Three Short Subjects

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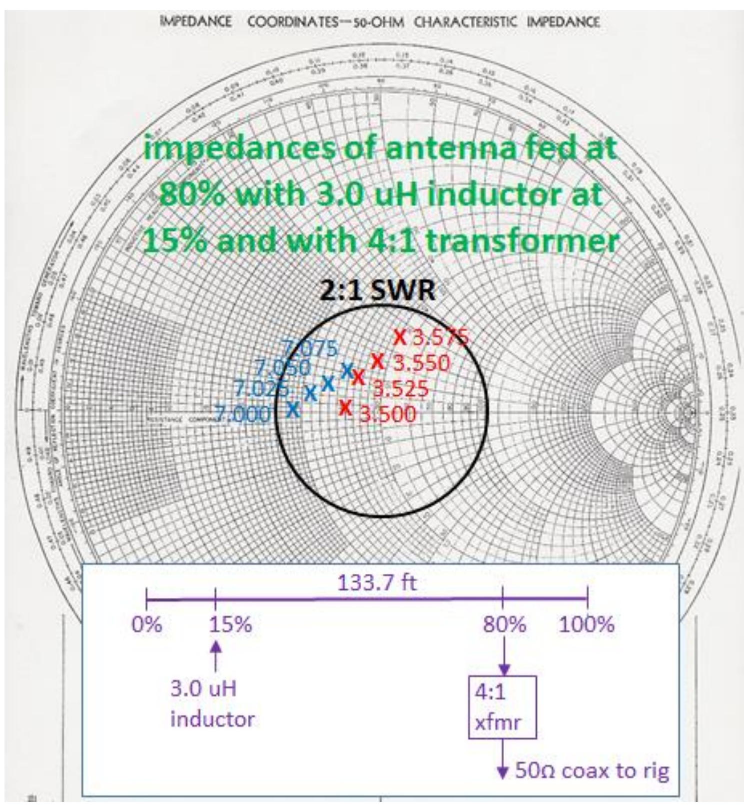
This month's column adds additional information to two previous Monthly Features and offers a quick review of long path propagation on 160m.

October 2019 – Off-Center Fed Dipole for 80m and 40m

My October 2019 monthly feature looked at an 80m/40m OCF (Off-Center Fed) dipole. The Smith chart on page 3 of that article showed the SWR for a 133.7 foot length of wire at 40 feet high and fed 75% from one end. Going through an ideal 4:1 transformer gave SWRs less than 2:1 from 3.500-3.575 MHz. But on 40m, the SWRs were out of the 2:1 circle from 7.000-7.075 MHz. The SWRs would be within a 2:1 SWR circle in the 40m phone band.

So what can you do if you want this OCF dipole to be optimum at the low end of 80m and the low end of 40m without using an antenna tuner? One answer came in an e-mail I received from Bill W6QR about the October article. He said "*I remembered your OCF dipole article for 80/40M when I was reading about an end fed half wave for 80/40M. They use a small compensation coil to add length on 40M which brings the 40M VSWR closer to the 80M value.*"

Thus I did more work with 4nec2. I now have three variables to vary: the feed position, the inductor position and the value of the inductor. After many runs, I chose to place a 3.0 uH coil 15% from the end and feed the OCF 80% from the same end. The following Smith chart shows the resulting 80m/40m SWRs, along with the new configuration of the OCF dipole.



These results look good – the low ends of both bands are within a 2:1 SWR. But remember it's only a starting point if you're going to do this, as your ground conditions may differ from the assumed average ground conditions (conductivity = .005 S/m and relative dielectric constant = 13), your height may be different than the assumed 40 feet, your inductor may not be exactly 3.0 uH and you probably won't be using an ideal 4:1 transformer.

