An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

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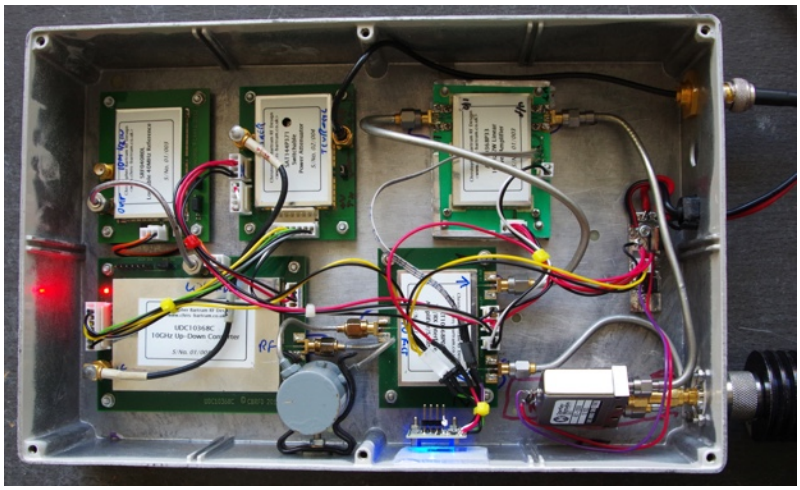
Assembly of a GW4DGU transverter

By Andy Talbot G4JNT



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Loan Equipment

Don't forget, UKµG has loan kit in the form of portable transceivers available to members for use on the following bands:

5. 7GHz 10GHz 76GHz

Contact John G4BAO for more information.

Subscription Information

The following subscription rates apply.

UK £6.00 US $12.00 Europe €10.00

This basic sum is for **UKuG membership**. For this you receive Scatterpoint for **FREE** by electronic means (now internet only) via the Yahoo group and/or Dropbox. Also, free access to the Chip Bank.

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!

You will have to make a quick check with the membership secretary if you have forgotten the renewal date. 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.

Please also note the payment methods and be meticulous with PayPal and cheque details.

PLEASE QUOTE YOUR CALLSIGN!

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!)

Articles for Scatterpoint

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

Please send them to

editor@microwavers.org

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

Reproducing articles from Scatterpoint

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You may not publish Scatterpoint on a website or other document server.

UKµG Chip Bank – A free service for members

The catalogue is on the UKµG web site at www. microwavers. org/chipbank. htm

Non members can join the UKuG by following the non-members link on the same page and members will be able to email Mike with requests for components. All will be subject to availability, and a listing of a component on the site will not be a guarantee of availability of that component. The service is run as a free benefit to all members and the UK Microwave Group will pick up the cost of packaging and postage.

Minimum quantity of small components supplied is 10. Some people have ordered a single smd resistor!

The service may be withdrawn at the discretion of the committee if abuse such as reselling of components is suspected.

There is an order form on the website with an address label which will slightly reduce what I have to do in dealing with orders so please could you use it. Also, as many of the components are from unknown sources, if you have the facility to check the value, particularly unmarked items such as capacitors, do so, and let me know if any items have been mislabelled. G4HUP's Inductance/ capacitance meter with SM probes is ideal for this (Unsolicited testimonial!)

Don't forget it is completely free, you don't even have to pay postage!

I have just updated the Inductor file and the ATC file in the chipbank catalogue on the website to reflect some acquisitions at Finningley, and to make a few corrections and clarifications.

Mike G3LYP

UKµG Project support

The UK Microwave Group is pleased to encourage and support microwave projects such as Beacons, Synthesiser development, etc. Collectively UKuG has a considerable pool of knowledge and experience available, and now we can financially support worthy projects to a modest degree.

Note that this is essentially a small scale grant scheme, based on 'cash-on-results'. We are unable to provide ongoing financial support for running costs – it is important that such issues are understood at the early stages along with site clearances/licensing, etc.

The application form has a number of guidance tips on it – or just ask us if in doubt! In summary:-

- Please apply in advance of your project
- We effectively reimburse costs - cash on results (eg Beacon on air)
- We regret we are unable to support running costs

Application forms below should be submitted to the UKuG Secretary, after which they are reviewed/ agreed by the committee

www. microwavers. org/proj-support. htm

UKµG Technical support

One of the great things about our hobby is the idea that we give our time freely to help and encourage others, and within the UKuG there are a number of people who are prepared to (within sensible limits!) share their knowledge and, what is more important, test equipment. Our friends in America refer to such amateurs as “Elmers” but that term tends to remind me too much of that rather bumbling nemesis of Bugs Bunny, Elmer Fudd, so let’s call them Tech Support volunteers.

While this is described as a “service to members” it is not a “right of membership!”

Please understand that you, as a user of this service, must expect to fit in with the timetable and lives of the volunteers. Without a doubt, the best way to make people withdraw the service is to hassle them and complain if they cannot fit in with YOUR timetable!

Please remember that a service like our support people can provide would cost lots of money per hour professionally and it’s costing you nothing and will probably include tea and biscuits!

If anyone would like to step forward and volunteer, especially in the regions where we have no representative, please email john@g4bao. com

The current list is available at

www. microwavers. org/tech-support. htm

80m UK Microwavers net – Tuesdays 08:30 local on 3626 kHz (+/- QRM)

73 Martyn Vincent G3UKV

Chairman's thoughts for November

I have been using digital modes like JT65 and JT4 on the higher bands for some years, especially on 23 and 13cm EME. A few weeks ago G4BAO suggested a terrestrial JT65C session on 23cm. Quite a few operators around the UK joined in and a number of lessons were quickly learned or relearned. JT65C does not like fast doppler from aircraft reflections. This lesson had been learned some years ago and then apparently forgotten. The late G4PBP and I had exchanged many signals on 23cm and above using the various digital modes and concluded then that JT65C was not optimum. Far better was to use JT4, often mode F, even on 23cm.

Once we changed to JT4F that evening the decode rate improved dramatically.

Since then I have run a number of tests on 13cm with DL4OGI in Dusseldorf at around 400km, again using JT4F. The results were interesting and successful, and Nick has been able to use even the negative results to further develop his propagation theories.

I hope to persuade Nick over to speak at the Martlesham Round Table in April. Nick doesn't often agree to speak at these type of events, so I believe this is our chance to hear from a propagation expert who has a lot of practical experience of microwave propagation dating back to his days as a GM.

A few evenings ago I was watching the 50/70MHz KST chat and noticed that MSK144 was at last starting to be used in preference to FSK441 for MS (now leading up to the November Leonids). MSK144 can be used with different transmission times. It is a 'fast' mode. It is not necessarily a very weak signal mode. The 50MHz MS seemed to be conducted with 15 second periods. Of course I was curious to see how this worked. I have WSJT-X RC 1.7 installed on my shack laptop.

I was surprised (not sure why?) to see a lot of decodes on my 50MHz screen using MSK144. Clearly this new mode is beginning to catch on for MS. It may be that it is also suitable for aircraft scatter on 23cm and above. I hope to see some of you using this new mode on our higher bands and maybe managing to work some interesting paths that may not have been workable in the past, or may have required longer aircraft reflections than usual.

I shall be attending the Scottish Microwave Round Table this month. I am looking forward to meeting all my Scottish (and Sassenach!) friends again. The last time I was able to attend was the first Round Table at BurntIsland!

73 de Sam, G4DDK
Acting Chairman, UKuG

Heelweg 2017

http://www.pamicrowaves.nl/website/

Timelapse Part I 2016 made by PA3FXB

https://youtu.be/dEmRo0xHCko

Some of the usual suspects from UKµG will be there –G4DDK, G4BAO, G4HUP and G8BHC.

G4BAO at Heelweg 2015

UKuG Report to RSGB Spectrum Forum

Introduction to UKuG

The UK Microwave Group represents the interests of amateur GHz bands radio enthusiasts in the UK. Its Committee is an elected body representing the interests of UK amateur microwave enthusiasts. The UKuG is open to membership for both UK and overseas microwavers. UKuG is now 17 years old, having been formed at the Martlesham Microwave Roundtable in November 1999 and it is affiliated to the RSGB. Current membership is: 480, up by 5 this year.

