Antenna of the Month

Gary, NA6O
April, 2024

The Sloper

Another modification to a simple half-wavelength dipole is the *sloper* where the dipole is erected at a steep angle, often 45 degrees. This only requires one relatively tall support, making it somewhat more convenient. Most often slopers are used on the low bands, 160 through 40 meters. They don't make much sense on the higher bands where a regular dipole or more complex antenna is probably just as easy to erect.

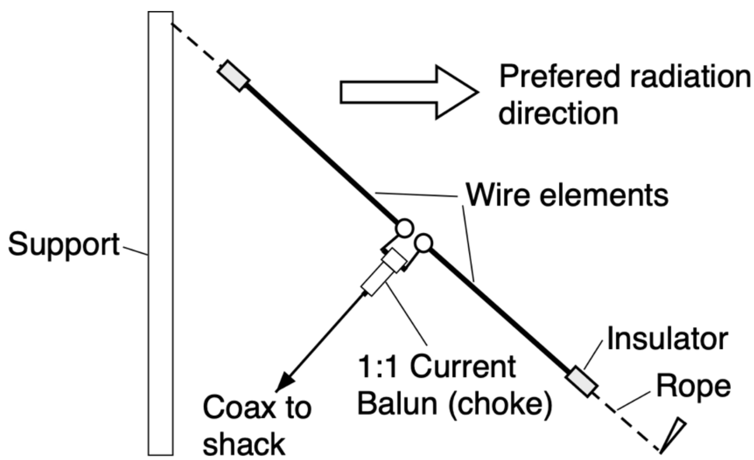

Figure 1. Typical sloper construction.

What are the properties of sloper, compared to a flat dipole? What you'll add is some vertically-polarized radiation and perhaps a somewhat directional pattern in the direction of the downhill slope. What you'll lose is gain since the pattern of the dipole has diminished and because you have lost some of the horizontal radiation, which would otherwise be reflected by the Earth. Exact results will depend upon the height above ground and the slope angle.

I did some simulation in EZNEC to compare a 40 m dipole to a sloper. I placed the dipole at a height of 30 ft (about a quarter wavelength, which is really too low for optimum performance), and the sloper was hung from 65 ft and at a 45 degree angle. The SWR chart in Fig. 2 shows some differences but either of these are completely acceptable to any radio with an antenna tuner. Height is the biggest driver of absolute impedance and low antennas often end up closer to 50 ohms. Both of these antennas are actually a better match to 75 rather than 50 ohms which is not unusual.

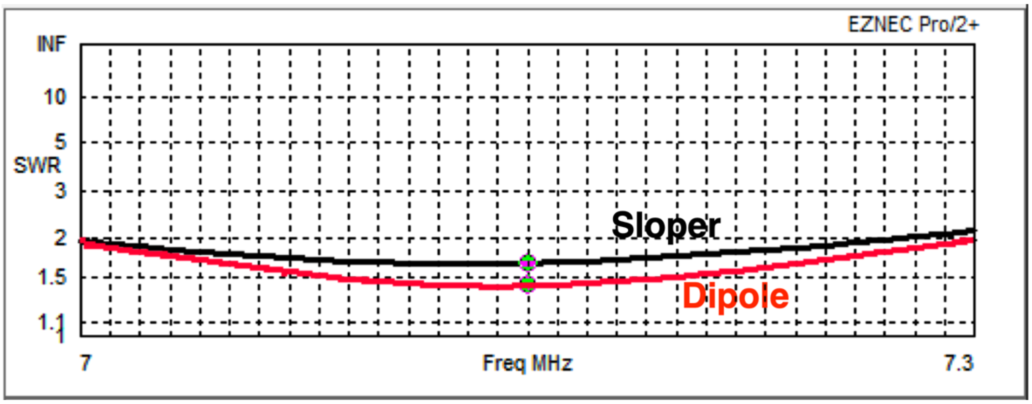

Figure 2. SWR comparison over average ground conditions.

Looking at the pattern in azimuth (Fig. 3), the two are similar in peak gain. However there may be cases where the small (~8 dB) null off the back of the sloper could assist in rejecting QRM. There also is significant gain in the far field—actually *more* gain—off the sides of the sloper! That's because the polarization is primarily horizontal off the sides and vertical along the direction of the slope. See Fig. 4. Again, horizontally-polarized radiation reflects off the Earth and at some angles you get constructive interference that can be worth as much as 5.5 dB. So it's funny that this antenna is normally sold as being directional along the slope.

