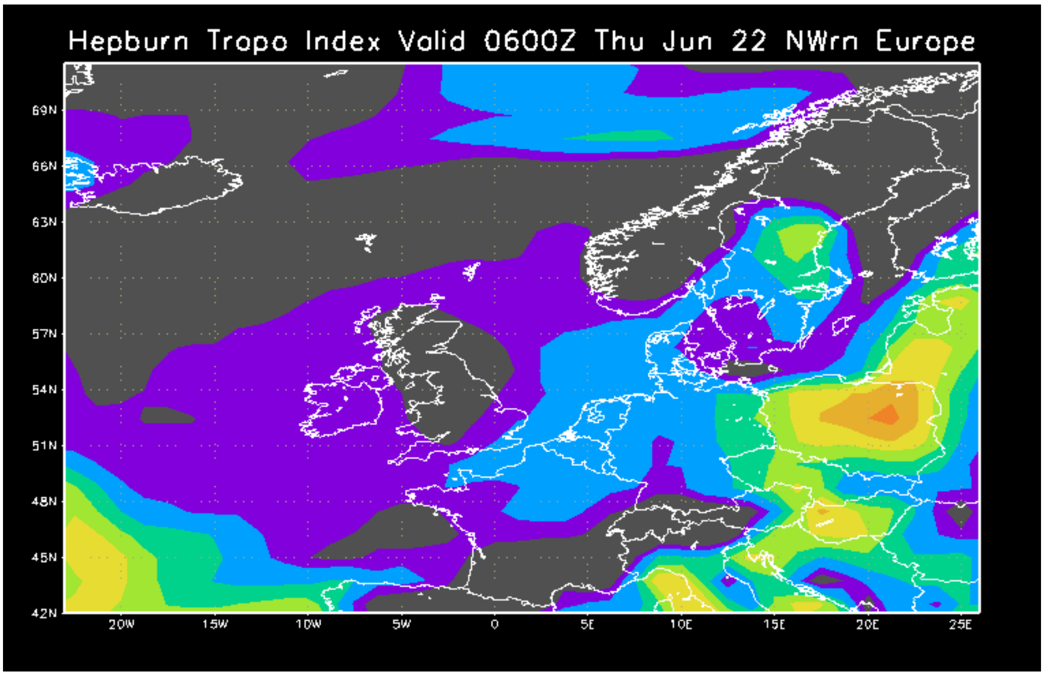
United Kingdom *Microwave* Group

Scatterpoint – *Issue 2*

June 2000

www.microwavers.org



The Midlands and Scotland missing the lift again!

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About the UKuG

The United Kingdom Microwave Group was formed in Autumn 1999.

Membership subscriptions are currently UKP12.00 per year.

The committee comprises of the following:

Chairman	***Membership Secretary***	***Newsletter Editor***
Sam Jewell, G4DDK Blenheim Cottage Kirton Road Falkenham Ipswich IP10 0QU jewell@btinternet.com	Lehane Kellett G8KMH Woodpeckers Church Lane Arborfield Berkshire RG2 9JA lehane@mm-wave.demon.co.uk	Martyn Kinder G0CZD 12 Jessop Way Haslington Crewe Cheshire CW1 5FU martyn@g0czd.clara.net Tel: 01270 505930

There are also six ordinary committee members;

Neil Whiting	G4BRK
Steve Davis	G4KNZ
Peter Blakeborough	G3PYB
David Wrigley	G6GKX
Alan Wyatt	G8LSD
Mike Willis	G0MJW

Membership enquiries and applications should be sent to the membership secretary.

A membership form is available at on http://www.microwavers.org/ukugmemb.htm

The UKuG web site is at http://www.microwavers.org

Contributions for Scatterpoint, letters, For Sale and Wanted should be addressed to the newsletter editor.

If you like what you see here, please tell others, if you don't like it, please tell me.
73, Martyn Kinder G0CZD

Front-end

Sam Jewell G4DDK

Welcome to this, the second official issue of Scatterpoint.

Some of you will know that I have recently moved QTH. I haven't moved that far, just half a mile, but that is enough to mean I have to start the work of re-building my station all over again. At the time of writing this piece I still don't have any working area available. My garage is full of boxes, and although I was careful to mark each box with details of what it contained, it wasn't enough to avoid mislaying essential items like my multiband horn (needed for some quick mid-band path tests between my QTH and that of Simon, G3LQR) and the 9cm beacon power supply. It has brought home to me the amount of microwave equipment I have built or acquired in the last few years. Getting it all back on the air so that I can again claim 'all bands 144MHz to 47GHz' will inevitably take some time. However, it will also be an opportunity to do some things differently this time. For a start, I expect to mount more of my equipment at pole-top, to reduce feeder losses. I also expect to replace some of the more ageing designs with newer and more efficient kit, including the 24GHz transverter, the 10GHz power amplifier and the 5.7GHz transverter. Some of these changes may be included as articles in Scatterpoint.

Earlier this year I was fortunate to visit Boulder, Colorado, on business. Whilst there I met up with Bill, K0RZ and Don, W0NUG, one evening. Following dinner at a local restaurant Bill invited me back to his QTH to see his microwave station. Bill is a well-known microwave, satellite and EME operator as well as the builder of the Oscar 13 mode S transponder. Bill also organised the 1998 Microwave Update in Estes Park, Colorado.

I was fascinated to see Bill's home built equipment for the higher bands, including 24GHz. With the Rocky Mountains just a few miles away, Bill has many opportunities to work portable stations. Bill's home QTH in Louisville is more than 1 mile above sea level and as a result experiences very different propagation to us in the relatively low-lying UK. In particular, Bill reports very little in the way of ducting propagation because of the low humidity, but this helps with 24GHz propagation due to little water vapour losses.

I was able to experience 10GHz propagation first hand when Bill allowed me to use his station to work Don. Until this time, the only other band I had used in the USA was 2m, both simplex and through the Boulder open repeater.

The point of this last piece is to point out how international microwave radio has become. Although microwave operating is a minority interest within amateur radio, it still presents many opportunities to meet with like-minded people, to experience the thrill of technically difficult QSOs and best of all, to talk about the thing that unites us all. Amateur microwave radio.

73 de Sam

TIPS FOR OPERATING A MULTIBAND STATION

Uffe Lindhardt PA5DD

Being QRV on microwaves can involve being QRV at 5,6 or 7 different bands. Contests and band openings often requires fast QSY between these bands, as well as simultaneous operation on more than one band at a time (e.g. talkback). To fulfill these requirements puts high demands on the station design.

This article tries to give some hints as to how this can be done.

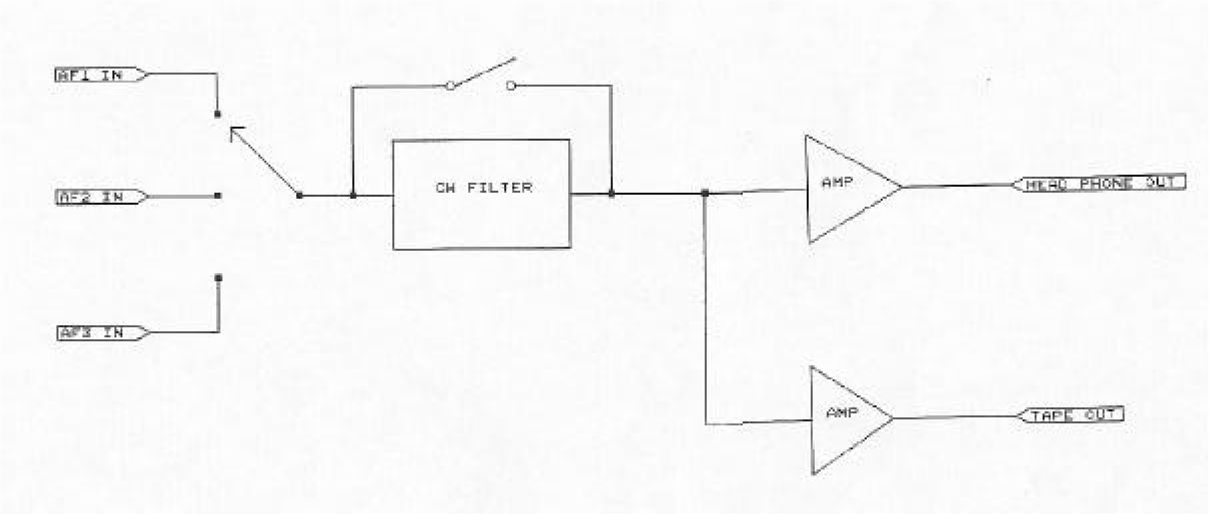
AUDIO & CW KEYING

In order to be simultaneously QRV on different bands, more than one transceiver is needed. As the choice of talkback varies (144 MHz, 432 MHz, 1296 MHz etc.) even more transceivers could be needed.

