A Look at Generalities and Unusual Observations

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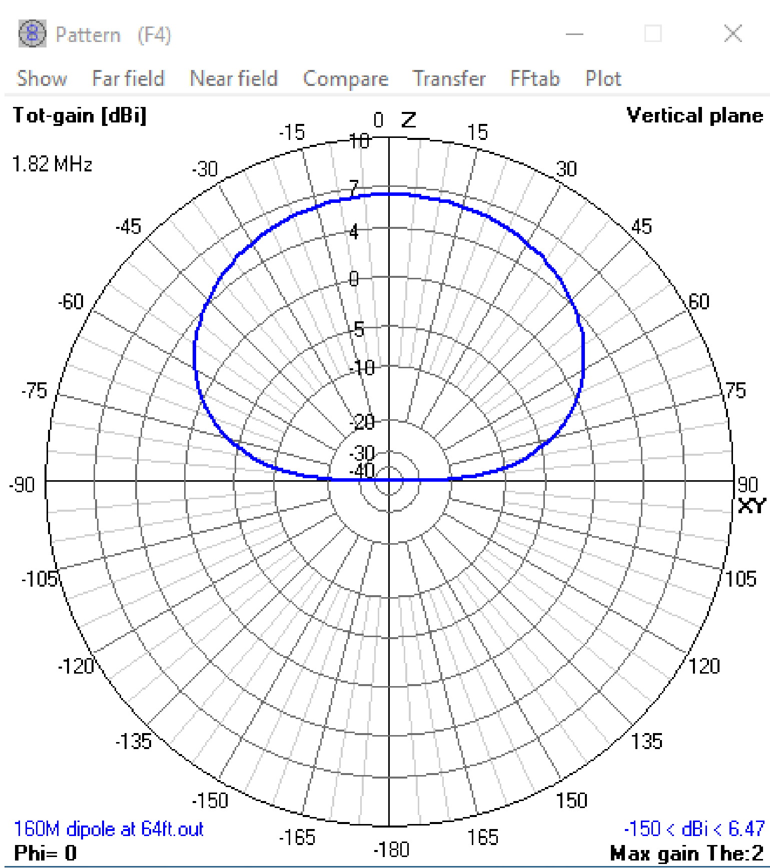
I occasionally see people making general statements that are true most of the time and therefore are good advice, and others commenting on what appears to be an unusual observation. In many cases I can think of an exception to the general statement or an explanation for an unusual observation. Let's look at three recent examples – two in the "general statement" category and one in the "unusual observation" category.

<u>General statement #1</u>

"A horizontally polarized receiving antenna only 64 feet high on 160 meters will have exceptionally poor performance at the angles you need for DX QSOs."

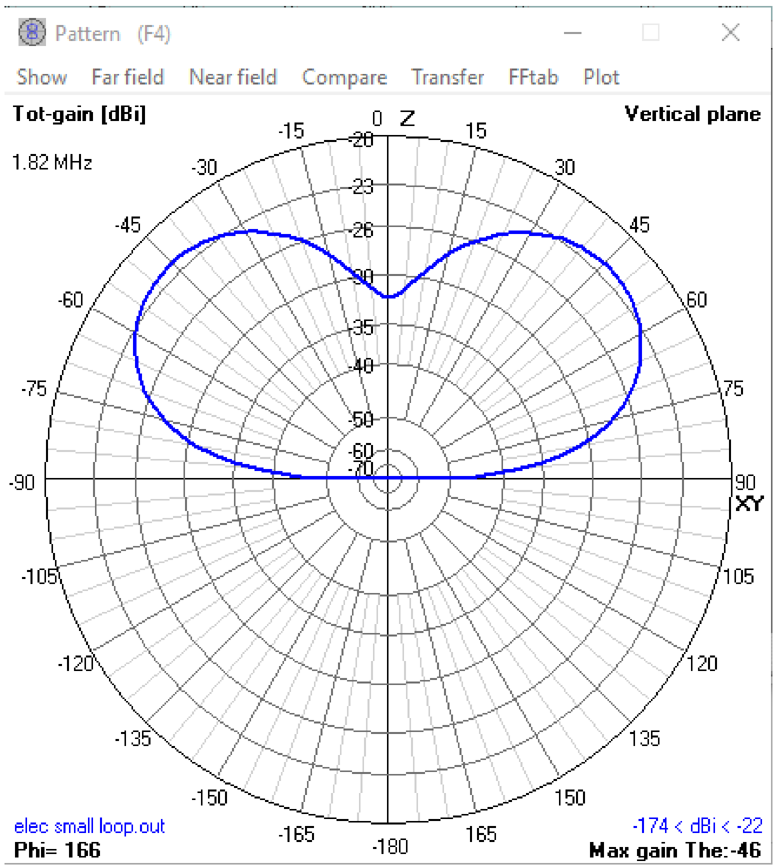
This statement should be well-recognized. The figure below (from the free antenna analysis software 4nec2 by Arie Voors) shows the elevation pattern of a 160-Meter dipole cut for 1.82 MHz over average ground (ε = 13, σ = .005 Siemens) at 64 feet.