Often a sloper is hung from a tower. The tower may or may not interact, depending upon whether it's resonant due to its height and what antennas are mounted on it. Sometimes it acts as a reflector that makes the sloper more directional with some added gain in the expected direction... And sometimes not. Simulation can give you an idea what to expect but every installation will be different.

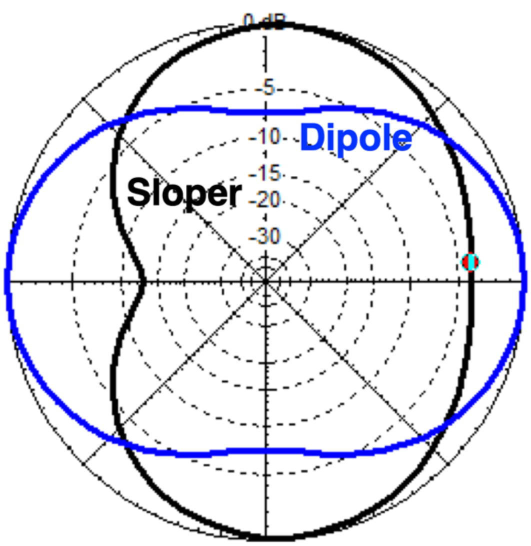

Figure 3. Azimuth pattern comparison showing total fields. The sloper goes downward toward the right. Elevation angle is 35 degrees. Outer ring is 4 dBi.

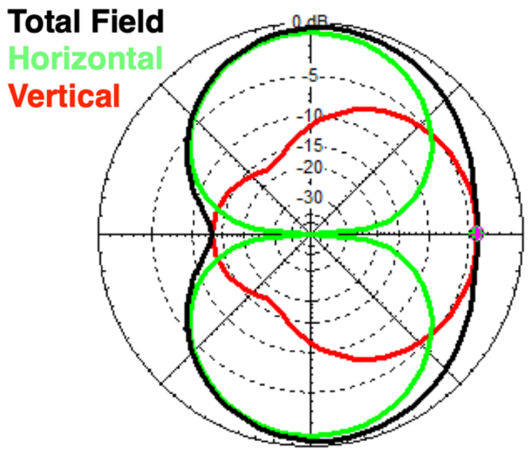

Figure 4. Investigating vertical and horizontal polarization in azimuth. The sloper goes downward toward the right.

Comparing the elevation patterns in Fig. 5, things are fairly evenly matched at low angles, and with the dipole radiation most strongly straight up since it's so low. The sloper shows its symmetrical broadside pattern (H polarized) and its forward-skewed pattern (V polarized) along the sloping wire. A higher dipole may be best of all, but it needs at least two supports way up there instead of the single one needed by the sloper.

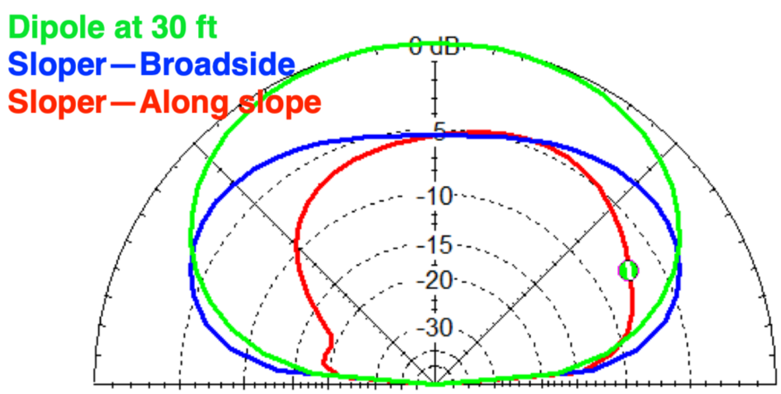

Figure 5. Elevation pattern comparison showing total fields. The sloper goes downward toward the right. Outer ring is 4 dBi.

In conclusion, the sloper is rather a degenerated dipole, giving up some gain in exchange for a more convenient installation. Some stations use a set of slopers as a directional array. In that case, two or more elements are driven via a phasing network thus combining to provide additional gain and steerable pattern.