Antenna of the Month
Gary, NA6O
March, 2024

Inverted Vee

One of the natural modification to a simple half-wavelength dipole is the *inverted vee*. As you know, most of the radiated energy comes from the part of an antenna where current is greatest, and that's the center of a dipole. So your first objective is to get that up as high and clear as you can. But if you only have one tall support, attach the center and the feedline to that, and let the ends of the antenna slope downward. That forms the inverted vee configuration and it's almost as good as the flat dipole.

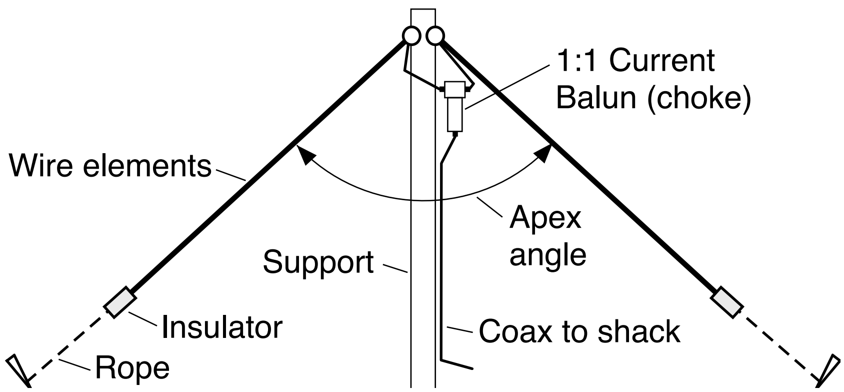

Figure 1. Typical inverted vee construction.

What are the properties of an inverted vee, compared to a flat dipole at the same height? What you'll add is some vertically-polarized radiation, a more omnidirectional pattern, and sometimes a lower SWR. What you'll lose is a bit of peak gain since the pattern of the dipole has diminished. Exact results will depend upon A) the apex angle and B) height above ground.

I did some simulation in EZNEC to compare a 40 m dipole to an inverted vee. Everyone should explore this free and very powerful program, available from https://www.eznec.com/ and discussed in the ARRL Antenna Handbook among other places.

Both antennas were placed at 30 ft (30 ft apex for the inverted vee), and I tested the apex angle at 100 and 130 degrees. The SWR chart in Fig. 2 shows the differences but any of these are completely acceptable to any radio with an antenna tuner. In general, the smaller the apex angle, the lower the feedpoint impedance but eventually the mismatch could become problematic if you collapse the antenna much below about 90 degrees. Also, if the ends get very close to the ground the impedance can change rapidly. Keep them up 6 ft or so and it's fine.

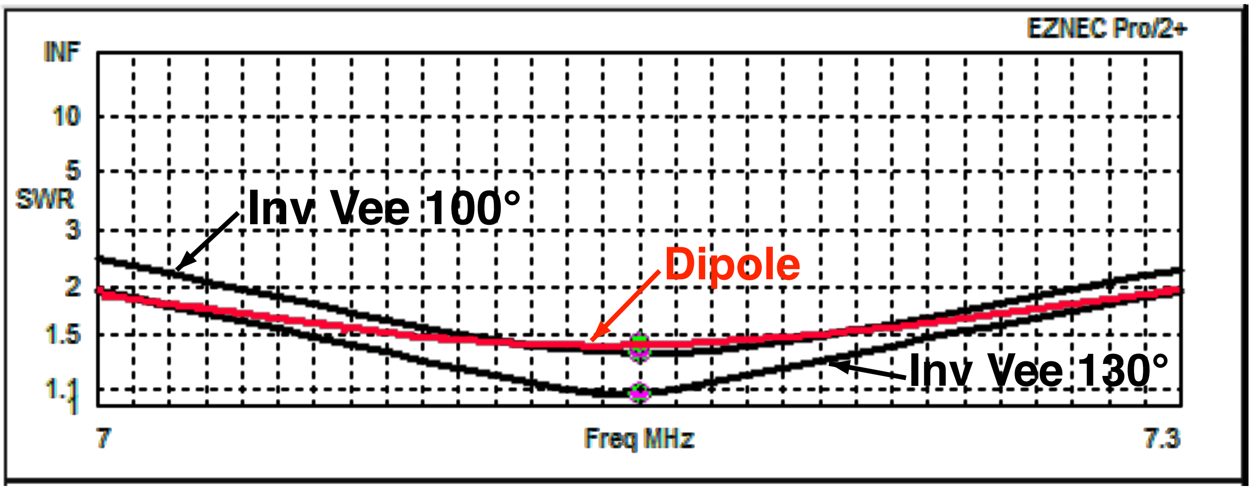

Figure 2. SWR comparison over average ground conditions.