This naturally gives some switching problems when it comes to one headphone and one CW keyer.

For the audio part I have made a “Headphone amplifier box” which takes the standard 200mV AF output available on most commercial transceivers as input. For the sake of standardisation I have equipped all my transceivers (6 in all covering 1.8 MHz trough 24 GHz) with phono plugs for the AF output. Inside the box I have a switch to select one on the AF inputs. The input is then amplified before being fed to the headphone. Result: I do not have to plug my headphones in and out all the time.

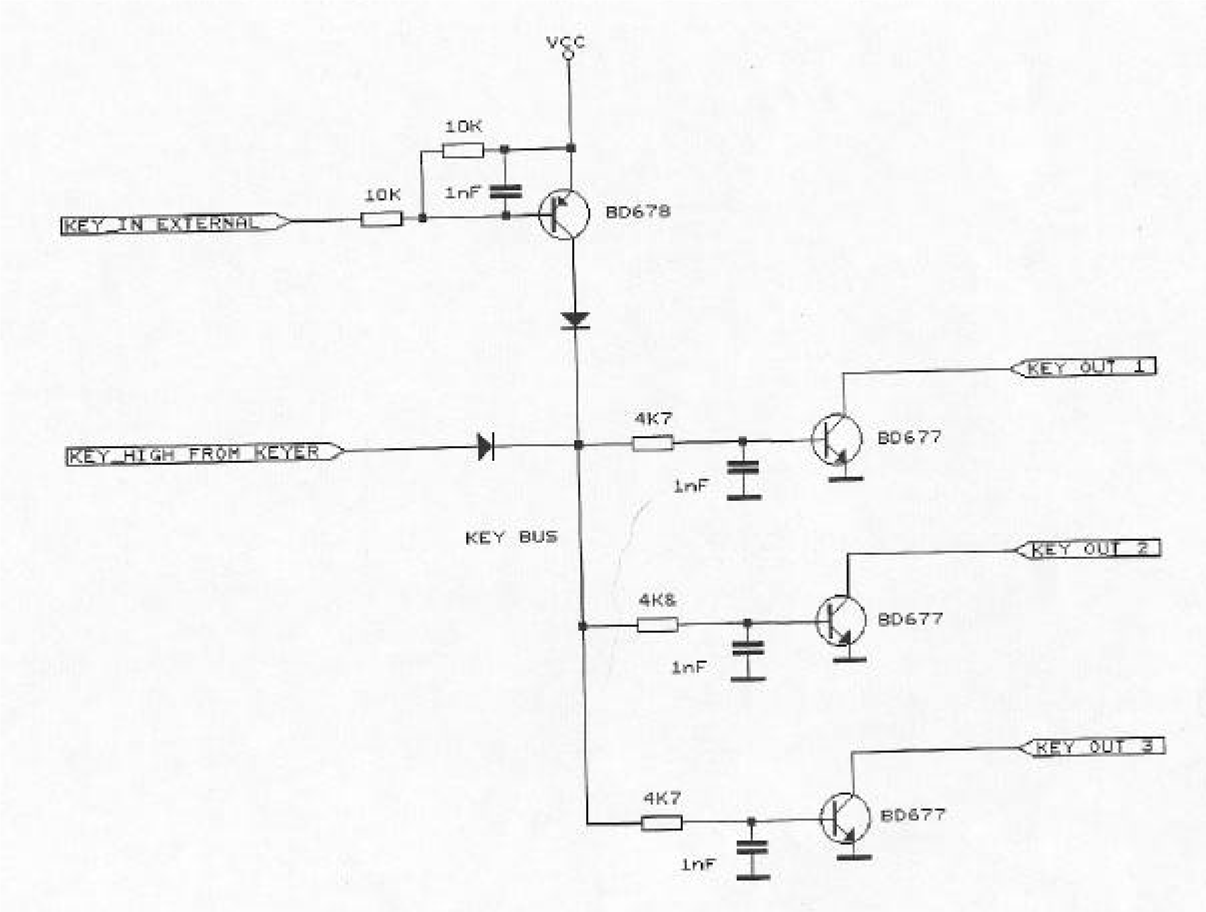
Taking advantage of the concentration of audio signals in the amplifier box, I have fitted a switchable audio CW filter and an isolated tape recorder / sound card output in the AF line going into the amplifier.



For CW keying I have chosen to key all transceivers in parallel. I am assuming, that only one transceiver will be transmitting at a time, so do not use break-in, or all your transceivers will be transmitting simultaneously. On the other hand this system removes any switching requirement for the CW key.

In order to achieve keying in parallel and having isolation between the keying inputs of the transceivers, I have chosen to make a keying serial "bus", which is active high. This bus keys a series of NPN switching transistors, one for each transceiver. The bus is driven from my electronic keyer, which has an active high (inverse) output. Extra inputs to the bus for a handkey or PC interface can be added by means of an inverting circuit (e.g. PNP transistor).

This is the circuit diagram:



IF SWITCHING

In order to bring down the transceiver count, it is natural to use the same transceiver for more microwave bands

I prefer to use separate RX & TX cables for the IF connection to my microwave transverters. This "dual line" approach makes it easier to introduce separate attenuation in the RX or in the TX branch, when there is a need to adjust the signal levels. It also gives more transparency during fault detection on a mast mounted transverter. Furthermore I use split RX & TX cables also on the lower bands, so my transceivers already have separate RX & TX connectors.

I order to speed up the process of QSYing from one band to another, I have built some IF switches. Since separate switches are need in each branch (RX & TX), and maybe a third switch for the TX control signal, I have chosen low cost DC relays.
These relays do not provide too much isolation on 144/432 MHz, but that is of less importance. I am using small "sugar cube" relays, which have a metal cover, that can be used for grounding.

These relays can be found surplus at reasonable prices, and by using more relays a split of 2,4 or more IF outputs can be provided. If you are using a pre-amp and a PA on the fundamental band of the transceiver, then even that band could be connected to one of the IF outputs.

The relays could be internal or external to the transceiver, but it is an advantage, if the switching can be controlled from the transceiver. In my ICOM 402 I use the S-meter light switch voltage to switch the relays as well, this gives a good visual indication of which band I am on (e.g. lights off is 6cm, and lights on is 3cm).

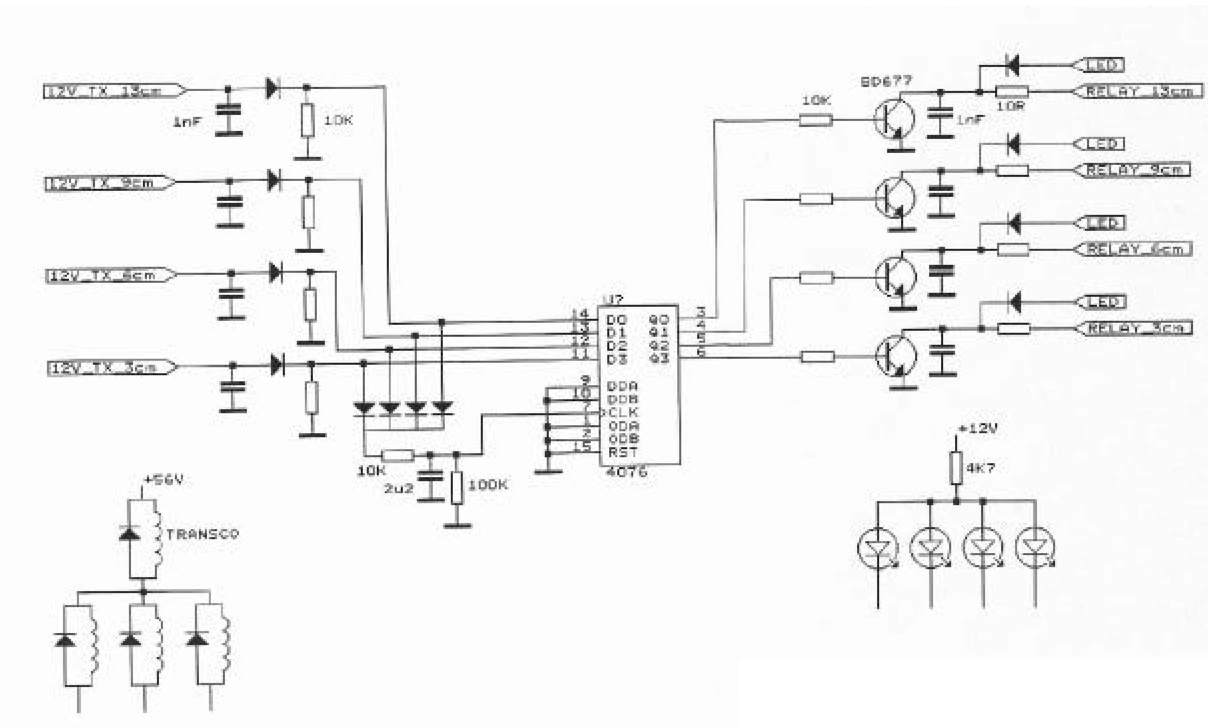
MULTIBAND ANTENNAS

In order to make an efficient use of antenna mast space, it becomes desirable to make use of multiband antennas, e.g. a parabolic dish with a multi band feed. If at the same time the transverters have been placed in the mast to minimize cable losses, a need for switching between the antenna and the transverters occurs.

