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Antennas for HF Receiving and Transmitting

Receiving Antennas
Receiving Antennas can be quite simple

- a random length wire 25’ to 50’ going out to a tree or other support can work great
- make sure to avoid touching metal with the wire and support it with a rope or some other non-conducting material, and you will be good to go for receiving Shortwave and amateur radio signals, as well as a lot of other signals in the HF portion of the band
- HF range is between 3MHz and 30MHz
- If you are using a portable radio any outdoor antenna might overwhelm the radio, but most should be ok
- Any antenna designed for transmitting on an HF amateur band will work well as a receiving antenna, so even if you don’t have your general license yet but plan to get one, you may want to put up something with which you can transmit later
- BTW, my first HF contact was made on a random wire going out the window to my garage, because my real antenna hadn’t arrived yet!

HF

- While it may seem hard to believe, HF signals only need thin lengths of wire properly matched to a radio to do their job.
- Common speaker wire that you would normally use with your home stereo is almost perfect for making a basic dipole.
- I actually like speaker wire for one very simple reason: it comes with both wires joined together through its insulating material; you only have to make one cut to get both wires to the proper length when making a center-fed dipole.
- Calculate the length needed for one arm of the dipole, measure and cut the speaker wire to that length, and now both arms of the dipole are exactly the same length!
- As you may remember from your license exam studies, RF current actually travels down the outside of the wire (called the “skin effect”), and in the HF frequency range almost any wire will do.
- I like to avoid really thin wire for permanent installations, but for portable installations thin wire is a great option just for the weight reduction it represents

Dipole

- A *dipole* antenna is made up of 2 poles or lengths of wire, often cut to equal lengths as described above.

- The antenna is considered *resonant* if the total length of the two arms equals ½ wavelength for a given frequency. (This means each arm is ¼ wavelength.)
- The outer ends of each wire are connected to insulators which are in turn tied off to some form of support, usually trees or masts.
- The inner ends of the wires are connected to a feedline in one of several ways, the most simple being ladder-line
- Coax may also be used, but this requires some form of matching since a dipole is considered a *balanced* line and coax is considered an *unbalanced* line
- These terms have to do with how the RF signal is affected by the feedline. Because the ½ wavelength dipole has two equal lengths, each side has an electrical balance, and this must be matched or transformed to travel along an unbalanced feedline.
- If using coax, one side gets connected to the inner coax conductor and the other side is connected to the outer shield of the coax
- If using ladder line connections are just as easy, and both methods require some form of support for strain relief at the feedpoint

What makes a Wire Dipole so Effective?

- The key to the effectiveness of a wire dipole antenna is that nothing is wasted, given proper construction.
- Electrically nothing is wasted and mechanically nothing is wasted, so the result is a maximum transference of energy where it is intended to go.

Making a Dipole: The Dipole Formula

The common formula for calculating the length of a dipole is:
468 / (f MHz) = dipole length in feet
(e.g. 468/14.275 MHz = 32.8 feet total length (approx. 16.5' per side)

Cut each length a bit long, adding 6 inches or so to each side and then trim or fold back as needed. If you cut the wire too short you will have to add length or start over, so it is always better to leave a margin of error.

Variations on a dipole

- There are numerous variations on a dipole such as an off-center fed (OCF) dipole, a folded dipole, an inverted V, a sloper, and the G5RV antenna
- Some of these can work on multiple bands with an external tuner or one built into a radio

- While SWR is not the only issue for good signals, tuners help match impedance levels to ones acceptable to the modern electronics in rigs
- If you have the room to go up high, say with a tall tree, you can even make a vertical dipole with some interesting radiation properties
- If possible the feedpoint (where the coax meets the antenna) should be approximately ½ wavelength above ground

Loops

- Loop antennas are a great option if you have the room
- A loop is a full-wavelength antenna shaped like a square (quad loop), a rectangle, a triangle (delta), or a circle (hardest to support)
- My first homemade antenna was a vertical delta loop for 20 meters; approx. 23’ per side with the feedpoint up about 32 feet
- If you have the room you could string the antenna up horizontally between three or four trees or other supports and feed it anywhere that was convenient and you would have a good antenna with 3db gain
- Loops are forgiving in that they don’t have to be perfect squares or rectangles or triangles. Get it as close as you can and then don’t worry about it
- Formula for a loop is 1005/frequency in MHz = length as a starting point; leave a little extra length and fold back or trim as needed

¼ wavelength Vertical

- A ¼ wavelength vertical antenna is basically a dipole turned on its side, electrically at least, with some tricks to shorten the actual size
- Remember our dipole is 2 ¼ wavelength arms cut to equal lengths; a ¼ wavelength dipole is like taking one arm and hanging it vertically, with the other half turned into 4 or more wires running outward from the base to simulate the other half
- What you are doing by using these radials is creating the second half of the conducting antenna element
- The feedpoint is just like a dipole except shield of the coax is connect to all the radials and the center coax wire connects to the vertical element
- Advantages are more antenna in a smaller space; good take-off angles for distance work; usually only needs one overhead support
- Disadvantages are needs room for radials; may not work close in depending on the band; usually picks up more noise from surroundings