Grounding Q&A

Roy Lewallen, W7EL, ARRL Technical Adviser replies to some questions posted on a newsgroup.

Q1. How important is a ground? Most people say that grounding is all-important, but I have had a few people tell me that grounds aren't necessary.

A1. Grounds fulfill three distinct functions. ***The best ground for one function isn't necessarily the best for another.*** **The three are:**

a. **Electrical Safety ground**. This protects you from a shock hazard if one of the mains or high voltage power supply wires contacts the chassis due to some kind of fault. The requirements for this ground are spelled out in your state's electrical code. I believe that most states adopt the National Electrical Code (NEC). The safety ground conductor in your wall sockets should be connected to ground according to this code, and **your rig's chassis should be connected to the safety ground.**

b. **Lightning ground.** The requirements for a ground for lightning protection are much more stringent than for a electrical safety ground. The topic has been discussed in this group many times, and there are numerous resources available for learning how to make a ground system for lightning protection.

c. **RF ground**. **This is required only for certain types of antennas, which are those that require current flow to ground to complete the antenna circuit. An example is a quarter-wave vertical**. One wire of the feedline connects to the base of the antenna, and the other connects to ground. The connection to ground has to have a low RF resistance, or you'll expend too much of your power heating the ground. A few radial wires will provide a moderately low loss connection. A ground rod will help a little, but the RF resistance will be high, resulting in quite a bit of loss. Chapter 8 of the ARRL Antenna Book shows the approximate trade between resistance and number of radials. If your antenna is much shorter than ¼ wavelength, you'll need many, many radials to get reasonable efficiency. If it's longer, you can get by with fewer. A ½ wavelength base-fed vertical needs only a very modest ground, and a ground rod is adequate. The requirements for various other end-fed antennas depend on their length**. If you use a "complete" antenna like a Basic Hertz (dipole) or a ground plane Marconi (that is, one that doesn't require your feedline to connect to ground), you don't need a RF ground, as long as you keep common-mode currents off your feedline. A "current" or "choke" balun is most commonly used for this.**

Q2. What are the ground / counterpoise alternatives to driving an 8-foot metal pole into the ground? I live in an apartment, and I highly doubt I can do this.

A2. Shallow-buried radial wires are the best. Connection to other conductors just under the surface, like a metal water pipe, is next. These are for the RF ground described above.

Q3. I have heard that balanced antennas don't require grounds. How do I get a balanced antenna?

A3. See RF ground, above.

Q4. How do mobile HF operators get RF grounds? For obvious reasons, the 8-foot buried pole won't work.

A4. In a typical HF setup, the car is capacitively coupled to the ground, so the antenna is something sort of like a cross between a lopsided vertical dipole (with the whip being one side and the car the other) and a vertical with elevated radial system.