It looks as though the summer conditions have taken their toll on 136kHz trans-Atlantic DX, with no recent crossings reported.

That doesn't mean that there was no long distance work being done. Alex, R7NT collates WSQPR and OPERA reports regularly, and, from his data, we can see that the maximum distances reached have tended to be just under 3000km. In early May, R7NT's 136kHz OPERA transmissions were received by 2E0ILY and G3XDV. Chris, 2E0ILY was the furthest away at 2988km. Alex was running only 200W into a loop aerial. In the reverse direction Mike, G3XDV was spotted by RN3AUS, again on 136kHz OPERA, also received by SV8BRV.

On 472kHz things have been a little better with Laurence, KL7L (Alaska) getting good reports from WH2XCR in Hawaii. Laurence was using his experimental call WE2XQG and a new MF aerial. He also got some good reports down the West coast of Canada to Washington state. All this despite it being broad daylight at midnight in Alaska at this time of year.

VO1NA has been getting mid-summer 5wpm CW reports from PAORDT, and from DK7FC on 477.7kHz in QSR10. WH2XCR (Hawaii) was pleased to get a report from VK7TW in Tasmania at his sunrise, but it's not mid-summer down there so conditions are likely to be better!

Hungary finally gets 472

Gyuri, HA6PGC tells me that since March all Hungarian amateurs now have access to the 472kHz band. He is currently busy on 50 and 70MHz but intends to concentrate on 472kHz when the Sporadic-E season ends.

**EbNaut on 136**

Although primarily used by VLF operators, digital mode EbNaut can be used over any stable path. 136kHz is pretty stable over medium length paths, especially in daylight. IZ7SLZ in Apulia (S Italy) has been received well by DK7FC and F5WK. Domenico was using a 120W GPS-disciplined TX that put 1.5A of RF current into his 8m high inverted-L aerial.

**VLF or ULF**

During the summer months the long hours of daylight and the high level of static makes MF and LF communication difficult. Long duration modes can still work in the presence of static crashes, the short noise bursts being integrated out in the processing. Faster modes like CW or two minute WSPR are more susceptible to corruption because each noise burst can knock out a significant proportion of the transmission.

Down on VLF, propagation varies very little between day and night, in fact it is often better during the day because static levels tend to be lower. Therefore the obvious choice of summer mode and band is to go as slow and low as possible, and that is what the intrepid band of 'Dreamers' have been doing; using **EbNaut** on frequencies below 9kHz. Leading light on VLF is Stefan, DK7FC who has been stretching things to the limit by attempting to radiate a signal on 2.97kHz, a wavelength of about 101km! His first test at 6.47kHz was a success, the message being decoded by Markus, DF6NM.

It's easy to generate power on this part of the spectrum, an audio amplifier is all you need, but resonating the aerial is another matter. A suitable loading coil for sub 3kHz needs to be able to pass a few hundred milliamps and withstand many kW whilst having an inductance of six Henries or so. Quite a challenge!

Stefan's first attempt involved a job lot of ferrite toroids inside a cardboard tube that would carry the windings, but that was rejected when it was realised that it wasn't going to be big enough to carry a sufficient number of turns in one layer. The current solution is to use some large 65mm wide ferrite 'E' cores of N27 material and make what looks like a monster TV line-output transformer with 15 layers of windings, about 3000 turns by hand! So far he has managed to generate a theoretical ERP of 100nW. To see how far the signal radiates he will visit a quiet site with a portable e-probe and Raspberry Pi recorder.

**What's a Red Pitaya?**

A number of amateurs have been experimenting with the Red Pitaya board, which is a development board containing a dual 14 bit ADC, dual 14 bit DAC and an FPGA – the makings of a software defined radio transceiver capable of use from VLF to 50MHz.

Pavel Demin has written some code for the board so that it presents itself to software such as PowerSDR mRX as a Hermes board and has most of its functions including Pure-Signal pre-distortion on transmit, which can clean up non-linear amplifiers. Initial results are very encouraging and I can see a lot of interesting projects being started. An SDR transceiver for the impoverished at last! Details at redpitaya.com or search for "red pitaya sidr transceiver".

**Propagation**

Is a mystery to many of us, especially on 'new' bands like 472kHz. Alan, G3NYK has been studying the subject for many years and has set down his thoughts in a very interesting article on the 472kHz.org website. Recently there have been a lot of solar flares upsetting propagation on all bands and Alan explains the mechanisms by which this happens.

**Derek Atter, G3GR0, SK**

I was sorry to hear of the death of Derek, G3GR0 recently. As a leading member of the Crawley club Derek encouraged many people to have a go on 73 and 136kHz in the early days. I remember that the club got hold of a quantity of ex-Decca Litze wire coils and Derek made sure that whoever wanted to construct that ultimate LF loading system was able to get hold of suitable parts. I still have mine: thanks Derek.

