ham radio TECHNIQUES

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the "radio ground" on 160 meters

My good friend Stew Perry, W1BB, is an avid 160-meter operator. He once told me that a fine "top-band" compromise antenna for hams with little space was an extended Marconi working against a good ground system. Taking his advice, I put up a 165-foot, series-tuned long wire (resonant at 1500 kHz) working against ground (**fig. 1**).

The ground consisted of the cold water copper pipes in the house, plus two ground rods — one at each end of the house — and a single quarter-wave radial wire running through the bushes about 2 feet above the ground.

This antenna worked quite well. However, when I went on 160 the ceiling light in the family room lit up! Obviously, the rf was getting into the house wiring somehow.

Using an MFJ-206 Antenna Current Probe, tuned to 160 meters, I started "sniffing" the house wiring for rf energy. Aha! I could put the transmitter on low power, lock the key, walk through the house with the probe, and actually trace the electric wires hidden in the walls. The house's whole electrical system was "hot" with rf.

My first thought was that the wiring was picking up induced rf energy merely by being in the near field of the antenna. But the amount of rf measured seemed too high, considering the physical separation of the Marconi antenna from the house. If this was not the path, what was?

The probe indicated that the power cable to the transceiver was full of rf energy. Most confusing. The rig actually had two grounds on it, didn't it? They were the radio ground system I installed, plus the neutral and ground conductors of the power line (**fig. 2**). A little thought revealed the problem.

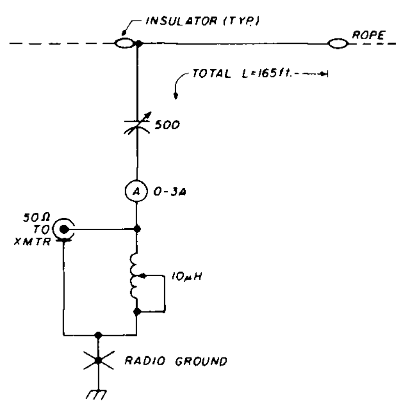

fig. 1. The series-tuned Marconi for 160 meters depends on a good radio ground to function properly. Do not let the power distribution ground get mixed up with the radio ground.

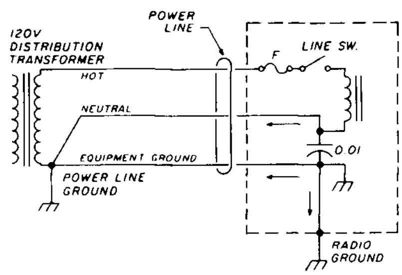

fig. 2. RF ground currents reach earth via the equipment power line as well as by the radio ground (arrows). RF and radio grounds should be decoupled by placing an rf choke in the power line.

separating the radio and electrical grounds

Figure 2 shows that two ground points exist: the intentional radio ground at the equipment, and the electrical ground at the power distribution transformer. The latter serves as a radio ground, as rf ground currents in the antenna circuit return via both paths. The unwanted path through the power cable is closely coupled to the other power conductors and feeds rf energy into them. And, if the power wiring has appreciable impedance at 160 meters, any rf fed into the power line can wander into some very unlikely places.

My solution was to wind the line cord of the transceiver around a ferrite rod (Amidon R-33-050-750), 7-1/2 inches long, and 1/2 inch in diameter. This was held in place by two plastic cable wraps. The rf antenna current immediately increased 30 percent (!) after the line choke was installed. Encouraged by this success, I took an 8-foot extension cord, wrapped it around a second ferrite rod, and placed it in series with the first line choke. This increased the antenna current an additional 5 percent and the family room light did not go on when I hit the key.

I "sniffed" the house wiring with the probe again. There was still a little rf present, but it was greatly reduced. It looked as if the problem was solved.

problems with a linear amplifier

Now that everything had cooled off, I decided to put my 160-meter, homemade linear amplifier on the air. It uses a single 3-500Z and runs about 1-kW PEP input.

As I fired it up, a loud cry came from the other end of the house. The family room lights magically turned themselves on, along with the light in the entry hall!

Since I had used up all my ferrite rods, I found a fine industrial rf filter for the 240-volt line in the junk box. It was a well-known brand built in a nice plastic box with heavy conductors on each end (**fig. 3**). Unfortunately, placing it in the power line to the amplifier made no difference in the amount of rf in the power line.

It seemed that the impedance of the power line neutral wire was sufficiently high at 160 meters to allow the neutral to rise above rf ground at the filter. If this guess was correct, the capacitors in the filter served merely to bypass the rf around the line chokes.