As the inverted vee arms swing downward (smaller apex angle), the pattern in azimuth becomes more omnidirectional (Fig. 3). Note that this dipole doesn't have a very strong pattern either. That's because it's quite low, at only 1/4 wavelength in altitude. You really need to get a dipole up 1/2 wavelength or higher in order to see substantial nulls off the ends (vertical axis in the plot). And if they were up at 1/2 wavelength, peak gain of both antennas would be 3 dB greater. So the rule "as high as possible" is a good one.

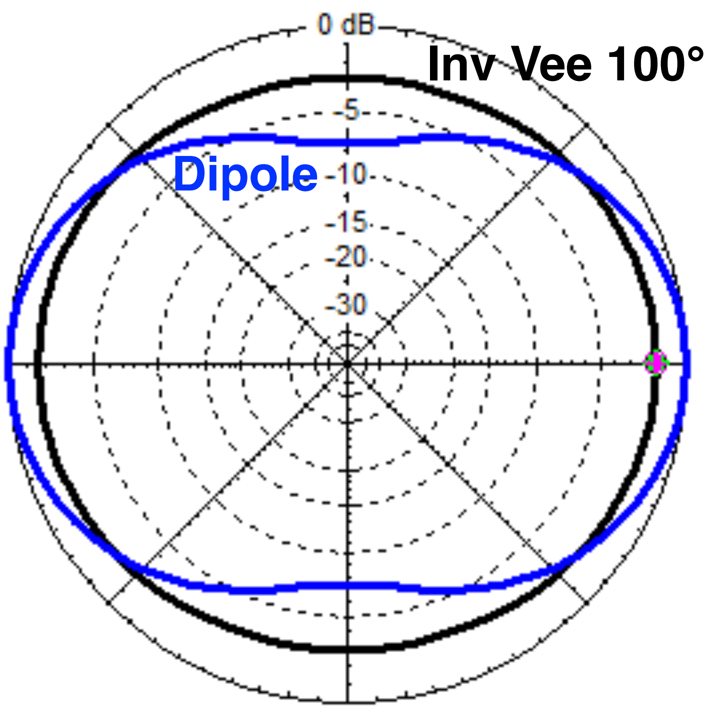

Figure 3. Azimuth pattern comparison. Outer ring is 4.0 dBi.

Comparing the elevation patterns in Fig. 4, there is again little difference, only a couple of dB even with the steeper arms. Also you can see that the gain is highest *straight up*, which is typical of any low, horizontally-polarized antenna. This is ok for local communication, but less desirable for long-range DX where low takeoff angles are needed. Still, you do radiate significant energy at some low angles and the antenna is generally useful.

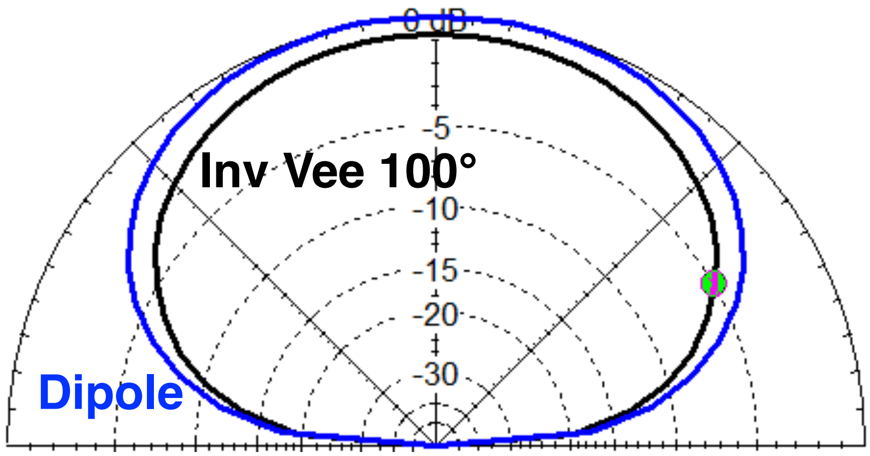

Figure 4. Elevation pattern comparison. Outer ring is 7.3 dBi.

In conclusion, the inverted vee can be more convenient to install than a dipole since only the center is at high altitude, and you pay only small penalty in terms of overall performance. Note that you can turn it into a multi-band antenna just like a dipole by adding parallel elements (a fan) or traps.