Doug DeMaw

Reduce QRN with an On-Ground Receiving Antenna

Does man-made noise in your neighborhood wipe out reception when you monitor the medium- and shortwave bands? This problem is a plague for many listeners who live in urban areas. It can also affect those of us who dwell in rural settings. Such items as electric motors, electric fences, noisy power lines and all manner of household appliances can spoil reception by covering up weak signals with hash and buzz.

Ordinary antennas that are high above ground can seldom reject this unwanted local noise. We can combat neighborhood QRN by installing antennas that are laid on the ground. If the noise reduction is not complete, we may often reduce it to an acceptable level with on-ground antennas.

Why Do These Antennas Help?

The intensity of man-made noise is usually maximum when the receiving antenna is aloft and close to the noise source, such as power lines. When the antenna is close to ground it is often out of the most intense part of the noise field, and hence we can enjoy quieter reception.

Also, most man-made noise is vertically polarized. This means that the worst receiving antenna you can use (relative to noise pickup) is one that is vertically polarized. A horizontal antenna discriminates against much of this raucous noise. A horizontally polarized antenna that is near ground or on the ground may not respond to the QRN, whereas a vertical antenna may pick up so much noise that signals can't be copied.

Practically all electrical conductors radiate noise. This includes your house wiring, the drop lines from the power source and even the phone lines. The source of the noise may be a block or two away from your home, but the noise pulses are carried on the phone or power lines to your area. They are radiated along the way to cause interference. This is similar to using a transmitter to supply RF power to a transmitting antenna.

The logical method for suppressing noise is to treat it at the source. AC line filters, for example, can be installed close to electrical motors that cause QRN. The power company should be consulted if you suspect a noisy transformer or insulators in your neighborhood. Most power companies are cooperative when you ask for help.

TV receivers often radiate a buzzy signal that occurs every 15.75 kHz across the tuning range of your receiver. This is the energy from the 15.750 kHz horizontal oscillator. This circuit produces rich harmonics that occur every 15.75 kHz in the MF and HF bands. The problem is especially troublesome from LF through the lower HF spectrum (100 kHz to, say, 4 MHz).

The TV QRN can usually be cured at the TV set by installing an ac-line filter and grounding it to a cold-water pipe or earth ground. A high-pass filter in the TV receiver antenna feeder also helps.

Placement of Your Antenna

When you erect your receiving antenna, try to keep it as far away from phone and power lines as practicable. In a like manner, keep it away from the house and its internal wiring. These are all prime noise radiators. Your antenna should be at a right angle to the power line or drop line. Never route your antenna under or over a power line. This can be lethal!

A center-fed dipole with balanced feeders (300-ohm ribbon or 450-ohm ladder line), if used with an antenna tuner, also helps to reduce noise. The feeder is balanced, and this prevents the feed line from picking up noise -- especially vertically polarized noise energy. The antenna tuner is used in the radio room, and it is adjusted for maximum signal strength for the medium- or shortwave band of your choice.

Examples of homemade antenna tuners are provided in *The ARRL Antenna Book* and in *The W1FB Antenna Notebook*. Both of these publications are available from the ARRL, Inc., Newington, CT 06111.

Some On-ground Antennas You Can Try

The least complicated on-ground antenna consists of a long random-length wire that is laid on the ground. The longer the wire the better. Try to install it in a straight line. If you can't do this, bend it to fit within your property area. A small antenna tuner will be helpful at the receiver in order to tune the wire to resonance at the receive frequency. It does not matter what wire size you use, nor should you be concerned whether or not the wire has thick insulation. This simple antenna may solve your noise problem.

A more effective low-noise receiving antenna is known as the coaxial "snake." Figure 1 shows the details of this unusual antenna. It is made from a random length of RG-58 or RG-59 coaxial line. The far end is short-circuited. Connect the inner conductor to the shield braid and seal it against the weather.

The receiver end of coaxial cable is not shorted. Rather, the center conductor is hooked to an antenna tuner or the receiver antenna jack, and the shield braid is left floating (no electrical connection to anything). This has been a very effective

