp with the transceiver mounted behind the dish. Everyone now operates on 3400.100+/- which makes life much easier.

Accessories

As mentioned earlier, knowing the frequency accurately is now much easier with GPS controlled oscillators in use at many of the stations active in the AW. Others used TCXOs referenced to beacons or counters. I use an G8ACE TCXO and set it on GB3MHS) Strangely, one of the other common modern EME station accessories , the SDR, reduces the requirement for high accuracy by allowing 100KHz or so of band to be displayed with visibility of very weak signals. Again many stations are using these and even a very simple one, such as a Softrock at the final IF, is extremely useful when the band occupancy is low. The final useful accessory is an indicator of moon noise. This enables the dish to be kept exactly on the moon and is also provides a continuous monitor that the receive side is working to specification. Several designs exist, see the websites of G4NNNS and VK3NX.

Results

In the AW G3LQR worked G3LTF, OK1KIR, PA0BAT, K5GW, W5LUA, and OE9ERC and then on the 25th June he worked G4NNS,VE4MA and OZ6OL.

G3LTF worked OK1KIR, G3LQR, DF9QX, DL4MEA, G4RFR, VE6TA, OE9ERC, G4NNS, PA0BAT, K5GW, W5LUA, VE4MA and WW2R.

G4NNS worked OK1KIR, DL4MEA, OK1CA, LX1DB, W5LUA, VE6TA, K5GW, G4RFR, OE9ERC and G3LTF.and on the 25th June OZ6OL and VE4MA. Brian had a serious visit from Mr Murphy during the AW which took out the PA PSU

G4RFR worked G4NNS, G3LTF, OK1KIR and W5LUA. They had a number of problems including QRM from nearby cellphone towers which meant they had to operate at 3400.450 They heard several other stations and plan to be back on with an improved system.

Conclusions

This was another successful AW and 3.4 GHz EME activity continues to build. The next burst of activity will be in the ARRL contest on November 7/8th If you have a dish of 2.5m or above and can get 30W at a CP feed then think about EME on this band, It isn't essential to have a sophisicated tracking system, manual adjustment with calibrated readouts or a polar mount can work perfectly well to start up. More information on 3.4GHz EME can be found at http://www.moonbounce.info/3.4%20GHz%20Moonbounce%20Made%20Easy.pdf and http://www.ntms.org/files/Florence_%203_4.pdf and http://vk3nx.com/9cm.html or email me at g3ltf@btinternet.com

Finally, Brian, G4NNS is organising an AW on 5.7GHz for August 15/16, keep an eye on the Moon-net reflector for details. (His report on the 3.4GHz weekend is on the back page of this issue of Scatterpoint ... editor)

Fig.1

The 3.4m dish normally used at G4RFR for 10GHz EME and showing Paul M0EYT and Andy G4JNT (who is supervising as usual !) This photo also shows the circular feedhorn with VE4MA choke flange inside the mouth of the 14" diameter feedbox (galvanised steel heating duct). The active bits of the system mount on a slide plate that is remotely adjustable for position using a small electric jack . Yes, the platform used is G0API's old G Plan sideboard top ... very 60's !

Fig.2 OZ6OL has integrated his 3.4GHz feed with his (larger) 1296 feed horn

Fig 3

G4NNS has mounted his feed and the complete Tx/Rx system on a remotely controlled trolley arrangement so that the correct point for the feed position can be readily found

G4NNS EME 3.4GHz WEEKEND REPORT

The 3.4GHz activity weekend, of the 20-21ST June this year, provided an ideal opportunity to try out a new feed support system which, for 3.4 and 5.7GHz, is designed to carry the transverter, feed horn and PSU regulators. This arrangement all but eliminates feeder loss. It also provides remote control of focus something which had been very difficult to adjust before.

The Saturday session went well enough with ten stations contacted via the moon including five initials (first time contacts).

On Sunday, before leaving for the Newbury Rally, I completed a contact with Peter G3LTF a distance, as the crow flies, of 10Km. Some may consider that using the moon as a passive reflector to complete such a contact might not represent the best use of technology but I believe an even shorter distance QSO has been achieved in the US between Al W5LUA and Dave WW2R (aka G4FRE).

Sunday was also session two of the 5.7, 10 and 24GHz cumulative contest so on returning from Newbury with my bargains (M4 stainless nuts and screws and a selection of self tapping screws) I joined in that event. All seemed rather slow on 144.175MHz so I ventured onto the ON4KST Microwave chat and was immediately 'meeped' by John G4BAO (contact unsuccessful) and, while trying to work John, by Bryan G8DKK. The contact with Bryan was at about EME signal levels so I felt quite at home. Next, I worked Ralph G4ALY and was 'meeped' and telephoned at the same time during this contact and was becoming rather stressed. It was at about this time that there was a noise like an M4 nut passing through a fan ! On checking the temporary PSU running the terrestrial transverters I could not find any problem. The fan appeared to be operating normally and the output was normal. It was then that I noticed that there was no power on the EME system. Bearing in mind that its power supplies are some 25 meters away, outside, on the dish, the noise I'd heard was
presumably unconnected with this failure. Unless perhaps it had been a much bigger nut ... perhaps M12 passing through one of the fans out on the dish! The fault turned out to be a short circuit in a 35A 200V bridge rectifier, which at the time had been off load, supplying less than 2A at about 24V. Strangely the fans were running OK when power was restored and no M12 nuts were missing as far as I can see. I was hoping that this would be the last of the distractions to the task of operating EME and a microwave contest concurrently. However, in the morning XYL Maria had gone to the local Farmers market and she returned with a crab purchased from one of the south coast fishermen who attend the market. I have always been puzzled by the description of "dressed crab". In fact this is a crab which has had its jacket (armour plated) removed while an "undressed crab" is one that still has its jacket on. Having got up quite early and being quite hungry by this time I could hardly refuse to assist in undressing, or should that be dressing said crab.

By the time all these distractions had passed, activity had tailed off both on the Cumulative contest and the EME activity session. I did manage contacts with John G8ACE/P on all three bands in the terrestrial contest though.

On reflection, I realise that trying to participate in an EME session and a terrestrial contest at the same time is tantamount to sending a personalised invitation to Mr Murphy!