Late Afternoon Openings in the Fall Months to Scandinavian Countries on 15m and 10m

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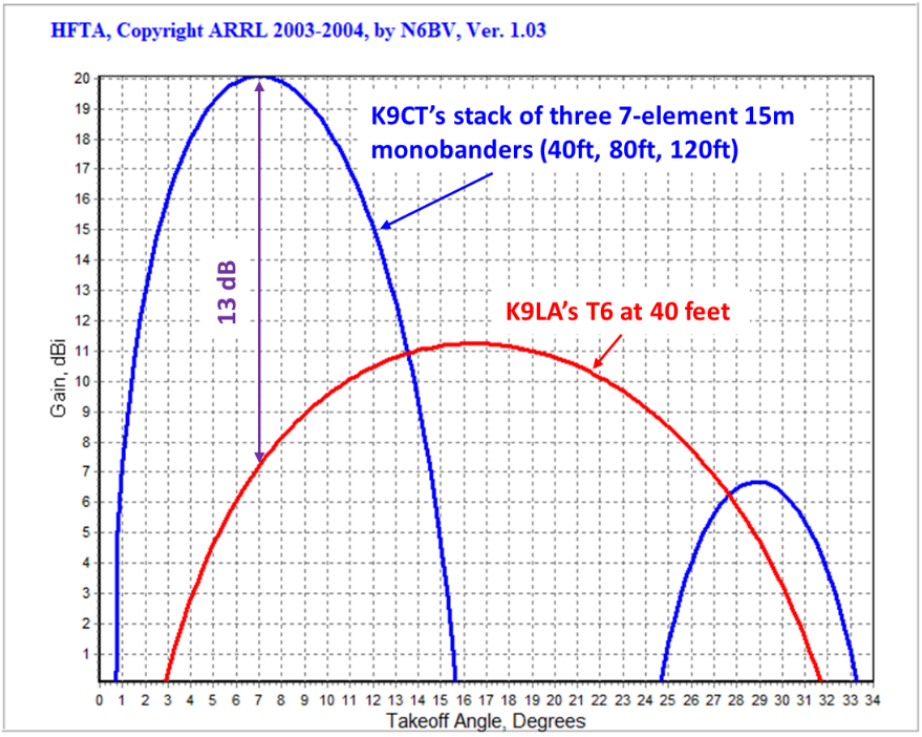
Our 15 meter band was a very pleasant surprise in last month's CQ WW DX Phone contest. There were many great scores – even by stations in the Midwest (affectionately known as the black hole). For example, Craig K9CT near Peoria, IL did a Single-Band 15m High-Power Assisted effort from his Multi-Two contest station. He had 1475 QSOs, 32 zones and 108 countries for a claimed score of 502,040. That works out to 2.43 points per QSO. Barring any major logging problems, that should set the new W9 record for the Single-Band 15m High-Power Assisted category set by W9RM (then WB9TIY) in 1990 (just after the peak of Cycle 22) with 986 QSOs, 36 zones and 134 countries for a score of 456,790.

I did a part-time effort on 15 meters, with my goal of seeing how many zones I could work. I ended up working 19 zones. I heard six more zones but couldn't work them with my 400 Watts to my little Tennadyne T6 LPDA (log periodic dipole array) at 40 feet. The six zones I couldn't work were 16 (UT Ukraine), 25 (JA Japan), 27 (KH2 Guam), 36 (ZD7 Saint Helena), 37 (5Z Kenya) and 40 (OX Greenland). I saw spots for some more zones, but I couldn't hear them.

