An Amateur Radio publication for the Microwave Enthusiast

scatterpoint

Formerly the RSGB Microwave Newsletter and now published by the UK Microwave Group

2006 June

Andy, M0GAV (right) makes his very first 10GHz QSO - Sheffield Microwave Workshop, 27 May 2006
See pages 14 and 15 for more details ...

In this issue ...

Latest News ...

- **First UKuG Beginners' Workshop a success!**
- **UkuG Official Beacon List Keeper appointed**
- **G3XDY wins May Lowband Microwave Contest**

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

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From the Editor's Desk

Once again we have had a bumper input of technical and general interest items. Many thanks to all our contributors ... you make this newsletter! If your material is not included this month, rest assured that it will be in the next edition.

The next issue of Scatterpoint will be sometime in early August and will the usual bi-monthly summer edition. We do this in midsummer and midwinter (Nov-Dec issue) so that you receive ten Scatterpoints a year.

Over the past few months, some of the the UK Microwave Group committee members have been very heavily involved indeed writing and submitting responses to the RSGB Spectrum Forum and to both Ofcom and European consultations. These include beacon planning and licensing, the new BR68 proposals, amateur usage of the millimetre bands, increasing levels of licence free users on many microwave bands, RSGB Yearbook microwave pages, annual reports to the Spectrum Forum and so on. Emails have been exchanged at around 0245BST on several occasions! It's rumoured that one of the members is actually an android as he never seems to sleep or eat!

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ERRATA

In last month's editorial the date of the Sheffield Microwave Workshop was erroneously stated as 27th April when it should have read 27th May!

A warm welcome to new members of the UK Microwave Group

WANTED: PIN CONNECTION DATA

and operating DC volts levels on following two ovened precision oscillators!

Item ONE: QUARTZ CRYSTAL 100 MHz ref temperature stabilised oscillator source, Manufacturer's markings as : C.E.P.E PILOTE A QUARTZ Sp 8744-962-iss 7 Fo 100.0000 MHZ f a 25 oC -0>5 10¬7 No Z.10532 The above has 5 pins on its base and no markings at all.
N.B! Any kindly French readers, please, you may just recognise and know this manufacturer. I just cannot find it anywhere on the Euro websites!

Item TWO: Cathodeon Crystals Ltd, Cambridge, ENGLAND. 10 MHz precision ref. temp. controlled Model, Type FS 5953-31 marked 5785. This canned frequency source has 4 pins on its base in square configuration , numbered 1 , 2, 3 & 4
One would think the above should also be easy to locate but, again, I cannot find it!

Please Contact me at :
adrian.g8psf@blueyonder.co.uk
or Tel:- 020 8 366 5164

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

WEAR YOUR BADGE WITH PRIDE !

UKuG is pleased to announce the immediate availability of its handsome LAPEL BADGE (see left). These are similar in size to the standard RSGB lapel badge and those of other national societies. We think they are extremely nice badges with their blue background, black lettering and gold trim. They come in an enamelled metal finish with a simple-to-use pin fastener.

They are available to UKuG members only.

If you want one (or two?) then email our Secretary, Ian Lamb, G8KQW at: **ianlamb@btconnect.com** for more details or, if you are in the UK, simply send him a cheque for £2.50, **payable to UK Microwave Group**. This price includes first class postage within the UK. Ian's postal address is on page 2 of this issue.

Overseas members should email Ian for details of postal charges to their country.

AMSAT-UK

International Space Colloquium 2006

AMSAT-UK will be holding their 21st International Space Colloquium at the University of Surrey, Guildford, England from Friday 28th until Sunday 30th July.

There will be guided tours of the Surrey Space Centre at the University with the satellite mission control centre and the satellite assembly facility. These tours are always popular and they provide a unique opportunity to see satellites in various stages of construction.

On Friday in addition to the main lecture programme there will be a special "Beginners Session" to show newcomers how to use the many Amateur Satellites that are available.

There will be UoS PhD student poster exhibition. About a dozen post graduate students will be present with posters and exhibits, and they will explaining the projects they are working on.

The RSGB GB4FUN van will be present throughout the event to allow visitors to work the satellites.

The event is open to all Amateurs and SWLs. Either Day passes or full packages, comprising overnight accommodation and meals at the University, are available. This year, an online booking service is available with PayPal, Visa and Master Card payments accepted.

For further details contact Jim Heck G3WGM Tel: 01258 453959
Email: **g3wgm@amsat.org**
Web: **http://www.uk.amsat.org/Colloquium/** (see Travel for maps)

Visitors can also just turn up on the day although AMSAT-UK would appreciate notification if possible.

73 Trevor M5AKA AMSAT-UK: http://www.uk.amsat.org/

UKuG PROCEEDINGS 2006

We still have a small number of copies available for purchase by post. To obtain one, please do the following:

(1) email G3PHO to reserve your copy.

(2) send the total required (see below) to Steve Davies, G4KNZ, UKuG Treasurer, whose address is on page 2 of every copy of Scatterpoint, or email him at [steve.davies:nokia.com]. Money should be send in any one of the following formats:

either: PAYPAL (contact Steve first to obtain his PayPal account info)
or: Cash Euros or US dollars (if you wish to take the risk!)
or: UK Sterling cheque
or: Bank draft (contact Steve first about this)

Once your funds have arrived, your book will be posted to you immediately.

If you are a UK resident, you can send a UK bank cheque (payable to UK Microwave Group) direct to:

G3PHO, Peter Day, 146 Springvale Road, Sheffield S6 3NU, U.K.

Doing things this way is the fastest method of getting your copy! This is only for UK residents. Overseas purchasers MUST pay via G4KNZ but reserve their book by emailing G3PHO as well.

PRICES:(inclusive of packaging and First Class or airmail postage):

UK: £7.00 (7 UK Pounds)
EUROPE: £8.00 (8 UK Pounds) or 12 Euro
REST OF WORLD: £10 (10 UK Pounds) or $18 US

SURFACE MAIL PRICES TO REST OF WORLD (outside Eu): £8 (8 UK Pounds) or $14 US

Sorry... no credit or debit cards.

If you use PayPal please add 4% as Steve will otherwise have to bear the charges on his account.

The European and US dollar prices have been rounded up to the nearest dollar (only a few cents difference!) to facilitate sending cash notes if you wish to chance it. If you do this we suggest you wrap the notes in metal foil or put inside a folded card to make detection difficult.

An Auto switching 10MHz Oscillator
by Dave Robinson G4FRE

Introduction

Recently, while working G4DDK off the moon on 1296 JT65B, I realized I needed a more accurate onboard auto switched 10MHz oscillator for my W7PUA DSP10 transceiver **(1).** This provides the "normal" frequency reference for the radio, but when an external oscillator is applied, automatically switches off the internal oscillator and feeds through the external reference to the board. Although the miniature Toyocom oscillators are no longer available, I have found many more uses for the circuitry in other microwave source applications.

Circuit Description

The circuit is shown in **Figure 1**. Q1 buffers and splits the input signal. One output signal drives Q5B gate that buffers the off board 10MHz source. The other output of Q1 drives D1, the output is used to drive switch Q2. Q3 and Q4 buffer and invert this signal to switch the supply voltage to the Toyocom Oscillator. Q5A buffers the 10MHz output from the onboard oscillator. Q5C switches between the two oscillators and provides the 10MHz output signal at TTL levels

To miniaturize the circuit, a plated through PCB was produced. Q3 contains a complimentary pair of FETS. Two wire links are needed on the board. **Figure 2** shows the component overlay. **Figure 3** shows the completed unit.

