



An Amateur Radio publication for the Microwave enthusiast

MICROWAVE NEWSLETTER

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Lambda House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JE

FROM THE EDITOR

2003 – MARCH

Here's another tightly packed issue for you this month! Many thanks to all who have contributed this time. There is even some material left over for next month ... a very nice state to be in! Many thanks to our new contributor John Share, G3OKA. He has just provided the Newsletter with several technical articles, the first of which appears this month. Thanks also to G3UKV, G8UBN, G4KLX and to Howard, G6KQP, who sent in the useful tips on page 2. He is not a microwaver but listens to the UK Microwave net on 3625kHz around 0830 during the week!

This edition clarifies the position regarding the IARU Region 1 bandplan changes mentioned last month. Please read the information herewith. You are urged to plan your move on 24GHz as soon as you can and certainly acquire the necessary crystal(s) in good time. There could be quite a "rush" on such devices as the year draws on! To start the ball rolling in the UK, I'm applying for an unattended beacon at Alport Height, IO93FB44, in the 24048.9MHz region and will be also moving the station transverter down to the lower part of the band by the end of December this year. Hopefully, others will follow!

The February Microwave Activity Day was a resounding success with over 30 stations active, more than some of the contest days last summer. Let us all hope this is the start of a real revival in activity.

Good hunting ... from Peter, G3PHO, Editor



In this issue ...

- For Sale and Wanted Ads
- Power level reduction for the FT817
- Handy tips from G6KQP (leadfree solder, etc)
- A Tracking Modulator/Detector System for Microwave Cavities
- IARU Region 1 Bandplan changes— further information about 5.7GHz and 24GHz
- A New Divide-by-10 Prescaler
- Microwave Update 2003
- Dorsten—G4KLX reports the event
- Activity News from the UK and overseas

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



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SUBSCRIPTION ENQUIRIES SHOULD BE SENT TO RSGB HEADQUARTERS AT THE ADDRESS SHOWN AT THE TOP OF THIS PAGE AND NOT TO THE EDITOR ..



David, G4DHF has COMPONENTS FOR SALE

Tin Plate Boxes (ex Pimper) New

| Type | Dimensions (mm) | No. | Price each |
|------|-----------------|-----|------------|
| 7760 | 74 x 111 x 30 | x2 | £3 |
| 7766 | 55.5 x 111 x 30 | x3 | £3 |
| 7752 | 37 x 74 x 30 | x2 | £2 |
| 7750 | 37 x 37 x 30 | x1 | £1.50 |
| 7758 | 74 x 74 x 30 | x2 | £3 |
| 7762 | 74 x 148 x 30 | x4 | £4 |
| 7768 | 55.5 x 148 x 30 | x1 | £3 |
| 7764 | 55.5 x 74 x 30 | x1 | £2 |

Diecast Boxes (approx. external dimen.)

| | | |
|-----------|----|----|
| 48x48x30 | x1 | £2 |
| 50x35x30 | x1 | £2 |
| 118x94x34 | x2 | £3 |
| 120x95x54 | x1 | £3 |
| 114x62x28 | x1 | £3 |

10GHz Relay: Transco, 28V, SMA, approx 2x3x1cm. New and unused, purchased from Mainline £45

Unused "Birkett" microwave devices:

the original types used in the 'WDG 10GHz units

Red Spot x6 @£3 each

Black Spot x2 @£4 each

SMA - SMA cables, assorted lengths, some copper hardline, others coax, ex. equip. Approx 30 @£20 the lot

Post and packing is approx. £1 on the boxes. All others @50p to be sent in padded bags.

Please email david@g4dhf.freeseve.co.uk

or telephone (01778) 440 079

Do you want to get on 10GHz?

G4NNS offers to **lend** a complete system to any group or individual who would like to have a go on 10GHz. The system consists of a set of G3WDG modules including HEMT pre amp and 1W PA all housed in a hermetically sealed diecast box. It includes a 45cm prime focus antenna, approx 10m of IF and control cables plus an FT290 and control box to drive it. It is a complete system, requiring only the addition of a 12V (or 13.8V) supply and a suitable talk back system. It is suitable for portable or home station use (fixed to the mast) so long as the cables are sufficiently long (no extensions).

Of course there will be conditions on the loan such as a convincing case that it will be put to good and frequent use and that it will be returned after a reasonable and agreed period. It will need collecting from and returning G4NNS's QTH near Andover and he will demonstrate it. If more than one person or group would like to take up the offer, Brian will try to share it around during the coming contest season.

Anyone interested should write or email Brian with their full contact details.

Brian Coleman, G4NNS

QTHR or email:

BrianColeman@compuserve.com

FOR SALE

Avantek 10W linear amp. AWP-64100, 5.925-6.425GHZ

STC wavemeter 5.30-8.20GHz, WG14

California Microwave Transmitter Modulator/Amplifier 11-026600-05

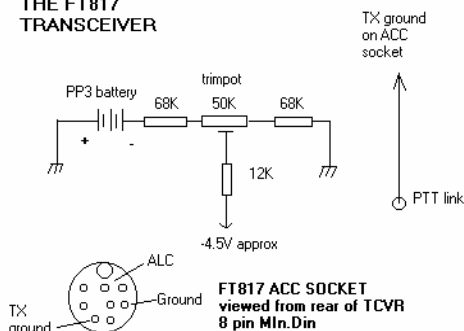
Rhode & Schwarz RF attenuator 0-109dB, 0-3,000MHZ

Daiwa NS-448U through line 20W RF power & SWR meter 900-1300MHZ

Dishes 2.0m, 1.25m & 1.0m

Roger Piper G3MEH, QTHR or tel 01442 826651, e-mail g3meh@supanet.com

POWER CONTROL FOR THE FT817 TRANSCEIVER



POWER REDUCTION FOR THE FT817 ..

G3UKV sent in this circuit of how he uses his FT817 as a driver for his microwave transverters. The transceiver seems to be an ideal microwave IF and he uses it both on 144MHz and 432MHz in this manner. Many thanks for the circuit Martyn.

By the way he has recently become active on 3.4GHz and would like to make skeds with anyone interested. You can ring him on 01952 255416

SOLDERING LEADS TO LEADS WITHOUT LEAD?

Yes what a question! But like it or not, European legislation is likely to have banned the use of lead (that soft, weighty metal) from all manufactured goods by January 2006 or 2007 at the latest.

That means not only will the soldered joints in circuits have to be lead free, but also all the joints inside the components themselves, and on their connections. Therefore, lead free components are now being manufactured for use in future equipments.

The lead content in the solder increases its melting point, lead melts at 327°C. So removing it will lower the solder's melting point to that of say tin, which is 232°C. So, higher temperature solders will now likely be of a tin-silver-copper alloy, which is of course more expensive. For many years plumbing joints have been supplied with lead free solders.