Events organised and supported during 2016

- Martlesham Microwave Roundtable with UKuG AGM - April
- Microwave Roundtable and buildathon organised by the Finningley Club – July.
- Microwave Roundtable organised by the Crawley Club - September
- Scottish Microwave Roundtable, Burntisland near Dunfermline - November
- RSGB Convention 2016

Club and outreach

The group has members on the RSGB Board, the Spectrum Forum, Propagation Studies Committee, Contest Committee, EMC Committee, RTC Committee, Examination Standards and Audit Committees, IARU Committee, and one of our members Chairs the Technical forum.
A UKuG member wrote the presentation for the recently-issued “VHF and up propagation” video from the RSGB Propagation Studies Committee that is now available to clubs.

We provided further technical support to Camb-Hams members who are starting out on the GHz bands. Members presented talks at all the GHz Bands Round Tables this year, on various GHz related topics. Members have visited several clubs to present talks on Microwaves or Millimetre-waves.

The Group membership provided twelve speakers, 4 more than last year, at the RSGB convention.

Technical Support and loan equipment

Two new beacons came on air this year, GB3USK on 1.3GHz and GB3PKT on 24GHz. A number of UKuG members provided technical support as part of our scheme including beacon repair and construction GB3PKT, GB3USK plus equipment testing. Members have continued to support Joe Taylor K1JT to further develop the WSJT-X suite of Digimode programs.

We have four "members' loan" transverter systems, covering 5.7, 10, 24 and 76GHz. Providing support for beginners and established microwavers.

Chipbank

The chipbank offers a completely free service to members, and includes a fairly comprehensive selection of chip resistors, capacitors and inductors as well as a good selection of useful semiconductors and other components. In the nine months to the end of September, 22 requests were received and serviced. This is about the same as in previous years. The roundtables at Martlesham and Finningley were attended with the full stock. The online catalogue was updated twice to reflect donations from the estate of the late G3PYB, and to include inductors from several Coilcraft kits donated by G4HJW.

Publications

UKuG members still write five of the regular columns in RadCom, write for Practical Wireless and regularly contribute technical articles and the European activity report for Dubus magazine. As usual, there have been a large number of RadCom articles, equipment reviews and features contributed by members this year.

Scatterpoint

The e-newsletter of the Group, under the Editorship of Martin, G8BHC, is published at least 10 times a year and continues to attract top-line technical articles as well as being a comprehensive repository of reports of activity. There are 475 members of the Yahoo Scatterpoint group. Copies of the monthly magazine are also available to members via Dropbox links. Older issues are available from the UKuG web site (issues for 2015 will become available at the end of December 2016). An annual index is produced for members.

Scatterpoint carries a regular activity report column, compiled by Neil G4LDR, which has detailed reports from members of their activities on the microwave and millimetre bands, illustrating the breadth of propagation modes and modes of operation in regular use. These reports cover Wideband, Narrowband and Machine Generated Modes (MGM) activity used for both local and DX operations.

Group website and beaconspot.eu

This year UKuG has now posted a number of GHz related videos on its YouTube video channel the Twitter feed @UKGHZ attracts a number of likes and retweets, highlighting innovation such as long-distance QSOs on the 47, 76 and 122 and 134 GHz mmWave bands. Our main website, microwavers.org, also provides listings for Operating Firsts/DX records, Chipbank stock updates, a regularly updated beacon maps and a rolling events calendar.

Our sister site, Beaconspot.eu reached 2500 registered users last May and now is now up to 2771. The beaconspot.eu Webmaster recently added an interface to allow PI4 spots to be processed directly from the PI-RX program

Beacons

The Group was pleased to see the site move for the 1.3GHz beacon, GB3USK approved this year and most impressed by the 4-day turnaround of the application for 24GHz beacon GB3PKT!

There are still three 1.3GHz Beacons that are waiting for site moves, changes, and approvals with delays between 5 and 19 months, plus two 10GHz, one 5.7 GHz and one 3.4GHz beacon awaiting approval.

We ask the Society to continue to pursue this issue at the highest level within Ofcom.
See http://www.ukrepeater.net/vetting_beacons.php

Operation

Development continues on all bands with an emphasis on mmWaves. 2016 saw the first recorded UK QSO on the 122GHz band and the 134GHz UK distance record was extended to 35.6km.

5.7GHz operation using re purposed, low cost commercial equipment is growing under the guidance of the Bolton group. Activity on 1296MHz is also growing driven by talks and articles about the band and the availability of a low cost transverter from SG lab in Bulgaria.

There has been an increase in the uptake of 2300MHz NoVs this year and the number currently stands at 247. The group hopes that new equipment for the 2300 MHz band by Kuhne and SG-lab will encourage even more uptake.

As per last year, activity is still clustered around UKAC and other contests, but small groups are encouraging activity on 1296 digital modes by promoting a centre of activity at 1296.165MHz.

EME

Small dish EME is continuing to generate interest, with UKuG members leading the way on 10GHz with QSOs with sub-1m dishes and new digital modes. There continues to be 1296MHz activity pretty much any time the moon is up. Stations with dishes smaller than 2m, are showing what can be done with JT modes and CW on this band. This demonstrates the increasing practicality of every day intercontinental DX on the microwave bands with a low-profile antenna.

UKuG Awards

The UKuG presents awards annually to recognize the achievements made by microwave operators in a number of different areas.

1. The G3BNL award is presented for innovation or technical development of microwave equipment or techniques, in honour of Les Sharrock G3BNL.

   The 2016 recipient is GW4DGU for his commercial development of the Gemini23 Power amplifier for 1296MHz.
2. The G3EEZ award is presented for contributions to microwave communications, in honour of Alan Wakeman G3EEZ.

   The 2016 recipient is G3WDG for his continued development of GaAn Power Amplifiers and his contribution to small dish EME.
3. The G3VVB memorial trophy. This presented for the best microwave home project exhibited at a microwave roundtable, in honour of Cyril James G3VVB.

The 2016 recipient is G4HIZ for his 24GHz signal generator.

4. The G3KEU trophy. This is presented for the leading entry in the 5.7GHz cumulative contests, in honour of Tim Leighfield G3KEU.

   The 2016 recipient is G8KQW

5. The G3RPE trophy. This is presented to the Winner of the 10GHz cumulative contests (Open Section), in honour of Dain S. Evans G3RPE

   The 2016 recipient is G8KQW

6. The G3JMB memorial trophy. This is presented to the Winner of the 10GHz cumulative contests (Restricted Section, 1 Watt max), in honour of Jack Brooker G3JMB.

   The 2016 recipient is G0LGS.

A new award is to be introduced in 2017 is in honour of G4EAT and in future will be awarded to the overall winner of the 23cm section of the Low Band events.

UKuG Contests and Certificates

Two squares awards have been issued to John Worsnop G4BAO for 20 squares on 2.3GHz and 60 squares on 1.3GHz, and Tony Collett G4NBS for 15 squares on 2.3GHz and 70 squares on 1.3GHz. . No other certificate awards have been made. The database of UK microwave “Firsts” has continued to be updated, including first contacts within the UK at 122GHz and 241GHz recorder by G8CUB/P and G0FDZ/P.

The UKuG contest programme for 2016 did not change significantly from 2015. There is continued interest in the mm-Wave band events, with a first on 122GHz recorded during this years events.

Entry levels on the other bands have remained fairly static.

The UKuG Contest Manager also adjudicates the SHF UK Activity Contests which continue to grow in popularity, particularly with the use of modified video sender equipment for 3.4 and 5.7GHz, and more stations getting on 10GHz with systems capable of working more than 200km.

Submitted by G4BAO on behalf of the UK Microwave Group, October 2016

Other RSGB Reports

UKuG, BATC, AMSAT-UK, Microwave Mgr and various other Spectrum Forum reports are now online at

http://rsgb.org/main/blog/spectrum-forum-posts-overview/spectrum-forum-meeting-minutes/2016/11/04/spectrum-forum-meeting-2016/

In particular:

RSGB Microwave Manager’s Spectrum Forum Report is at

http://rsgb.org/main/files/2016/11/5.3_Microwave-Managers-report_Oct2016.pdf

See also the briefing paper *UK Amateur Radio in 47GHz*

http://rsgb.org/main/files/2016/10/RSGB_47GHz-brief_160824.pdf

Assembling a GW4DGU Transverter System

By Andy Talbot G4JNT

This has been written as a spur to those of you out there who originally purchased one of Chris, GW4DGU's, 10GHz Transverter systems but haven't yet got round to assembling things. It really is almost a plug-N-play assembly – even if the instructions (well, the ones I had, anyway) were a bit sparse.