Figure 1. Circuit Diagram

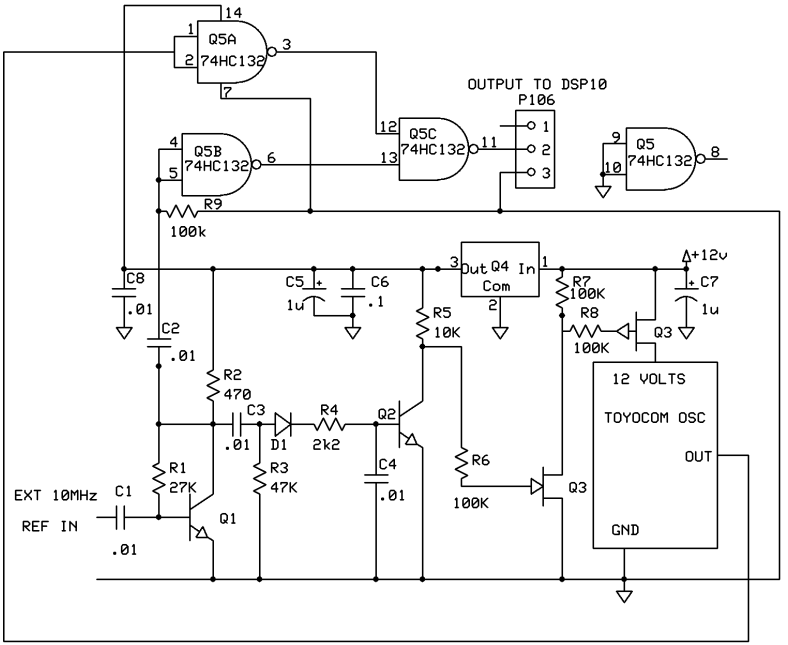


Table 1. Component listing

Component	Value	Component	Value	Component	Value
C1,2,3,4,8	0.01u	Q1,2	BC846	R1	27K
C5,7	1u tantalum	Q3	IRF7309	R2	470
C6	0.1u	Q4	78L05	R3	47K
D1	BAS16	Q5	74HC132	R4	2k2
		Q1,2	BC846	R5	10K
				R6,7,8,9	100K

Figure 2. Component layout (track view)

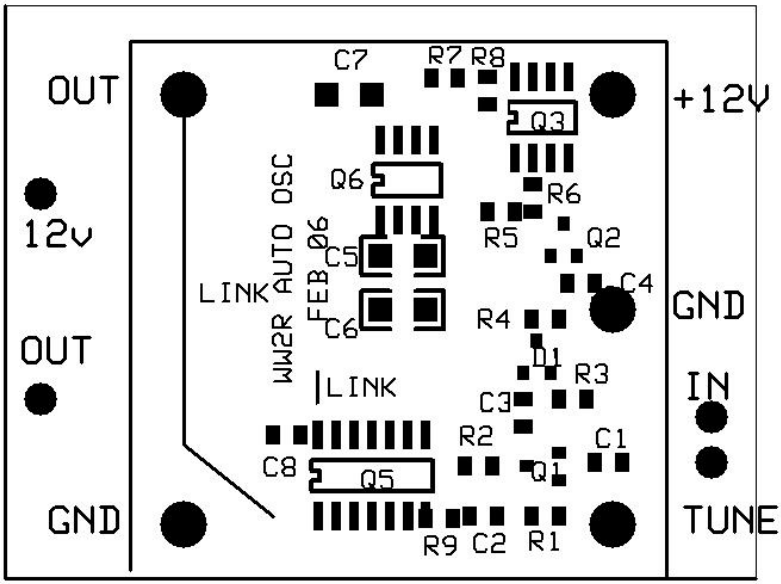
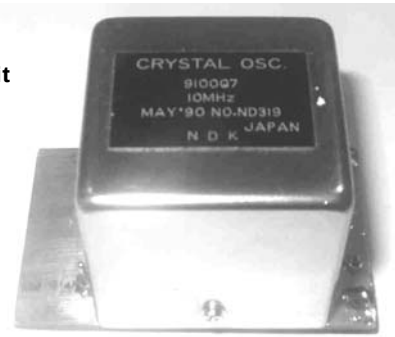


Figure 3. Finished unit



References

1. http://www.proaxis.com/~boblark/dsp10.htm

Simple and Cheerful L-Band Synthesiser

by "Independent Microwave Radio"

Here is a design for a simple synthesiser covering 1GHz to a little under 2GHz. It is based around an off-the-shelf Mini-Circuits VCO package and a PLL Synthesizer IC of the type used in low cost 2.4GHz Tx/Rx modules and cable TV decoders. The poor phase noise (due mainly to the small low-cost VCO package) makes it unsuitable for narrowband use, but as a microwave test source, or for TV or high speed data it is quite up to the job.

The circuit is shown in **Figure 1** and could hardly be simpler. The U6239 synthesiser chip contains the crystal reference oscillator and a fixed reference divider, a prescalar and programmable counter combination for dividing the prescaled VCO input by any integer up to 32767, a phase/frequency comparator and interfacing logic. An external NPN transistor is needed to complete the loop amplifier assembly allowing a drive voltage higher than the 5V logic Vcc to be delivered to the VCO for extended frequency tuning range. With the 4MHz reference crystal specified, the loop operates at a comparison frequency of 7.8125kHz, which with the divide by 16 prescalar means the final output frequency can be set in steps of 125kHz. A 3.2MHz reference would give 100kHz steps, and pro-rata.

A 16F84 PIC microcontroller sends the divider values and set-up information to the U6239 chip at turn on. The values are stored in non-volatile EEPROM in the PIC and can be modified by connecting the module to a PC via an RS232 serial interface. A simple 'operating system' is stored on the PIC, allowing frequency codes to be set arbitrarily with simple hexadecimal values sent as ASCII characters from any serial control software such as *Hypertrm*, or from custom software. The operating system permits the non-volatile memory to be changed without having to use a PIC programmer, and also allows the synthesizer to be tuned in real-time for swept or stepped applications. When not under RS232 control, the PLL state is monitored and a LED is illuminated when the synthesizer is correctly locked.

The output from the VCO, after passing though a 3dB attenuator, is buffered by an ERA-5 modamp running into slight gain compression to give an output level of around 17 – 19dBm. The actual level obtained depends on supply voltage.

