Understanding Propagation

Although just seven discrete frequencies, the 5MHz band (60m) has been allocated as a trial to experiment with propagation.

SUNSPOTS. So far in this series, we have looked at all the HF bands between 160m and 17m. I have deliberately left the 21, 24 and 28MHz bands until a) we have more sunspots or b) we have Sporadic-E conditions (mid May onwards).

The astute among you will have realised that I have, so far, missed out 5MHz (60m), so let's put that right.

The 60m 'band' isn't a band as such, but seven discrete USB frequencies – 5258.5, 5278.5, 5288.5, 5366.5, 5371.5, 5398.5 and 5403.5MHz. These have been allocated to UK radio amateurs as a trial and to enable us to experiment with propagation on a band that sits mid way between 3.5MHz (80m) and 7MHz (40m). As such, it occupies a unique part of the RF spectrum that is very suitable for high-angle or NVIS (Near Vertical Incidence Skywave) communications.

Before I go any further, to operate on 5MHz you must be a holder of a full amateur radio licence and also obtain a NoV (Notice of Variation). Ofcom has agreed with the MOD to permit experimental operation until 30 June 2010 and you can find out more at www.rsgb.org/spectrumforum/hf/5mhz.php.

THE THEORY. Now, let's take a look at propagation on 60m. You may recall from our discussion on 80m in January that contacts around the UK rely on high-angle signals being transmitted towards the ionosphere. This needs the critical frequency to be higher than the frequency we are using – the critical frequency being that where a wave sent vertically from our station is just reflected back to earth.

We denote the critical frequency of the F2 layer as being f_oF2, where f_o denotes a signal sent up with zero degree deviation from the vertical.

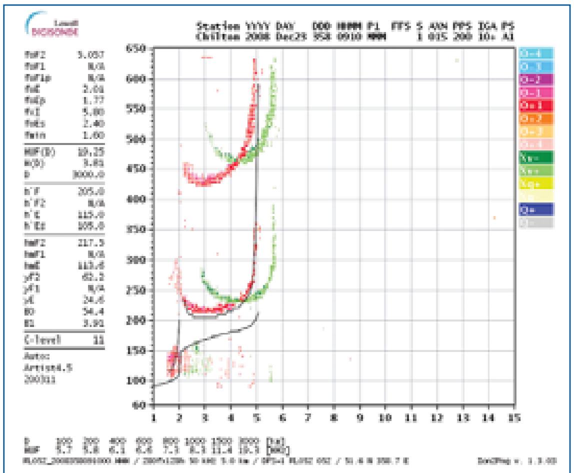
If f_oF2 is higher than 3.5 – 3.8MHz we can generally use 80m for inter-UK contacts. At times of high solar flux, we often find that f_oF2 is higher than 7MHz and 40m can be used for inter-G contacts too. But then the increased solar activity can cause greater D layer absorption so 80m contacts around the UK become more difficult.

There can come a point where the critical frequency is not quite 7MHz, but absorption is too high on 80m for reliable contacts. So what do you do?

This is where 5MHz comes into play. In theory, it can offer reliable inter-G contacts at times when both 80m and 40m are unsuitable, which is why the 5MHz experiment was set up.

So how can we predict propagation on 60m? As always, our good friend the Chilton Digisonde has the answer – see www.ukssdc.ac.uk/ionosondes/view_latest.html.

You have to register to download the data, but it is very easy. The Digisonde data are updated on a regular basis and, in theory, all you have to do is look for the f_oF2 figure. If this is above about 5.4MHz then you should be able to use the band for close-in inter-G contacts. If it is just below 5MHz you may find that you can talk to stations at the other end of the country, but not closer as the angle of incidence is more shallow the further we wish to communicate.



This Chilton Digisonde image clearly shows the critical frequency of the extraordinary wave (green) is higher than the ordinary wave (red) by about 0.7MHz. 5MHz was probably open to stations around the UK at this time.

Unfortunately life isn't quite that simple, as fellow RSGB's Propagation Studies Committee member Marcus Walden, G0IJZ showed in his article in the March 2008 issue of *RadCom*.

The charged particles in the ionosphere lead to refraction or bending back to Earth of the radio waves. Additionally, the Earth's magnetic field leads them to have a second refractive characteristic. This means the ionosphere has two different refractive indices – we say that it is birefringent (double refracting). Some crystals are optically birefringent giving a double image when objects are viewed through them.

The result is that a passing radio wave is split into two components; the ordinary and extraordinary waves. Research has shown that the critical frequency of both these waves is slightly different and we need to look at both f_oF2 (ordinary) and f_xF2 (extraordinary) – the critical frequency of the ordinary and extraordinary waves – if we are to actually predict whether we can use 5MHz for NVIS communications. Generally, the ionosonde parameter f_xI can be used as a measure of f_xF2.

Over the UK, the extraordinary wave critical frequency f_xF2 is higher than that of the ordinary wave by about 0.7MHz.There have been many occasions when f_oF2 has been lower than 5MHz, but the band has still been open.

EXPERIMENTAL WORK. To help you get a better feeling for the band there are three beacons, GB3RAL, GB3WES and GB3ORK, operating on 5MHz that will give you a real-time indication of conditions. More information on these beacons is available at http://www.rsgb-spectrumforum.org.uk/5mhz%20beacons.htm.

But what about propagation from further afield? There are many countries where the 5MHz is in use, including Canada, USA, St Lucia, Greenland, Finland, Denmark, Eire and Iceland.

A good propagation program like VOAProp will be able to predict openings to these countries, although as a rule, the frequency is so low that you really require a dark (night) path between you and the other station. This means that DXing on 5MHz is really a night-time pursuit, although mid-winter (especially at sunspot minimum) can throw up some real surprises.

At the moment, the band is an oddment in the HF spectrum. We only have a few spot frequencies, you need a notice of variation to your licence to use it and it should really only be used for experimental purposes. Working DX on the band goes against the original idea of allocating it to UK amateurs, although many people do.

Working overseas stations on 60m is certainly harder than, say, 20m, but there is definitely a club-like feel to the band. And, if you do experiment on 5MHz, you could be paving the way for the UK to have a wider allocation in the future.