December 2019 – VK4YB to NO3M on 630m and 2200m

My December 2019 monthly feature looked at the QSO between VK4YB and NO3M on 630m and the receptions of VK4YB at NO3M on 2200m. To try to understand the hop structure of these events, I used Proplab Pro V3. As a refresher, Proplab Pro V3 uses the 2007 version of the International Reference Ionosphere (IRI) for the model of the ionosphere. This is a well-respected model, but the results gave ionospheric absorption values that said the QSO on 630m and the receptions on 2200m never should have happened.

But based on my prior work with VY2ZM's monitoring of GB3SSS on 1.96 MHz in December 2006, I believe the model of the lower ionosphere (regardless of whether it's IRI 2007 version or the current IRI 2016 version) has too many electrons – which means too much ionospheric absorption. Are we stuck with these results? Not necessarily. I received an e-mail from Bill NQ6Z in response to the December article reminding me of the ITU document ITU-R P.1147. The title of this document is *Prediction of sky-wave field strength at frequencies between about 150 and 1700 kHz.*

Due to the limitation of the analysis in the ITU document to 12,000 km (VK4YB to NO3M is 14,979 km), I set up a 10,000 km path with a transmitter power of 10 Watts and a transmit antenna gain of 0 dBi. The comparison of field strength on this 10,000 km path between IRI 2007 in Proplab Pro V3 and the ITU document is as follows:

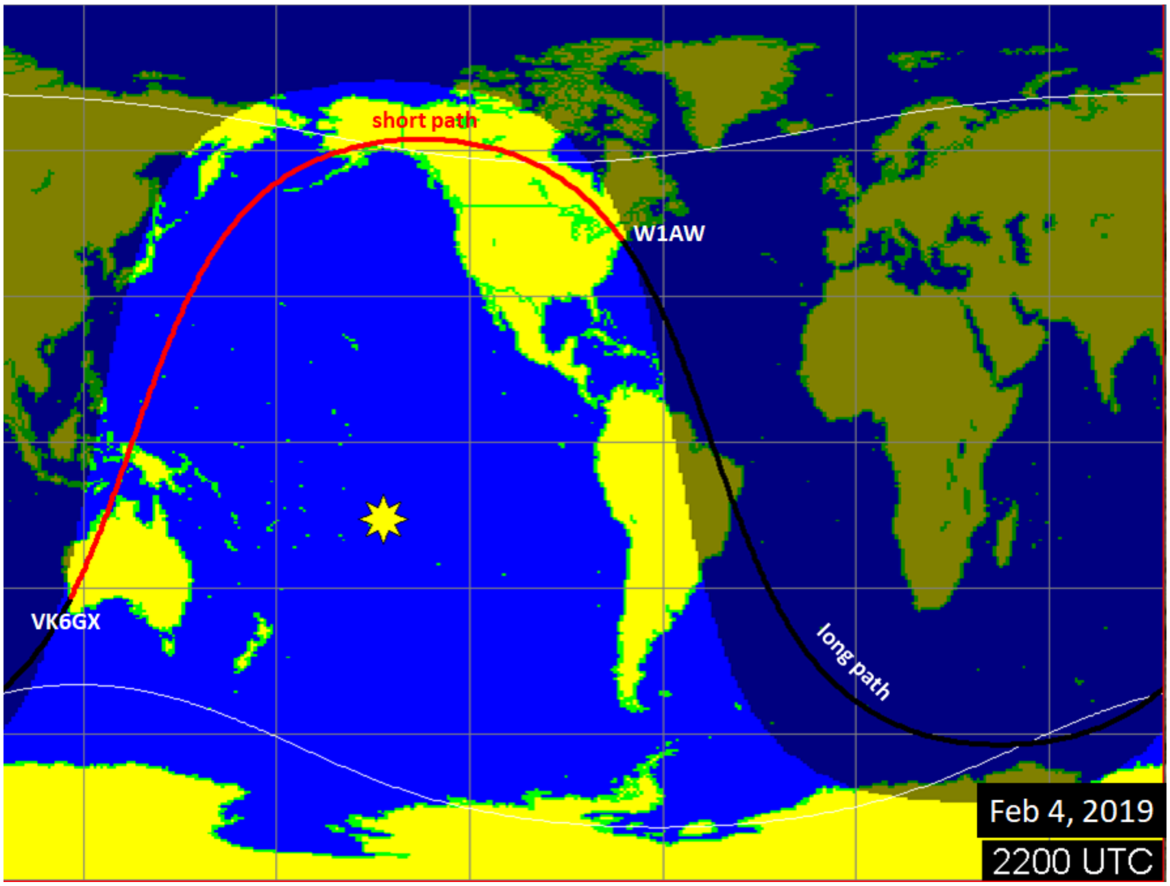
frequency	IRI 2007 field strength	ITU field strength	difference
137 KHz	-45.5 dB ref 1 uV/m	-11.7 dB ref 1 uV/m	33.8 dB
475 KHz	-60.2 dB ref 1 uV/m	-14.9 dB ref 1 uV/m	45.3 dB