Not having had a standalone 10GHz Transverter system for several years now (when the 1980's vintage G3JVL + TWT finally gave up the ghost), I started contemplating what could be put together from junk box bits . I almost had everything, including a rather old Qualcomm 1W PA, but it was going to be a real hotch-potch and wouldn't be at-all a neat solution. THEN, at the Crawley Microwave Roundtable, someone (I shan't say who, to save their embarrassment) had a set of the GW4DGU modules for sale at a very favourable price. So, needless to say. . .

The modules came with a set of basic assembly instructions printed out but that was all. There was the UDC transverter module, a switchable attenuator (transceiver interface, referred to here as the SWAT), a bi-directional intermediate amplifier with low power Tx and Rx ports, a filter, 2 Watt power amplifier and the LO source that could operate standalone or locked to an external 10MHz reference. There was also what appeared to be a DC and control signal distribution module with relay driver. Apparently, an LNA module had also been available but that wasn't included in my set. The RF interconnections were all via SMA connectors and looked obvious enough, even without reading the manual, with the PCB connectors all labelled. The instructions suggest the filter could go in one of two places; either in the low power Tx path to clean up the transmitted signal, or between the converter and low level amplifier so it works in both receive and transmit. I chose the latter position. I had plenty of SMA leads in both conformable semi-rigid and flexible form, garnered over the years from rallies and skips, so assembly could start after a bit of testing of each module.

The initially confusing bit was that each module appeared to have many multiway header pins for the power and control. The various printed manuals went part way to saying how the interconnections should be made, but wasn't terribly clear what all the signals actually did. However, it did appear to be the case that all the headers of each type of multiway connector (except the 5-way ones), were to be wired pin-to-pin, ribbon cable style; the system had been designed as plug-N-play. There were two 8 way ones on the UDC and SWAT, and these appeared to carry sequenced signals between the two modules. Four-pin connectors carried +12V power to all but the LO; two-pin ones were used for Tx logic level switching and a pair of three-pin connectors on the LO and UDC carried +8V supply for the LO module.

The T/R control from the transceiver was a bit convoluted. A 5 pin header on the SWAT module is intended for interfacing to transceiver control ports and has both +V to Tx and Gnd to Tx options on separate pins. Whichever of these is used, the other has to be put into its active state; ie. they are effectively ANDed . So a link needs to be made on this header for the 'unused' control line. RF sensing of the 144MHz drive was included, with a link to disable this if not wanted. But an option that wasn't available, and one I specifically wanted, was +Volts on the 144Hz coax to control Tx/Rx switching; using the aux socket of my FT817 as the manual suggested was not an option. Fortunately, it was easy to modify the SWAT module to do this. The shielding lid was easily removed – it had been spot soldered in 4 places. The pick-off for RF sensing consists of a resistor and capacitor in series followed by a rectifier diode then a choke going off to the selector link and onto the logic board. By the simple expedient of shorting the series capacitor, and removing the diode, a DC connection via the series resistor then exists from the transceiver IF input to the logic. The polarity of this signal, +V transmit, matches the standard FT817 modification for +V on the coax that many use. So no other work for DC-level based Tx/Rx switching would be required.

All the modules had by now been tested separately using flying leads and PSUs and test equipment and passed with flying colours. So it was time to move on to integration. At this point Chris had supplied me with a set of circuit diagrams, so it was now possible to work out exactly what each signal did , instead of just interconnecting blind!

Assembly

A suitable second-hand diecast box was found (several old holes in it had to be filled with Araldite) and a layout devised for the modules to be mounted on its bottom that allowed SMA cables to be formed and installed in situ. The final thing can be seen in Photo 1. Drilling the holes for mounting the modules proved to be an eye-opener. All the modules have their M2.5 clearance mounting holes spaced on a 2.54mm grid (0. 1" for those born before 1955). Initially I was more than a bit annoyed and began to curse someone, as I've never used inches and the only rulers to have them on were marked out in binary sub-multiples, not tenths. (Subscribers to the RSGBTech Yahoo Group may get a sense of Déjà-Vu here). So I was just about to get out the calculator

and convert to mm when I realised I had some bits of Veroboard already drilled out to this very grid size. So, marked the positions of the various module mounting screws on this with a felt-tip and used a 1mm PCB drill to make pilot holes in the diecast box base. These were enlarged to M2.5 clearance and resulted in a much better positioning than I'd ever have managed just with a scriber, rule and centre punch. (Note to self: in future, however much against all principles it may be, when laying out PCBs, place the mounting holes on a 2.54mm grid. And make sure there's always a piece of Veroboard to hand).

A set of Molex housings for all the different pin-count connectors (2, 3, 4, 5 and 8 way) and a bag of pins had been provided with the kit of bits. Since this type of connector has to be made up individually, one pin at a time, it was going to be tedious. One option I considered was to invest in a set of IDC connectors and ribbon cable. Assembly of the leads would then have been just a matter of a few minutes with scissors and the jaws of a vice. It was clear that this was probably Chris's original intention, especially with the provision of the DC distribution module so only one-to-one leads would have been needed. However, I felt making ribbon cables up with many cores not used was just-not-right, so set about making a daisy chain wiring harness using only the individual pins that were needed on each connector. Doing it this way meant I could dispense with the DC distribution module – which only had all its connectors paralleled and would have necessitated terminating even more pins. Making up the Molex connectors was a bit fiddly, especially where two cores had to go into a single pin, but after a couple of practices the crimp-first-then-solder technique was soon perfected. Different coloured wires were used for each signal type.

As I wasn't using the distribution board, a driver had to be made for the output coax relay. As I had a nice relay with a 12V coil no 28V inverter was going to be needed, and the relay driver could be just a RFD3055 power FET. A small PCB was made up for this (the crude way with a pen for the etch resist) and to serve as a 12V input terminal point. It also holds meaty Schottky input polarity protection diode. This PCB can be seen at the right of Photo 1

Once the box was drilled, (with N-type and BNC connectors for RF and a clear window for some LEDs, see later) assembly was straightforward. A few semi-rigid and flexible coax leads to do the interconnections, the pre-made harness plugged in and it was ready to go. Connected FT817, applied 12V and noise increased. Supplied a test signal from my synthesizer and it heard it. Connected HP432A power meter (with 40dB attenuator) set FT817 to its lowest power setting and pressed the PTT. 2.3 Watts coming out, a bit high, so adjusted the drive pot on the SWAT module to bring it back to 2 Watts. The transverter was working! However, I had no indicator of its functioning at this stage, not even a Tx/Rx LED indicator.

Monitor

The instructions for the PA module showed that the 5 pin connector on this provided two analogue signals for monitoring purposes. One is a DC level going from 0.5 to 3V, proportional to power out. A calibration curve is given in the instructions. The other is a DC voltage proportional to absolute temperature of the PA base plate at 4mV/Kelvin. An over-temperature trip on the PA operates at 70C so this temperature monitoring was only ever going to range over about 1.1 to 1.36V. Other pins supply a trip monitor-LED.

A small microcontroller module was built up with a 16F688 PIC and a matrix of 12 LEDs showing through a window in the wall of the box. A 2.5V reference defines the internal 10 bit A/D converter , the temp signal being applied directly to one A/D channel and the RF monitor divided by two to another. Eight of the 12 LEDs in the matrix (7 green, one orange) are used as a bargraph indicator of output power. The thresholds for each LED were selected by reading off the curve in the instructions and lie roughly at 3dB intervals of P_{out}, with the final orange one set at a bit over 2 Watts. Two LEDs, orange and red were set to illuminate when base plate temperature reaches to 40C and 60C respectively. One blue LED was allocated to showing when the unit was in Rx mode (a logic signal had to be supplied via the harness) . Blue is the best colour for daylight visibility. The remaining LED (white) of the matrix was unused so I just made it flash on for a second when first powered up so it didn't feel unwanted!