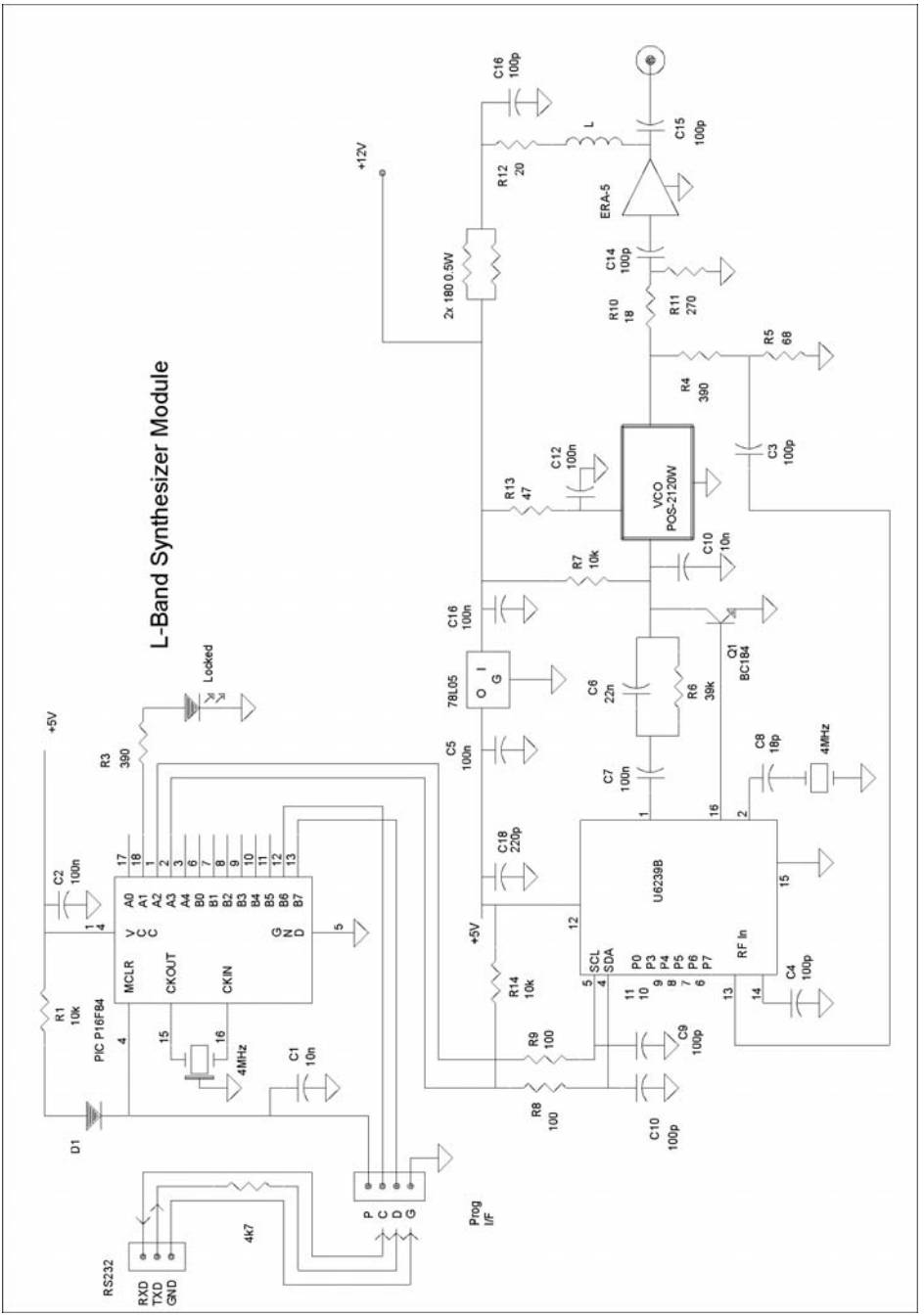
Operation, Construction and Build notes

The loop-bandwidth of the PLL is only a few tens to a hundred Hz, so frequency modulation can be generated by applying a suitably attenuated voltage through capacitive coupling directly to the VCO control pin. The 10k collector load resistor ensures there is a reasonable impedance to inject against, and MHz FM deviation is typically generated at 1.3GHz from a 5V peak signal through a 200k level-setting resistor and DC block. The modulating frequency can extend to many MHz making FM TV modulation straightforward.

The reference oscillator circuitry is a little strange, and uses the 4MHz crystal in series resonant mode. This means that if the normal cheap-and-cheerful catalogue 4MHz device is used, the final output frequency ends up around 70 part-per-million high, ie with around 100kHz error at 1300MHz. With a 125kHz step size this is not tragic, and if accurate frequency setting is required, a proper series resonant crystal or external source should be used instead.

The supply voltage can range up to 20V (but beware dissipation in the ERA-5 and its biasing resistor) which would permit the full 1 to greater than 2GHz tuning range of the VCO specified. With a 12V supply, the upper frequency limit is typically 1.8GHz. The U6239 is specified to 2GHz and Mini-Circuits VCOs extend to this region.

A Printed Circuit layout is shown in **Figure 2**, using surface mount components (1206 size, nothing fiddly!) with a continuous groundplane on the underside. A few ground vias connect top tracks through to the groundplane. The supply resistor for the ERA-5 is made up from two parallel


L-Band Synthesizer Module
+5V
+12V
Locked
R3 390
C2 100n
R1 10k
PIC P16F84
MCLR
CKOUT
CKIN
VCC
GND
A0 A1 A2 A3 A4 B0 B1 B2 B3 B4 B5 B6 B7
4MHz
C1 10n
D1
RS232
RXD
TXD
GND
4k7
P C D G
Prog I/F
C16 100p
L
C15 100p
R12 20
ERA-5
2x 180 0.5W
C14 100p
R10 18
R11 270
R5 68
R4 390
C3 100p
C12 100n
R13 47
VCO POS-2120W
R7 10k
C10 10n
C16 100n
78L05
C6 22n
R6 39k
Q1 BC184
C5 100n
C7 100n
C8 18p
4MHz
C18 220p
U6239B
SCL
SDA
P0 P3 P4 P5 P6 P7
RF in
R14 10k
R9 100
R8 100
C9 100p
C10 100p
C4 100p

wire ended ones on the ground side of the board at this component dissipates around 0.5 watt.

PIC Operating System

If no RS232 lead in connected when the module is powered up (or reset) the synth chip is booted with the frequency and set-up information stored in EEPROM. The LED flashes four times and illuminates when the PLL achieves lock-up.

If a correctly configured RS232 interface is connected at turn on, the synth chip is booted with the stored frequency and programming mode is entered instead with no lock-monitoring performed – the LED remains off. RS232 parameters are 1200 baud, 8 bit data, no parity, 1 stop bit. If Hypertrm or similar software is being used on the host PC, an introductory message is presented:

6239 Control
G/E/D/C/W/S/

Single letter commands are used to set-up the device:

D	Displays the current EEPROM contents
E	Allows four hex characters (two bytes) of frequency information to be entered when requested. NO carriage return is needed, the data is accepted as soon as four characters have been entered
C	Allows 2 hex characters (one byte) of configuration information to be entered when requested.
S	Sends these values to the synth chip WITHOUT writing to EE. The new frequency should appear immediately, but the LED will remain unlit even if the PLL is locked up
W	Writes these to EEPROM
G	Puts the synthesizer module into normal operation without any further writing to EEPROM, and exits command mode. The LED will now correctly respond to PLL lock status. T0 re-enter command mode the module has to be powered down or the PIC reset by briefly grounding the RST line while the RS232 interface is connected.

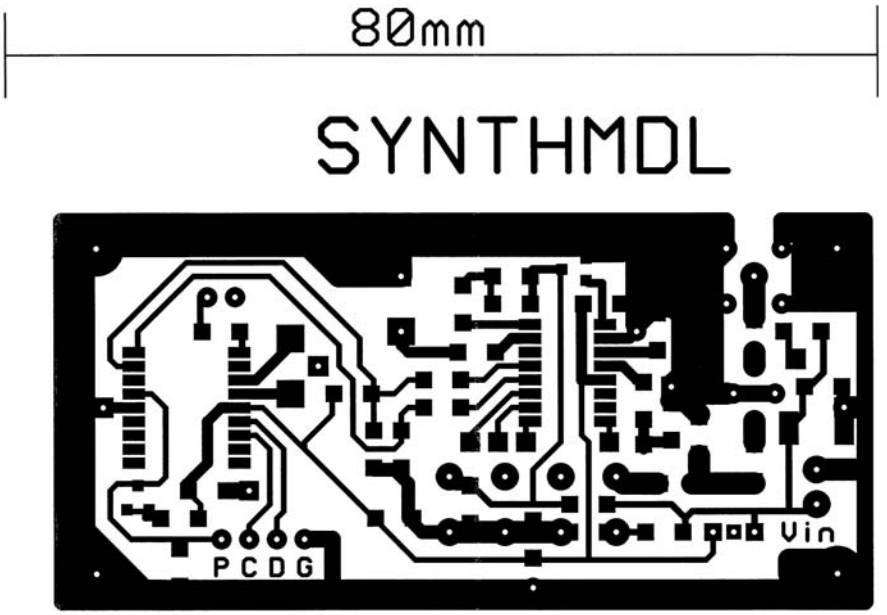
Consult the data sheet for the U6239 (or any other synth chip) to find the options possible by altering the programming of the Configuration register. The synth chip specified does have 5 Optional I/O lines which can be used as required for controlling (or reading) external functions. Apart from bringing the pin connections out to pads on the PCB, they are not used in this module and the Operating System provides no access to the P register.

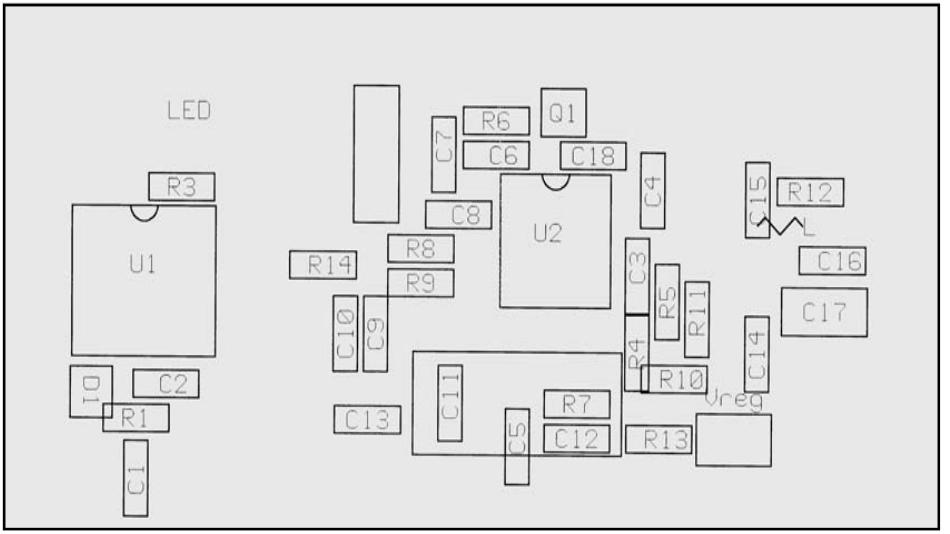
The default values for the pic code as supplied are 125kHz steps and a nominal frequency of 1296.25MHz based on a 4MHz reference crystal.

