# Wire Gain Antennas for 6 Meters

## Get some gain on 6 meters—without investing in a beam and rotator!

**By J. Robert Witmer, W3RW**

In August 1995 I came across an old Clegg Venus 6-meter SSB/CW transceiver (a 1960s vacuum-tube rig). After the radio had sat on my workbench for several months, I finally got around to fixing the previous owner's "design improvements." Soon thereafter, the Venus was on the air!

I had a great time in the 1996 January VHF Sweepstakes and enjoyed the sporadic-E season in the spring and summer of 1996. Until recently, however, I had been using a vertical antenna cut for the FM portion of 6 meters. It was terrible for local SSB work—most SSB and CW operators use horizontal antenna polarization on the VHF bands. During normal groundwave operation you are at a big disadvantage if you operate with the opposite polarization. During long-distance band openings, it doesn't matter quite as much, but the vertical still seemed to be lacking in performance.

### Why Not a Beam?

I live in a neighborhood where RFI/TVI/BMI (baby monitor interference) reports can begin just with the *installation* of a new antenna, let alone an actual transmission. Because of the desire to maintain a low antenna profile—plus my unwillingness to make the investment in a tower, beam and rotator—I decided to investigate other approaches to reasonable antenna performance for 6-meter SSB/CW operation.

What follows is the highlights of what I've found. I haven't had the opportunity to thoroughly check all of the antenna possibilities I will describe, but I've included the references and important information so *you* can try these antennas for yourself.

By the way, going to horizontal polarization has made a big difference in BMI so far—baby monitors use vertically polarized antennas!

### The Long-Wire Antenna

We don't usually think of long-wire antennas for VHF applications, but they can be used on 6 meters almost as easily as on the HF bands. In fact, a wire is typically not considered "long" until it is several wavelengths long. At 6 meters a wire four wavelengths long is only about 75 feet—a length that will fit in many locations. According to *The ARRL Antenna Book*, an antenna four wavelengths long can have a gain over a dipole of approximately 3 dB (3 dBd) in some directions. The antenna can be fed at the end, or at a *current loop*. Because of matching considerations (I don't have a 6-meter antenna tuner) I chose to use the current-loop approach (see **Figure 1**).You could make the antenna longer and pick up more gain if you like. An antenna six wavelengths long should have a gain of almost 5 dB, and an antenna 10 wavelengths long should have a gain of approximately 7.5 dB.

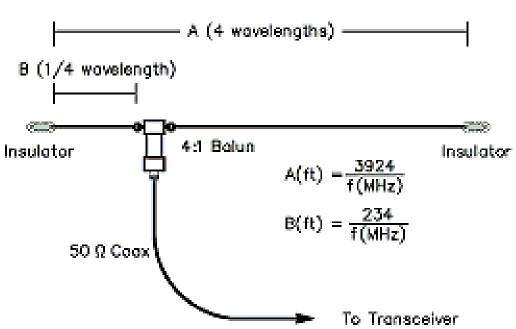


**Figure 1—An off-center fed long wire antenna for 6 meters. It's basically just two pieces of wire linked by a 4:1 balun. Choose your antenna's "center frequency" (f) and cut length A using the formula shown. Mark the current node point—$^1/_4$ wavelength (B) from one end—and cut again. Cut the lengths of both sections a little longer than your calculations call for, so you have a little surplus for adjustment purposes.**

Along with an increase in gain, there will be a change in the radiation pattern. You're familiar with the doughnut-shaped radiation pattern surrounding a half-wavelength dipole—that pattern breaks up into a multilobed pattern as the length of the antenna is increased. The bottom line is that you may end up with 3 dB gain in *some* directions with that four-wavelength long wire, but there will also be nulls (where the gain becomes *less* than that of a dipole) in other directions. With a fixed long-wire antenna, you take "pot luck" on what your gain will be in the direction of a station you hear—but if you hear him, you stand a fair chance of working him.

### Building a Long Wire for 6 Meters

I used the formula 3924/f (where f = frequency in MHz) to determine the overall length of my four-wavelength long wire. That antenna would fit in my 80-foot space. I then determined the current-node point by using the formula 234/f, and feeding the antenna that distance from one end. The radiation impedance at that point is about 130 Ω. The resulting SWR, using a 4:1 balun and 50-Ω cable, should be less than 2:1.

When you cut your wires, always make them a little longer than the formulas indicate. When you attach the wires to the insulators as shown in **Figure 1**, wrap the surplus length back on the wires. That way, if you need to lengthen the antenna, you can simply unwrap the extra length.

At the current node you can attach both wires to a commercially made 4:1 balun. Just make sure it is rated for use on 6 meters. (Two examples: The W2FMI-4:1-HBM200 made by Amidon Associates, PO Box 25867, Santa Ana, CA 92799; tel 714-850-4660; fax 714-850-1163. The Centaur baluns sold by Amateur Electronic Supply; tel 800-558-0411.) These baluns tend to be bulky and their weight might make your wire sag unacceptably. If this is the case, attach a run of 300-Ω ladder line at the current-node point. The line should be $^1/_2$ wavelength at the frequency f. Snake the ladder line back to the 4:1 balun and go from there.

### Long-Wire Antenna Performance

I've compared the performance of my 6-meter long wire to my $^5/_8$-wavelength vertical during several band openings. The long-wire antenna often performed better! The most noticeable change occurred when I used the long wire for local communication. The difference was substantial. On some weaker signals switching to the vertical would make the signals disappear! My biggest thrill was working the only "double-hop" station I heard during the June VHF contest—and the rare DX of Sable Island!