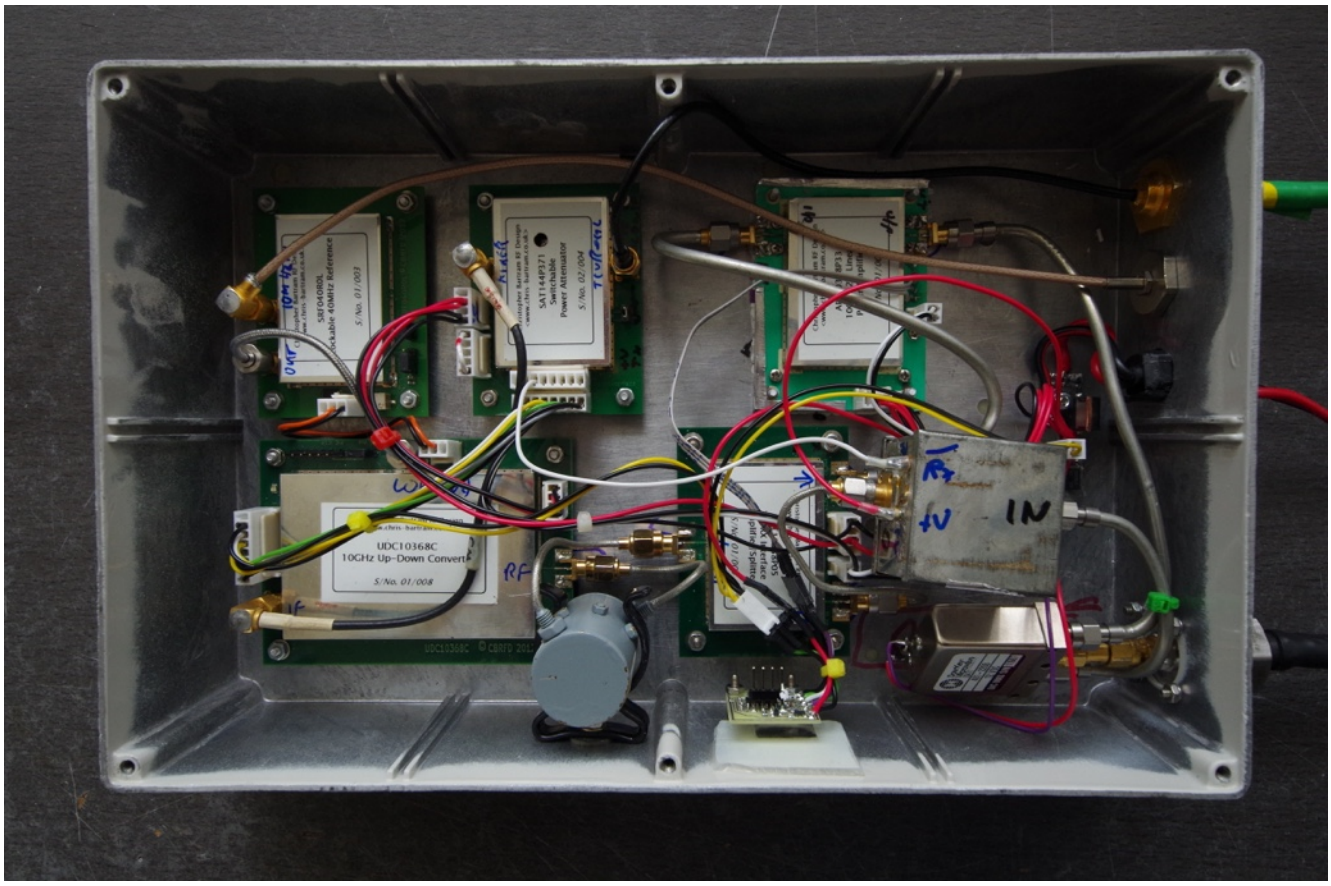
The power-out versus voltage curve in the instructions proved to be spot-on; I had expected to have to change some of the thresholds at final test but this proved unnecessary. At the time of writing, I haven't managed to get the unit hot enough to light either of the temperature warning LEDs – but this is being written just the day after completing the final integration so it may yet happen. Contact me if you want details / circuit / PIC code for the monitor module.

Final Results

The integration was only finished yesterday; it works. See cover picture. Can hear GB3SCX strongly from my local high spot. Apparently, the Rx noise figure without an LNA is about 4 to 4.5dB which will do for now. It supplies 2W on Tx when driven with the FT817, and the LEDs flash bar-graph style with SSB drive. Chris informs us that the LNA device is obsolete and no longer available, but I do have a couple of older G3WDG HEMT LNA modules in the junk box. However, in their tinplate boxes these look to be a bit too big to squeeze

in. Something can no doubt be cobbled together from an old Sat-TV LNB module – that can wait. Now I need to psych-up to actually go out /P on 10GHz. Ouch !

At the back of a cupboard I found an old G3WDG HEMT preamp dating from the 1990's. This tested out OK, and even had all its voltage regulators (+5 and -2.5V) inside the tinplate box. There was room to shoehorn it into my diecast box, provided it was happy enough to be mounted in "free space", i.e. supported only on its semi-rigid cables. Being lightweight this seems to be acceptable (and had originally been mounted this way in my old G3JVL system).



Finished system with added “floating” HEMT

To allow the LNA to be switched I added a small P-channel FET inside, switching the regulated 5V onto the HEMT. The drain of this was controlled from the "Electronics Enable" logic level signal on the 8 way connectors interfacing the UDC and SWAT modules. 0V on this enables the LNA and the +5V Tx signal disconnects the HEMTs drain supply

The -2.5V gate bias stays running continuously.

Note from Chris GW4DGU

I discontinued the modules about a year ago, as sales simply didn't justify the costs and effort it took to design and produce them. Keen as I am to promote microwave amateur radio, that can't extend to losing lots of money in doing so.

Note from the Editor

Who has built one of these? Who has been inspired by Andy’s article to blow the dust off the boxes and complete construction? Care to write about your experience? Ed.

WSPR tests on 3cm

By John S. Roberts G8FDJ

The digi-mode transmitter from QRP Labs (U3S Ultimate Keyer, ver. 3.10a) and an ADF4350 synthesiser have the potential to provide a simple digital beacon transmitter for the microwave bands at low cost and with modest hardware requirements. The digi-mode investigated here is WSPR on 3cm, which is probably most demanding with respect to frequency stability and spectral purity.

Transmit and receive system

The transmit set-up consisted of a simple “Rat Race” mixer to generate a very low power test signal on 10368.189Mhz using a 144Mhz IF. The U3S keyer includes an ATmega 328 PIC driving a Si5351A synthesiser with an output at 144Mhz. This 12dBm synthesiser signal was then processed by a 144Mhz LPF before mixing to 3cm. A Khune xtal heater type QH40A attached to the 27Mhz xtal of the Si5351A synthesiser provided additional stability. Although this heater has a working voltage of 9V, it can still provided effective temperature stability using the U3S 5V supply. The LO for mixing to 3cm was an ADF4350 and external 10Mhz Morion MV85 OCVXO, both purchased from eBay. The Morion MV85 10 MHz source has a good reputation and easily fits into the smallest size of Maplin die-cast box, where it can be packed with expanded polystyrene for additional thermal insulation. The ADF4350 was configured for a third harmonic of 10223.7 MHz, using an Aldunio Nano and register address programme written by Barry Chambers (G8AGN). Both the ADF4350 and U3S were powered by separate 12V Li ion batteries.

The receive system consisted of an Icom IC910 on 144Mhz with a DB6NT transverter for 10Ghz. Frequency control for 10Ghz receive was provided by an external VE1ALQ PLL and 106.5 Mhz xtal, together with a second Morion MV85 10Mhz OCXO. This reference was again mounted in a small die-cast box with polystyrene insulation.

Results

The first test was to simply determine the quality of WSPR decodes on 144 MHz using the IC910 and U3S source. Figure 1 shows a screen shot of decoded WSPR data from the U3S where the drift is 0 or -1 per spot and where each 2 minute period resulted in a decode. The power shown is arbitrary and is probably much lower than 10dBm. There is a positive drift of 20Hz over 12 minutes operation, which could be associated with either transmit or receive stability. No attempt was made to improve the stability of the IC910.

UTC	dB	DT	Freq	Drift			
1522	13	-2.0	144.489540	-1	G8FDJ	IO93	10
1524	14	-1.9	144.489545	0	G8FDJ	IO93	10
1526	14	-2.0	144.489549	-1	G8FDJ	IO93	10
1528	14	-1.8	144.489552	0	G8FDJ	IO93	10
1530	14	-1.8	144.489555	-1	G8FDJ	IO93	10
1532	14	-1.9	144.489558	0	G8FDJ	IO93	10
1534	14	-1.7	144.489560	-1	G8FDJ	IO93	10

Figure 1: decoded WSPR data from the U3S

The WSPR test on 3cm was between two rooms in an attempt to minimise reflected signals. Doppler effects at these frequencies are comparable to the shift associated with a data bit and therefore very destructive. Hopefully these errors have been kept to a minimum. Figure 2 shows a Spectran trace from a WSPR transmission at 3cm. The overall quality is typical of WSPR when seen on HF, but the data has to decode in order to check the effectiveness of the mode.