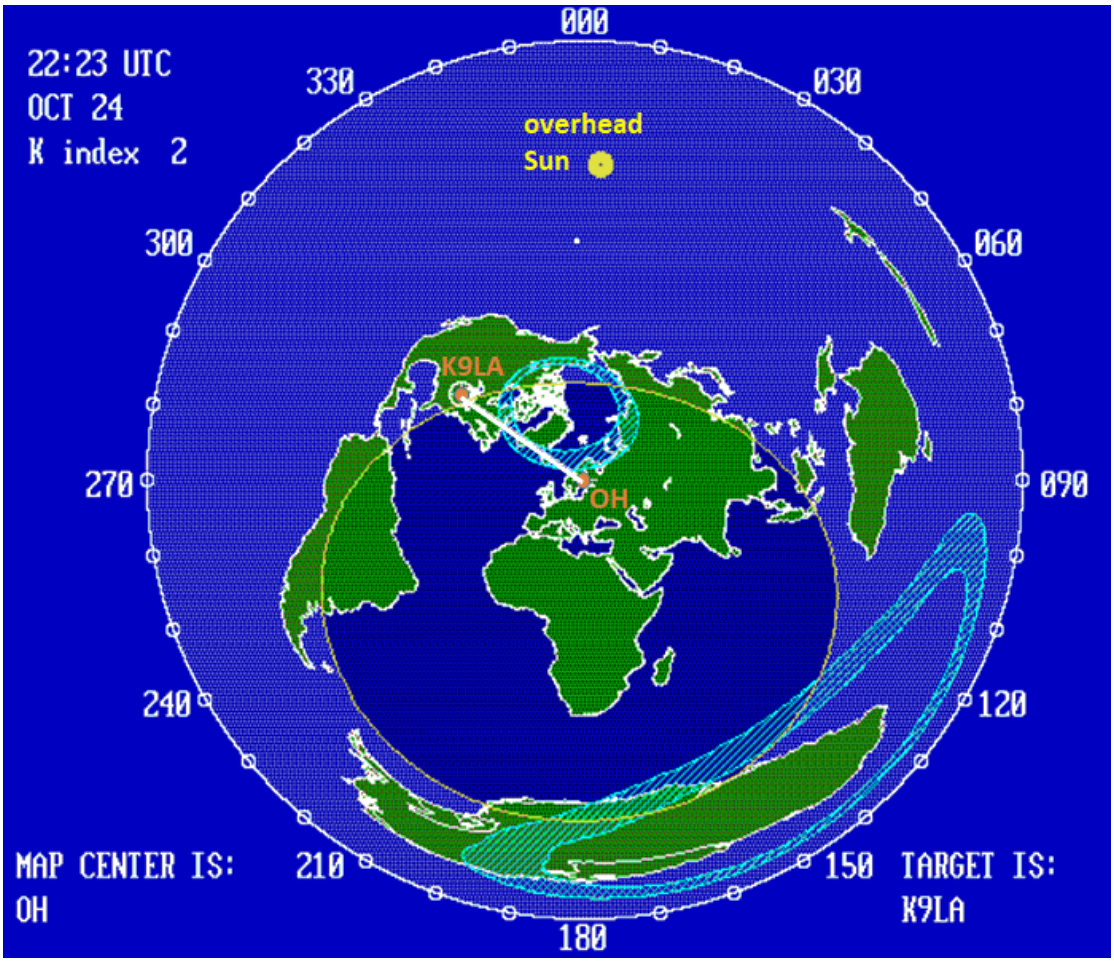
I wondered how many dB K9CT had on me. First, he was running 1500 Watts, so that's almost 4 dB more than my 400 Watts. And his stack of three 7-element 15 meter monobanders (at 40 feet, 80 feet and 120 feet) have a gain of about 13 dB (from N6BV's HFTA software) over my T6 at low elevation angles. That results in about 2 S-units on receive (since receive doesn't have the 1500 Watt amp) and about 3 S-units on transmit. That's a bunch when signals are somewhat marginal. The following plot shows the antenna gains.



If you think I had the advantage over K9CT if a signal was arriving around an elevation angle of 20 degrees, think again. K9CT could select an individual antenna in the stack, so his lowest monobander (at 40 feet) would still beat me by about 1 S-unit. C'est la vie.

In spite of this disadvantage, I did work the path to Scandinavian countries that can occur in the fall months in the late afternoon on 15 meters (and on 10 meters, too). K9CT worked his share of OHs on this path in the contest, as did other Midwesterners and even Jim K5RX in North Texas.