The whole exercise is related to the future programme of recycling as many materials as possible from discarded equipment of all types. So will there be a great future in "skip diving" at rallies etc and doing your bit of recycling for the environment?

For more information see: <http://www.lead-free.org>

RUSTLESS

If you are making or fitting things for outside use, it may be worth while doing it in something that is resistant to rust or corrosion.

Aluminium, brass and copper are traditional metals used in radio work. However these do corrode to a greater or lesser extent depending on their make-up and may cause bad electrical joints after some time. So have you considered using stainless steel? If you think it is too expensive or difficult to obtain and work think again. With the advent of cheap imports from China and India, etc, there are lots of stainless utensils, containers, canisters, plates, bowls and trays that can be used or cut to make covers, clips and a host of other fittings just for a £1 or so. But for the best results don't forget to use stainless screws, nuts and washers, though these may cost a lot more, but are available from good hardware or engineers merchants.

USEFUL BITS

Whilst repairing some equipment, I had cause to dismantle a Belling Lee panel mounting 1¼" cartridge fuse holder. The hard plastic type, with the screwdriver slot for changing the fuse. This type of holder has been around for 50 years or so in its original and modern patterns, and was standard on many commercial and military equipments. Anyway, to cut a long story, the internal plated brass, 'sleeve' contact (and the fuse holding screw cap) has the same thread (?" UNEF) as a panel mounting BNC socket. So you can use this 'sleeve' as a mounting for the socket. The sleeve can be soldered into copper, brass or tin boxes and tubes etc, making a neat RF sealed assembly, without burning or damaging the socket. So save the fuse holders before putting the rest in the skip!

73 from Howard, G6KQP

A Tracking Modulator / Detector System for measuring Microwave Cavities.

~ by John A. Share, G3OKA

A simple method of determining the resonant frequency of a newly made cavity is to excite it with a low level signal from a generator and to look for a peak in the detector output. A typical microwave signal generator will deliver +10dbm and when lightly coupled to the test cavity the resultant signal from the detector is probably less than 1 mV. Amplifying this direct current signal can pose numerous problems, an established solution is to amplitude modulate the signal generator and measure the amplitude of the modulation from the detector. This is an ac signal and being at audio frequency its amplification poses few problems. A fundamental problem does exist in that the detector output contains not only the required audio frequency but also noise and 50Hz. Some filtering is therefore essential.

The ready availability of integrated Active Filter devices, and the ease with which they can be configured for centre frequency and selectivity make them an obvious choice. Their centre frequency is controlled by their clocking rate, the devices used had an on chip oscillator that required only two external components, or they could be clocked from an external source. This clock was also used to generate the modulation, if it varied then the detector filter tracked the modulation. High selectivity in the detector filter could then be used to improve the signal to noise ratio.

A number of MF8CCN and 741 Operational Amplifiers were immediately available and a circuit was designed using these devices (**figure1**). There are other, probably better, devices that could be used. All the circuitry is at audio frequency and there are few constraints on the amplifier devices, circuit layout or construction.

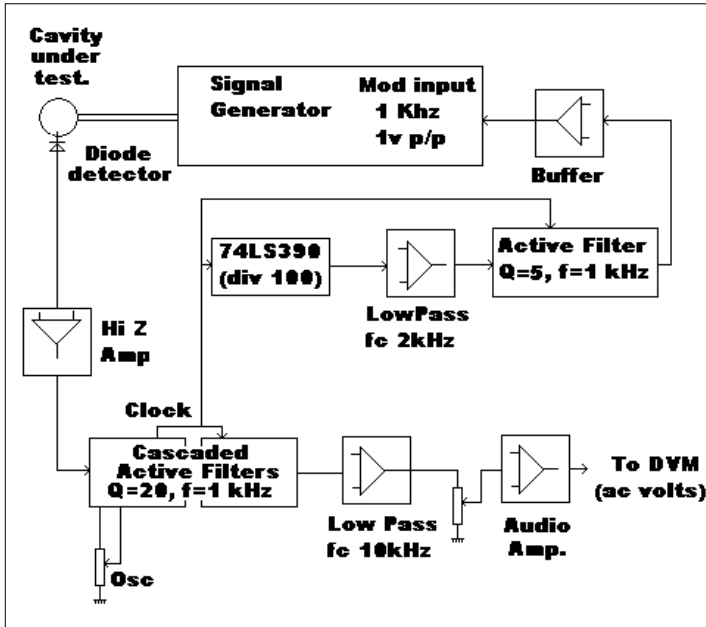
The cascaded detector Active Filters have a hardwired Q of 20, this was found to be more than adequate, and the centre frequency was selected for a nominal 1 kHz, clock rate is at one hundred times the centre frequency. This clock is also divided in a dual decade divider (73LS390) generating a 1 kHz square wave. A simple low pass filter with a cut off of 2kHz removes the odd order harmonics from the divider output and passes a recognisable sine wave into the modulation Active Filter. This is hardwired for a relatively low Q and its output is a sine wave of good purity. The modulation frequency and the detector filter centre frequency are thus locked.

The MF8CCN has a relatively low input impedance, as such it excessively loaded the detector and a high input impedance amplifier was placed between the detector and the filter. The design constraints on this stage are negligible, it needs to have an input impedance of >1 Megohm and a bandwidth of a few kHz and was built around three 741 Op amps with a nominal gain of ten. The Low Pass filter following the Detector Filter is necessary to remove switching transients at clock frequency that are superimposed on the output signal. It is possible that a passive R/C filter would remove these spikes but an active stage eliminates them completely. The Audio Amplifier simply increases the amplitude to a convenient level for the Digital Volt Meter. The Keithley 199 DMM that was used as the output indicator is able to measure ac signals at Audio and there was no need to rectify the signal.

This circuitry has been used extensively in the measurement of cylindrical cavities developed for use at 9 GHz and 14 GHz.

Dr John A. Share, Geomagnetism Laboratory, Oliver Lodge Building, University of Liverpool, Liverpool, L69 7ZE. Email jashare@liv.ac.uk

Fig.1



IARU REGION 1 BANDPLAN CHANGES ... FURTHER INFORMATION

Last month's Newsletter detailed proposed bandplan changes for both 5.7GHz and 24GHz narrow-band and beacon operation. Since that issue, Arie, PA0EZ, has clarified the position for both bands. The changes were accepted at the IARU Region 1 Conference last November.

There is definitely no proposed change for 5.7GHz so everyone can rest assured that, for the time being, they will not be asked to move from the present narrowband and beacon allocation. Mike, G3PFR, sends his apologies for misleading folk with his own report.