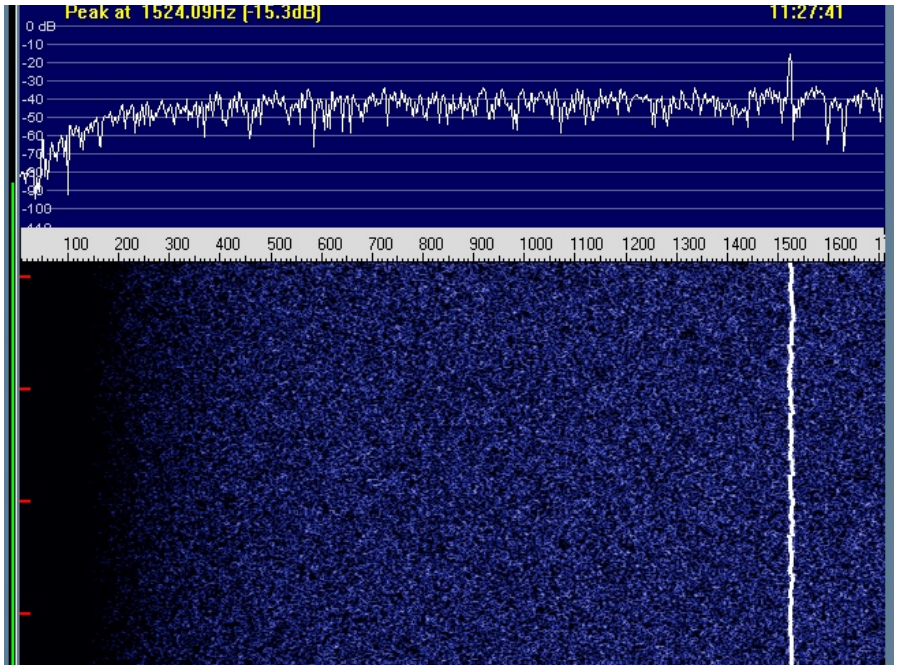


Figure (2), Spectran display of a WSPR signal at 10368.189 MHz

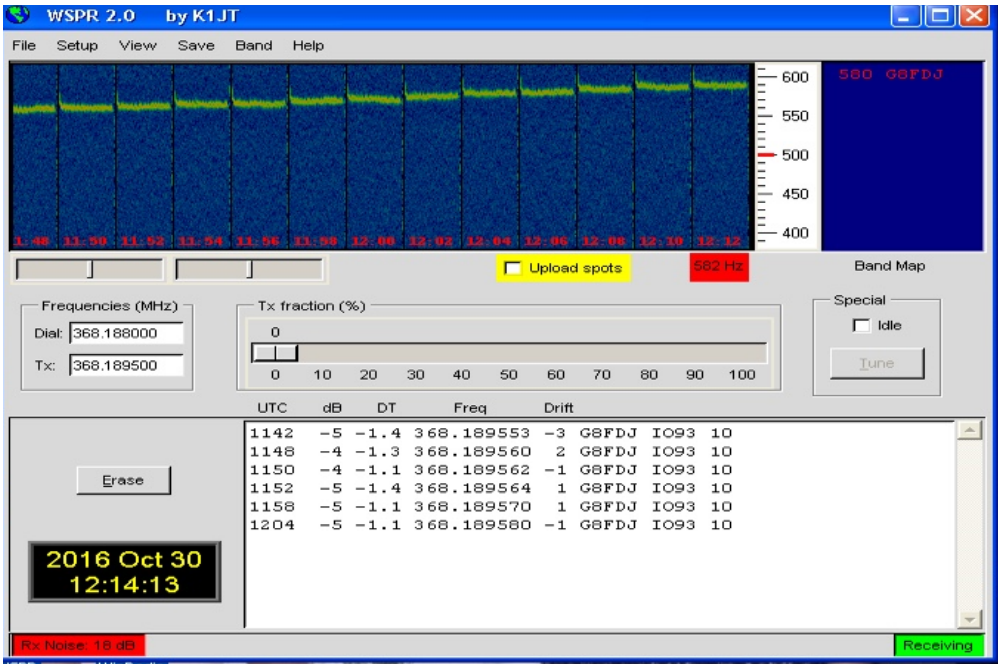


Figure (3), 10368.189 MHz WSPR decodes over 22 minutes

(Note, "10" had to been removed from the entered 3cm frequency of Figure 3 to allow it to be displayed.)

Figure (3) is complementary to Figure (1) and shows a number of decodes over a period of 22 minutes together with other received data. The drift values within a spot are poorer than 144 MHz at between -3 and 1 and there is a positive overall drift of 27Hz over 22 minutes. This long term drift is similar to the 144 MHz value and is probably associated with theIC910. More importantly, many of the received transmissions result in no decodes, unlike the 144 MHz test. Presumably there were severe data errors, either associated with the ADF4350 spectral quality or Doppler effects. The WSPR software uses extensive error correction, but for some spots this was still insufficient to provide an effective decode.

Although WSPR decodes have been seen at 10368.186 MHz, there is a reliability problem that needs to be resolved.

In a second 3cm digit-mode test the transmit mode of the U3S was changed to JT65a and WSJTX software was used to monitor the transmission. The same path was used as WSPR, but this mode might be expected to be more tolerant of errors associated with the AD4350 or Doppler effects. This was in-fact the case and a JT65a message was resolved after every 1 minute transmission period.

Conclusion

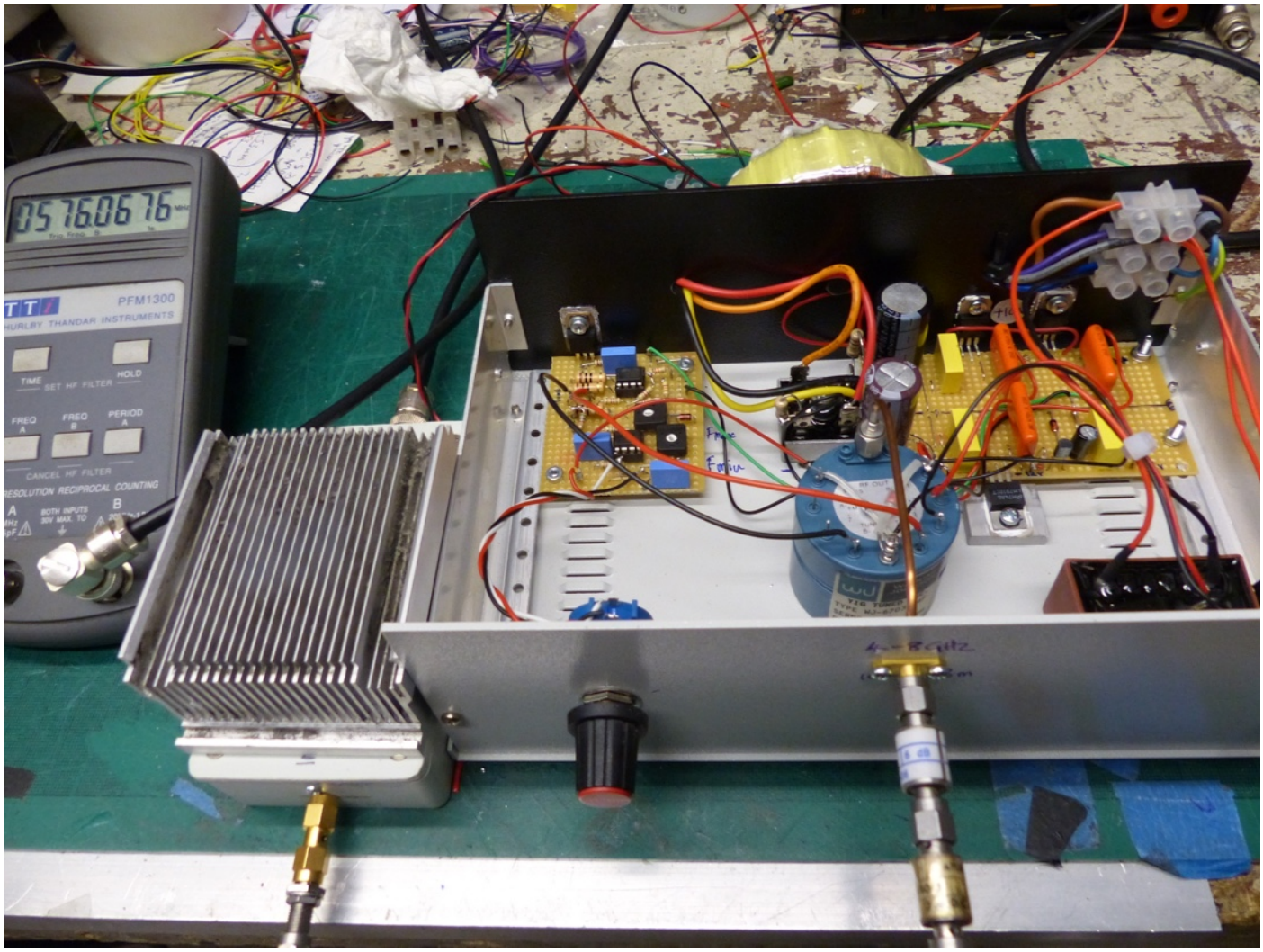
A series of in-house tests using a local oscillator based on the third harmonic from an ADF4350 synthesiser and a U3S keyer from QRP Labs showed that 3cm WSPR is possible, but the decode rate is lower than expected as a result of either Doppler shift or jitter from the ADF4350 microwave synthesiser.