160-Meter Horizontal Dipole at 64 Feet

This dipole has much of its radiation straight up – not at the lower elevation angles good for DX [note 1]. Note that in this 4nec2 plot that 0° is straight up and 90° is on the horizon – this is backwards from our normal plots – normally 0° is on the horizon and overhead is 90°.

Do all horizontally polarized 160-Meter antennas at 64 feet perform the same with radiation mostly straight up? Most do, but I can think of one exception – an electrically small loop mounted horizontally. Here's the elevation plot at 1.82 MHz of a small loop (10 feet by 14 feet – 48 feet total perimeter, which is 0.089 wavelengths on 160-Meters) mounted horizontally at 64 feet over average ground.

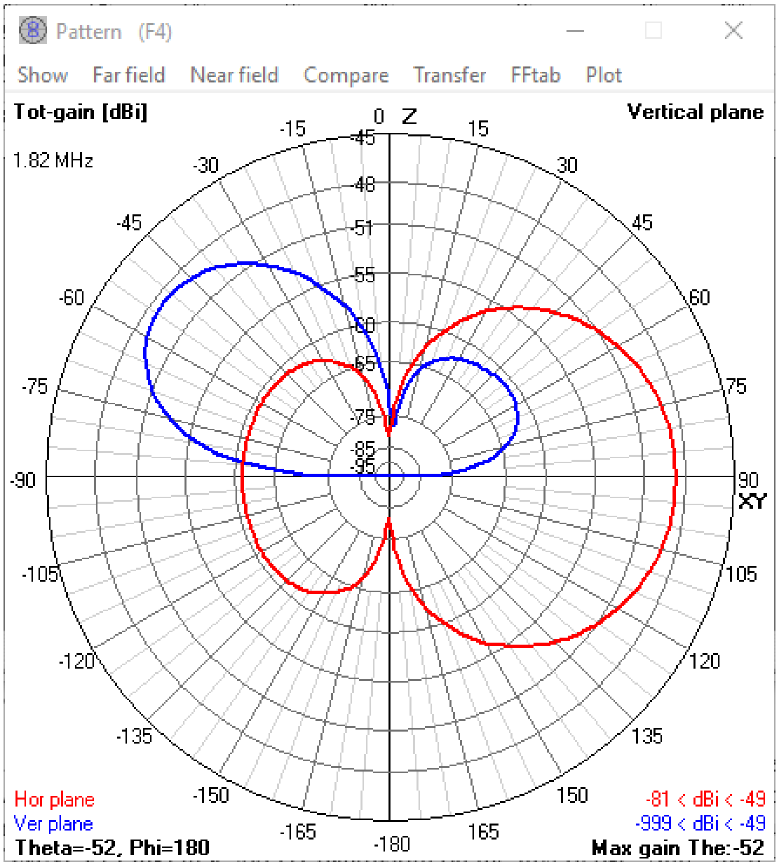


Small Loop Mounted Horizontally at 64 Feet on 160-Meters

The elevation plot for this small loop at a low height is quite different from the elevation plot for the dipole at low height. The reason for this is the electrically small loop has maximum radiation in the plane of the loop and minimum radiation perpendicular to the plane of the loop. Thus when mounted horizontally, the electrically small loop has minimum radiation towards the ground.

An electrically small loop usually isn't used in transmit (it can be if you pay special attention to losses), but it certainly can be used in receive. In fact, a Waller Flag antenna uses two such small loops appropriately spaced and fed 180º out-of-phase. The resultant pattern is essentially unidirectional, and thus it makes a good receive antenna that improves SNR (signal-to-noise ratio).

The following azimuth and elevation plots on 1.82 MHz are for a Waller Flag using 14 foot by 26 foot loops on a 42 foot boom and mounted horizontally at 64 feet over average ground.



Waller Flag Mounted Horizontally at 64 Feet

The azimuth plot (red) shows decent front-to-back and good side nulls. This suggests a decent RDF (receiving directivity factor) – the model says 11.6 dB.

The elevation plot (blue) shows maximum radiation is received at an elevation angle of around 35-40^o – not bad for DX with an antenna at only 64 feet high on 160-Meters. At an elevation angle of 15^o, the response is 6 dB down.

The main issue with a Waller Flag is the low gain due to the loops being so small. For the above Waller Flag, the maximum gain is -49 dBi. A very well-designed preamp is needed for this system. Moving the Waller Flag up to 150 feet would increase the gain to -43 dBi, and the maximum radiation would be at an elevation angle of around 30-35^o. Because of the characteristics of an electrically small loop mounted horizontally, the performance of this antenna is somewhat height independent.