However the situation on 24GHz remains as stated in last month's Newsletter, ie. we are all being asked to move from the 24192MHz region down to 24048MHz. Here is a direct quote from Arie's IARU Region 1 Newsletter:

"The third important change/addition to our bandplans concerns the bands above 24 GHz. The most important decision here is that in all those bands the segment where the amateur and the amateur satellite services have a primary status will be used initially. This implies that the **current use by narrow-band activities of the 24192-24194MHz segment must stop per 1-1-2004 and those activities shall move to the already recommended 24048-24050MHz segment.**

Experience has shown that such a change will not be possible without the support of all microwavers. **HERE AGAIN YOUR ACTIVE SUPPORT IS ESSENTIAL** by approaching those amateurs explaining the background. In the UK there are already problems in obtaining permission for unmanned operation in the 24192 MHz area. A good solution probably will be to not accept contest contacts in the "old" segment after 1-1-2004."

A New 10GHz Divide-by-10 Prescaler

Grant Hodgson G8UBN
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Introduction

A prescaler is a digital frequency divider; the output signal is simply the input signal divided by an integer (i.e. a whole number). Prescalers are digital devices and therefore the amplitude of the output is constant and bears no resemblance to the amplitude of the input signal.

Prescalers have two main functions for amateur microwave use: to extend the range of frequency counters and for dividing the output of a Voltage Controlled Oscillator when used in a frequency synthesiser. This article will concentrate on the former application, although the same design can be used in the latter application as well.

Digital Prescalers

Dividing the frequency of a signal by two is very easy; all that is required is a single D-type flip-flop (or latch) with the input signal being connected to the clock pin and the Q' output being connected to the D input as shown in **figure 1**. The output signal is usually taken from the Q output.

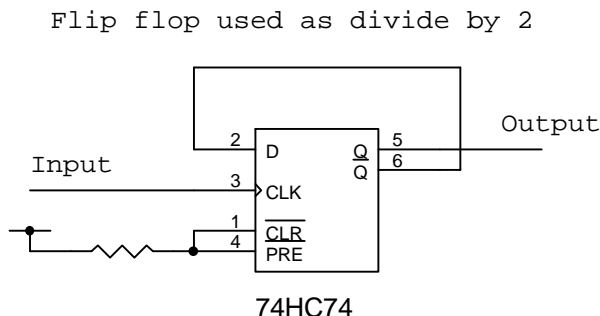


Figure 1

Cascading prescalers (i.e. connecting them in series) is also easy; in this way it is possible to generate division ratios of 4,8,16 etc; division by 64 and 256 is very common. Prescalers operating at microwave frequencies are now commonplace; semiconductor manufacturers such as Fujitsu and Hittite have been making divide by 8 prescalers that can be used with input frequencies exceeding 10GHz for several years [1], [2].

Low cost frequency counters are now readily available that will operate at frequencies up to 1GHz or even 3GHz, the quality varies somewhat and generally speaking, you get what you pay for. However, microwave counters operating up to 10GHz or above are very expensive, even on the second-hand market, and are often difficult to find at all.

By combining a divide by 8 prescaler with a frequency counter operating up to (for example) 1.5 GHz, it is possible to measure the frequency of a 10GHz signal, and possibly being usable to 12GHz. However, in order to determine the exact frequency of the device under test it is necessary to multiply the reading on the frequency counter by 8 - not too difficult if the counter reads 1.1101101, but multiplying a displayed number such as 1.2778563 is a little more complicated,

usually requiring a calculator.

New Divide by 10 prescaler

Thanks to some recent advances in high-speed digital electronics, the problem of multiplying the displayed frequency on the counter by a factor of 8 has been solved. Hittite Microwave Corporation [3] have recently (October 2002) released the HMC438 which is a revolutionary divide by 5 prescaler IC. This remarkable little IC requires only a single 5V supply and a couple of external **capacitors to operate; the input** frequency extends from DC to 7GHz. The internal circuitry of a divide by 5 prescaler is a trivial task when working at low frequencies using standard CMOS techniques, but when working at microwave frequencies the number of individual transistors required to form the appropriate circuitry poses a number of technical problems, and the availability of the HMC438 marks a significant breakthrough.

Hittite also make a divide by 2 prescaler which operates from DC to 11GHz; cascading these devices results in a true divide by 10 prescaler that can be used up to at least 10GHz and beyond.

The full circuit diagram is shown in **figure 2**. All three ICs are powered from a single +5V supply, and a 5V regulator is fitted to the PCB but not shown on the schematic for clarity. This allows the prescaler to be used with a standard 12 – 13.8V DC supply, and gives some protection against accidental polarity reversal.

The input signal is DC blocked by the capacitor C1. The value of this capacitor determines the sensitivity at both high and low input frequencies. Due to the fact that the prescaler is intended for high frequency operation, the value of the capacitor has been chosen to maximise the input sensitivity at higher frequencies.

The input signal is amplified by IC1. This is a Gali-1 MMIC (Monolithic Microwave Integrated Circuit) from Mini-Circuits. For input signals greater than approximately -10dBm this amplifier is driven into saturation, which ensures that the output level is constant. IC2 also provides a secondary function in the form of an input protection buffer; a large input signal will simply be limited by IC1, thus giving a constant level output signal. If an excessively large input signal is applied IC1 may be damaged, but this is much easier and cheaper to replace than IC2.

The level of the signal is then attenuated by the Pi-attenuator R1-R3. The signal level at the output of the attenuator is at a level of approximately -2dBm which is close to the optimum level for IC2. IC2 is the first prescaler which is an HMC361S8G. This divides the signal by a factor of 2. The HMC361S8G has two balanced inputs; the attenuated signal from IC1 is connected to one input (pin 5) and the other input is connected to ground via the capacitor C12. The HMC361S8G also has two complementary outputs; again only one of which is used – the other is simply left open circuit. The divide-by 2 output at pin 3 is DC blocked and connected to one of the inputs of IC3, an HMC438 divide by 5 prescaler. As with IC2, there is an unused input which is grounded by a capacitor and an unused output which is left open circuit. The output of IC3 is at pin 7 which is DC blocked by C11; this output signal is exactly $1/10^{\text{th}}$ of the input frequency and can be connected to any suitable frequency counter. The level of the output signal is approximately -1dBm.