This month I 'ave mostly been...

From Geoff Pike GI0GDP

Just a picture of "what I have mainly been doing". There seems to be plenty of Yig oscillators/filters on Ebay these days. As I have just finished getting my 6 cm gear sorted I noticed a gap in my signal generation capability at 5.7 GHz. I got this WJ Yig oscillator for 4 - 8 GHz on Ebay at about £40. Runs about 10-20mW (enough for power amp driving). It's not in a pll but for the moment is stable enough after about an hour. The photo shows the Yig oscillator in the centre of the box with the driver to the left and power supplies to the right.

For homebrew 10 GHz transverters there are plenty of 8-18 GHz Yig filters on EBay also, I just got 2 but not for transverter use at present.



From Gordon Fiander G0EWN

The dish advertised in last month's Scatterpoint went very quickly...in fact there seems to be a lot of people looking to obtain an EME dish...great news but sadly a further four people were disappointed that the dish has gone. I am busy altering a fixed base to obtain AZ EL for new offset dish. Also lots happening at the moment with getting people interested in milli metric and nano metric bands,

Last night G0RPH, G8AGN and myself set what we believe will be both a UK and indeed world record contact using IR 850nm with a 102km contact from Flaxby to Holme Moss

ON0EME 10 & 24 GHz Terrestrial beacons

by Eddy Jespers ON7UN & Walter Crauwels ON4BCB

Two new beacons have been installed at the same location as our 1296 Moon beacon ON0EME. At this location we have a 60 m high tower. A 3cm beacon with 5-watt power output and an Omni antenna, as well as a 1,2 cm beacon with 1-Watt power output became active on Sept 13th. EIRP is 100 Watt on 3cm and 20 watt on 1,2 cm.

Both beacons are transmitting MGM in PI4 for the first 25 seconds of the minute, followed by around 15 seconds of CW identification and locator, followed by around 20 seconds of clean carrier.

More information about PI4 can found here:

http://www.rudius.net/oz2m/ngnb/index.htm

Frequency is 10368,875 and 24048,875 and the locator is JO21JG. Nice signal reports have been received for the 3cm beacon. The 24 GHz beacon has been heard by us while contesting in JO30AM (121 km).

We also installed a WebSDR just north of Brussels in JO21FB, at 32 km from the ON0EME location. You can access the WebSDR here: http://websdr.on0eme.org The WebSDR is fully GPS locked, both RF LO as well as the RTL dongle.

The QTH is 18 m ASL so the terrestrial beacons are at 78m ASL.


10 G


24 G

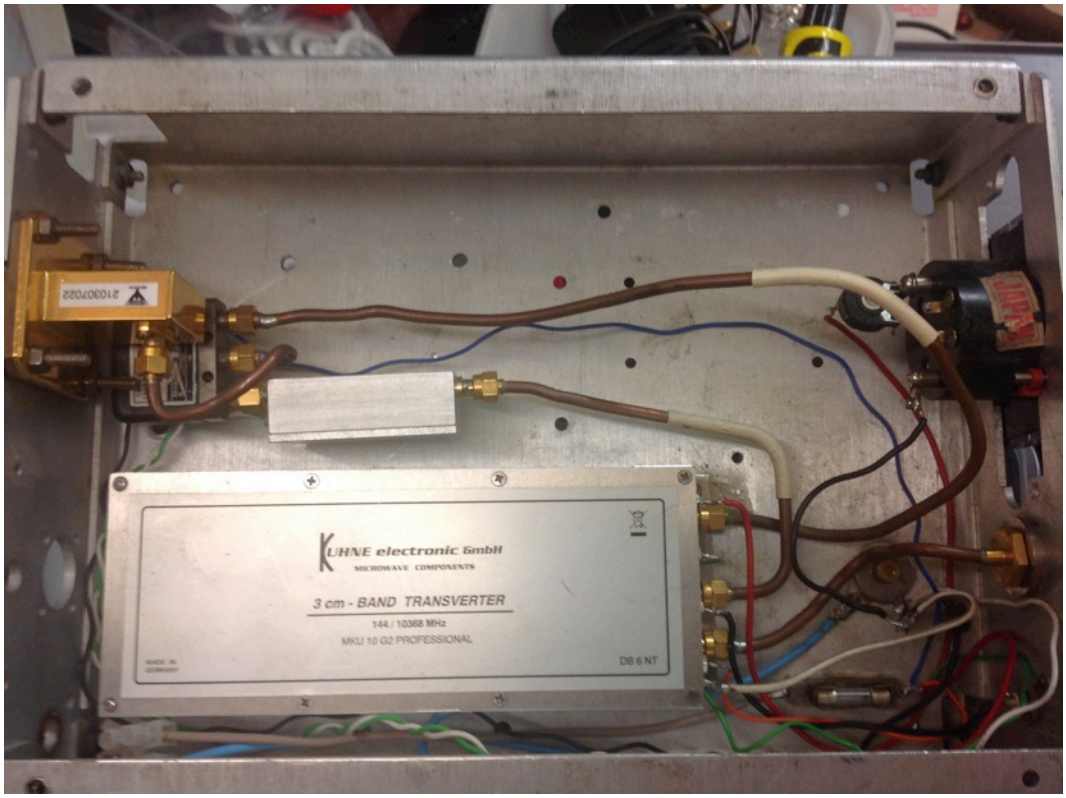
View from near the top

More views here https://drive.google.com/drive/folders/0B8uP6lMFhyXcRVlDcEdLeFVOYk0

For Sale

Kuhne MKU 10G2 Professional with Kuhne pre amp and Procom dish. My contact is tm0sin@yahoo.com

Regards Tim Brundrett M0SIN



Contest Results

John G3XDY, UKuG Contest Manager

Erratum

In the 24GHz Contest results for August 2016, G3ZME/P should have a score of 39 points as this was a 1 way QSO. This has the effect of increasing G8CUB/P's overall score in the 24GHz Championship to 2632 points.

In the September 47GHz event the best DX for G8CUB/P should be 93km, as this QSO took place from IO91CL not IO81WU.

5.7GHz Contest September 2016

A low entry was received for the final session of this event. Congratulations go to Neil G4LDR as winner of this session, with the Telford group G3ZME/P as runners up. G3ZME/P commented that conditions were good to the North.

The overall championship is decided on the best three session scores from five. This year, the winner is the Telford & District ARS G(P)3ZME/P with 3000 points from four session wins and a runner-up slot. Neil G4LDR is runner-up, winning the other session.

Telford & DARS (G3ZME) are the winners of the G3KEU Memorial Trophy for 2016.