Fortunately multi pole microwave relays are available e.g. TRANSCO 14300, which is a SP4T relay.
In order to make the switching as seamless to the operator as possible, I decided to make some control logic, that switches the relay to a given band when the transverter of that band is switched to TX. Afterwards the relay stays in that position until another transverter is switched to TX.

With this system the operator simply has to flick the PTT on a given band to acquire a connection to the multi band antenna.

The control logic was realised with D-flip/flops, connecting the TX/RX switching signals (e.g. 12V_TX) output signals of the transceivers to the inputs, and using the RX-to-TX transition of any of the signals to clock the flip/flops. The schematic shows a system for four bands using the TRANSCO relay.



HS400 - A useful and simple modification

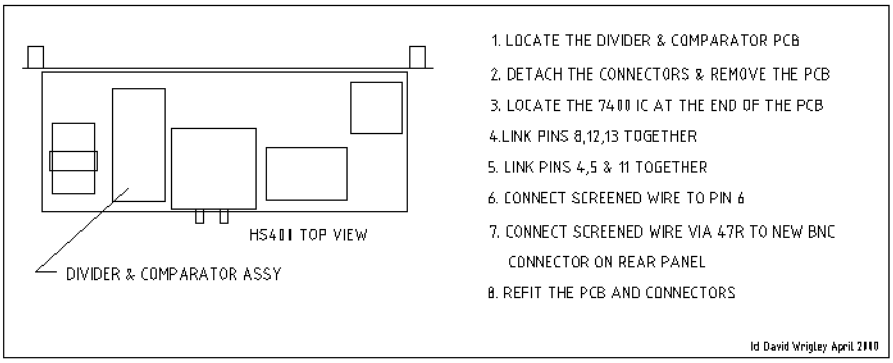
David Wrigley G6GXK

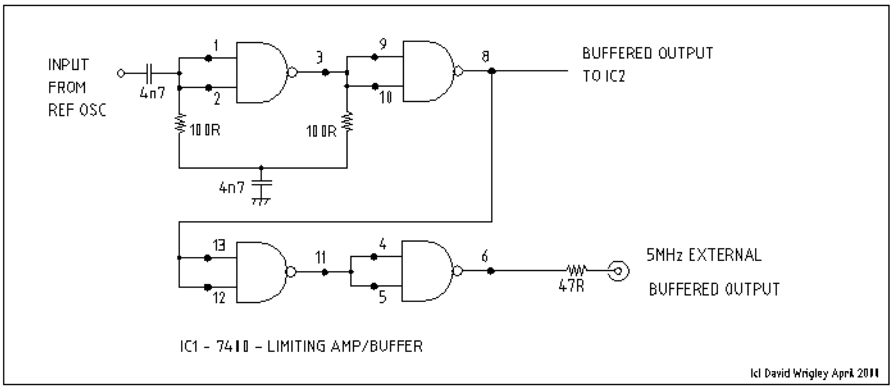
The HS400 contains a very useful and high quality reference oscillator. We all need a frequency source that we can rely on to set up the local oscillator in our transverters and any frequency counters that we may have. This 5MHz reference oscillator is just the job to use as a reliable local source. It was the author's intention to control this oscillator by synchronising it with MSF – hopefully more of that later. The first stage is to get at the voltage control connections and the output. These are all available on the connector at the end of the Divider and Comparator PCB which is located next to the reference oscillator.

A simple connection would be possible but unwise. These oscillators can be affected by load even when buffered by a single stage and it is vitally important to keep it low and constant. It was decided that the connection would be made further away from the oscillator and the output of the Limiting Amplifier would seem appropriate. With amazing good fortune there are two spare gates in the 7400 (IC1), which have been used in this modification to further isolate the output from the internal circuitry.

The only further consideration is the possibility of shorting the output. Well the man who doesn't make mistakes is a myth – we all do. So I have added a 47R resistor in series with the IC – this also cuts down the output voltage swing to a more reasonable level and limits the potential for damage to other equipment.

Well that's it. The diagram below gives a bit more detail.





The next stage is to build a PCB to control this oscillator from MSF via a PIC chip controller feeding a Digital to Analogue Converter IC. The purpose will be twofold.

1. The provide a long term lock to MSF accuracy
2. To minimise drift in the short term between MSF updates.

It should be possible to get an accuracy of 1 part in 10^10 using this system which is 1Hz in 10GHz. This might be bit over the top in terms of accuracy but it should be fun seeing what can be achieved.

SIMPLE MICROWAVE SYSTEM BENCHMARKING

Uffe Lindhardt PA5DD

This article describes a simple way to test the receive performance of your microwave system. It requires that you are able to receive a signal from a known source from within 0-25 km (e.g. a beacon or a neighbouring amateur).

The method relies on free space propagation theory, so it is important to have an unobstructed path to the source. The method does not include any compensations for refraction, reflection, atmospheric losses or ground gain, hence results should be used with caution. Neither does it take account of antenna illumination efficiency and receiver performance. The idea is to keep the calculations as simple and clean as possible. Afterwards the figures can be seen in the light of the omissions.

To further increase transparency and simplicity the units for antenna gain has been adapted to the free space propagation formula, so that the frequency independence of the spreading of energy over the path becomes apparent. Therefore the effect of the transmitter antenna is characterised in dBi and the receive antenna in aperture. This approach and the use of dB as unit makes the calculations a matter of adding together some figures.

Note that anything but the TX EIRP are frequency independent, which is convenient when comparing different bands, where the same multiband parabolic dish is used. The antenna aperture is approximated to be equal to the area of the parabolic dish used.

To perform the benchmarking you need to be able to determine the signal-to-noise (S/N) ratio of the incoming signal. This is most easily done using a adjustable attenuator in the IF line (eg. 144 or 432 MHz) of the microwave transverter. You should preferably have so much IF gain that the noise without attenuation produces a S-meter reading. After having determined that S-meter reading (with fast AGC), you tune to the signal for a maximum reading, afterwards you add attenuation until a reading equal to the noise reading is achieved. The S/N should be at least 20dB for this method to work.

Now you are ready to fill in a table like the one below. You need to know the EIRP of the source signal, the distance to the source, the radius of the parabolic dish used and the bandwidth used for the measurements (normally 3kHz). Start at the top, and calculate your way to the bottom.

Calculations		Unit
TX EIRP	10 * Log [power in mW] + TX antenna gain (dBi)	dBm
Path gain	-10 * Log (4 * ? * [distance in meters]^2)	dB
=		
Power density at RX antenna		dBm/m^2
RX antenna aperture (ideal)	10 * Log (? * [parabola radius in meters]^2)	dB/m^2
=		
Power at RX input		dBm
Noise floor @290K,0dB NF	10 * Log [bandwidth in Hz] - 174 dBm/Hz	dBm
<>		
Ideal free space S/N		dB
Measured S/N		dB
<>		
Difference ideal to measured		dB

When comparing the calculated and measured figures, be aware that at least the first 7 - 10dB of difference is accounted for by the omissions in the calculations. The antenna illumination efficiency accounts for 5 - 6 dB, receiver noise figure and feeder loss for another 2 -3 dB. The rest can be attributed to propagation factors, faults in the system or inaccuracy of the data used (e.g. the true EIRP of the source).

Conversion between dBi and antenna aperture can be made using the following formulas:

Antenna gain [dBi] = [Aperture in dB/m^2] + 10 * Log ((4 * ?) / [wavelength in meters] ^{2})

Below are my own benchmarking using PI7EHG at Schiphol airport. The distance is 25km, and is very close to line-of-sight because the beacons are placed 90 meters higher than the receive antennas. I use the benchmarking to get a picture of absolute performance, but more importantly to track any changes in system performance over time.