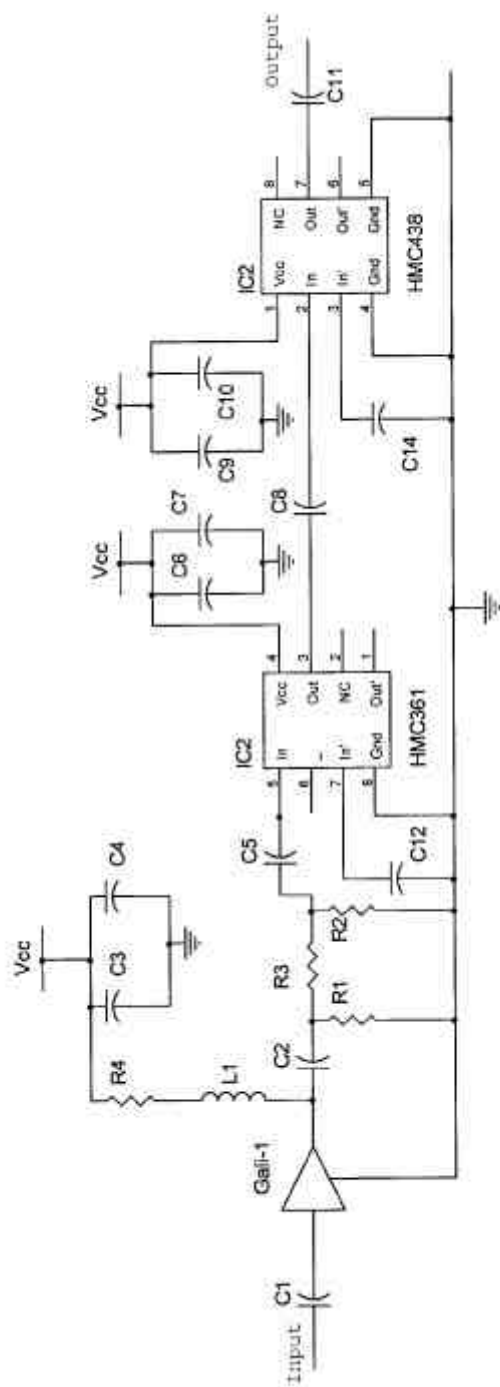
IC1-3 are connected to a single +5V supply; both prescaler ICs have two decoupling capacitors placed close to the VCC supply pins. L1 is a Mini-Circuits ADCH-80A broadband choke which provides a high inductive reactance from 50MHz to 10GHz – quite a remarkable performance in it's own right! R4 sets the current through IC1 to 25mA.

Construction

A PCB has been made for this project for those that feel confident to be able to solder the small devices. The PCB has provision for all the components including a 5V regulator and SMA 'end-launch' sockets for the input and output. The PCB also has provision for a number of other features that will be briefly described later.

The biggest problem when trying to build this particular project is soldering the prescaler ICs, and in particular the HMC438 which is very small indeed. Both the HMC361S8G and the HMC438 have a ground 'slug' on the underside of the package that cannot be seen when the IC has been

Figure 2 – circuit diagram



soldered. The intention of the IC manufacturers is that these components are soldered using commercial SMD re-flow techniques whereby solder is applied automatically in paste form, and melted in a special oven. These techniques are not suitable for small production runs, and the equipment required costs about as much as a small house. However, it is possible for advanced constructors to solder these devices at home, although some experience with small surface mounted components is required, as is some form of optical aid, a heat gun and some solder paste.

For best results the prescaler ICs are soldered first, one at a time. The technique involves placing a small amount of solder paste on the central ground pad on the PCB, and either applying a small amount of solder on each of the PCB pads for the IC pins, or applying the solder paste in a long line for pins 1-4 and 5-8. The prescaler IC is then very carefully placed onto the PCB, taking care to note the correct orientation. The IC will sit on top of the solder paste, and it helps if it is pushed down very slightly without twisting or moving it. The solder paste is then melted using a heat gun; the most suitable tool is a small, high wattage (> 1000W) gun used for heatshrink tubing with a small nozzle. Extreme care must be taken to ensure that the correct amount of heat is applied – too little heat and the solder paste will not have melted, which can lead to small solder balls which in turn can cause short circuits. Too much heat will damage the PCB and/or the IC. The right amount of heat will melt the solder paste properly, simultaneously soldering all 8 pins and the ground slug. As the heat is applied, several things happen :-

- 1) The solvents in the solder paste evaporate and the flux becomes active.
- 2) The solder on the pads for the IC pins melts. As this happens, the surface tension of the liquid solder pulls the IC on each of the 8 pins. If the solder on all 8 pins melts at approximately the same time, the IC will automatically be pulled to the exact centre of the pads – even if it was placed with a slight offset. The effect of this has to be seen to be believed – it really does look like magic, but is really just the application of physics!
- 3) As the solder melts, it naturally flows onto the exposed, tinned pads on the PCB, and so any paste that has been applied onto the areas covered by solder resist (the green coating on the PCB) will tend to flow towards the nearest exposed pad, thus automatically reducing the chances of a short circuit between adjacent pins.
- 4) At this point, the solder paste on the underside of the ground slug has not fully melted. It is necessary to keep the heat applied to the IC whilst the solder on the outer pins is still molten.
- 5) Then the IC will move slightly downwards as the solder under the IC melts and the surface tension pulls the IC further down onto the PCB. This is a very subtle effect, but can be seen with some experience and especially with good optical aid such as a microscope.
- 6) At this point the heat is removed and the board is left to cool, and then the solder paste for the other prescaler can be applied and soldered as above.

There has been some considerable debate on the US Microwave reflector [4] recently about alternative methods of soldering devices such as the Hiittite prescalers with the 'hidden' ground slug; alternatives to the use of a heat gun are to place the PCB on a hotplate at a temperature considerably greater than the melting point of solder, or to use a conductive epoxy to mount the prescaler ICs. The hotplate method is currently being investigated by the author and will be reported in a future edition of the Newsletter. The use of epoxy would be an option, but unlike solder paste is very difficult to obtain in very small (i.e. cost-effective) quantities, and requires special care when curing, so it is felt that the use of solder paste would be the best option for home construction.

Note that the HMC438 is considerably smaller than the HMC361S8G – the HMC438 has pins on a pitch of only 0.65mm – that is the distance between the centre of the pins, not the gap between them! Although very small, this is an industry standard package, and is widely used for many ICs – especially microwave ICs. The use of good optical aid is mandatory; there has been discussion of this recently both on the US microwave reflector and in Technical Topics in Radcom.

Some of the RF coupling and de-coupling devices are also very small, being of 0603 size – i.e. 1.5mm long x 0.75mm wide. These components can be soldered with a soldering iron with a small tip, fine solder (preferably 30SWG, although 26SWG can be used), optical aid and of course a steady hand! The reason for using such small capacitors is that they have a much lower self-inductance, and therefore a higher self-resonant frequency. This means that higher values of capacitor can be used (4p7) for the high frequency part of the circuit, which increases the sensitivity at lower frequencies such as 4GHz. Therefore, smaller capacitors have the effect of increasing the effective frequency range over which the prescaler can be operated.