5.7GHz Contest September 2016

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX km
1	G4LDR	IO91EC	5	857	F6APE	423
2	G3ZME/P	IO82QL	5	771	G4ALY	248
3	M0GHZ	IO81VK	3	352	G4ALY	177

10GHz Contest September 2016

In the Open section Neil G4LDR won this session, with the Telford group G3ZME/P as runner up. In the restricted section the Stewart G0LGS/P was the leader, with son Matt 2E0MDJ/P as the runner up. Some rain scatter was noted and best DX distances of over 400km were achieved in the Open section.

This event concludes the five sessions of the 10GHz Championship. Overall winner of the Open Section is the Telford Group G(P)3ZME/P who scored the maximum 3000 points from 3 wins, and were runners up in the other two sessions. Runner up was Neil G4LDR, who won the other two sessions and also gained a second place.

In the Restricted section the honours go to Stewart G0LGS/P for the second year running, with 3000 points from four session wins. His son Matt 2E0MDJ/P takes the runner up position this year with two joint wins and a second place.

The G3RPE Memorial Cup will go to the Telford & District ARS(G3ZME), and the G3JMB Memorial Trophy is awarded to Stewart G0LGS.

10GHz Contest September 2016

Open Section

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX km
1	G4LDR	IO91EC	11	2027	F6APE	423
2	G3ZME/P	IO82QL	10	1759	GM0USI/P	402
3	G4BAO	JO02CG	6	1242	G4KUX	298
4	GM4BYF/P	IO85QV	2	182	GM0USI/P	110

Restricted Section

Pos	Callsign	Locator	QSOs	Score	ODX Call	ODX Kms
1	G0LGS/P	IO81XW	7	781	G4KUX	302
2	2E0MDJ/P	IO81XW	6	694	G4KUX	302
3	M0GHZ	IO81VK	5	466	G4ALY	177

5.7/10GHz Championship Tables

Final positions after five events, the best three count to the total.

5.7GHz

Pos	Callsign	29/05/16	26/06/16	31/07/16	28/08/16	25/09/16	TOTAL
1	G(P)3ZME/P	1000	1000	1000	1000	900	3000
2	G4LDR	0	333	424	347	1000	1771
3=	GW3TKH/P	827	0	455	471	0	1753
3=	GW4HQX/P	827	0	455	471	0	1753
5	M0HNA/P	0	408	671	655	0	1734
6	G4BRK	406	406	0	385	0	1197
7	M0GHZ	471	0	0	0	411	882
8	G3VKV	156	0	226	152	0	534
9	2E0NEY	0	0	0	250	0	250

10GHz Open

Pos	Callsign	29/05/16	26/06/16	31/07/16	28/08/16	25/09/16	TOTAL
1	G(P)3ZME/P	1000	1000	800	1000	868	3000
2	G4LDR	0	630	1000	741	1000	2630
3	GW3TKH/P	530	0	373	472	0	1375
4	G4KUX	466	850	0	0	0	1316
5	G4BAO	271	202	0	0	613	1086
6	G0EHV/P	0	0	692	0	0	692
7	G3VKV	99	0	277	95	0	471
8	M0DTS/P	424	0	0	0	0	424
9	G8GTZ/P	250	0	0	0	0	250
10	G4GSB/P	163	0	0	0	0	163
11	GM4BYF/P	0	0	0	0	90	90

10GHz Restricted

Pos	Callsign	29/05/16	26/06/16	31/07/16	28/08/16	25/09/16	TOTAL
1	G0LGS/P	1000	1000	1000	620	1000	3000
2	2E0MDJ/P	1000	529	1000	445	889	2889
3	M0HNA/P	0	708	602	1000	0	2310
4	GW4HQX/P	549	0	283	746	0	1578
5	M0GHZ	498	0	0	304	597	1399
6	G0PEB/P	487	0	545	0	0	1032
7	G1DFL/P	54	23	0	245	0	322
8	G3YJR	0	0	215	0	0	215

Nanowaves

Scouts

From Martyn Vincent G3UKV

Just to pass on the fact that there is life (and light) in Shropshire.

As part of JOTA weekend, one of the organisers in this area, John M0JZH, asked for "light comms" as an addition to normal HF/VHF QSOs between JOTA stations.

So Paul M0PNN, Dave G8VZT and myself dusted off our 2012 red-light gear (Bernie G4HJW style) and checked it all out, since it hasn't been used since August 2013. Dave loaned his tcvr to John M0JZH and Graham G7LMF who climbed the Wrekin (IO82RR) with two groups of Scouts, I operated from home (IO82RR57 – what luxury!) and Paul with his son went across to a local hill monument IO82TR17 (Lilleshall Monument).

What worked really well was that once we established 2X light comms. (distances only 9-13 km), we used 2metres FM for cross-band working, so that the scouts got an instant response as they called on the nanowaves from the Wrekin to each of the 'out' stations (M0PNN/P and G3UKV) - and of course there were no licence issues. It was a really clear evening, and signals were S9++ (audio overload distortion noted!).

The young and not-so-young really enjoyed the evening, and it was really something different for the scout groups.

Nanowaves: A new World record

From Barry Chambers G8AGN

This evening, on Wednesday 2 Nov 2016, Barry G8AGN/P and Gordon G0EWN/P worked Richard G0RPH/P over a 102km path using infra-red "light" at 850nm.

G8AGN and G0EWN were operating from the car park close to the Holme Moss TV transmitter site near Holmfirth IO93BM77 and G0RPH was operating from Claxby in Lincolnshire.

Because 850nm is invisible to the eyes, initial link up and rig alignment was made directly using red light 625nm. We then switched to infra-red and G0RPH's signal was immediately heard by both G8AGN and G0EWN.

Signals using 850nm were very much stronger than those received using 625nm even though the IR transmitter was much less powerful than the Phlattlight LEDS used with red light. G0RPH's signal was so strong that it was measured at 50dB S/N using Spectran. The detector we use is a standard wideband diode SFH2030 , not the filtered one.

G8AGN and G0EWN then took it in turns to transmit to G0RPH using 850nm and he also reported receiving strong signals from both stations.

At the Holme Moss end of the link, at 1700 ft asl, visibility was excellent. The wind was light but it was very cold - down to 1C by 1900 hrs UTC.

The signal strength at 850nm was remarkably high but with evident QSB which was most noticeable when listening to a steady tone which it sounded almost "bell-like".

It is believed that this 850nm contact represents a world first over 100km.

NB This was a contact using infra-red radiation not visible. Also, we used LEDs rather than lasers (for which longer distances have been achieved). To the best of my knowledge, all previous records were done using visible light. You cannot see 850nm IR and the propagation at IR will certainly be different from visible.

Richard Hanes G0RPH adds

The station at my end was located in IO93UK17 and on 859nm I was running just 900mW input to a star type LED. The receiver used a plain (ie without IR filtering) SFH 213 photodiode (which has been slightly modified optically to better match the receive lens) into a KA7OEI type receiver. Transmitter and receiver share an A4 Fresnel lens and all signals were amplitude modulated voice.

As a part of the experiment, I reduced the input power to about 100mW and still received a 5/4 signal report from Holme Moss. Conditions were obviously very good!

Thanks to Barry and Gordon for a most interesting experiment.

Activity News : October 2016

By Neil Underwood G4LDR

Please send your activity news to:

scatterpoint@microwavers. org

Introduction

As reported elsewhere in this edition of Scatterpoint, there has been some ground-breaking tests carried out at infrared (IR) wavelengths (850nm) which have resulted in a contact over 100km. Meanwhile there has been activity on the cm and mm bands which have included some wide band 10GHz Amateur Television and some enhanced conditions, which for once I managed to catch.

Activity on the cm bands

From John G3XDY JO02

Here's a snapshot of activity here over the past month, starting with the October UHF Contest on the 1st/2nd October. It's been quite busy, with 154 QSOs on 23cm alone in the period.

A nice opening to the Pyrenees on 6/3cm on the 30th in the French activity day - unfortunately my 2m system was out of action so I missed some potential contacts through lack of talkback. I have also included some news on microwave beacons.

UHF Contest 1st/2nd October.

1.3GHz: SK7MW JO65; DF4IAO, DR9A JN48; DL3IAS, DJ5AR JN49; F6KFH, DF2VJ JN39; DH0LS, DM5D, DG6QF JO61; DL0GTH, DK0NA, DL4NFA JO50; DJ6OL, DJ3AK JO52 F1AZJ/P JN28; OK2A, DH5YM JO60; DK2ZF/P JO43; F6KNB IN94; OZ9PZ JO46; OZ1FF JO45.