PA5DD JO22IC22	3400 MHz	5760 MHz	10368 MHz	24192 MHz
PI7EHG (JO22JH14) EIRP	+ 39 dBm	+ 41.5 dBm	+ 32 dBm	+ 26 dBm
Path gain (25km)	- 99 dB	- 99 dB	- 99 dB	- 99 dB
=				
Power density at RX antenna	- 60 dBm/ m^2	- 57.5 dBm/ m^2	- 67 dBm/ m^2	- 73 dBm/ m^2
RX antenna aperture (ideal)	- 4 dB/m^2	- 4 dB/m^2	- 4 dB/m^2	- 7.5 dB/m^2
=				
Power at RX input	- 64 dBm	-61.5 dBm	- 71 dBm	- 80.5 dBm
Noise floor @3kHz,290K,0dB NF	- 139 dBm	- 139 dBm	- 139 dBm	- 139 dBm
<>				
Ideal free space S/N @3kHz	75 dB	77.5 dB	68 dB	58.5 dB
Measured S/N @3kHz	57 dB	52 dB	56 dB	36 dB
<>				
Difference ideal to measured	18 dB	25.5 dB	12 dB	22.5 dB

Direct Digital Synthesis for Microwavers

Andy Talbot G4JNT

I am in the process of producing a DDS module for the Analog Devices AD9850 and AD9851 devices. This will include on onboard PIC controller to translate simple text based commands from a PC serial (COM) port to command words for the DDS chip to set frequency and phase. Non volatile RAM will store a default switch on frequency.

The 45 x 54mm approx. PCB will cost around £8.00, and a bulk purchase of the DDS chips still has the price to be fixed, but 3 years ago was around £13 - it may be less or more by now though ! Mounting of the tiny 0.65mm pin spaced devices on the PCB may also be possible, but for us SMT experienced constructors that shouldn't be a problem anyway.

The board is currently with the PCB manufacturer for delivery in about 3 - 4 weeks.
HF Instruments (WWW.HF-INST.CO.UK) will be handling the sale of the PCB and chips so don't contact G4JNT about them.

The AD9850 will accept a clock input of up to 120MHz and generate an output from DC up to the 40MHz region in tiny steps (which to microwavers will appear to be general coverage). The AD9851 includes an on chip x6 multiplier which will allow an internal clock up to 180MHz with an input of 30MHz, and so give output frequencies up to 70MHz.

However, a very interesting aspect mentioned in the data sheet is the use of aliassed products from the DDS to generate higher frequency components in the range above and below 180MHz by bandpass filtering the DDS output rather than low pass filtering. This means the all important microwave drive range of 90 - 120MHz is directly available allowing a continuously tuneable microwave source after multiplication by the 'DDK etc designs.

For full details of the DDS chips, see the Analog Devices web site at WWW.ANALOG.COM

Andy G4JNT

SK - Mar van der Hoeven, PE0MAR

I regret having to report that my friend Mar, PE0MAR, passed away on 12 April after a short illness. I have known Mar for over 20 years and have had the opportunity to operate on many occasions from the 'Lighthouse' contest group in JO21bx from which his call, PE0MAR/P was so well known.

I know that for many of you a contact with "MAR" has been your first QSO into the Netherlands on the microwave bands. He will be sadly missed by all. He leaves a wife Ria.

Keith, G4FUF

The Manchester 10368MHz Beacon

David Wrigley G6GXK

History:

The beacon was started by John Greenwood (G4XHS) and David Wrigley (G6GXK) who have between them contributed most of the bits and effort. Mike Dixon(G3PFR) kindly contributed the slotted waveguide antenna along with the offer of the GB3XGH Callsign for an already licensed but now not operational beacon. Several others have helped with the development. notably Paul Widger, G0HNW over across the border (with Yorkshire) in Holmfirth, who found the source of the problems in our multiplier chain. Also Bert (G8TTU) from the local Club, RADARS who helped with the testing..

The reason for the beacon is that we had suffered several problems with our 10GHz systems and we didn't have a local beacon to check that firstly our receivers were working and secondly that they were on the right frequency. We decided that we had enough bits to construct a beacon which could then be used as a frequency reference.

Present status

The Beacon has now been running as an attended personal Beacon since April - there have so far been few reports although we know from Martyn G3UKV that the beacon has been received from as far away as Clee Hill. Early reception tests have shown that the reception of the intermittent tone appeared to be less strong than the Morse ID. The system keying has now been changed (Monday 5 June 00) to incorporate a steady carrier between Morse ID transmissions. The frequency is currently about 40Hz lower than the theoretical frequency of 10368.810240.

The photo above shows the general construction of the beacon. The overall waterproof cover is a piece of square Rain Water Pipe with a glassfibre end cap (shown at rear). In the foreground is the main galvanised steel chassis, with the slotted waveguide antenna at the right and the connector plate at the left. The three modules mounted on the chassis are from left to right, the DDK004, the WDG001 and a Teledyne PA which feeds through an isolator into the antenna. At the extreme left is the mast clamp which has been fabricated from half a scaffolding fixing. The two captive nuts can be seen welded to the chassis at the left. On the right can be seen the Adret synthesiser with the PSU and the ID generator PCB on top. These latter units are all inside out of the weather.

Frequency Source: Currently this is provided by an Adret Synthesiser running at 108.00844MHz locked to a Philips HS400 5MHz precision reference oscillator. Once the frequency has been agreed the source will be provided by a replacement temperature controlled crystal specific to that frequency. This will free up the Adret for the next project. The design of this replacement unit has already been completed and is based on a copper block (a 2 inch length of 1.5 by 0.25 inch copper bus bar) with a precision temperature controller on one side and a crystal oscillator on the other. The whole assembly is surrounded in shock absorbing and heat insulating foam and enclosed in a tinplate box. Leads are internally connected to permit monitoring of the temperature of the oscillator as well as the fine control of frequency by means of an applied voltage. The prototype unit is working with a 10MHz crystal, but will eventually have a fifth overtone crystal fitted. This unit will be fitted with a remote fine frequency adjustment system. The objective is to provide a reliable frequency source and for this purpose a frequency accuracy of 100Hz would be reasonable (1 part in 10^8) The current system which is locked to the HS400 reference crystal is stable to better than 5 parts in 10^10 although not yet precisely on frequency. On 9 June 2000, the frequency was 38 parts per 10^10 low relative to the BBC1 reference and drifting very slowly upwards- This represents a final frequency error of about 39Hz from the specified 10368.810240MHz.

Keyer: This is based on the PIC16C84 single chip computer. The program and constructional details can be found on Peter Day's site The World above 1000MHz - go to "Technical Articles" section, The file is "Microwave Morse code and tone generator" cwid.zip and has been updated to correct several errors in the original publication. The latest file should be dated 1999 Oct 26 and is about 325kbytes. The circuit has been modified slightly in that we are only interested in key output rather than tones, so we don't need the microphone connection or the associated components. The software has been modified to accommodate the inversion effect of the output transistor switch. So in this unit the LED and the keyer transistor are fed from two separate outputs, one the inverse of the other. Rather than design a separate PCB for this use, the switching transistor originally used to operate the PTT was used for the keyer output. Note that a 0 Volt output from the PIC gives a +5 volt output from the keyer drive switch and keys the carrier "ON". Simultaneously a +5 Volt output from the PIC turns the LED "ON".

Cables to Masthead unit:

12 Volt DC Stabilised Supply - two pairs of 3 pair cable to 6 pin DIN connector.
TTL Level Keyer output - one pair of 3 pair cable to 6 pin DIN connector.
108MHz Frequency Drive - Coax cable terminated in BNC connector.

At both locations, all cables pass through an existing ducting through the wall to the mast. They can easily be withdrawn and replaced if necessary, without removing the connectors.

The Masthead unit: This consists of a length of 60mm square section Rain Water Pipe (RWP) for water proofing. Inside this running almost all along it's length is a folded galvanised steel channel section to provide an internal chassis on which to mount the various components and onto which the mast clamp is bolted – it will also help distribute the internal heat generated and help dissipate this over the surface area of the RWP. The steel chassis only extends upwards as far as the base of the antenna and beyond that the RWP is transparent to microwaves. The actual attenuation of the plastic was not measured - a future project perhaps. The base of the unit is closed by a welded steel plate, up inside the RWP and carrying the BNC and DIN connectors. This type of construction has survived the last two years on the current personal ATV Beacon without any noticeable deterioration. More importantly it permits rapid access to connections. Any repairs can be carried out inside, out of the weather. The modus is to detach the two connectors under the masthead unit and just unfasten the single scaffolding clamp bolt, thus releasing the entire masthead unit. Stripping the unit requires just a further two screws to be removed (nuts are captive). The whole of the connections and modules are then exposed for access and testing.