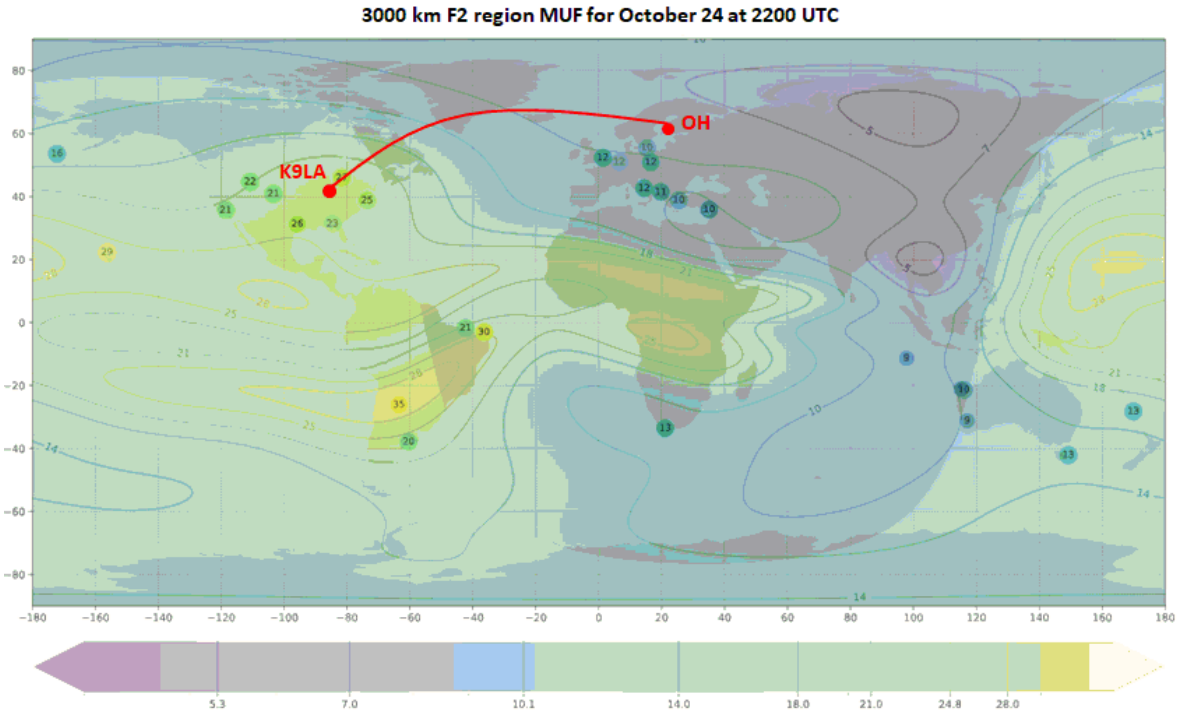
For example, I worked OHØZ at 2223 UTC on Saturday with ease as hardly anyone else was calling. This leads me to believe that many contesters (and non-contesters, too) aren't aware of this path that is somewhat consistent. You can work LAs, SMs and OHs while not hearing any farther south Europeans (I'm sure there are exceptions to this – perhaps via a scatter mode). So what makes this path tick? The following image details this scenario.



This is an azimuth equidistant map (also referred to as a great circle map) with OH in the center. Any great circle route out of OH is a straight line. The distance from OH to the perimeter is half the circumference of the Earth – 20,000 km. This map comes from the old DOS program DXAID by Peter Oldfield.

The path shown (the white line) is from OH to K9LA at the time of my QSO on Saturday October 24. The auroral ovals are shown for a K index of 2 (from the 21-24z data on October 24 at https://www.swpc.noaa.gov/). Note that the southern auroral oval and Antarctica are highly expanded – that's because this type of map projection distorts items near the outer perimeter.

The path from OH to K9LA is around 6900 km, and at 2223 UTC OH has been in darkness for about 8 hours. The latter fact strongly suggests that a hop via the F2 region on the OH end is highly unlikely. But it's still possible on the K9LA end, since the K9LA end hasn't been in darkness very long. Is an F2 hop on the K9LA end possible – in other words, is the F2 region MUF high enough? Here's a worldwide 3000 km MUF map from http://prop.kc2g.com/ with the OH-to-K9LA path added by me.



The contour lines of this map are the F2 region MUFs for the midpoint of a 3000 km hop, and the contours are interpolated/extrapolated from the individual ionosonde data values that are in the dots.

To answer the question "is the F2 region MUF high enough on the K9LA end of the path," we see that the MUFs are indeed in the ballpark of 21 MHz to the northeast along the path from K9LA to OH. We can also confirm that an F2 region hop on the OH end is not very likely.

Assuming a 3500 km F2 hop on the K9LA end (the MUF for 3500 km would be a bit higher than the MUF for a 3000 km path because of the lower elevation angle out of the transmit antenna and a subsequent lower grazing angle on the F2 region of the ionosphere), that leaves 6900 – 3500 = 3400 km. As mentioned above, a second F2 hop is not likely due to the F2 MUF being too low. That leaves two E hops, each of about 1700 km. What likely makes this last 3400 km possible is the auroral-E mode.

In short, the auroral-E mode is when the path is tangential to the nighttime portion of the auroral oval (revisit the second image), and the ionization in this portion of the oval can be high enough to refract 15 meters (and even 10 meters when there are more sunspots). There must be a link to the auroral-E mode, and the F2 region is likely in the fall months in the northern hemisphere when the ionosphere is “best”.

For more about the auroral-E mode, read my Propagation column in the March/April 1999 issue of NCJ (the National Contest Journal) and my Propagation column in the September 2004 issue of WorldRadio. I can supply these two documents – e-mail me at k9la@arrl.net if you’d like them.