It is fully appreciated that some microwave constructors will feel somewhat nervous about performing such delicate soldering techniques on tiny, expensive devices. For this reason the author is considering the option of making the PCB available with the ICs already soldered and tested, and possibly some of the other small surface mounted devices mounted as well. This would give a 'half-way house' whereby the hardest part of the construction has already been done, but the easier parts such as soldering the connectors and IC1, and mounting in a case would still be done by the constructor.

Printed Circuit Board

The PCB for this project requires special mention. It is made from 1.6mm FR4 (fibreglass), but instead of having the components on one side and a groundplane on the other, the PCB has 4 layers, with 2 groundplanes sandwiched in the middle of the board. The reverse side of the PCB is thus free for extra circuitry, and has been used as a 'Microwave Experimenter's Project Board' which consists of pads for two Mini-Circuits Gali-MMICs, a passive, broadband frequency doubler, a SPST RF solid state switch and the possibility of a second frequency doubler.

The use of a 4-layer PCB is believed to be unique in amateur microwaves. It has the advantage that although the RF properties of FR4 are inferior to Duroid and equivalents, the groundplanes are only 0.3mm below the surface layers, which may allow the use of this type of board at 24GHz. Of course the losses in the FR4 will preclude the use of this type of PCB for LNAs and PAs at such frequencies, but for other purposes such as doublers, mixers, filters and driver/buffer amplifiers this new 4-layer PCB technology may be usable at a much lower cost than Duroid, and can be manufactured commercially with plated through holes (vais) in very small quantities. Any losses can easily be overcome with new high-frequency MMICs (such as the Galis), (at 10GHz or 12GHz) and 1.6mm FR4 is considerably stronger than 0.25mm (or similar) PTFE material. More details will be presented in a future edition of the Newsletter.

Performance

The maximum input frequency at which the prescaler will work is determined by a number of factors, including the gain of IC1, the loss associated with L1, the reactance of C1, C2 and C5 at frequencies above 10GHz and the upper frequency limit of IC1. In practice, the prescaler has been found to have an upper frequency limit of around 14GHz at an input level of +13dBm.

IC2 has a specified maximum frequency of 11GHz, so this extra performance should be considered a bonus and cannot be guaranteed. For use at 10.4GHz, the minimum input level is approximately -15dBm, which makes the prescaler very sensitive. The maximum input level is 15dBm which is the absolute maximum input power for the Gali-1 MMIC. The prescaler has a definite cut-off point; when the input signal is even very slightly above the maximum operating frequency the prescaler simply stops working and the output becomes unstable. Therefore it is very evident whether or not the prescaler is working properly. Note that this is usually not the case with a frequency counter, where the counter usually starts to display a frequency slightly less than the true input signal. Also note that when no signal is present at the prescaler input, the prescaler becomes highly unstable and oscillates. However, unlike the Fujitsu divide by 8 prescaler (which oscillates at a fairly constant frequency with no input signal), the Hittite prescalers seem to produce a number of spectral lines which cannot be resolved by some frequency counters, although the may be harmonics of the fundamental oscillating frequency. This instability is to be expected, and is believed to be caused by the positive feedback action of the input circuitry which tries to

'capture' the input (sine wave) signal. With no input signal present, the input circuitry of the prescaler is trying to capture noise and becomes unstable. However, as soon as an input signal of sufficient level is present, all signs of instability disappear and the prescaler behaves normally. The DC current drawn by the prescaler does not increase in the unstable (no input signal) state.

Options

It is fully appreciated that this is not a cheap project, although it is felt to give reasonable value for money considering the high performance and the use of the newest prescaler technology. For those that want a 10GHz prescaler at a lower cost, IC2 can be replaced with an HMC363S8G divide by 8 prescaler IC, IC3 and associated components are not fitted and the output from IC2 routed directly to the output socket.

For an even higher frequency prescaler, IC2 can be replaced with an HMC364S8G which is a divide by 2 prescaler identical to the HMC361S8G, but with an upper frequency limit of at least 13GHz, and may be useable well beyond that, although this has not yet been tested.

For more sensitivity at 10 or 12GHz, IC1 could be replaced with a Gali-19 or Gali-19 high frequency MMIC; the author is currently testing this option.

Parts List

| | |
|-----------|-----------|
| C1,2,5,12 | 4p7 |
| C3, 11 | 100pF |
| C4, 6, 9 | 10nF |
| C7, 10 | 10uF Tant |
| C8,14 | 10pF |

| | |
|-------|------|
| R1, 2 | 220R |
| R3 | 22R |

| | |
|-----|-----------|
| IC1 | Gali-1 |
| IC2 | HMC361S8G |
| IC3 | HMC438 |

References

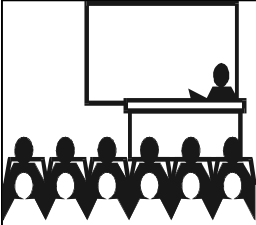
- [1] 12GHz Prescaler, David Wrigley G6GXX, CQ-TV 185 (published by the British Amateur Television Club)
- [2] New 12GHz Prescaler using Hittite HMC363S8G, David Wrigley G6GXX, www.microwave.fsnet.co.uk/projects/projects-1.htm
- [3] www.hittite.com
- [4] www.wa1mba.org/reflect.htm

PLEASE NOTE

The following new email addresses:

Dermot, **EI2AK**: annc@hotmail.com
Andrew **MOSPS** (exG6SPS): andrew@m0sps.fsnet.co.uk

The Microwave Directory (maintained by Martyn Kinder **G0CZD**) is now online at: <http://www.czd.org.uk/radio>



Microwave Update 2003/Pacific Northwest VHF Conference

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MICROWAVE UPDATE 2003 IN SEATTLE

Microwave Update 2003 organizers and the Pacific Northwest VHF Society are joining forces to host a joint conference in the Seattle, Washington, area on **September 25-28, 2003**. Registrations for the joint conference will be accepted beginning April 1, 2003. **Cost of the registration will be \$40 prior to September 12, 2003**, and covers all three days. Single-day or single-event registrations are not available. Late registrations, including at the door, will be \$50.

Registration forms can be downloaded at www.microwaveupdate.org or send a SASE to John Price, N7MWV, at 12026 81st Ave NE, Kirkland, WA 98034 and a form will be mailed to you.

Completed registration forms and payment should be sent to the same address. Make checks payable to "Microwave Update 2003."