Multipliers: A series of Multipliers at the masthead convert the Source frequency to 10368MHz (overall multiplication of 96). The Adret is input to a modified DDK-004 module. The crystal oscillator was removed and the 108MHz source feeds via a capacitor into the second stage of the Butler oscillator. The 2.5GHz output of the DDK-004 unit then feeds into a WDG-001 multiplier which has had the last amplifier stage removed and the two final stages are then keyed using the gate bias lines via a TTL level interface. A small PCB was designed to fit inside the WDG-001 case and feed the bias lines through the main PCB from the ground plane side. This new PCB carried two NPN transistors and pulled the bias lines down towards -5Volts when 0 Volts was on the Keying Line, and applied the normal preset bias when +5Volts was applied.

Power Output: Two PA Modules are available, A sealed Teledyne block giving about 250mW and a modified Qualcomm unit giving about 1 Watt (One of the units sent to us by Chuck Houghton (WB6IGP)). The Teledyne unit is being used for trials and will continue in use until the Qualcomm PSU and heat sink arrangements have been proved for continuous use in a restricted space.

Antenna: The Slotted wave guide antenna was given to us by Mike Dixon G3PFR and much work was therefore saved. The antenna has one set of slots covered by a piece of PCB material held in place by epoxy resin and parcel tape and it gives about 180 degrees of coverage in the horizontal plane and 6 degrees in the vertical plane. Simplistically this would indicate an overall gain of about 19dB over an isotropic radiator but more likely 16dB or less to allow for beam spread past 3dB points.

Current Work

Most of the current work has been to improve the frequency stability of the unit. It would be nice to be able to rely on a signal within say 1Hz of the listed beacon frequency. So far it would appear that it is going to be relatively straightforward to get the beacon to within 10Hz but getting it to within 1Hz may be a little more difficult.

Many measurements have been carried out over the past weeks. Each measurement takes 2000 seconds (33minutes) in order to be able to get a resolution of 1 part in 10^10. Using the TV line locked oscillator, BBC1 and 2 shows variations over a day of only a few parts in 10^10. CH4 was close but different in frequency by 40 parts in 10^10. ITV and Ch5 were well out (-460 and +796 respectively). The satellite channel ZDF was found to be good on average but subject to large daily variations which are assumed to be propagation changes since they repeat each day by varying amounts. It would be interesting to know whether others have had similar experiences. MSF has been received but is subject to too much local interference here to be of use – maybe we need more tuned circuits.

So far we have resisted the idea of locking the Adret directly to the TV , preferring instead to let the HS400 run as the reference and then to check that occasionally against the TV locked oscillator – this was partly because we wanted to check the stability of the HS400. The HS400 clearly has to remain on all the time if it is to be stable and therefore may as well be used. We are now trying to determine the source of the slight changes in frequency against BBC1. It may be due to the shack temperature and there may be some advantage in installing a digital thermometer in or on the reference oscillator just to see how this varies with time.

William Hepburn's

VHF/UHF

Tropospheric Ducting Forecast

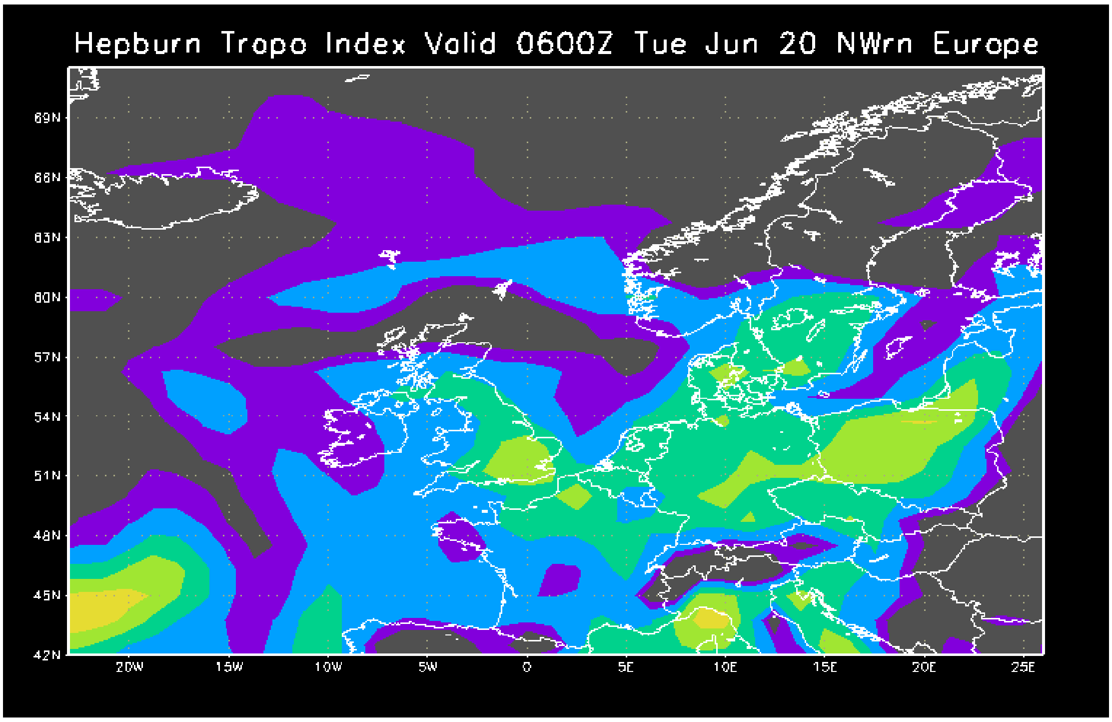
Created By William R. Hepburn, WTFDA

William Hepburn has kindly allowed me to reproduce the following from his Web Site,

http://www.iprimus.ca/~hepburnw/tropo_nwe.html

The Hepburn Tropo Index (HTI)

The HTI is the degree of tropospheric bending forecast to occur over a particular area, which is an indication of the overall strength of Tropospheric DX conditions on a linear scale from 0 to 10."
Negative Tropo Index = Below normal conditions. Bending occurs, but skyward.
Tropo Index of 0 = Normal midday "dead-band" conditions (Standard Atmosphere). Tropo Scatter only.
Tropo Index of 1 = Some downward bending occurs, but usually no discernible tropo.
Tropo Index of 1.4 = Seems to be the average threshold of discernible tropo.
Tropo Index of 2 = Weak opening.
Tropo Index of 3 = Fair opening.
Tropo Index of 4 or 5 = Moderate opening.
Tropo Index of 6 or 7 = Strong opening.
Tropo Index of 8 = Very strong opening.
Tropo Index of 9 or 10 = Extremely strong opening.
(Yes, the Tropo Index can indeed exceed 10!...it is not a finite scale).



Background

I first attempted to receive distant TV signals in 1970 as a kid playing around with rabbit ears in my hometown in Southern Ontario. My first DX (tropo) was seen in 1972 when I received Channel 11 Toledo before our local Channel 11 came on the air. I started keeping a log of stations received on July 25, 1976. I had no knowledge of DX modes or that there were others who DX'd. On that 1st morning, I broke the Toledo record by picking up Channel 6 Columbus. Then on my 3rd day of organised DXing, I received Channel 3 Pensacola, FL (to my dad's amazement), destroying the Columbus record. (I wrote to the address given in an news editorial and was pleasantly surprised to find a WEAR-TV QSL Card in the mail the next week!). After picking up Florida from Canada, I wondered just what the limit was (of course, that was E-skip). I later learned more about DXing from a copy of "Communications World" magazine. In that magazine, I learned of the "World-wide TV-FM DX Association" (which I joined in early 1977) and learned about the various modes and what others were picking up. In 1981, I got my first taste of F2 skip with TV audio from the UK & Franc, and probable video from Ireland. Other modes such as Meteor Scatter and Aurora were stumbled upon as the years passed.

Forecasting Tropo.

Using my many years of experience as a professional meteorologist with Environment Canada and an avid TV/radio DX enthusiast...I began experimental text DX forecasts for the Toronto-Buffalo area in 1997 (using E-mail). Once the Internet & newsgroups caught on, the forecast coverage eventually grew to cover North America. With continual gains in experience and real-time feedback from DXers, I was able to refine my methods and to gradually improve the quality of the forecasts. Later I developed the Hepburn Tropo Index to attempt to quantify the strength of Tropo Ducting Areas. Over time, the Index has been adjusted and refined and now does a decent job of representing the potential strength of Ducting. Then in May 2000, I prepared my first forecast maps. I automated the forecasts by having a computer program emulate what I had been doing manually to prepare the text forecasts and now have the computer prepare the maps. As a result of this automation, I have been able to expand the forecasts' coverage to encompass much of the world.