### Multielement Collinear Wire Array

As I mentioned earlier, a four-wavelength wire has gain over a dipole of about 3 dB. The gain isn't higher because the antenna currents are not in phase, creating some field cancellation. To increase the antenna gain, it is necessary to get the RF currents in phase. **Figure 2** shows how this can be done using a *collinear wire array*.

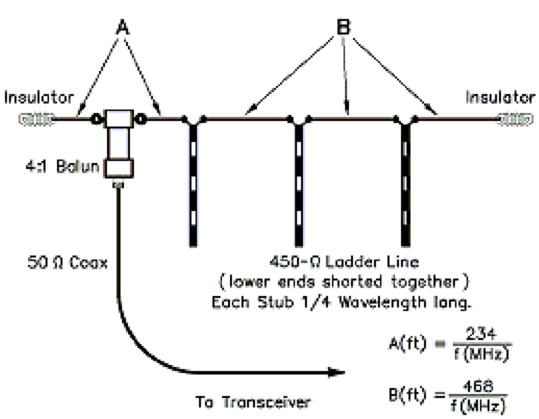


**Figure 2—The multielement collinear array uses stubs to get the RF currents in phase. The stubs in this example are made of $^1/_4$-wavelength sections of 450-W ladder line (shorted at the ends). To calculate the lengths of the stubs, use the formula (246/f)×V, where f is the center frequency of the antenna and V equals the velocity factor of the ladder line you've**

**chosen. The 4:1 balun is once again attached at the current node point.**

The collinear is fed the same way as the long-wire antenna but uses $^1/_4$-wavelength shorted *phasing stubs* between the half-wavelength elements. You can make phasing stubs out of common 450-Ω ladder line, but you have to watch the *velocity factor*. Don't let this term scare you. It merely refers to how fast a radio signal travels through a given piece of feed line, expressed as a decimal percentage of the speed the radio signal travels in free space (ie, the speed of light). Velocity factor is an important consideration when you're playing with the phases of radio waves. Depending on its velocity factor, the cable you cut to a mechanical $^1/_2$ wavelength might be something quite different in an electrical sense.

I've discovered that velocity factors vary between manufacturers of 450-Ω line. Several samples I've tried had velocity factors varying between 0.85 and 0.9—neither of them close to the commonly quoted value of 0.95. Try to verify the velocity factor of the line you plan to use. If you can get your hands on a grid-dip meter, you can couple it to the shorted stub and check the resonant frequency.

Using the phasing-stub technique, I put up four $^1/_2$-wavelength sections with their accompanying matching sections in the same space my four-wavelength wire occupied. Maximum radiation is off the sides of the antenna. It's difficult to achieve optimum gain because you're bound to have unequal currents in some of the $^1/_2$-wavelength sections, but it is still better than the long wire.

## The Sterba Curtain

The Sterba curtain antenna is also composed of $^1/_2$-wavelength radiating sections and phasing sections. An implementation of this antenna for 10 meters was described in the October 1991 *QST* ("Curtains for You," by Jim Cain, K1TN). The antenna shown in **Figure 3**, made up of eight $^1/_2$-wavelength elements, should have a gain of about 8 dB over a dipole. This is a physically complex antenna, but it is a superb performer. It is also less than 38 feet long on 6 meters. Again, remember that, while enjoying that gain in the most-favored directions, other directions will have less gain.

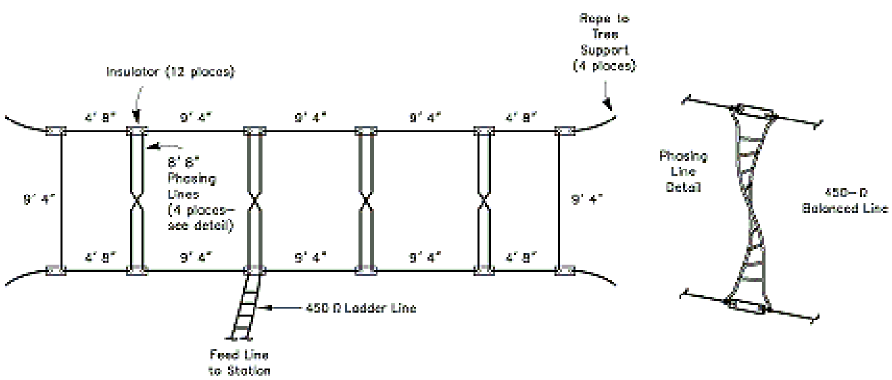


**Figure 3—Construction details for an eight-element 6-meter Sterba curtain. The design frequency is 52 MHz. Note that the phasing section is twisted once, so that the conductors cross. The inner end of an upper element feeds the outer end of a lower one. If you have a 6-meter antenna tuner with a balanced output, you can feed the curtain with 450-W line between the antenna and the tuner. Otherwise, use a 4:1 balun at the feed point (as in Figures 1 and 2) and you can feed the curtain with 50-W coaxial cable. As the name implies, you hang this antenna vertically, just like a window curtain!**

I haven't tried the Sterba on 6 meters myself, but I'm up for the challenge. Regardless of the complexity, it still beats the cost of a beam and a tower!


146 Forest Trail Dr
Lansdale, PA 19446
e-mail **witmerjr@aol.com**