Joint conference sessions and the Saturday evening banquet will be held at the Everett Holiday Inn and Conference Center, a short drive north of downtown Seattle. Special rates have been arranged with the hotel for conference participants. Rooms are \$69 per night plus tax...a real bargain for the Seattle area! It is suggested that early reservations be made directly with the hotel at (425) 337-2900. Be sure to mention "Microwave Update" to get this rate. Reservations must be made by August 21 for this rate.

"White papers" are currently being solicited from potential authors and speakers for publication in the 2003 conference proceedings. Topics specifically of interest to Microwave Update attendees, as well as those on VHF and UHF subjects usually associated with the annual Pacific Northwest VHF Conference are solicited. Papers will be accepted until July 1, 2003, to allow enough time for printing. White papers should be sent directly to Jim Christiansen, K7ND, via e-mail at k7nd@att.net. MS Word format is preferred. Microwave Update 2003 and the Pacific Northwest VHF Society respectively will be the sole judges of whether presentation requests and white papers are accepted.

If you are interested in making a session presentation at one of the Microwave Update 2003 sessions, **please respond to NU7Z (nu7z@aol.com); for presentations at the Pacific Northwest VHF Conference sessions, contact N7CFO (n7cfo@ix.netcom.com)**. LCD projection equipment will be available for those using PowerPoint presentations. Slides and video presentations can be accommodated with advance notice.

Editor's comment:

Update is a great event. Everyone should go at least once in their amateur radio life! The 2000 and 2001 Microwave Updates are described in photographs on the Web at www.g3pho.org.uk

26th Dorsten UKW-Tagung, 8th February 2003

.. A report by Jonathan Naylor, G4KLX/HB9DRD

Cheap flights are a wonderful thing! With the advent of EasyJet and others like it, many big airlines have been forced into providing cheaper fares. Lufthansa is no exception, and so when I was asked if I was going to the microwave meeting in Dorsten (in JO31) this year, it was a simple matter of finding a suitable cheap flight and booking it. A train journey would have been at least eight hours and more expensive.

The event only takes place on one day, from 9am to 4pm, but since many amateurs come a great distance to the meeting, there is the opportunity for the meeting to continue in an unofficial capacity at one of the local hotels. The hotel I stayed in was called "Haus Berken" and has the advantage of being only five minutes walk away from the school where the meeting was held. I may add that food at the hotel was simply sensational, although the rooms are merely adequate. Nino DL3IAS was also in the same hotel and so we travelled around together.

The meeting was held in two rooms, the main room is an open plan area with tables and chairs and is where

the socialising takes place. There were a number of trade stands of which Kuhne Electronics and ID Electronics were the most visible, and from time to time someone would take over a table, open his suitcase and sell components and give away price lists. At one end of the room was a machine selling hot drinks and snacks, sandwiches were also available. The second room was a well equipped lecture theatre and this was where the single band of lectures took place.

Within the printed Proceedings of the event are photographs of the stations that made the record breaking 2079 km QSO on 10GHz between Israel and Lampadusa (IG9), and articles for which there were no lectures.

The full program was:

0900 - 1000 Opening of the meeting
1000 - 1015 Greetings and preview of the day (DL4BBU)
1015 - 1045 2002 contest results and trophy presentations (DL9GS)
1045 - 1115 News about 47 GHz transverter construction (DC0DA)
1115 - 1145 Improving system performance on 76 GHz (DC0DA)
1145 - 1230 Fascinating microwave radio - historic developments DJ4AM, DL1RQ)
1230 - 1400 Lunch break
1400 - 1445 DLOGTH contest group - organisation and techniques (DK4RC)
1445 - 1515 Report of the IARU meeting in San Marino (DF7VX)
1515 - 1530 Multi-band dish feed for 23/13/9 cms (DK2FD)
1530 - 1600 A preview of Dorsten 2004 and closing remarks (DL4BBU, DJ6XV)

One of the strengths of such a meeting is the personal contact and a chance to discuss ideas. I had an interesting chat with Freddy ON6UG about the new satellite from AMSAT-DL, the highlights being that it will contain 10 and 24GHz downlinks and they hope to have a 47 GHz beacon (5 Watts !) also. The planned launch is in 2005, it will be based on an Oscar 13 frame and so will be a little simpler than Oscar 40. I also had a very long chat with Oliver DL1EJA who has an extremely large 2m EME system and we discussed the development of DSP techniques, none of it was particularly relevant to microwaves but very interesting all the same.

Kuhne Electronics were showing their new 2m and 70cm transverters and a small range of their modules. They did not come with a big selection to sell, this meeting was obviously more for pleasure than business. ID Electronics who normally specialise in microwave ATV equipment were also showing a couple of modules of great interest to microwavers. The first was a built PCB that locked an onboard 10MHz crystal oscillator to broadcast TV transmissions, this is around 65 EUR. His other item was an OCOXO which at first sight appeared to be a clone of the G8ACE design, with similar performance figures. When produced it will come as a finished unit in a machined case with thermal insulation and will be around 300 EUR.

The trade stands as mentioned earlier were a mixture of individuals selling surplus items through to the likes of DB6NT and almost everything in between. I bought a 6cm waveguide transition with N socket for 20 EUR, a new Narda 20dB directional coupler for 7.0 - 12.4GHz for 80 EUR and a new thermal power measuring head rated from DC to 60GHz with SMA socket for 50 EUR with complete instructions for building the display section. There was much more available for hardcore microwave fiends, a lot of which were at reasonable prices ... anybody want a 2m two way power divider fitted with 7/16 sockets for 20 EUR ?

One thing that I found interesting was the information and pictures of the DLOGTH contest station. They are the most successful contest group in Germany in the V/U/SHF contests and they have good equipment for 2m up to 47 GHz. However comparing their equipment to a cutting edge UK or Dutch contest group, they are not even in the same league. If G8P were to set themselves up on a similar location in Germany, they would absolutely destroy the opposition.

Of course many more attended and I am sure I missed some people I have worked on 3cm and other well known microwave personalities. Maybe next year I will wear a callsign badge. One problem with Dorsten this year was that it clashed with the PACC contest on HF and that probably reduced the number of Dutch amateurs attending, certainly Uffe, PA5DD, did not come for that reason.

After the main meeting many of us went along to the hotel where DB6NT and DL6NCI were staying for the serious business of eating and drinking and the exchanging of news and gossip. Much of what went off has become a little hazy despite being less than 24 hours ago but a few things remain. I floated the idea to Michael of looking into designing and building a 4m transverter, watch this space. DF9IC is the designer of packet radio link radios and he and Michael DB6NT spent quite a lot of time looking at designs on a laptop.

The evening continued until 1am by which time we left. The journey back to Switzerland was uneventful, although it was a shock to go from warm and dry JO31 to cold and snow covered JN47.

I recommend Dorsten very highly to all UK microwavers. The journey from Dusseldorf airport to Dorsten via train is about one hour and costs only 15 EUR return. I will certainly make the effort to go next year.