The Tropo Index alone is not an indicator of whether or not there will DX. The HTI is only indicative of favourable conditions overhead. In order to receive distant DX, the HTI will need to be relatively high over a large area. The larger the area, the longer the potential DX paths. Ducting paths will be straight-line (or Great Circle) only. Remember also that the longer the path, the more signal attenuation becomes a factor. Therefore for very long paths, a higher Index will be needed than that required for shorter paths.

If an area's HTI is above normal, it indicates that conditions are favourable in that area. The actual combination of weather conditions on surface and aloft will be the final factor in determining whether or not DX will be received in any particular locality. As well, physical barriers such as large hills or mountains may make reception via ducting practically impossible in some directions. The Tropo Index does not factor in variations in Tropospheric Scatter, only Tropospheric Bending (Enhancement & Ducting). In the absence of any enhancement, and with only ever-present weak Scatter, the Tropo Index will be near 0. Also, don't be too concerned with the exact value of the Tropo Index at your exact location. The purpose of the Index is to show potential duct paths (it is NOT a reading of the "probability" of ducting). Often, if you are within line-of-sight or within tropo scatter range of a duct located nearby, you may get in on that duct.

Tropospheric DX Modes
"Tropo"

The modes are defined by the mechanics behind them. A Tropo DX mode is any condition that scatters, reflects or refracts signals in the Troposphere allowing DX to occur. Refraction occurs when the normal Index of Refraction has been altered. Vertical boundaries between different types of airmasses usually cause this, where a temperature inversion (warm air over cooler air) exists. However, the most important influencing factor is water vapour (humidity). Thus, a warm dry airmass on top of a cooler humid airmass produces the best conditions. Dry Mexican air flowing across the Gulf of Mexico or Dry Saharan air flowing across the Mediterranean are two examples of prime tropo-producing conditions. High pressure subsidence (the sinking and drying out of air)..if it occurs over the oceans, can produce reception across several thousands of km! Hawaii to California reception, both on UHF and VHF, is not as uncommon as one might think. On the other hand, high mountains can physically block tropo

DX, and deserts are generally too dry for tropo. Thus, tropo is rare in the very mountainous or dry regions of the world.
As far as classifying DX, enhancement and ducting in particular form a grey line. As a rule of thumb, Enhancement is DX via inversions below 450 m (1500 ft) above ground...Ducting is DX via inversions above 450 m. (The layer of the troposphere below 450 m is called the "boundary layer" in meteorology).

Tropospheric V/UHF DX Modes..

Line-of-Sight (GW)

is normal continuous reception where the receiving and transmitting antennas can see each other, taking into account the 4/3 Earth curvature of radio waves.

Tropospheric Scatter (TrS)

is ever-present under normal conditions. That's the mode that produces the distant fluttery signals that randomly fade in and out. These are your most distant regular stations that barely make it in. Depending on your location and equipment, tropo scatter can extend to 300..500..or even 700 km. The theoretical maximum limit for most TV/radio DXers is 800 km (500 miles) (Some semi-professional set-ups can extend further). Scatter is caused by small particles/droplets in the air such as haze, dust, volcanic ash, clouds, etc.

Tropospheric Enhancement (TrE), (aka Tropospheric Refraction)

is common under normal conditions. On most clear nights, the ground radiates and the air near the ground cools. Eventually an inversion is formed and signals begin to refract off the inversion. Stations that normally fade in and out via tropo scatter come in continuously, with increasing strength. Also, weaker tropo scatter stations that are normally not heard (because their signal strengths never cross the background noise threshold signal level) also begin to appear. When the sun comes up, the ground & air heats up, the inversion breaks down, and the enhancement disappears. The enhancement is subtle on some nights, and very obvious on other nights. Distances are no different than your tropo scatter catches, it's just that the signals are stronger. Tropo enhancement is greatly influenced by terrain, with valley and coastal paths favoured. ("Fog-prone" areas are also "DX-prone" areas!!). From a DXers point of view, multiple directions usually are enhanced at the same time.

Tropospheric Ducting (TrD)

is an abnormal condition. An inversion has formed at a much higher level above the ground...the vast majority of duct-producing inversions lie between 450 and 1500 m (1500 to 5000 ft)..with a few between 1500 and 3000 m (5000 to 10,000 ft). These inversions are not formed due to night time radiation/cooling, but rather because of some other weather phenomenon (high pressure subsidence aloft, warm frontal boundary, cold frontal boundary, oceanic or lake inversion, Chinooks, etc.). Because of this, ducting can occur day or night (though it strengthens at night), is not usually influenced by terrain (East of the Rockies), and from a DXers point of view is usually either uni- or bi-directional. In fact, typical ducts are sharply directional. Signals refract off of and also travel along the inversion, thus the analogy of a duct. Distances are theoretically unlimited. One large area can have multiple ducts going on simultaneously, but they are usually parallel paths. It is possible in a very strong high pressure system to have large areas of ducting creating multi-directional openings. These are the rare "blockbuster" openings that make DXers' mouths water.

Additional Characteristics of Ducting.

Ducting may or may not occur simultaneously with enhancement (caused by night-time cooling). Often there is both a low-level radiational inversion caused by night-time cooling (producing enhancement)...and a mid-level "system-produced" inversion above that (producing ducting). However, just as often there is only the higher duct-producing inversion, especially if the skies are cloudy or if it is windy. So, do not use your regular scatter/enhancement stations as propagation beacons for longer-distance DX achieved via ducting! Sometimes ducting can even display a "skip-like" character where distant stations on the same frequency and bearing can be received while closer-by stations are nowhere to be seen.
Ducting is also very height selective, with maximum signal transmissions at and just below the altitude

of the inversion. Side lobes (what most ground-based DXers see from ducts) are similarly directional and narrow. Thus, conditions usually vary over short time periods as opposed to enhancement which is more stable. Ducts located behind cold fronts ("post-frontal ducts") are notoriously unstable as paths can even be interrupted by things such as heavy rain showers associated with the cold front itself. Expect the unexpected from these types of ducts with sudden and rapid changes in signal strengths quite common (some post-frontal ducts last only 15 to 30 minutes). High-pressure and oceanic ducts are a bit more stable and can last for days, but again expect the unexpected as changes can occur quickly.

Frequencies affected by ducting are determined by the vertical thickness of an inversion. Individual ducts will have a LUF (Lowest Usable Frequency) associated with them. Thin inversions (i.e.-thin ducts) will only propagate Microwaves. Thicker inversions will propagate UHF signals as well, while the thickest inversions will also propagate VHF signals. Unfortunately there is no reliable method known for forecasting inversion thickness'. See LUF page.

Special Cases (Exotic DX Modes)..

Rain Scatter (RS)

is a rare mode that sometimes occurs on the higher UHF-TV channels. A band of very heavy rain (or rain and hail) at a distance can scatter or even reflect signals. The effect is the one used for microwave Weather Radar. Distances are typically around 160 km, though up to 650 km (400 miles) is theoretically possible. (Note that heavy snow is not an useful reflector).

Ice Pellet Scatter (SS)..(called Sleet Scatter in the US)

is similar to Rain Scatter but is caused by bands of Ice Pellets in the wintertime.

Aircraft Scatter (AS)..(aka Tropospheric Reflection)

is simply reflection off of aircraft, although reflections off of flocks of birds are also possible. A rare form of reflection is "Chaff Scatter". Chaff is strips of metal foil sent out by the military during training exercises. Chaff helps to confuse enemy radar, but also helps to produce DX. Maximum distances for all reflection modes are again up to 800 km (500 miles).

Lightning Scatter (LS)

is a mode that is sometimes discussed, but there is little documentation on it. The theory is that lightning strikes produce ionised trails. Reception is similar to other forms of scatter except that the DX is more burst-like similar to MS. LS is a mode that is very hard to distinguish and rarely reported.

Reflections off of hills and mountains, and Knife-Edge Diffraction are not considered true DX modes since they are Omni-present, though they can help to extend DX via the other modes.

So these are the conditions in the troposphere that allow reception of VHF and UHF signals beyond their normal range. Basically, these are DX modes that are affected by the weather.

In the forecasts, the reason that I stick with just Ducting is because it is a large-scale phenomena, can be put down in a forecast in a reasonable amount of time, and produces the best tropo.

Enhancement is forecastable, but it is so dependant on regional and local terrain and conditions that it would be a labour-intensive effort (not to mention a very lengthy one) to forecast for all of North America. The process that one would have to use to properly forecast Enhancement for a particular area is the same that a meteorologist would use to forecast overnight low temperatures, chance of fog patches, etc.