Component availability

The U6239 chip was used because a number of samples were to hand. From the author's memory, these devices were not available from any supplier in small quantities, although it may be worth asking. However, the SP5055 device is functionally similar, as is the TSA5511 1.3GHz device, and all should directly work as a drop-in replacement, although other devices have not been tested here. (Routines in the PIC code were taken from a design that *did* use the 5511 chip). It might be worthwhile looking at junked RF modules at rallies etc for surplus devices. As different synth chips appear to require the same circuitry and control codes, there may well be yet other types out there that will work – perhaps a bit of web searching in this area may prove fruitful!

For the VCO, other Mini-Circuits VCO packages that are pin compatible will work, and the chip/module will function down to 300MHz with suitable choice of VCO. Mini-Circuits are quite


80mm
SYNTHMDL
PCDG
Vin


LED
R3
U1
D1
C2
R1
C1
C7
R6
Q1
C6
C18
C8
U2
C4
C15
R12
L
R14
R8
R9
C3
C16
C10
C9
R5
R11
C17
R4
R10
C14
Vreg
C11
R7
C13
C5
C12
R13

smaller-user-friendly and credit card orders are accepted against a not unreasonable minimum order charge of £20; the VCO with a handful of modamps to keep as spares will reach this target.

The PIC code is available in the package called *SynthMdlPic.ZIP* which can be downloaded from: **http://www.microwavers.org/software/SynthMdlPic.zip**

The source code is included, as well as the .HEX code for downloading directly to any PIC programmer. Feel free to play with the source code and do whatever you want with it. If there is sufficient demand, it may be possible to organise the supply of programmed PIC devices through the UK Microwave Group.

A GPS Display .... by G8BKE

Although the Rockwell Jupiter TU30-D140 GPS receiver module (**ref.1**) provides 1pps and 10kHz outputs it does not incorporate a 3D lock indicator, except via the normal GPS NEMA output. Tommy Sullivan, W1AUV, can provide a PIC which lights a lock LED, but he has recently gone one step further and produced a PIC which, via a 2 line LCD display, can display a number of other GPS parameters including, Lat/Long, 3D lock, number of satellite's tracked and Maidenhead locator information. The locator information is useful for confirming new site information when out /P.

The circuit is very simple, so I opted to make it up on a small piece of veroboard and with a suitable 2 line display and an 8MHz crystal from Farnell , I was soon in business. I took the GPS data from pin 11 of the GPS module and the picture shows the completed display integrated into my 10MHz standard box. Two push buttons allow independent scrolling of the two display lines.

A stand alone decode and display unit can also be produced, as G8ACE has done, by adding a MAX232 chip to the input of the basic unit. This will allow it to interface to other similar GPS receivers which have a NEMA output on an RS232 link.

Tommy can supply the circuit details and a pre-programmed PIC for $4, or for a bit more, a PCB too. He can be contacted at tpsully@verizon.net

Ref.1 http://www.gpskit.nl/index-en.htm

WANTED

At a recent RAL, I'm reliably informed that somebody brought a ridged waveguide to WG17 adaptor as part of box of waveguide bits. **If you did, and you've no use for it, I need one!**

I have a big(ish) TWTA, with an output port using a WRD-750 ridged waveguide flange, which I want to use. I can't even check the tube until I can put a matched load on it...

WRD-750 is a doubly ridged waveguide. Its basic inside dimensions are about 17.55 x 8.15mm. The ridges are about 4.4mm wide (in the H-plane) and 2.35mm high, leaving a gap of about 3.45mm.

If anyone can help, please email me direct:

gw4dgu(at)blaenffos.org

Many thanks, Chris GW4DGU

24GHz "Easy Build" Transverter

By IanLamb,G8KQW

Having spent 10 years QRT (working overseas and then pressure of work back in UK), I finally found time early last year to start planning the re-assembly of my station. As we were due to move house late in 2005, I decided that all of my microwave operating should be portable but that any equipment that I would build should be able to also operate fixed from my QTH in future.

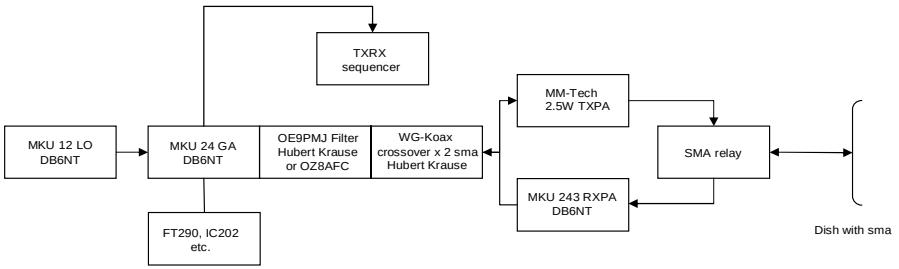
Looking at recent contest results and the discussed the activity levels on 24GHz with various active amateurs, I decided that my original WBFM TRX would be best used as a door stop – it is actually still useful for listening to local beacons on 24.192GHz !

Having talked with one of my pals Roy, G3FYX, and invited him out to Cleeve Common for the next 24GHz cumulative contest, the reality was that I had 4 weeks before the next 24GHz contest in which to design and build a working narrow band system or simply go along as his talk-back operator!

So, the design and build criteria for my system (see Figure 1) was:

- Off the shelf building blocks requiring no alignment or set-up using specialist microwave test equipment
- Minimum amount of mechanical / waveguide work (saves burning fingers)
- A plug and play solution that can be built in one day and would work first time
- A compromise solution that may not give the optimum performance
- Easy build for newcomers to 24GHz in future (funds permitting)

Figure 1:

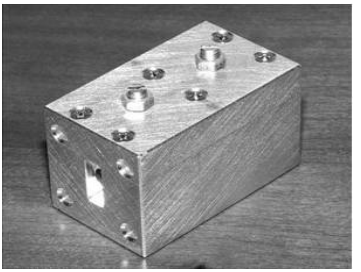


Notes:

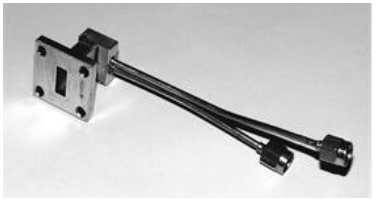
The MKU24, OE9PMJ 2 stage filter and the dual WG-Koax crossover are all bolted together into one unit using 3mm studding with no interconnecting waveguide.

The 2 "outputs" from the WG-Koax crossover are connected either way round to the TXPA input and the RXPA output.

An obvious alternative to this WG-Koax crossover is to fit a single sma transition on the output of the filter connected to an sma relay which in turn connects to the RXPA and the TXPA – using this component and transmitting a small amount of RF up the output of the RXPA with no volts on it has not caused any problems and saves the requirement for an extra relay.



The OE9PMJ 2 stage filter supplied by Hubert Krause of Micro-Mechanik or by OZ8AFC



The WG-Koax crossover x 2 sma also supplied by Hubert Krause

Connections between the MKU 12 LO and the MKU 24 GA plus between the SMA relay and the dish were made using "Quickform 141" (Farnell part # 157-995). The MM-Tech TX PA and MKU 243 RX preamp are connected directly to the SMA changeover relay using back to back SMA connectors

TX/RX sequencer is homebrew but a suitable commercial alternative an EME66B is available from Minikits of Australia. This sequencer ensures that the sequence of events going from receive to transmit is:

- The RX preamp volts are removed
- The antenna changeover relay is energised
- The TX PA is turned on
- The TX driver stages are turned on

and vice versa going from TX to RX. In this way nothing will ever get blown up, even when operating, for example on NBFM during rain scatter.