Dave Pick, G3YXM
daveyxm@gmail.com
VO1NA has continued to radiate test signals for keen listeners to receive, best reports recently are on 136kHz OPERA mode to IZ7SLZ at 5426km. He has been regularly spotted in the UK by Mike, G3XDV and others. Mike's own transmissions on 136 have been received over 2000km away despite high levels of summer static.

OPERA has also been in use on 472kHz with G3KEV reaching SV8RV at 2449km using the 'fast' OF8 mode.

The low down tests continue
DK7FC has been continuing his LF experiments, attempting to radiate a signal on 2.97kHz. His latest loading coil looks like a giant multi section choke wound on a large pipe. To find out if the signal is propagating into the far field he built a battery powered remote receiving and recording station and left it for a few days at a quiet place 17km away. On returning to the site he was pleased to find that the gear was still there, the batteries had lasted and the Raspberry Pi recorder had kept running, so it was back to base to analyse the received audio stream. After processing 30GB of WAV files Stefan could see a signal 12dB above noise in a 212kHz bandwidth and 17dB in 47Hz bandwidth. Since this experiment he has been steadily increasing the ERP. The ultimate goal is to get a report from someone like Paul Nicholson in Todmorden, but no luck so far. The next stage is to take the remote receiver 30km away and try again.

Novel receiving system
The space needed to erect an effective receiving aerial for LF is quite considerable unless you use a small loop. Tom, DK1IS has made the best of his urban surroundings to install a multi-mode 'ground dipole' from his garage about 100m away from his house. The total length of the dipole is just over 40m along the back of the row of garages and it is coupled at the 11m point via a ferrite transformer to the remote receiver. Tom has installed relays between each end of the dipole and the earth stakes so that he can have various configurations. He describes them as "earth dipole (both ends grounded), Windom on ground (both ends free) and something like mini-Beverage with special feeding (right side or left side grounded)". There is no mains electricity in the garages, which means there is a lot less interference than at his home station. His setup is solar powered and connected back to the shack by a 5GHz Wi-Fi link.

New PA project
During the summer with its high static levels and short hours of darkness, I thought I might make some progress with a new LF and MF transmitter. It would have to work on any mode that is in use on LF and MF, whilst accommodating any new ones that come along. Some modes, like PSK08, should have a linear PA, whereas others such as JT65 and OPERA can quite happily use the more efficient Class D or E designs. Another consideration is duty cycle. Modes like Ebatnaut require hours of key-down at 100% output, few amateur spec amplifiers are rated for that kind of abuse! Obviously the more efficient switching designs have an advantage here as there is less heat generated for a particular power output.

So is a Class D amplifier the way to go? Chris, 2EOILY has used one to good effect on 136kHz, but he has had to go to some trouble to generate square-wave drive at twice frequency from his TS-590. The usual divide-by-two push-pull gate drive circuit also raises issues at the start and end of 'key down' periods within the transmission. If the RF drive stops then one FET gate is left biased on and the other off; needless to say, this usually causes the 'on' FET to explode! A protection circuit of some sort is required to protect the FETs - more complication.

In the end I decided to take the conventional route and build an LF/MF version of my 'Throtatron' 160/80/40 FET amplifier. This is a Class AB design using a pair of IXYS switching MOSFETs that I have found to be very reliable in RF service. I have reduced the gain to keep things stable and incorporated a 10W amplifier - again using a pair of MOSFETs - to drive the 500W output stage.

Obviously the Class AB configuration is inefficient and a lot of heat will be generated. I have built it on a heat-sink 'tunnel' with a large fan blowing air through. I hope that will be enough. The power supply has no regulation so as to reduce losses and is built with large components as in the original HF version.

I shall be driving the amplifier from the 1mW output of my Elad transceiver - many sets now have a broadband TX output at low level - and the first stage is an eBay 1W broadband module that I have modified slightly to improve its LF response.

I'm still at the testing stage, but one interesting thing I have found is that the amplifier still works well right up to 80m so I'll still be able to use the same setup on all my favourite bands.

If you don't need a linear and want to generate power more efficiently, then an easy way into Class D is to use one of GOMRFi's boards. David has had a 136kHz 300W design for some years and has just released a 427kHz version. It includes SWR and over-current protection and it requires about 2.5V peak to peak drive at twice the desired output frequency. It is ideal for use with the QRP Labs U35 beacon Tx. Details at www.g0mrf.com/630m.htm

A new version of Joe Taylor's WSJT-X (V1.7) has been developed that can generate a "times two" output tone suitable for dividing down when using a transmitter like GOMRFi's. To activate the new feature go to "File / Settings / Advanced" and check the box labelled "x2 Tone Spacing".

Dave Pick, G3YXM
daveyxm@gmail.com