There are also conditions in the ionosphere that produce distant reception via a whole different set of modes. Ionospheric "skip" and scatter are not caused by the weather, but instead by the interaction between the Sun and the Earth's outer atmosphere, or by objects such as meteors. For information on these modes, consult the ARRL Handbook.

The DC Bands - 1.3 and 2.3GHz News

John Quarmby G3XDY

On the bands

April 1.3GHz & 2.3GHz Contest

Conditions were poor for this contest, activity seemed to be largely confined to the Southern part of the UK and the near continent. It was nice to see two ON's making a special effort to get on for the contest, and as usual there were some well known PA call signs around on both bands. On 2.3GHz Neil G4BRK was doing well, getting into double figures, and Andrew G6SPS/P was making a strong showing on both bands. David GM4WLL/P was flying the flag for Scotland on 1.3GHz but had some equipment problems.

May UHF Contest

Yet again conditions were pretty much at rock bottom, and activity levels on the lower microwave bands did not appear to be very good, there were several reports that stations had made more QSOs on 10GHz than 1.3GHz, thanks to good rainscatter. GD0EMG were on with a good signal but again the North of England seemed poorly represented. GM4WLL/P heard PI4GN over 670km but 2W was not enough to make a QSO. M1CRO/P worked DK2GR at well over 700km from their Walton on the Naze site and also worked into OZ, as did G0KPW. G4LIP/P from Dover were also putting in a strong showing, as usual. PA6NL and DF0HS/P were consistent signals from the continent.

On 2.3GHz I found that paths that usually work, such to PA6C in JO33, just were not possible this time, and signals were very marginal in many QSOs. That said, the number of stations with 2.3GHz seems to be increasing, and equipment capability is also improving as higher power solid state P.A.s are becoming available. M1CRO/P made a very respectable 30 QSOs overall.

Continental Field Day Contest 3-4 June

The first weekend in June is traditionally HF NFD in the UK, more recently joined by the 50MHz contest, but in Europe several countries have microwave events on this date. French stations were around on 432MHz and higher, with German stations active on the Microwave bands. I worked F6CTT/P in IN98, F5FJL/P in JN37, F6APE in IN97, and DK0FLT in JN59, in fairly average conditions. A test on 2.3GHz with F6CTT/P was unsuccessful however.

French Activity Contest 18 June

Luckily this event, which ran 0500-1100gmt on 432/1296/2320MHz, was blessed with quite good conditions, with stations in Northern and Western France putting good signals into south and east England and the near continent. F6GCT (JN18), F1DBN/P (JO00), F6DKW (JN18), F1PYR/P (JN19), ON4PS/P (JO20), F6APE (IN97), F1BQ (JN09), F1HNF (IN97), F1FYE/P (JN08), F2LQ (IN98), and F6CTJ (JN06) were all active and worked from the UK on 1296MHz. On 2.3GHz F1PYR/P, ON4PS/P, F6APE, and F1FYE/P were available.

Regular Activity

Andy GD0TEP reports that GD4GNH has been suffering from wideband QRM on 1.3GHz which appears to emanate from the Kippur area in Eire. Please contact Andy at gd0tep@qsl.net if any of you have any information or can help DF the source.

Tropo openings have been fairly thin on the ground so far in 2000. On 13 May G0KPW (JO02OD) worked SM6HYG (JO58RG) at 941km, plus other stations in OZ/northern DL
Around the 17-18th June conditions improved, with the French contest mentioned above plus several PA0's on 1.3GHz, and a late opening to Scandinavia in the evening of the 18th, with OZ6HY (JO45) a good signal, but nil from SM6TZX (JO67) when attempting to QSY from 432MHz. PE1EWR is now active again on 2.3GHz from JO11, PE1BTL and PE1KXH were also active on the band in this period. Although the weather has returned to normal (i.e. wet) after the short spell of tropo, I hope it heralds a period of better summer conditions during the next few weeks.

Beacons

GM4OGI has been regularly monitoring 1.3GHz beacons from his QTH in IO85DX, and regularly hears GB3MHL, particularly around dawn, with GB3IOW occasionally heard, but nothing so far from other UK beacons and PI7QHN.

Internet Resources for Microwave DXing

The internet provides a lot of useful information for helping to work that elusive DX, as mentioned in my previous columns. Here are some more sites that you may find useful for tracking tropo openings :

http://www.weather.nl This is a large site linking to a wide range of weather forecasting sites. I find the UKMO charts very good, as they show the position of weather fronts where many of the other models only show Sea Level Pressure. For longer range forecasts (of debatable accuracy) then the MRF models provide forecasts out to 10 days, see http://vreme.yunet.com/mrf/mrfpriz.htm for an example.

A site I have recently found claims to predict European tropo openings, it did give a reasonable indication of the tropo on the 18th June so keep an eye on it. Thanks to William Hepburn in Canada for providing this service:

http://www.iprimus.ca/~hepburnw/tropo_eur.html

If you don't mind trying to follow articles written in Dutch then PA0NZH's site gives up to date VHF and Microwave news from a Netherlands perspective at:

http://www.hamnet.demon.nl

Antennas and feeders for 2.3GHz

Having looked at PAs for 2.3GHz last time, this time I will take a look at antennas for 2.3GHz. Both dish and Yagi antennas are practical propositions for high performance at this frequency.

Dishes over 75cm diameter offer good performance. An 80cm offset fed satellite TV dish could be used with a suitable feed such as the W2IMU dual mode feed horn, to give a gain of 23 dB, and a 1.2m dish should be capable of 26dB. Dishes offer clean patterns and whereas Yagis can be critical to construct accurately, surplus commercially made dishes can be obtained quite readily and suitable feeds are straightforward to build.

For home stations Yagis have the advantage of lower windage and a more neighbour friendly profile. For homebrewing the designs of DL6WU can be recommended, but need to be accurately constructed.

The G3JVL Loop Yagi designs are also popular, a 44 element version on a 2m long boom is described in Volume 3 of the Microwave Handbook and offers a claimed gain of 22dBi. Longer versions are also practical if more gain is needed, or they can be stacked and bayed.

Commercially produced yagis are also available. Tonna make a 25 element yagi using an unusual horn feed arrangement with the elements suspended on insulators above the boom in similar fashion to their 1.3GHz antennas. Mike Walters, G3JVL, can supply Loop Yagis to order (although Mike mentioned to me that it is a secondary activity these days and delivery can therefore be rather long). Mike can be contacted via email at mh_emwalters@26fernhurst.freeserve.co.uk

A recent DUBUS magazine contains an advert for WiMo Antenna Ltd who offer 40 and 67 element Yagis on 1.6 and 3.0m booms respectively, and Simon Lewis GM4PLM is their UK representative. Has anyone out there any experience with these antennas?

Having chosen the antenna, the next question is how to get the hard won power up to the feed point. Mast head mounted systems are a practical proposition, and mean that feeder losses are virtually eliminated. If the equipment stays in the shack then cable such as Andrews LDF4-50 is a good workhorse for main feeder runs, with a loss of about 0.135dB/metre. If you can find it then FSJ4-50 is good for places where flexible runs are needed such as round a rotator. Cheaper cables such as W103 and H100 both still work quite well at this frequency with losses around 0.23 and 0.19 dB/m respectively (note that H100 is better than W103), but avoid UR67/RG213 which is up at 0.42 dB/m. H100 is fine for connecting a masthead preamp down to the RX, or for taking drive up to a masthead PA.

If you are concerned about the weight and size of all the cables needed for a multiband station it is worth considering using a single feeder run on several bands, either through co-ax relays at top and bottom, or by using some of the commercial diplexers and triplexers available. I have re-tuned the 1.3GHz port on a Comet CFX4310 triplexer to minimise through loss on 2.3GHz , and use this to share a single piece of W103 feeder between 144MHz (TX and RX), 432MHz TX, and 2.3GHz RX, whilst using a single piece of LDF4-50 for transmit on both 1.3GHz and 2.3GHz with relay switching top and bottom. With H100 used for 1.3GHz RX and 432MHz RX via a diplexer, 3 coax cables provide 4 band capability including masthead preamps on all UHF bands.

Sign off

Any input for this column would be welcome, please let me know your news and views. I can be contacted as below. Information for this column has come from G4DDK's "A View from East Anglia" web site, from the DX Cluster network, VHFDX reflector, and the websites listed in the article, plus contacts on the bands.

73

John, G3XDY

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Post: John Quarmby, 12 Chestnut Close, Rushmere St. Andrew, Ipswich, IP5 1ED
Phone: 01473 717830 (between 18.30-21.00 preferred)

The UK Microwave Group Chip Bank

The UK Microwave Group's Chip Bank contains a number of passive and active devices.
These are available to members only

Allan, G8LSD has kindly offered to run the service.