The MKU 24GA mixer accepts 2.5W therefore no attenuation of the 144MHz drive is required.

Suppliers of the modules used:

DB6NT	- www.kuhne-electronic.de
Hubert Krause	- www.micro-mechanik.de
OZ8AFC	- www.oz8afc.dk/sale.html
Farnell	- www.farnellinone.co.uk
Mini Kits	- www.minikits.com.au

Once I had purchased all of the modules, bits and pieces, this system was firstly assembled on the bench on an aluminium plate which would subsequently be fitted into the box as one unit. After switch on, there was an encouraging increase in the noise level on the IC202 144MHz transceiver. Switching the RX preamp power on and off also gave a corresponding variation in noise level, so I was happy with that ... no sophisticated tuning or even attenuators fitted at this stage. On keying up the TX into open waveguide, the system current consumption was 2.4A at 13.8V DC, very much as expected and in line with my calculation of the sum of the system components on TX, at this point I was able to verify that I could work myself on my old 24GHz WBFM system (not that that's much use but at least it worked as far as the bench!). I calculated that, after the filter

and the WG-Koax crossover, I was slightly over driving the MM-Tech TX PA, but only by a few dB, so it was left well alone at this stage.

This system can easily be assembled a standard, large sized die-cast box or an IP56 plastic box, I chose a die cast box as I found it easier to mount the TX PA heat sink to the box. So, I was now ready to go portable with Roy G3FYX ….

On Cleeve Common, July 10th 2005, Roy was able to hear the Telford beacon GB3ZME but I was not. After much messing about changing dishes our conclusion was that the 0.3 dish I purchased and was using was faulty as I could hear the Telford beacon on Roy's dish, so much for the working first time objective! So, the only piece of second hand rally junk I used in the system build was faulty – now you know why I don't favour buying junk at rallies!

My first attempt at a QSO was with Andy G4MAP/P, using Roy's dish and, although I could hear Andy, his signals were well down on those using Roy's equipment. So off came the lid and after investigation I was horrified to find that the filter tuning screws had come loose in transit – disaster! Thankfully Andy was able to have a sleep and leave on his TX whilst I roughly returned the filter screws for maximum signal. Then Andy couldn't hear me so the lid came off again and further investigation revealed that I hadn't soldered the choke (that takes the PTT DC feed to the sequencer) back on to the incoming BNC RF socket when fitting in the box. That resolved my first QSO ensued over 33km. We later worked G3UKV/P and G8VZT/P on Brown Clee at 72km.

Lessons to be learned:

- Be careful of surplus, used equipment performance
- Araldite / fix filter screws before you do anything else
- Always assemble correctly in the box after bench testing
- Testing alongside another working system is preferred to verify operation

If I had followed the 3 points above, this system would have realised the objectives I set and I believe it is repeatable for others who may want to enjoy 24GHz portable or fixed station operating.

One could argue that using a waveguide dish feed together with a waveguide changeover switch and a waveguide entry RX PA would give better receive performance but, as this system is not intended for EME, I believe the performance is more than adequate. Once the filter had been re-aligned and the tuning screws fixed the system noise figure of my unit has been measured at <3dB and the TX output power at +34.7dBm.

This system was used with a Procom 0.48m dish for the August, September and October 2005 cumulative contests, working 31 QSOs, 10 of which were 100km+ and 3 of which were 150km+. This system won me the 24GHz cumulative trophy 2005. I have also used this system out portable on many other occasions outside of contests and (touch wood) it has been perfectly reliable.

For 2006 I have upgraded the Procom 0.48m for a PCom (Andrew) 0.6m J fed dish which is mounted above my 47GHz system on a Terracom tripod (courtesy of SBRS) for portable use **(see photo on the previous page)**. My intention is to install the 0.48m Procom dish with a second transverter at the home QTH so that I can take advantage of the opportunities that G4EAT has presented and also so that my XYL can monitor when I'm operating out portable!

73 and see you on 24GHz soon, I hope! **Ian, G8KQW**

UK Microwave Group Workshop at the Burton Street Project, Sheffield 27 May 2006

An independent report by Chris Pearson,M0JRQ (one of the 18 attendees)

There seemed something oddly familiar about the Burton Street Project when I arrived on the morning of Saturday, 27th May. I parked on what had once been the playground of this old stone-built school. Now a community resource centre, this Victorian school had been the setting for the school in the film The Full Monty. So that's why it looked so familiar!

I was feeling a little apprehensive – a bit like my own first day back at school – as I arrived for the UK Microwave Group Beginners' Workshop.

I knew that this was the right workshop for me since I was – just at that moment – an absolute beginner!

After informal introductions and a welcome cup of coffee, Peter Day (G3PHO) opened the workshop with Microwaves – The final frontier? This was just the introduction I needed, taking us through the history of microwave technologies, amateur achievements and tales of Peter's own (not inconsiderable) involvement in microwave communication. There were many examples of hardware to pass around and to peer inside. Everything from pieces of waveguide to a complete narrowband transverter, via Solfan modules, LNBs, LNCs and a 10GHz transceiver built on a sheet of plywood *(see photo right...editor)*

With our appetites for microwave well and truly whetted, the morning session was rounded off with our introduction to amateur television. Peter Blakeborough, G3PYB gave us the background, showed us the hardware then demonstrated TV in action *(see photo left).* Along the way, Peter's presentation included lots of practical advice on using satellite TV-surplus plus some hands-on hardware and goodies to take away and experiment with.

We had plenty to talk about over an excellent lunch provided by Peter's wife, Judy.

Barry, G8AGN opened the afternoon session which was, perhaps, a little more technical than the morning had been but by now I think we'd all had the necessary grounding in microwaves. With our lunches eaten, we were now hungry for equipment for ten gigs and that was what Barry had

ready for us.

Barry took us through transmitters and receivers for 10GHz. Again this was an informative and entertaining presentation that took us very naturally into the final presentation of the day: Gordon, G0EWN on antenna *(see photo right).* The presentations were supported by a delegate's pack for each of us – A goodie bag containing printed information, a contact sheet of presenters and attendees, a membership form for UKuG and a CD. The CD usefully contains all the presentations made on the day (that saved a lot of note-taking!) plus a wealth of other documentation and software.

During the day there had been a number of short-range microwave demonstrations but, after Gordon's presentation, it was time for us all to move outside for a real 10GHz hands-on in the playground.

The playground demo *(see front page photos)* was a great finale to a great day. I think I speak for all who attended when I express my thanks to Peter, G3PHO, to his team of presenters – Peter, Barry and Gordon – and to Judy who kept us properly fed and watered.

One thing I realised when I saw those photos of accomplished microwavers at home; as a microwaver what I need now is a bigger house on top of a hill, with more storage space and a bigger shack in a bigger garden. (but just for now, I've sent off my UKuG application and I'm seriously thinking about a DB6NT 10GHz kit!)

Editor's note: *My thanks to Chris for his nice comments about our first attempt at such a project. The UKuG Committee hope that this is just the start of a nationwide drive to recruit new microwavers. Anyone attending a round table meeting in the past couple of years will realise why we need some younger devotees to this absorbing facet of Amateur Radio! Those already in microwaves are aging rapidly! There are embryo plans afoot to stage another workshop on the South Coast, organised by a prominent club down there. The Sheffield workshop will no doubt be repeated next year but now it's the turn of you experienced folk out there to organise one in your area. There is a real demand for this sort of thing if the emails your editor has been receiving are anything to go by.*

UK Microwave Group Beacon List Keeper

It gives me much pleasure to announce that **Nick Shaxted, GM4OGI,** has very kindly accepted the responsibility of UK Microwave Group Beacon List Keeper.

Many of you will already be aware of the work Nick has done in this field. He has been supplying me with updated beacon lists for my personal website and for the UKuG website for some time now. Up to then the beacon lists have tended to be inaccurate and unreliable, sometimes even relying on hearsay!