2.3GHz: DL3IAS JN49; DR9A JN48; DL0GTH JO50; F1AZJ/P JN28; OZ1FF JO45.

3.4GHz: DL3IAS JN49; DF0MU JO32; DL0GTH JO50; DK0PU JO31.

5.7GHz: F5KMB/P JN19; PE1MMP JO21; DF0MU JO32; OT5A/P JO30; DL0GTH JO50; F1AZJ/P JN28; PI4GN JO33; DK0PU JO31.

10GHz: F5KMB/P JN19; DK1VC, DK0PU, DL0LN JO31; PE1MMP JO21; DF0MU JO32; PI4GN JO33.

1.3GHz UKAC 18/10/16

OZ9KY JO45; DL0VV JO64; DL3IAE, DJ5AR JN49; OZ9PZ JO46; SK7MW JO65; GM4JTJ IO86; GW4HXO IO71; G8BCG IO70; GD8EXI, GI6ATZ IO74.

2.3GHz UKAC 25/10/16

SK7MW JO65; DL0VV JO64; DF9IC JN48; PE2TV JO32.

3.4GHz UKAC 25/10/16

PE1ITR JO21;

Tropo Opening 30/10/16

1.3GHz: F1AZJ/P JN28; F1NYN/P JN06; F6APE IN97; F6EAS IN98.

2.3GHz: F6CIS IN94; F1NYN/P JN06.

3.4GHz: PE1CKK JO22.

5.7GHz: F2CT/P JN02AX 1015km 57 SSB; F1NYN/P JN06: PE1CKK JO22.

10GHz: F1NPX/P JN19; F2CT/P JN02AX 1015km 55 SSB

From Neil G4LDR, IO91

On the evening of Sunday 30th September I switched on the TV to find all Freeview HD channels were unwatchable due to co-channel interference despite being line of sight to the TV transmitter. On checking the Southampton University 10GHZ SDR located at Farnham (IO91), it showed that numerous 10GHz beacons were being received.

At my QTH a number of GHz beacons from the Netherlands were received. I proceeded to have a contact with ON7FLY on 10GHz (JO22) at 59 on ssb and 55 on FM as well as 23cms. I then worked PE1CKK on both 6cms and 9cms.

Activity on the mm bands

From Keith GW3TKH IO81

The 27th October was a momentous day! Pete's (G4HQX) 24GHz gear was finally ready for testing.

We started out at Old Passage near the Severn Bridge to compare signal levels of GB3AMU at 35km, very similar on two equipment's, but there was a slow beat on Pete's received signal which turned out to be a failed GPS antenna. No spare with us, but no problem on FM.

I then moved to Cefn Y Galchen, IO81LS, and Pete to Coaley Peak, IO81UR. Signals were quickly found and resulted in a 59+/59+ exchange in FM at 52km.

Pete's gear is based on Alcatel modules running 600mW to a 30cm dish.

Ready for some real tests next year.

From Neil G4LDR IO91.

On Sunday 30th October John, G4BAO, called me to say he was hearing GB3SEE beacon on 24GHz. We therefore tried to work on 24GHZ but without success, at the time John was only 519 with me on 10GHz.

The following evening, the GB3SEE beacon on 10GHz was again 599 (normally 519) so I listened for the GB3SEE 24GHz beacon and eventually found it, but not a very strong signal at 419 at best. This is the first time I have heard the 24GHz beacon from Reigate over the 103km obstructed path.

Activity at nm wavelengths

See separate report in this issue (page 20).

Microwave Amateur Television

From Denis G3UVR IO83.

A report of new 3cm ATV activity around The Wirral and Merseyside.

Just before the start of the September UKAC 10GHz contest I was preparing for the evening when I noticed I could no longer receive my own WBFM signal and so no contacts were made on WBFM that evening. Sunday 9th October was a suitable good weather day to be able to go up on the roof and take down the LNB and Squarial used to receive wideband modes for repair. Back in the shack with it all and opening the LNB I found the lossy foam had gone rusty and the DRO was no longer stuck to the PCB. There was much corrosion to the chassis of the LNB due to ingress of water over twenty five years out on the roof previously performing without any issue.

I had another LNB already modified with a 9.1GHz DRO so I was able to mount that on the Squarial and get it all back out onto the rotator on the roof. Only the day before I had heard of two new arrivals to ATV on 3cm would like me to try and receive them. Tests started at 18:00 local time Sunday 9th October I was able to receive a P5 noise free picture from Bill G4YWD at a distance of 8.1km followed by the same from Jim G6NOI at 5.5km. They were both running 500mw with DG0VE amplifiers recently purchased.

10GHz Wide band dishes at G3UVR's QTH

I had also asked a previously active 3cm ATV station John G7LLQ if he could come on and try some pictures again to test my replacement LNB. John decided to go out mobile and sent me a P5 noise free picture from the Liverpool side of the Mersey at Otterspool promenade this being 12km distance from me. He then said he would drive outside Liverpool on the A580 to another site 23km away and I was again able to take P5 noise free pictures from him running 1w of RF. When John got back to his home QTH he switched on his fixed Squarial on the roof pointing at me running just 30mw which I received a noisy picture at P2 The distance between us was 14.7km. Since Friedrichshafen this year John now has a new DG0VE SSB transverter with 432MHz IF and was able to go out mobile giving me an extra QSO in the September 10GHZ UKAC.

All in all a great day I was able to restore my failed wide band receiving system and be rewarded by signals from five different locations as well. Pictures attached showing the roof mounted rotatable wide band dish for receive and a fixed transmit dish pointing at Winter Hill to work stations from the Bolton wireless club. The second picture shows the failed LNB after 25 years' service.

Locally there is still life in old wideband modes yet.

G3UVR's failed 10GHz LNA, after 25 years of service.

Microwave Beacon News

On

From Matt Wilkinson 2E0MDJ, Chairman - Gloucestershire Repeater Group

GB3CCX 10GHz Beacon
10.368940 GHz
Locator: IO81XW81
150mW
Slotted Wave Guide Antenna - 4M AGL approx 330M ASL

GB3CCX 47GHz Beacon
47.088940 GHz
Locator: IO81XW81
10mW
Slotted Wave Guide Antenna - 4M AGL approx 330M ASL

Off

From Geoff Findon G3TQF, beacon keeper for GB3LEF, GB3LES, GB3LEX, GB3LEU

GB3LEX, 10.955GHz beacon has been taken out of service for the investigation of the cause of reduced radiated output following reports that although it was audible locally listeners further away were no longer able to hear it.

… and finally

The deadline for activity news for the next edition of Scatterpoint is Thursday 1st December.

UKµG Microwave Contest Calendar 2016

Dates	Time UTC	Contest name	Certificates
13 -Nov	1000 - 1400	5th Low band 1.3/2.3/3.4GHz	F, P,L

Key:	F	Fixed / home station
	P	Portable
	L	Low-power (<10W on 1.3-3.4GHz, <1W on 5.7/10GHz)

Contest results are also published online – please follow the link from the UKuG Contests page at:

www. microwavers. org/?contesting. htm

73
John Quarmby G3XDY

Events calendar

2016

Nov 12	Scottish Round Table	www. gmroundtable. org. uk/

2017

Jan 14	Heelweg, Westendorp NL	www. pamicrowaves. nl/
Feb 11	Tagung Dorsten	www. ghz-tagung. de/
Apr 8	CJ-2017, Seigy	cj. ref-union. org/
Apr 8–9	**Martlesham Microwave Round Table & UK*µ*G AGM**	http://mmrt. homedns. org
Apr 22	RSGB AGM, Cardiff	http://rsgb. org/agm
May 19–21	Hamvention, Dayton	www. hamvention. org/
July 14 – 16	Ham Radio, Friedrichshafen	www. hamradio-friedrichshafen. de/
Sept 8 – 10	62. UKW Tagung Weinheim	http://www. ukw-tagung. de/
Sept 29–30	National Hamfest	
Oct 6 – 8	RSGB Convention	rsgb. org/convention/
Oct 8 – 13	European Microwave Week, Nurembourg	www. eumweek. com/
tbd	Microwave Update, San Jose, California	

2018

June 22–24	Ham Radio, Friedrichshafen	http://www. hamradio-friedrichshafen. de/
August 16–19	EME2018, NL	
Sept 23–28	European Microwave Week, Madrid	http://www. eumweek. com/

NB Some of the 2017/18 event links may not be working yet.