The differences between the IRI 2007 field strength and the ITU field strength at the two frequencies are approximately equal to the absorption reported by Proplab Pro V3 using the IRI 2007 model. And a back-of-the-envelope estimation translating the ITU data to the VK4YB-to-NO3M path suggests that the QSO on 630m and the reception reports on 2200m could have been possible on a good day [note 1].

A quick review of 160m long path

In a post to the topband reflector, Phil VK6GX reported hearing the W1AW code practice signal on 160m (1802.5 KHz) via long path from 2141-2220 UTC on February 4, 2019. Phil says he has heard many VE1 and W1 stations via 160m long path at his sunrise, but never W1AW. The 160m antenna at W1AW is an inverted-vee with its apex at 110 feet. The receive antennas at VK6GX are Beverages, which allowed him to discern from which direction W1AW was coming.

Here's a map of this path using the mapping feature in W6ELProp at 2200 UTC (midway between the reception times of 2141-2200 UTC). The great circle long path out of W1AW is 141.5 degrees, and the great circle long path out of VK6GX is 213.2 degrees.



There's a bit of daylight at both ends of the path. But remember that what's overhead at your QTH is not important – what really matters is what's happening where your RF encounters the ionosphere, which could be hundreds of km away from your QTH.

The best place for 160m RF is in the dark ionosphere where ionospheric absorption is minimal. It very well could be that the RF from W1AW took a more southeasterly path to get into the dark ionosphere quicker. Similarly, RF from VK6GX could have taken a more southwesterly path to get into the dark ionosphere quicker. These two new great circle paths would meet in the southern Indian Ocean, and ionization at the equatorward edge of the southern auroral oval (the white line in the map) could have provided skewing to join these two new great circle paths [2].

Another possibility is that ionospheric absorption was abnormally minimal near the terminator for both W1AW and VK6GX. Unfortunately our understanding of the D region isn't complete enough to determine if this is feasible, as our D region model is mostly from intermittent rocket flights and intermittent incoherent scatter radar data.

There is another possibility for somewhat similar scenarios, but with the short path in total darkness (for example, the US East Coast to Asia). It comes from Bob NM7M (SK), and he hypothesized that it could be short path with an overfly of the target location with the signal being scattered back into the target location due to the turbulent ionosphere around sunrise/sunset [note 3].

Notes

1) What's a "good" day? A good day on both bands means the man-made/atmospheric noise, ionospheric absorption and geomagnetic field activity were favorable. Additionally, it may mean ducting was possible on 630m.

2) See Ed N4II's article in the November/December 2016 issue of the ARRL's QEX magazine titled *Gray Line Propagation, or Florida to Cocos (Keeling) on 80m* for details of this skewed path hypothesis.

3) See Bob NM7M's (SK) article in the November/December 2000 issue of the ARRL's QEX magazine titled *On the SSW Path and 160-Meter Propagation*.