Nick approaches this work with real dedication and with a distinct raison d'etre as you can read from his own words:

> "The role a beacon plays in the hobby is usually taken for granted but is usually the first thing people look for when starting out on a new band or when assessing conditions when switching over to a new band. Beacons are paramount in the hobby and having a reliable and trustworthy information resource is an essential part of that structure."

Nick will appreciate beacon information from you at any time, from both the UK and Europe. The listings will be kept from 23cm right up to our highest millimetre bands on which we have beacons. Let's support him as much as we can in his endeavour. His work will complement that which the new UKuG Beacon Working Group will be doing on the practical side of helping beacon builders realize their projects. The next few years should see the UK Microwave beacon system system greatly improved and hopefully be the envy of the "rest".

We can do it folks... it just needs all of us to help when and where we can.

Peter Day, G3PHO, Chairman UK Microwave Group

Internet Access via Pay-as-you-go GPRS for Portable Operation.

by Brian W. Flynn, GM8BJF.

For microwave operation, a useful addition to a station is the ability to arrange skeds via the ON4KST microwave reflector. This is straightforward from a home station but is more difficult for portable operation away from Internet connections. One option here is to access the Internet via GPRS over the the GSM phone system. To do this two approaches are possible. Firstly a GPRS enabled phone could be used in conjunction with a laptop PC or secondly a GPRS card could simply be plugged into the laptop and used to communicate directly. For my purposes I decided to use the second approach. I also wanted a pre-pay set-up as I did not want the overhead of a contract. which would be expensive for my relatively modest portable requirements.

GPRS cards are available on Ebay for typically £10-25. They are not in great demand now as 3G cards give higher performance, but this is not an issue for telnet access to ON4KST. The card I bought is a Vodafone Mobile Connect Card. It is manufactured by Option Wireless Technology and the model is Globetrotter.

The second requirement is a SIM card to plug into the GPRS card. I bought mine directly from Vodafone's website for the princely sum of £2 and once I knew it's phone number I topped it up at my local cash dispenser.

The next step is to get the card enabled for GPRS. By default, Pay-as-you-go SIMs not have GPRS enabled. To do this I put the SIM in a normal phone and called the helpline on 191 and simply asked them to "enable GPRS on this number please". This seemed to be a routine request and there were no issues about doing it. I was warned that it could take up to 48 hours to take effect. So far so good.

The final requirement is the software. The latest version is available for free download from Vodafone's website. I recommend that you get this rather than any older versions that may come along with the card. I have version 5.00.0017. This comes as a zip file and is installed in the usual way. It is important that the software is installed before inserting the card into the laptop. Once the software is installed the card can be inserted. The blue LED on the card should flash and the software can be started. It will search for the network and indicate when it has been detected and the signal strength. Once the network has been detected and the machine is ready to connect, the Mobile Connect icon in the task bar will highlight and not be greyed out. This process can take up to 30 seconds.

There is one important remaining step to be done before connection can be made. This foxed me for a while until I did some research on the Internet! Go to the tools menu and select Profiles and click Edit. This will bring up an Edit Profile. Select GPRS and click OK. Click Next twice and and you should arrive at a screen that allows you to edit the APN, Username and Password. The APN will be set to "internet" and needs to be changed to "pp.vodafone.co.uk" to allow Pay-as-you-go access. The username and password do not need changing. For more details have a look at **http://www.filesaveas.com/gprs.html**. By default, the software assumes you are contract customer! All being well you should now be able to connect to the Internet via the GSM phone system.

GPRS is charged by the Mb and not by connect time. I do not recommend using it to "surf the web" as it is expensive at £4/Mb and you will soon gobble up the credit on your SIM card! For the Microwave reflector I have downloaded EA6VQ's ON4KST Telnet Client program. This is much less hungry on bandwidth than using an internet browser and is perfectly adequate. I have found that provided you do not run other applications that want access to the Internet a 10 top up is more than adequate for a 24 hour contest. There are more details of setting up your laptop to ensure that only telnet traffic is allowed at PA5DD's excellent website, **http://home.hccnet.nl/uffe.noucha/gprs.htm**

NEW 5.7GHz WORLD EME RECORD

On May 23, 2006 at 0225 hours UTC, a new World Record distance of circa **15,931km** for a 5760 MHz EME contact was set by myself... Alan - **VK3XPD** and the Czech Republic's **OK1KIR** EME Team of... Vladimir - **OK1DAK**, Tonda - **OK1DAI** & Jan - **OK1VAO**.
This QSO is also the FIRST ever 5760 MHz EME contact for Australia (VK) !

Signal Reports were "O" Copy from VK3XPD & "M" Copy from from OK1KIR.

The OK1KIR station uses Circular Polarisation with a 60 Watt (SSPA) feeding a 4.5 metre dish.

The VK3XPD station is a VE4MA Feed, Horizontally Polarised with a rear dish mounted TWTA feeding a 3 metre dish. It is fully Coaxial (Coax Relay @ the Feed) because no Waveguide bits were available at the time.. so my in circuit losses are somewhat higher than a WG setup.

The event was also not without it's problems... my TWTA recently developed an RF Output problem which resulted in the Output Power dropping (varying slowly and unpredictably) by up to 10 dB from the maximum available output of about 100 watts. Additionally, there were overcast conditions (no visible Moon) in VK and very poor wet weather in the Czech Republic at that time.

I'm hoping to resolve my TWTA difficulties soon and chase a few more QSO's shortly.

My thanks to Vlad & his OK1KIR Team for persisting....
73 from Alan Devlin - VK3XPD, Melbourne, Australia.

(And heartiest congratulations from the UK Microwave Group Alan.. A fantastic achievement! ..editor)

OTHER EME NEWS

From Dave Robinson, WW2R (G4FRE):
I have now worked G3LTF on 13cm EME and am working on the gear to work the UK on the next higher microwave band.

From Chris, GW4DGU
<gw4dgu@blaenffos.org>
I continue to have fun on 10. I can hear my echoes reliably whenever the dish can see the Moon, although I haven't completed that many QSOs recently as I still need to get the new feed mounted.
Although my receiver is good (~0.6dB preamp NF, measured by a couple of methods) I find it difficult to copy stations running QRP. The over-illumination resulting from the use of the current feed results in a poor G/T ratio. When my brother gets around to finishing the horn(!). I estimate that I will pick-up around 2dB in threshold sensitivity. I'm also building a new all waveguide 'focus box' to accommodate the higher power I plan to run and to make it easy to move over to circular polarisation when it (as it inevitably will!) becomes the usual standard. This should also bring 1 - 1.5dB extra receive threshold, as I'll not only loose most of the losses in the T/R switching, but I'll be able to very much reduce the losses in the current microstrip input matching network by using a WG match. The potential NF improvement simulates at around 0.15dB.

I'm also looking at my tropo system, and will be replacing the the current yagi on 1296 with a 1.5m 'semi-offset dish' made by extending a 0.9m TV sat offset reflector, fed with a double-dipole on a groundplane. The 0.9m reflector will be used for 6 and 3 with a dual-mode feed on 3, and a bodge on 6! All this work should result in a vastly improved signal, particularly on 3cm where the vast majority of my tropo contacts have been made with my old PW dish poked out of a south-facing window. Incidentally, RS has allowed me to see around the corner of my house and to work Russ, G4PBP with good signals each way when we were both beaming at a scatterpoint SE of Bristol.

SCOTTISH MICROWAVE ACTIVITY

From: Brian Flynn, GM8BJF<bwf@ee.ed.ac.uk>
I have just finished assembling a dual mode feed from giant "Yorkshire" fittings as per the G3PHO website. I intend to use it for a 80cm Amstrad dish I have been using for 3cm. I was out for the May microwave contest as GM3HAM/P and we managed 7 contacts from IO77WV which is just at the back of Gatehouse-of-Fleet. We were running my transverter which is based on Charlie Suckling's modules. I have been trying to make the gear more reliable and optimise it's performance. We were running 1W and the next step is to get the power up a bit. It seems that 10W is about the norm for contest groups.
73 from Brian, GM8BJF

Activity Report from G3XDY

This covers the period from late April to 7 June 2006.

