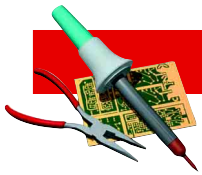
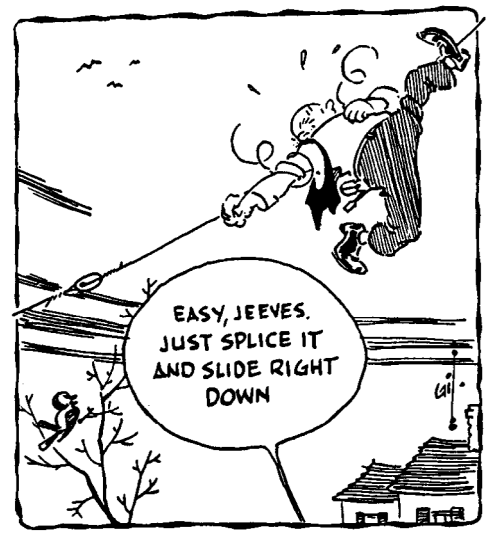


By Van Field, W2OQI

HF Antennas 101

Here are 10 tips and truisms that every ham should know.



1. An antenna does *not* have to be resonant to work. The only reason to make an antenna resonant is to eliminate the need for an impedance-matching device such as an *antenna tuner*. Actually, a non-resonant wire dipole antenna fed with open-wire line and an antenna tuner is a great multiband antenna. See the article "The Classic Multiband Dipole Antenna" by WB8IMY in the March 2004 *QST*.

2. Two wires are needed to power a lamp. The same is true of your antenna. The best antenna configuration calls for feeding energy from the transmitter to a balanced antenna, such as a dipole. If you can do this with a balanced, parallel-wire feed line, so much the better. However, many of us choose coaxial cable for convenience sake. The problem with coaxial cable is that it is not a balanced two-wire feed line. In fact, coaxial cable can be said to consist of *three* wires: the center conductor, the outside of the shield and the inside of the shield. RF travels on the surface of a conductor. In a parallel wire arrangement (such as ladder line), there is a balanced RF field between the two conductors. But with coax, the field is between the center conductor and the inside of the shield. This leaves outer surface of the shield braid free to get into trouble. Since it is connected to one side of the antenna, the outer braid becomes part of the antenna and the result can be RF feeding back to your station (see W2DU's excellent book, *Reflections II*). This is the reason some hams prefer to use a 1:1 balun (*bal*anced-to-*un*balanced transformer) at the center of the dipole to isolate the unbalanced coaxial feed line.

3. Antenna "gain" is derived by shaping and aiming RF where you want it to go. For example, so-called "beam" antennas get their name from the fact that they concentrate RF energy in a particular direction, like a flashlight. Other types of antennas, including wire antennas, can exhibit "shaped" radiation patterns (and therefore gain) as well. Take a look at the latest edition of *The ARRL Antenna Book* and you'll see what I mean.

4. The function of an antenna tuner is to effect a match between the output of a transceiver and the input of an antenna system. Modern transceivers can only deliver full power into a 50 Ω load. Antenna tuners are variable-impedance transformers that allow you to transform the antenna system impedance (which can be almost anything) to 50 Ω for the transceiver. Some antenna tuners exhibit a wide impedance-matching range. Others, such as the ones typically built into HF transceivers, have quite narrow ranges.

5. A wire antenna doesn't always have to be center fed. For instance, you can feed a long wire at the end with a two-wire feed line. Connect one conductor of the feed line, but not the other. You'll need an antenna tuner at the other end of the feed line to provide a 50 Ω impedance for your radio. This type of antenna used to be called an end-fed Zepp. To work well, however, the ground side of the antenna tuner needs to be connected to a network of radial wires, or a counterpoise.

Another old-time antenna is an off-center-fed dipole, called a Windom way back when. Cut a wire a half wavelength long, find the center and connect a single wire 14% off center. This also requires a counterpoise for good results. The impedance is about 600 Ω, so you'll definitely need an antenna tuner.

6. A dipole antenna does not have to be perfectly horizontal. That's the way it is usually depicted in books and magazines, but you can bend the legs of the antenna up, down or sideways. The antenna can also be on an incline, or even vertical. The shape of the antenna and its height above ground will affect its impedance at the feed point, so you may need to experiment to obtain a low SWR, if you are feeding it with coax.

7. Vertical antennas shorter than a half wavelength need a ground system. This usually takes the form of radial wires, either elevated or buried. Beware of short vertical antennas that claim to operate without radials. These designs tend to be inefficient. Yes, they "work" in the sense that they radiate some RF, but you'll enjoy much better performance with a good radial system.

8. With vertical antennas there is no such thing as too many radials. The more radials you install, the more efficient your antenna system. Yes, you can reach a point where the benefits of adding more radials levels off, but that number is somewhere around 100!

9. Having a 1:1 SWR does *not* mean you have a good antenna. A 1:1 SWR only means that you have an impedance match between your transceiver and your antenna system. It says nothing about how well your antenna is working. For example, a vertical antenna with a poor ground system can be tuned to the point where you'll measure a 1:1 SWR at your station, but the antenna is so inefficient, most of the RF is being wasted as heat!

10. Always use the best feed line you can afford. Resist the urge to be penny wise and pound foolish. This is particularly true of coax. Better (less lossy) coax will cost more, but this is the cable that is carrying your precious RF signal to and from your antenna. A good investment now will pay off in better antenna system performance.

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