General statement #2

"If your inverted L is any good at all it will suck as a receiving antenna."

I can believe this general statement if you live in a residential noise environment. Then you would likely need a receive antenna that improves SNR.

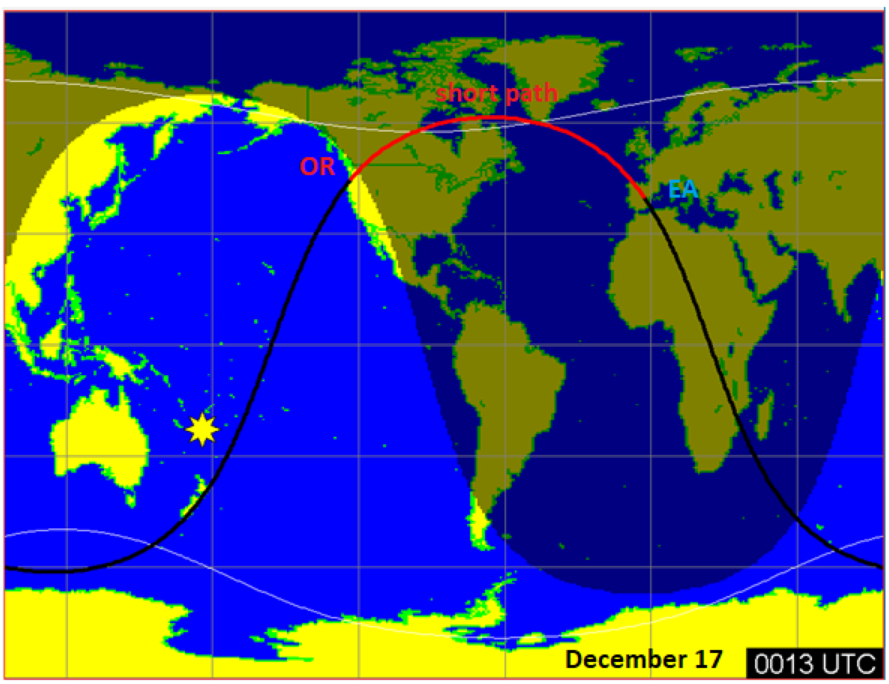
But if you live in a quiet noise environment, then I think that statement is questionable. For example, I achieved DXCC on 160-Meters using my inverted-L (60 feet up, 65 feet sloping down, three elevated radials). On a typical winter night, my noise level is around -103 dBm (S3 on my OMNI VI Plus) in a 500 Hz bandwidth on the inverted-L. Sure, there were many stations that I couldn't hear, which means many times I had to wait for a good night propagation-wise.

If you have patience and live in a relatively quiet noise environment, you can work many DXCC entities on 160-Meters with an inverted-L.

Unusual observation

An Oregon station reported on PacketCluster hearing EA3JE on 3793.8 KHz at 0013 UTC on December 17, 2018, and commented *"coming in from Barcelona during the day!"*

The following map from W6ELprop shows this path between Oregon (OR) and Spain (EA) via the short path (the red line).



Yes, the Oregon station is in daylight – but it's only 17 minutes before his sunset at 0030 UTC.

What's NOT important is where you are in relation to the dark ionosphere. What IS important is where your RF encounters the ionosphere. Since this report was on 75-Meters, absorption is the critical parameter (not the MUF). Thus where the ionosphere encounters the D region is critical.

Assuming a 15 degree elevation angle and assuming the D region is around 75 km high, this means the RF will encounter the D region about 300 km from the Oregon station. That puts it just east of the terminator in the dark ionosphere.

Of course the terminator is not an abrupt change from daylight to darkness as shown in the above figure. But it shows that the encounter point with the ionosphere is more in “darkness” than in “daylight”.

A related daylight issue is a path across the higher latitudes in the winter (for example, a path from K9LA in northeast Indiana to Europe in the late afternoon in winter when there is still much daylight). With the Sun in the southern hemisphere, the amount of absorption incurred is significantly less than along the same path as in the summer. Thus it’s possible to have much daylight along a higher latitude path in the winter.

Of course the band also comes into play – 40-Meters can withstand more absorption (more daylight) than 80-Meters, which can withstand more absorption than 160-Meters.

For more details on these daylight issues on the low bands, please take a look at the January 2017 Monthly Feature at https://k9la.us/Jan17_Sunrise_Sunset_and_Daylight_in_Relation_to_Low_Band_Propagation.pdf.

Notes

1. Note that I said “much of its radiation is straight up”. I didn’t say “all of its radiation is straight up”. You can still work lots of DX on 160-Meters with a low dipole. You won’t be first in the pile-ups, and you’ll likely need an amplifier – but if that’s all you can put up, go for it.