1.3GHz QSOs > 500km

23/04/06 F9OE (IN78), GM4CXM (IO75)
06/05/06 UHF Contest: F9OE (IN78QG), DK6AS (JO52JJ), DK8SG(JN48)
07/05/06 F8KOP/P (JN06); DL0GTH (JO50); OK4W (JO60); DK0ZB (JO42), DF0YY (JO62), DM7A (JO60) (836km).
10/05/06 SM6HYG (JO58), OZ5BZ (JO45), LA3EQ (JO28), SM6AFV (JO67)
04/06/06 Low Band Contest F4CKV/P (JN16), DM7A (JO60), DL0GTH, DF0MTL, DK0NA (JO50)

2.3GHz QSOs >500km

06&7/05/06 UHF Contest: DK6AS (JO52), DL0GTH (JO50), DF0YY (JO62), DM7A (JO60) (New square)

07/05/06 EI5HN JO62OO - new country and square. Worked by aircraft scatter after a couple of failed tests.
10/05/06 SM6AFV (JO67), OZ8AFC (JO45)
11/05/06 SM6EAN (JO57), OZ1CTZ (JO46)
12/05/06 OZ8AFC (JO45)
04/06/06 Low band contest: DL0GTH (JO50)

3.4GHz QSOs >400km
04/05/06 DF9IC (JN48IW) New Square
06&7/05/06 UHF Contest: GM4ISM/P (IO74) New Square, DK2MN (JO32), DL0V (JO31)
7/5/06 EI5HN (JO62) by aircraft scatter. New country/square
10/05/06 SM6HYG (JO58) tropo - new Square and Country. The SMs had temporary permits to 31/5/06 which has now been extended to 31/12/06.
04/06/06 Low Band Contest: DK2MN (JO32), DL0V (JO31), DL0GTH (JO50)

5.7GHz QSOs>400km
06/05/06 UHF Contest: DK2MN (JO32)
10/05/06 SM6HYG (JO58), SM6AFV (JO67)
11/05/06 SM6EAN (JO57)
21/05/06 G4ALY (IO70)
04/06/06 DK2MN (JO32)

10GHz QSOs > 400km
6&7/05/06 UHF Contest: DK2MN (JO32), DL0V (JO31)
10/05/06 LA3EQ (JO28) One Way - TX problem at LA end.
10/05/06 SM6AFV (JO67), OZ8AFC (JO45)
11/05/06 SM6EAN (JO57)
12/05/06 OZ8AFC (JO45)
3/06/06 DL0V (JO31)
4/06/06 DK2MN (JO32)

The low band contest at the start of June was quite successful, with several good contacts with German stations taking part in their Microwave contest.

Final QSO numbers were 23 on 23cm, 13 on 13cm and 8 on 9cm (pity I didn't get one more on 9cm to make the numbers neatly aligned with the bands!)

As I write, tropo is above normal but I have not made any QSOs in the past couple of days, just a couple of non-productive 9cm tests with SM stations.

73 from John, G3XDY

MAY 10GHz CUMULATIVES

The weather conditions were so poor that your scribe made a monumental decision not to go out on the hills (the first time in nearly 30 years of these cumulatives! A few hardy souls did make the effort though, viz:

From: Steve Cooke, G1MPW/P <s.cooke375@btinternet.com>

Steve G1MPW + Dave G6KIE attempted to work from JO00AU in the May contest . Sadly, the weather forecast was spot on for once. The rain started 10 mins before the contest and the wind started soon after. Steve managed 5 QSOs before the weather defeated the pair -- the FT290 has dried out and started to work again and the Araldite has nearly dried on the repaired feed horn mount after the tripod blew over !!

It was the worst weather they had ever encountered -- this rain scatter might be good for home stations but not so good for / P !! It was the first outing for Steve's new DB6NT transverter which seemed to come through unscathed but they will be back next month for another try.

(well that make's your old editor feel alot better!)

From: Paul Marsh M0EYT <pjmarsh@compuserve.com>

Having spent many hours on Saturday checking out the 10 and 5.7GHz systems and loading up the Landrover, I had full intentions of going up to Bell Hill first thing on the Sunday. Checking the Rain Radar / WX forecast on Sunday morning put a stop to the M0EYT/P operation as most of Southern England was under a mass belt of rain-scatter. Since the trip to IO80UU59 was aborted, I set up the two transverters into horn antennas and managed to work a few stations. Best DX of the day, via a North-East scatterpoint, was Ralph G4ALY, in IO70VL, on 10GHz. Dave G0RRJ (IO91FF) was also worked on both bands, with a pleasant rag-chew in FM on 5.7GHz for a few minutes . John, G0API, was also worked on 10GHz and he could hear my signal omni-directionally which shows the massive amount of scattering taking place. I also heard 4 or 5 beacons on 10GHz just using the horn antenna. Roll on good WX for the 18th June!

From Mike Parkin, G0JMI <mike.karen1@tesco.net>

I operated from the Home QTH (IO91MD) for the 10GHz contest on 21st May 2006 and worked the following station via mainly rainscatter: G3PYB (33km) FM, G3YGF (30km) SSB, G0MJW/P (42km) CW, G4NNS (42km) CW and G4LDR (47km) FM. These QSO's using 10w SSB/FM/CW to 18 inch dish and a 2x3 fly-swatter at 25 feet agl.

For the Low Bands 23,13 and 9 cm contest I operated /P from Lane End, Winchester, Hants (IO91JA) and worked the following stations:
G4LDR on 23/13/9cm (31km), G8ACE on 9cm (7km), G8VOI/P on 23/13/9cm (18km), M0EYT/P on 13/9cm (77km), G0NZO/P on 23cm (77km), G1JRU on 23/13/9 cm (22km) and G4ALY on 23/9cm (220km).

The QSO on 9cm with Ralf, G4ALY, is my best DX to date on 9cm. It was hard work but we made it! My QRP operation on the low bands included 23cm 3w, 13cm 0.5w and 9cm 300mW. All to a 2.5 foot dish on a tripod.

From: Bob Reeves, G8VOI/P <bobg8voi@reeves59.freeserve.co.uk

I did go out to Butser for the 5.7/10GHz May cumulative, honest! I've got the car park ticket to prove it! On site at 8.30am, sat in car until 10.45, rain, wind, low cloud... went home in disgust!

Editor's note: *Bob has some interesting points to make about the UKuG contests in general but there just isn't space to put them all here . Some of his views can be found on page 19.The rest will appear next month, perhaps as a separate item.*

JUNE LOW BAND MICROWAVE CONTEST

From Peter, G3PHO/P (IO93PW)

Peter operated with 23 and 9cm from a roadside location on the Yorkshire Wolds. For the non geographers these are NOT the North York Moors! Conditions seemed rather average to poor and activity on the 144MHz talkback channel was at a low once gain. By contrast the KST chat room was running off the top of the screen faster than one could receive replies from stations to Peter's "CQ" calls!! There seemed to be hundreds of DLs on KST, all using German and not really interested in working IO93 for some reason. 144MHz is SOooo much easier to use for liaison during contests.

23cm brought only 16 contacts, the best being M0GHZ (IO81VX) GM4CXM (IO75TW) and GM3SBC/P(IO86JF) who said Peter was his only contact southof the GM/G border! Peter was

very peased that the GMs were CW men, much the best way of making a decent QSO!

9cm brought 10 contacts, the best being 'Reliable Ralph', G4ALY in IO70VL. Ralph never gives up on a QSO.

From: Bob Reeves, G8VOI/P (IO90MX) <bobg8voi@reeves59.freeserve.co.uk

Contrary to some speculation I saw in print, I have not abandoned the microwave bands!

A mixed bag of results, propagation did not seem anything special and very low activity levels, 144MHz talk-back very quiet - comments later! I left my digital CQ box running on 23cm for long periods and picked up quite a few of my contacts that way, including the DL and ON ones. All equipment worked reasonably well, first time out on 13/9cm for 7+ years. It was really good to hook up with a few old friends again, had long chats with several, gradually progressing up the bands as we chatted (thanks Mike G0JMI and Del G1JRU).

