Short Dipoles for 160 Meters

Get on the "top band" with limited real estate—build one of these shortened dipoles. Apply these principles to 80 and 40 meters, too.

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Many hams do not operate 160 meters due to the size of a resonant antenna required for this band. Using the accepted formula of 468/f, the length of a dipole cut for 1.84 MHz would be 254 feet, 4 inches. What we shall endeavor to do here is to design a simple structure that approaches the performance of a full-length dipole, but is less than half that size. For simplicity, most of the antennas (in 7 examples) shown here are 120 feet long and at a height of 60 feet. Shorter and lower dipoles can be designed, but they will have degraded performance (impedance, gain and bandwidth all decreasing).

Arguably, the three most important antenna electrical parameters are impedance, gain, and the VSWR bandwidth. If the bandwidth can be wide, then a tuner will not be needed, since today's broadband transceivers will operate directly into 50 Ω. To operate over the full band, however, a tuner will be needed with any of these antennas.

The Full-Length Dipole

The full-length dipole is the standard to compare against. By using *AO* software for the initial modeling and then *NEC Wires* software to take into account the ground effects, the dipole was computed to be 257 feet, 5 inches long.[1] For average soil at 60 feet:

Impedance = [45.8 + *j*2] Ω at 1840 kHz.
Gain = +1.27 dBi at 60 feet and +3.15 dBi at 100 feet (at 30° elevation).
2:1 VSWR Bandwidth = 65 kHz at 60 feet and 95 kHz at 100 feet.

As expected, higher dipoles have more gain and greater bandwidth. In all of the figures that follow, the numbers (parentheses) represent that antenna point's height above ground. The non-parenthetical numbers represent length.

[1]Notes appear on page 00.

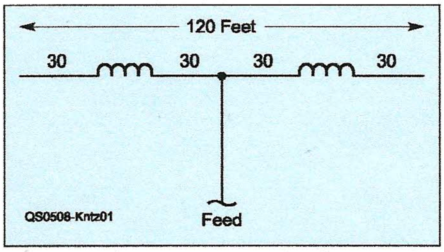

Figure 1—A 160 meter dipole shortened with loading coils.

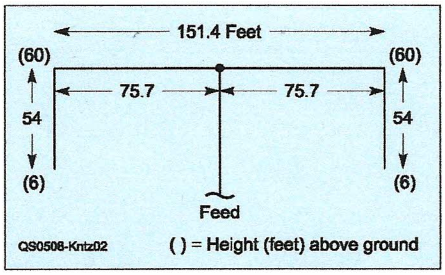

Figure 2—A "hanging ends" shortened dipole. The ends are perpendicular to the antenna main radiator.

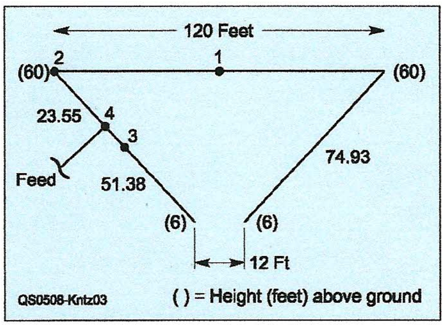

Figure 3—Bringing the wire ends close to the antenna center can increase the antenna's effective length.

Example #1

The first approach (Figure 1) is to add coils in both sides of the dipole to reduce its physical length. The design of this type of dipole was covered in a recent *QST* article.[2] The coils were computed to have an inductance of 129.85 μH. The performance was calculated using a coil Q of 500. For average soil at 60 feet:

Impedance = [21.2 + *j*0] Ω at 1840 kHz.
Gain = –0.51 dBi at 30° elevation.
2:1 VSWR Bandwidth = 10 kHz.

No evaluation was done at 100 feet.

Example #2

Figure 2 shows one of the simplest dipoles of reduced length. The ends of the wire hang straight down and approach (6 feet) the ground. The ends of the wires should be tied down to keep them from flopping around in the wind. The total length of the wire is the same as a full-length dipole.

Impedance = [42.8 + *j*3] Ω at 1840 kHz.
Gain = –0.36 dBi at 30° elevation.
2:1 VSWR Bandwidth = 65 kHz (same as a full-length dipole).

For a wire height of 75 feet, the horizontal length can be reduced to 120 feet.

Example #3

Another way to gain wire length while keeping the width of the dipole at 120 feet is to bring the drooping wires back toward the center of the antenna and tie them to the ground with small ropes. The impedance can be raised by using "off-center feed," such as feeding at the corner or in the center of one of the sloping wires. Figure 3 shows this example.

Center feed impedance at point (1) = [13 – *j*0] Ω at 60 feet.
Corner feed impedance at point (2) = [23 – *j*0] Ω at 60 feet.