**ACTIVITY NEWS
FROM THE
WORLD ABOVE 1000MHz**

High and higher they go! A tale of friendly rivalry between East and West Coasts USA

The following series of email postings to the USA's Internet Microwave Reflector detail a remarkable series of millimetre wave contacts, over period of just a few days, in two regions of the USA, separated by around 3000 miles. Read and marvel!

From: wa1zms@arrl.net

[wa1zms@worldnet.att.net]

We (W4WWQ and myself), pushed our **322GHz "DX" to 1.4km on March 4th, 2003.**

QSO Details:

Date: 4 March 2003

Time: 01:17z

W4WWQ: Lat 37-21-14.7 Long 79-10-13.7

Loc: FM07ji

WA1ZMS: Lat 37-21-23.6 Long 79-11-10.8

Loc: FM07ji

Distance: 1.432km

Freq: 322.6GHz

Mode: FSK-CW

Temp: 0C

Dew Pt: -6.7C

RH: 61%

Pressure: 992mb

Atmosph. Loss: 10.6 dB/km <---WOW!

We likely would have had better results if we had a day with a lower dew point. The QSO on the WA1ZMS end was tough at best. Problems with frequency stability limited the application of weak signal software like Spectran, etc.. So good old fashion 5WPM CW and headphones were used. Since one station has a better RX mixer than the other (isn't that always the case!) Pete, W4WWQ had about 6dB of margin on his end while I had 0dB on mine.

The gear is the same that was used in the recent past for other 241/322 GHz QSOs. Photos of gear can

F9FT "Mr Tonna Antennas"

now Silent Key

We are sad to tell you of the death of Marc, F9FT, on Sunday, 2nd March 2003. Marc was an EME pioneer and the manufacturer of the famous Tonna 9 element 2m yagi in the earlier sixties and then the 16 element. He had a passionate interest in antennas and the amateur radio hobby until end of his life.

You can send e-mail to his son F5SE and the family at Franck@cbsky.net

Marc we'll never forget you !

Marius F8DO

still be found at www.mgef.org .

For this QSO the 80GHz drive level into the diode multiplier was reduced during RX to get a lower conversion loss.

I hope that others can get some gear running on +300GHz and give this DX record a smashing!

73, Brian, WA1ZMS/4

Just when you thought that was that, in came another email from Brian

From: wa1zms@arrl.net

[wa1zms@worldnet.att.net]

Subject: 120GHz DX..

Hi again to all. Sorry to keep doing this but.....

W4WWQ and myself, bettered our **120GHz DX to 12.79km** on March 10th, 2003. This should be a **new World and North American DX record. The former record was held by W0EOM and KF6KVG at 11.6km back in 1999.**

QSO Details:

Date: 10 March 2003

Time: 01:24z

W4WWQ Lat:37-20-28 Long:79-10-39 (FM07ji)

WA1ZMS Lat:37-25-48 Long:79-16-01 (FM07ik)

Distance: 12.79km

Freq: 120.GHz

Mode: CW

Temp: 11.1C

Dew Pt: -4.4C

RH: 33%

Pressure: 998mb

Atmos Loss: 1.22 dB/km

Signals on the W4WWQ end were about 8dB S/N, while signals on the WA1ZMS end were only 1 or 2 dB S/N. Since the atmospheric losses at the time were about 1dB/km we decided not to try and push it any farther until we can get better performance out of the gear.

We hope to have some 120GHz photos at www.mgef.org over the next few days.

73, Brian, WA1ZMS/4

But wait a minute!

Shortly after Brian's microwave reflector posting, up came this one from California on the west coast of the USA!

From: W0EOM@aol.com

Subject: [Mw] 120 GHz

Hi Brian - good work, but I have been late in announcing that Bob and I did 16.5 km on Fri, Mar 7. We have been trying 120GHz for the last two weeks and finally got a good day.

More details later but basically the same rigs as before with more tweaking.

Will, W0EOM

AND THEN CAME THIS FURTHER EMAIL FROM WA1ZMS/4 !!!

From: wa1zms@arrl.net

[wa1zms@worldnet.att.net]

Sent: 11 March 2003 18:49

Subject: East coast vs West coast...

Hi all,

Well the competition for DX records on 120GHz is continuing.

Mother nature gave the local area a blast of cold and dry air last night. I just couldn't pass it up! (Also gave us light snow this morning.)

W4WWQ, KA4YNO and myself took to the local hills and **managed three QSOs on 120GHz with our best DX being 20.6km.**

WX on WA1ZMS end of QSO

Temp -2.7C

Dew Point -18.3C

RH 29%

Pressure 906mb

Calculated loss ~1.09dB/km

Interesting point to note ... as the WX gets colder, the total loss per km can go UP as oxygen replaces water vapor (Interesting twist for the bands near oxygen absorption lines). The same thing can happen on 75GHz at the low end of the band.

That's it for me on 120GHz. **Now it's W0EOM's turn or for someone else to join the competition.**

Remember, DX records are made to be broken. Had the WX not turned dry/cold here, I'd be stopped at 12km.

Photos and a noisy audio file can be found at

http://www.mgef.org/zms_120.htm

73, Brian, WA1ZMS

Editor comments:

Congrats to these West and East coast USA millimetre men for what they are doing on these "super high" frequencies. It must be a great stimulus to have real competition up there!

UK MICROWAVE ACTIVITY DAY 23 FEB 03

The February activity day was a resounding success with an unprecedented number of microwavers active across several bands throughout the day. Many came on to work JO03 square which was activated by G3PHO on both 5.7GHz and 10GHz, but the other bands saw some good contacts also.

Peter, G3PHO/P was on from JO03AD47, a few km SE of Horncastle in Lincolnshire. He knew beforehand that it was a desirable new square for some but was staggered at the number of contacts made as a result! Here's his report:

- Yesterday was a great success! I must thank all of you who came on one or more microwave band to make the February Activity Day the best winter non-contest day I can remember!

According to my calculations there were at least 31 active microwave stations on yesterday (Sunday) including an LX station!

Thanks very much to the ops who put me on the DX Cluster! It certainly aroused some interest and it felt nice to be DX for a day.

The total activity figures are as follows:

10GHz: 25 G stations, 3 PA, 2 F, 1 LX

5.7GHz: 6 G stations, 3PA, 1 F

3.4GHz: at least 3 G stations.

No figures for the other bands.

My personal results are:

27 QSOs in 9 LOC squares across 10GHz and 5.7GHz (18 on 10GHz, 7 on 5.7GHz and two "one ways" on 5.7GHz).

Remember this was not a contest yet the activity was as good as most of last year's summer contest days and this was in the winter!