Results:

23cm - worked 15, best DX - DR5A in JO30EM at 518km, also worked ON7WR 376km
13cm - worked 9, best DX -ON7WR in JO20EP at 376km
9cm - worked 7, best DX -G3PHO/P in IO93PW at 329km

As for my comments, probably these will cause offence to some, hopefully provoke comment, thought and discussion!:

If the lack of activity on 144MHz talkback was due to the use of KST and mobile phones, then perhaps these should be outlawed during contest periods! A quick look at the contest results, and note those heard on 144MHz should reveal if that was the case.

I will qualify those comments. One of the main aims of contests /cumulatives and activity periods is to encourage activity, and hopefullyentice new blood onto the microwave bands. From my own experience, when I was first licensed, I was very active on 144/432MHz, it was hearing others at the time trying 1296Mz, and working as far or further than I was doing on 432MHz, along with seeing activity reports in DUBUS that encouraged me to acquire gear for 23cm. At the time I did not think I had the ability to construct a transverter (early 80's) so I went down the commercial route. The success I had on 23cm led onto 13cm.

It was by HEARING locals (G2DSP, G3JVL, G3YGF, G4BCH etc.) on 144MHz during the 10GHz cumulatives that introduced me to that band and made me aware that there WAS activity LOCAL to me. When repeatable designs and kits became available and my skill levels had progressed, I built my 10GHz gear, very quickly followed by 5.7 / 3.4 and 24GHz transverters. For personal reasons I have not been able to be very active for a number of years, but my interest has remained. Hopefully I should be out and about a lot more in the coming months.

I repeat, it was HEARING people ON THE AIR arranging their microwave contacts, and hearing 10GHz signals being relayed that was the spark for me to explore further. I am sure that there are quite a few casual listeners on 144MHz during the contests that are intrigued by the microwave world, and might lead them to take that interest further in the future. If contacts are set up using KST / phones, that activity is lost from the airwaves AND potential listeners and future microwave operators.

There does appear to be an element of 'cherry picking' associated with KST operation; don't get me wrong, there are amazing contacts being made that perhaps otherwise might not have been **but**, to promote microwaves and that must be a significant factor in organising events, it needs people to be on the air and visible (ok audible!), not stuck in front of computer screens.

At the end of the day, we are all there because of our interest in microwaves. Spread the word (preferably via 144MHz)!
73 from Bob, G8VOI

From: John, M0ELS

Just to inform you of a short opening on 23cm this evening (10 May 06) starting at 21h00. I worked OZ5BZ and SM6DJH.I suspect it was a temperature inversion ducting over the sea.
73 from John, M0ELS

AMSAT-UK Colloquium Presentation - Receiving Voyager 1

AMSAT-UK is privileged to have Achim Vollhardt DH2VA give a presentation to the International Space Colloquium at the University of Surrey, Guildford on the remarkable achievement by Radio Amateurs in receiving signals from the Voyager 1 spacecraft at a distance of 14.7 billion kilometers. This is certainly the furthest ever DX signal to be received by any Radio Amateur. It was achieved by a dedicated international team of AMSAT-DL and AMSAT-UK members at Bochum in Germany.

VOYAGER 1 was launched on 5th September 1977 by NASA. It transmitted the first close-up pictures of Jupiter and Saturn. In 2004 VOYAGER 1 passed the Termination Shock Region, where the solar wind mixes with interstellar gas. VOYAGER 1 today is still active, measuring the interstellar magnetic field.

The following Radio Amateurs were involved in the project:
Freddy de Guchteneire, ON6UG
James Miller, G3RUH
Hartmut Paesler, DL1YDD
Achim Vollhardt, DH2VA/HB9DUN

The International Space Colloquium takes place from Friday 28th until Sunday 30th July and all Radio Amateurs and SWL's are welcome to attend.

For further details contact Jim Heck G3WGM
Tel: 01258 453959 or
Email: g3wgm@amsat.org
Web: http://www.uk.amsat.org/Colloquium/ (see Travel for maps)

For additional background info see:

http://www.southgatearc.org/news/april2006/voyager1.htm
http://voyager.jpl.nasa.gov
http://www.amsat-dl.org/cms , under "News"

APRIL 2006 LOWBAND CONTEST RESULTS

There were 13 entries, 9 fixed stations and 4 portable, the same total as in April 2005, but more fixed stations, and with all stations having 23cm, 7 stations having 13cm, and 7 stations having 9cm.

There appeared to be good activity from France and Scotland, and Peter G3PHO counted around 45 UK stations supporting the event.

Conditions were generally reported as average, and no great DX worked.

This year, there were three separate winners for each band:
G4BRK on1.3GHz from his new Abingdon QTH at IO91HP; **G4WYJ/P on 2.3GHz**, operating from Ditchling Beacon at IO90WV, and **G3PHO/P on 3.4GHz,** operating from Houndkirk Moor at IO93EH. In each case, there was a comfortable margin between the leading station and the runner up.

However, the **overall winner was John G3XDY**, who put in good scores on all three bands, unlike the band leaders, none of whom entered all three bands. As a result, in the overall table, John leads by a comfortable margin. **Overall runner up was G3PHO/P** - perhaps it is time for him to acquire that missing 13cm band!

Several stations commented on the use of ON4KST for talkback. G3PHO commented that it was quite problematic trying to use this /P with the Telnet connection dropping in/out; G3XDY commented that it was quite time consuming.

Thanks to everyone who sent in an entry. A similar event has just been held in June, with further events scheduled for August and October— lets hope for plenty of activity again - and do please send in your entry, however
small!

Regards, Steve Davies G4KNZ

Overall Scores	1.3	2.3	3.4	Total
G3XDY	769	811	688	2268
G3PHO/P	789	0	1000	1789
G1EHF/P	582	484	629	1695
G4WYJ/P	528	1000	0	1528
M0GHZ	423	300	530	1253
G3ZME/P	409	0	734	1143
G4BRK	1000	0	0	1000
G4LDR	120	130	486	736
G4RGK	285	337	0	622
G8KQW	511	0	0	511
GW3HWR	363	0	0	363
G8AIM	157	37	144	338
GM4CXM	326	0	0	326

1.3GHz	Best DX	Located	Distance	QSOs	Score
G4BRK	DJ9BV	JO30KI	596	31	6150
G3PHO/P	F1PYR/P	JN19BC	536	25	4851
G3XDY	F9OE	IN78QG	592	17	4729
G1EHF/P	G3LRP	IO93HO	333	23	3580
G4WYJ/P	G3LRP	IO93HO	313	19	3246
G8KQW	G3LRP	IO93HO	281	23	3143
M0GHZ	GM4LBV	IO86RQ	585	15	2604
G3ZME/P	G3XDY	JO02OB	263	19	2516
GW3HWR	G4DDK	JO02PA	371	13	2235
GM4CXM	G3XDY	JO02OB	564	7	2005
G4RGK	G3LRP	IO93HO	231	15	1753
G8AIM	G1EHF/P	IO80WP	190	10	966
G4LDR	G3PHO/P	IO93EH	247	7	741

2.3GHz	Best DX	Located	Distance	QSOs	Score
G4WYJ/P	G3LRP	IO93HO	313	12	2061
G3XDY	F1PYR/P	JN19BC	336	8	1671
G1EHF/P	G3XDY	JO02OB	280	9	997
G4RGK	G3LRP	IO93HO	231	6	695
M0GHZ	G3XDY	JO02OB	246	5	618
G4LDR	G4WYJ/P	IO90WV	107	4	268
G8AIM	G3DVV	IO91FW	42	2	76

3.4GHz	Best DX	Located	Distance	QSOs	Score
G3PHO/P	G1EHF/P	IO80WP	303	9	1758
G3ZME/P	G3XDY	JO02OB	263	9	1290
G3XDY	G1EHF/P	IO80WP	280	5	1209
G1EHF/P	G3PHO/P	IO93EH	303	8	1086
M0GHZ	G3XDY	JO02OB	246	8	931
G4LDR	G3LRP	IO93HO	279	6	854
G8AIM	G3PHO/P	IO93EH	113	3	254

That's all we have space for this month.Many thanks to all contributors.

73 until early August when Scatterpoint returns...

Peter, G3PHO