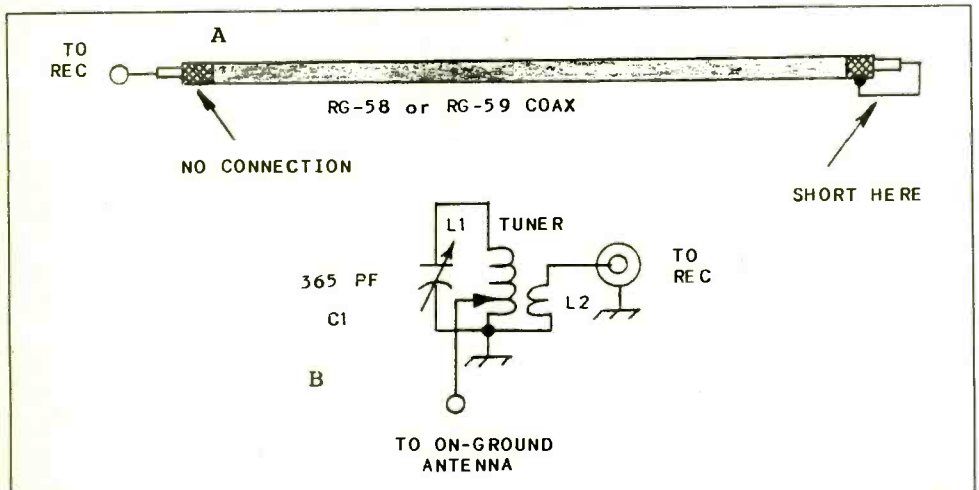

Figure 1 -- Illustration of a snake antenna for low-noise short-wave reception (A). The coaxial cable may be any length, but the longer the better. Use at least 75-100 feet of cable or greater for best results. Illustration B shows how an antenna tuner is arranged for use with wire or snake antennas. The antenna is tapped up and down on L1 to obtain maximum signal while adjusting C1. L2 consists of 3-6 turns of insulated wire over the grounded end of L1. The inductance of L1 is chosen to provide resonance with C1 at the receive frequency.

noise-free antenna for a number of users. I have used it successfully for Amateur Radio low-noise reception on 160 meters.

Here again, the longer the snake antenna the greater the signal pickup. Do not expect any on-ground antenna to provide signals that are as strong as those from a normal above-ground antenna. You may have to advance the receiver audio-gain control to a higher setting in order to yield comfortable copy when using an on-ground antenna.

Signals can be made louder by installing a preamplifier between the receiver and the feed point of your on-ground antenna. Keep an eye out at radio flea markets for one of the old RME DB-22A or Millen R-9er preamps. Ameco also built preamps that are suitable for this purpose.

Loop Antennas

Loop antennas (large or small) are inherently quiet receiving antennas. This is because they are closed-circuit antennas. Above-ground full-wave loops are much quieter with regard to local manmade noise than are dipoles or verticals.

A loop can be any convenient shape, but a circular loop has the most gain. Next comes the square loop and then the triangular one. You can determine the overall wire length from L (ft) = 1005/f(MHz). The loop has a feed impedance of roughly 115 ohms, but you may feed it with RG-59 (75-ohm coax) and have suitable results for receiving.

The loop can be located high above ground and it may be erected vertically or horizontally. I use a square loop that is 50 feet above ground on one side and only six feet above ground (tilted) at the far side. It has an overall length of 529 feet. I feed it with 450-ohm ladder line, a 4:1 balun transformer and 10 feet of 50-ohm coaxial cable into an antenna tuner.

It works very well from 1.8 to 30 MHz. It is the quietest receiving antenna I have used to date, and I have a 4800-V power line on my property that is only 100 feet away from my loop.

Figure 2 shows how a loop may be installed. It can be any convenient overall size -- the larger the better -- if you use a tuner with it. Small receiving loops work well also, but they are not very sensitive. A preamp is generally required with small loops (less than 1/10th wavelength, overall). *The ARRL Antenna Book* describes small loops in detail.

You may also lay your loop on the ground for low-noise reception. Use insulated wire if you do this. I like to use no. 14 house wiring with vinyl plastic insulation. Ordinary insulated hookup wire may also be used.

Closing Comments

The name of the game is "experimentation." Try various on-ground antennas and determine which one works best for you at your location. Small receiving loops with preamplifiers are excellent for indoor use. This should appeal to condo dwellers and those of you who can't have an outdoor antenna. An on-ground or near-ground antenna can often be out of the major field of the radiated QRN, so it's worth a try. The simplest of antennas may end your noise problem forever.

mt

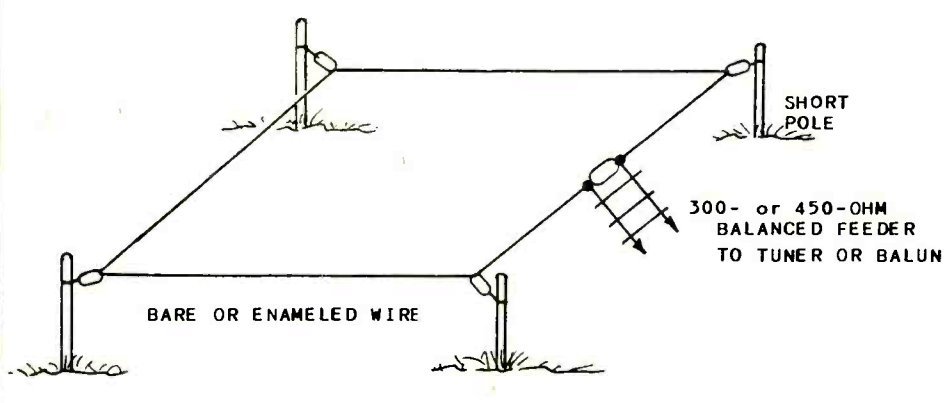

Figure 2 -- Details for a loop antenna that is close to the ground. It can be supported on short masts that are only a few feet high (see text). The balanced feeder may be replaced by coaxial cable without significant impairment of the performance. A 4:1 balun transformer may be installed at the feed point to allow the use of RG-58 coaxial cable between the loop and the receiver.