I was delighted to give JO03 square to lots of you, especially to PA0EZ, PA0WWM PA5DD, F6DKW and F1PYR/P, most cases on both 5.7GHz and 10GHz. F6DKW was best DX at 511 km.

My mobile phone was very busy all day long! I had more QSOs on that than on 5.7GHz ... with three countries!

It was nice to have so much activity and yet not have to bother with contest numbers and rubber stamp contacts.

I might go back to the location again later in the year but the low trees around the field could very well be a problem during the summer. The site is on a gently sloping hillside and it's difficult to get clear of the trees and distant obstructions in every direction, even though they were several hundred metres away. In fact I worked PA0EZ through the local church tower!!

73 from Peter, G3PHO

From: Peter, G3PYB (Portsmouth, IO90)

[peter@papine.demon.co.uk]

I managed to squeeze in some time on nearby Ports-down Hill from 3:30pm on the 23rd February to give

the winter 5.7GHz project some time on the air. The contact to G3PHO on 3cm was straight forward and was followed by my "first" on 5.7GHz with 200mW and 60cm offset. The log beam feed was hurriedly assembled in a Raspberry yoghurt pot "organic of course" to help the Q and placed approximately at the focus of the dish. Signals on 5.7GHz were quite good with no difficulty in working G3PHO in JO03AD. The total of 4 contacts were made on 5.7 and 2 on 3cm before sundown all added to a pleasant few hours on the hill.

From: Roger Kendall, GOUPU (Cheltenham)
[Roger.Kendall@BTInternet.com]

Unfortunately I had to go out for much of the day on Sunday 23 Feb but I was able to get on for a couple of hours in the morning and an hour in the late afternoon and had contacts on all bands from 23cm to 3cm. Unfortunately I missed out on JO03 square!

While working G4MAP on 13cm we were called on that band by G3VKV and were able to have a three-way contact which is a first for me on that band. My new 9cm rig with 10W output was used to work G3UKV/P and G4NKC. There do seem to be a lot more stations on the intermediate bands nowadays. On 6cm I only worked G4NKC. I would like to increase my power output on that band as I only have 200mW at present. On 3cm I worked G4MAP and G3LRP.

I would like to do something this year to improve the mounting system which I have for my dishes as it is quite a job putting them up and taking them down again. I have also started work on improving the stability of my oscillators. On 3cm I use an Adret source which is very stable but I hope to lock all my other transverters to a 5MHz reference oscillator which can be locked to an off air reference.
73, Roger Kendall, GOUPU.

From: Martyn Vincent G3UKV (Telford)
[ukv@globalnet.co.uk]

A brief report using the new 3.4GHz gear from Brown Clew IO82QL during the Feb 23rd Activity Day

QSOs: G4NKC 59 out 59 in. IO82SM (Bridgnorth.) It works - first QSO ever for me on 3.4GHz!
G3YK1 599 out 599 in IO92BD nr Evesham. Flutter. Dish waggling everywhere!
GOUPU 59 out 59 in IO91AX, again with severe flutter due to unstable dish.
G1SLE no signals heard.

I'm claiming the first 2003 "Heard all beacons on 3.4GHz"! Obviously GB3ZME (Telford) and GB3OHHM (B'ham) were both S9+, but then I also heard GB3MHS (Martlesham JO02PB) on 3400.830 MHz at about S2, and later GB3SCF (Bell Hill, IO80UU) at about S1 on 3400.905 MHz. I thought it was about 5 KHz LF off nominal frequency. Not bad as my info says it only runs 2.5 watts ERP. So, those 4 beacons are the total number QRV at this time in the UK. Hence my record claim! Also had a few 10GHz QSOs from Brown Clew. G0RRJ (IO91FE), G4NKC (IO82SM) and G1SLE (IO931F).

From: G3XDY (Suffolk) [g3xdy@btinternet.com]
February had some unusually good tropo for the time of year. It started about the 17th and continued in various phases through to 26th Feb. It started here with OZ1CTZ (JO46), worked on 1.3GHz, but nothing was heard on 10GHz. Later Brian was hearing the GB3CCX beacon over 800+km but there was no activity from that part of the UK at the time.

Conditions for the UK Activity contest on the 18th were slightly enhanced on some paths but no long DX. There was some welcome activity from PA0 on the higher bands but all my UK contacts were on 1.3/2.3GHz.

Conditions lifted a little on the 20th, with a surprise catch of LX1DB on 1.3GHz (thanks to G4EAT who spotted him on the DX Cluster) and we successfully moved up to 2.3GHz for a new country/square. LX1DB has QRO on all bands to 10GHz (including 3.4GHz) and I suspect there may be a good opportunity to make the first G - LX QSOs on the middle bands when conditions are better. We had no success on 3.4GHz on this occasion.

On the 23rd G3PHO/P was a good signal on both 5.7 and 10GHz from JO03, and a few other stations were worked during the activity day, mainly on 1.3 and 10GHz. Tests with G1JRU and G4ALY were largely unsuccessful.

Conditions on the 24th remained good over to PA but no exceptional DX. The 25th was the star turn. The Scandinavian Activity Contests now have a microwave evening (2.3GHz and up) on the 4th Tuesday of the month and on this occasion it coincided with a good duct to Southern Sweden. SK7MW was 57 on 2.3GHz (They use a 4.5m dish!). Later in the evening I found SM7ECM (JO65NO), and after starting on 2.3GHz with 559 reports we moved to 5.7GHz (549/559) and then 10GHz (519/519), rounded off by a quick QSO back on 1.3GHz at 59. Interestingly several tests with OZ1FF in JO45 were tried with no success, so the duct was quite selective. The following day there was still a lift in evidence to the JO30 area of Germany, but not a lot of activity.

The weekend of 1/2 March also saw a good level of microwave activity from the continent. This date is used for a multiband contest in Europe, while the UK is 144/432MHz only. A small UK contingent (G4BRK, G4EAT, G0RRJ and myself) used the WW Converts network as a very effective talkback channel for setting up tests with our continental counterparts. At times there were around 45 stations logged into Ch10368 from all over Europe. I made 20 contacts on 1.3GHz, 14 on 2.3GHz, 7 on 3.4GHz (after fixing a connector that had pulled off the feed), 7 on 5.7GHz and 16 on 10GHz. DK2MN (JO32) was the best DX on all bands except 1.3GHz where DL3YEE (JO42) came out on top. Some rainscatter was evident on both 5.7GHz and 10GHz at times during the weekend, with DL0NS in JO30 the best DX by this mode.

Overall, this was an interesting month with some very good DX available. **73 from John G3XDY**

Oops .. No more space! See you all next month ... Peter, G3PHO, Editio