Grounding the common point of the capacitors to the radio ground at the amplifier helped but did not solve the problem. Now the amplifier had a radio ground point, plus two power line ground points: one at the distribution transformer and a second at the transmitter radio ground. This complex grounding situation left me uneasy, so I tossed out the 240-volt line filter and wrapped the power cord to the amplifier around two ferrite rods held together with plastic tape. (I used two rods because the amplifier power cable was heavy and difficult to wrap around a single rod.)

I was happy to note that the lights no longer blinked as I keyed the amplifier. All was as it should be. Thus I learned that when a Marconi antenna is used, the ground system may be more complex than it looks. It is important to decouple the power line

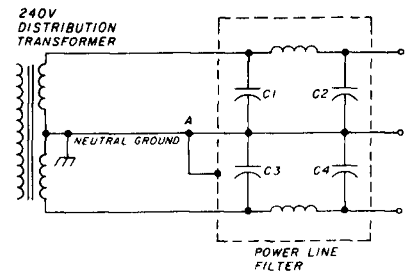

fig. 3A. Typical power line filter. If a metal box is used, it is grounded to neutral wire.

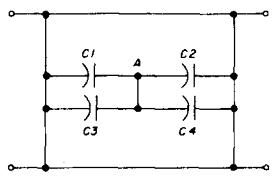

fig. 3B. If rf impedance of power line is high at the operating frequency, the ground return point A is not at ground potential and line capacitors act as bypasses around the line chokes.

from the rf ground system, and the easiest way to do this is to wrap the power cable around a ferrite rod. The old-style line filter made up of inductors and capacitors just doesn't do the job if the neutral line is used as the filter return ground point.

a two-band dipole antenna

Much is written about two-band antenna designs using tuned traps in the radiating element. A different approach is shown (**fig. 4**) in a design by Ron May, VK1PM.

This dipole covers the 80 and 40-meter bands. On 40 meters, the center section of the antenna acts as a folded dipole with a feedpoint impedance of about 300 ohms. The end sections, each a quarter wavelength long, are decoupled from the antenna and act as linear traps. On 80 meters, the full length of the antenna forms a half-wave element, fed with a T-match to the 300-ohm feedpoint. A 300-ohm TV-type feedline, with a 6:1 balun at the end, is used to match a nominal 50-ohm feedpoint (Palomar PB-6 balun). A coax line runs from the balun to the station. Overseas Amateurs using 75-ohm coax can use a 4:1 balun.

The idea can be applied to any two harmonically related bands, such as 40/20, or 20/10 meters.

HB9ADQ delta loop for 7/14/21/28 MHz

The delta loop shown in **fig. 5** can operate on four bands. Maximum current is in the horizontal wire for best low angle radiation. The loop can be slung between two trees for ease of installation. Maximum radiation is at right angles to the plane of the loop (into and out of the page).

The loop is fed with a two-wire transmission line. The original design called for a 600-ohm line, which could be made up easily by any old-timer who has had experience building a Zepp antenna. Modern substitutes are the Saxton Products Corp. 1562 insulated open wire line (using a polyethylene web) or the 2500 open-air line. The length of the line is adjusted for minimum SWR on the coax feedline. When the 600-ohm line is used, a 20-pF capacitor is connected across the feedpoint.

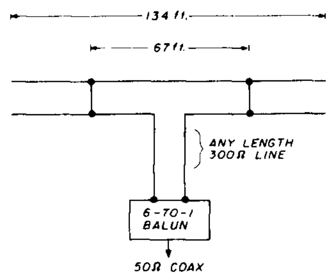

fig. 4. The 80/40 meter dipole of VK1PM is made of 300-ohm twin lead, as is the feeder. Jumpers between the two conductors are placed as shown. The end wires of the dipole are left open.

The open wire line can be extended to reach the station where it is fed with an antenna tuner that provides balanced output in the range of 100 to 600 ohms.

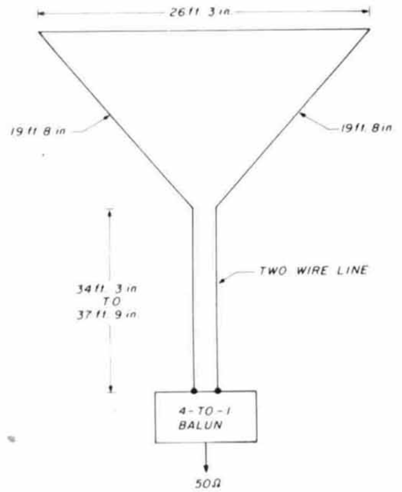

fig. 5. Four-band loop for 7/14/21/28 MHz. Balanced feedline and balun provide match to 50-ohm coax. Adjust length of two-wire line for lowest SWR on coax.

The loop need not be in the vertical plane. It can be laid on the side or at a 45 degree angle and still do the job.

ham radio

✓ 249

✓ 248