Here's how it works.

On the chip bank site are listed the components currently available and an indication of quantity. It is up to you to decide what you would like from the bank and how many. Send an e-mail with the details of the items and £2 (or US$3) and the items will be despatched by snail mail (surface in the case of overseas orders - airmail by negotiation). The £2 nominally covers the packaging and postage and a small amount to allow us to restock and/or buy in other items.

If Allan decides that you have ordered too many then he may have to restrict the numbers to allow others access to the components. This can only work if everyone is sensible. Allan has the final say though.

Some components which are being bought in will have a price against them in £. You may order these along with the 'free' devices.

Please let us know about components you'd like added to the service or if you have any surplus which you'd like to donate/sell to the Group

Component Listings

0805 series chip resistors								
0805	1	10	100	1k	10k	100 k	1M	10 M
1.0	s	s	s	s	s	s	l	s
1.1	o	s	s	s	s	s	o	o
1.2	o	s	s	s	s	s	s	o
1.3	o	s	s	l	s	s	o	o
1.5	s	s	s	l	l	s	s	o
1.6	o	s	s	s	s	s	o	o
1.8	o	s	s	s	s	s	l	o
2.0	o	s	l	l	s	s	o	o
2.2	s	s	s	s	s	s	s	o
2.4	o	s	s	l	s	s	o	o
2.7	o	s	s	s	s	l	l	o
3.0	o	s	l	s	l	l	o	o
3.3	s	s	s	l	s	s	l	o
3.6	o	s	s	s	s	s	o	o
3.9	o	s	s	l	s	s	o	o
4.3	l	l	s	l	s	s	o	o
4.7	s	s	l	s	s	s	l	o
5.1	o	s	s	l	s	s	o	o
5.6	o	s	s	s	s	s	o	o
6.2	o	s	s	s	s	o	o	o
6.8	s	s	s	l	s	s	s	o
7.5	o	s	s	l	s	o	o	o
8.2	o	s	s	s	s	s	o	o
9.1	o	s	s	s	s	o	o	o

1206 series chip resistors								
1206	1	10	100	1k	10k	100 k	1M	10 M
1.0	o	s	s	s	s	s	l	s
1.1	o	s	s	s	s	s	o	o
1.2	o	s	s	s	s	s	s	o
1.3	o	s	s	l	s	s	o	o
1.5	o	o	s	l	l	s	s	o
1.6	o	s	s	s	s	s	o	o
1.8	o	o	s	s	s	s	o	o
2.0	o	s	l	l	s	s	o	o
2.2	s	s	s	o	s	s	s	o
2.4	o	s	s	l	s	s	o	o
2.7	o	s	s	s	s	l	l	o
3.0	o	s	l	s	s	s	o	o
3.3	s	s	s	s	s	s	s	o
3.6	o	s	s	s	s	s	o	o
3.9	s	s	s	l	s	s	o	o
4.3	o	l	s	l	s	s	o	o
4.7	s	s	l	l	s	s	s	o
5.1	o	s	s	l	s	s	o	o
5.6	s	s	s	s	s	s	o	o
6.2	o	s	s	s	s	o	o	o
6.8	s	s	s	l	s	s	s	o
7.5	o	s	s	l	s	o	o	o
8.2	o	s	s	s	s	s	o	o
9.1	o	s	s	s	s	o	o	o

0805 series chip capacitors								
0805	1pF	10p F	100 pF	1nF	10n F	100 nF	1uF	10u F
1.0	s	s	s	s	s	s	s	o
1.1	o	o	o	o	o	o	o	o
1.2	o	s	s	s	s	o	o	o
1.3	o	o	o	o	o	o	o	o
1.5	s	s	s	s	s	o	o	o
1.6	o	o	o	o	o	o	o	o
1.8	s	s	s	s	o	o	o	o
2.0	o	o	o	o	o	o	o	o
2.2	s	s	s	s	s	s	o	o
2.4	o	o	o	o	o	o	o	o
2.7	s	s	s	s	s	o	o	o
3.0	s	o	o	o	o	o	o	o
3.3	s	s	s	s	s	s	o	o
3.6	o	o	o	o	o	o	o	o
3.9	s	s	s	s	o	o	o	o
4.3	o	o	o	o	o	o	o	o
4.7	s	s	s	s	s	s	o	o
5.1	o	o	o	o	o	o	o	o
5.6	s	s	s	s	o	o	o	o
6.2	o	o	o	o	o	o	o	o
6.8	s	s	s	s	s	s	o	o
7.5	o	o	o	o	o	o	o	o
8.2	s	s	s	s	o	o	o	o

9.1	o	o	o	o	o	o	o	o

1206 series chip capacitors								
1206	1pF	10pF	100 pF	1nF	10nF	100 nF	1uF	10uF
1.0	o	s	s	s	s	s	s	o
1.1	o	o	o	o	o	o	o	o
1.2	o	s	s	s	s	o	o	o
1.3	o	o	o	o	o	o	o	o
1.5	o	s	s	s	l	s	o	o
1.6	o	o	o	o	o	o	o	o
1.8	s	s	s	s	s	o	o	o
2.0	o	o	o	o	o	o	o	o
2.2	s	s	s	s	l	s	o	o
2.4	o	o	o	o	o	o	o	o
2.7	s	s	s	s	l	o	o	o
3.0	s	s	o	o	o	s	o	o
3.3	s	s	s	s	s	s	o	o
3.6	o	o	o	o	o	o	o	o
3.9	s	s	s	s	s	o	o	o
4.3	o	o	o	o	o	o	o	o
4.7	s	s	s	s	s	o	o	o
5.1	o	o	o	o	o	o	o	o
5.6	s	s	s	s	s	o	o	o
6.2	o	o	o	o	o	o	o	o
6.8	s	s	s	s	s	s	o	o
7.5	o	o	o	o	o	o	o	o
8.2	o	s	s	s	s	o	o	o
9.1	o	o	o	o	o	o	o	o

Transistors etc.					
0805 links	s	BCF32 npn	m	BFQ23	s
12 way switch smd	10	BCF81	s	BFR30	s
1206 links	s	BCW160	s	BFR53	s
1M smd pot CUR42A	10	BCW60D	s	BFS13	s
22k smd pot CUR42A	9	BCW72	s	BFS17 npn	m
4 way switch smd	10	BCX51	s	BFT93	s
4k smd pot 3204	2	BCX56	s	BSR12	s
8 way switch smd	10	BF510	s	BSS65	s
BBY31	3	BF512	s	BST84	s
BBY40	s	BF569	s	FMMT2369A	s
BC808-25	s	BF579 pnp	s	MPN3404	s
BC84613	s	BF991	s		
BC847B sot23	l	BF992	s		
BCF30 pnp	s	BF994	s		

How to Order

Key to stock levels/prices:
£n = price in Sterling
o = out of stock,
s = small quantity available,
m = medium quantity available,
l = large quantity available.

All components without set prices are free to members, but please order the minimum quantity that you require so as to leave stocks for everyone else.

E-mail me with your requirements, then send £2.00 (overseas members send $3 US for surface mail) to cover post, packing & a donation for replenishment purchases to:

UK microwave Group, 75 Millbrook Road, Crowborough, East Sussex, TN6 2SB.
chipbank@microwavers.org

Closedown

Apologies to those with Web Access for the full paper listing above . Please appreciate that not everyone has Web/e-mail access.

I have had some feedback from the previous issues – mainly positive. I have also had a request to publish a members contact list. Having been down this minefield before with the "Microwave Directory" I would appreciate your views on its usefulness and especially how we would get around the Data Protection Act. I suspect that a disclaimer on the membership form is the way forward but not helpful to the almost 100 members we have already signed up. Yours views on this topic please.

I have also been asked to publish a UK (and near continent) beacon list. Again – no problems with this – however I need a reliable and up to date list of active beacons – it's a bit pointless publishing details of SK beacons! Can anyone help here – is this what you would like to see?

Publication dates. This issue is a couple of weeks late – issue 1 came out Mid March – by the time you get this it will be early July. I would like to keep to a fairly tight schedule – my reckoning is that the next issue should be out by the end of September and the Christmas edition end of December. If you have something for me to print, the deadline (unless its really good) will be mid September and mid December!

We need input. The society is a co-operative society and will survive only if we all contribute to its future. Almost any article that is Microwave related will do – most of you will be doing something fairly interesting to others and single page articles will be ideal. I will take articles in any format – even scribbled notes and I'll turn it into something that hopefully you will be proud of.

That's it for this issue. Thanks to all the contributors – I hope to see some different names on the contributors list next time.

73 and have a superb summer,

Martyn
G0CZD