

Dealing with Man-Made Noise

Short-wave listeners and radio amateurs contend with a host of man-made electrical noises when trying to sift weak signals out of the QRN (man-made and atmospheric noise). The problem is usually worse when the SWL lives in an urban area where power lines and appliances spew out electrical pulses that spoil reception. This month we will explore various ways to reduce or eliminate electrical noise that can enter our receivers via the antenna and ac power service.

Antennas and their Placement

Power lines and internal house wiring are transmitting antennas for man-made noise pulses such as those from leaky pole insulators and overload circuit breakers. The ac wiring inside the walls of our homes radiates pulse noise from such appliances as food blenders, vacuum cleaners, furnace motors, fish-tank thermostats, electric blankets, and such. Our antennas and their feed lines pick up these unwanted radiations and allow them to enter our receivers. I have seen ambient QRN levels as great as 20 dB over S9 at some home locations.

The physical placement of the short-wave antenna is critical in most urban settings. It should be as far away from power lines, service drop lines, and telephone cables as possible. When the antenna must be relatively close to these radiating wires (never directly above or below power lines, for safety reasons), it should be erected at a right angle to the power line to minimize what is known as mutual coupling.

Whenever practicable, use a coaxial feed line between the antenna feed point and the house to discourage noise pickup on the feeder. Most man-made noise is vertically polarized and many feed lines are erected vertically, thereby making them especially receptive to the transfer of vertically polarized noise.

In this context, vertical antennas are especially prone to picking up man-made noise. Use a horizontal antenna whenever possible. Loop antennas are the quietest of the receiving antennas and discriminate rather well against man-made noise. For example, my 160-meter full-wave horizontal loop antenna is only 100 feet from the 10-kV power line that passes through my farm. I do not detect line noise on any MF or HF band. But, when I use my 160-meter inverted-V dipole (same

distance from the high line), the S meter registers a steady S8 noise level.

Dealing with TV "Birdies"

TV receivers emit numerous spurious signals that can interfere with reception, especially from the standard BC band through 4 MHz. Particularly troublesome are the birdies from the 15.750 kHz horizontal oscillator that appear every 15.750 kHz across the receiver tuning range. These manifest themselves as strong, raucous buzzing noises that shift in tone as the video level in the picture changes. Generally, the ac lines in the house, plus the TV feed line, radiate this energy, and it is picked up by our antennas.

The cure for this common annoyance must be handled directly at the TV receiver. A high-pass filter can be installed where the TV antenna or cable service attaches to the TV set. This allows TV signals to pass, but blocks the passage of low-frequency energy that can be radiated by the TV feeder and/or antenna. A "brute force" ac line filter (see Figure 1) should be added between the TV line cord and the wall outlet. The metal case of the filter needs to be attached to an earth ground in order for the filter to be effective.

In my home I use a filter between the hi-fi gear, VCR, and TV receiver. I can no longer tell when the TV set is operating because the crud from it can't enter the ac line and radiate

to my antennas. A secondary advantage of the brute-force filter is that my amateur radio signals no longer interfere with the TV receiver and hi-fi equipment.

Reducing Noise with Chokes

Electromagnetic impulses (EMI) can often be suppressed at their sources. This is the ideal approach to eliminating man-made noise—before it is allowed to radiate from the house wiring. Depending upon the severity or amplitude of the noise pulses, we can often suppress the interference at the source. Noisy brushes in electrical motors can be toned down by placing a 0.1µF capacitor between each brush terminal and the frame of the motor. The capacitor must be rated higher than the ac voltage that is present (1000-volt capacitors recommended).

Appliances which generate noise can frequently be quieted down by wrapping their ac cords around a ferrite rod (see Figure 2) and taping the winding to the rod. A 7-1/2 x 1/2 inch rod with a permeability of 850 (Amidon Assoc., Inc. no. 43 material rod) is okay. The line cord, when coiled, provides an inductance that acts as an RF choke. The ferrite rod increases the inductance substantially to make the choke more effective.

Large ferrite toroids may be used in a like manner when wound as shown in Figure 2. The toroids are less expensive than the rods

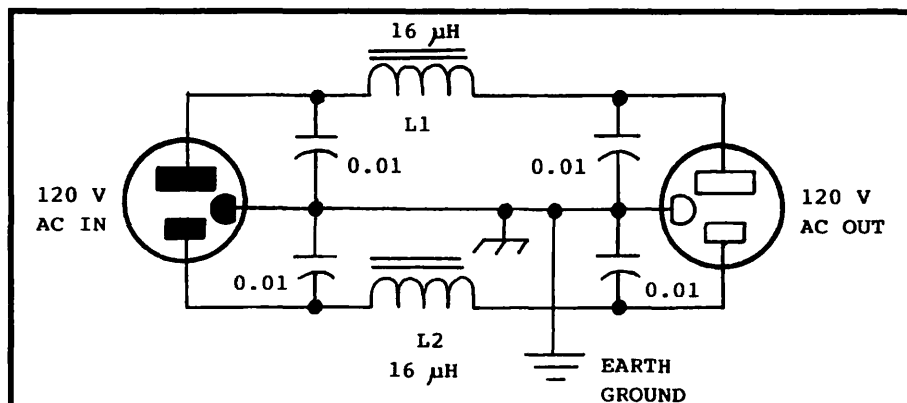


Figure 1: Schematic diagram of a brute-force line filter. Capacitors are 0.01µ at 1000 VDC. L1 and L2 have 16 turns of no. 14 enamel wire on Amidon FT-140-61 ferrite toroids. Wrap the cores with teflon pipe-joint tape (two layers) before winding the coils. You may add 150-volt MOVs (metal oxide varistor) from each side of the ac line to the filter chassis, and one MOV across the ac line, to provide spike protection for your TV and hi-fi gear.

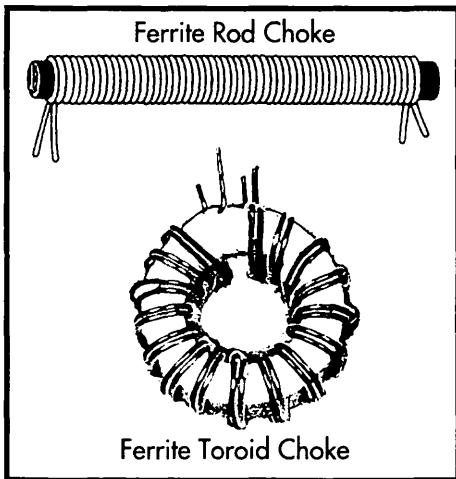


Figure 2: Illustration of a ferrite rod (top) and a toroidal RF choke (bottom) that can be used to suppress noise pulses (see text). Insulated wire is required for both styles of choke.

and are more compact. A 2-1/2-inch ferrite toroid of no. 43 material is frequently used for this purpose.¹ These chokes permit the 120-volt ac current to flow, but they block the passage of noise pulses. All that is necessary when winding these chokes is to use as much of the ac cord as possible, thereby filling the core to capacity. The more inductance the better.

■ Dealing with Power Line QRN

Always call your power company and ask for help in curing a line-noise problem. They have special troubleshooters who are equipped with directional antennas and a mobile multifrequency receiver. These specialists can pinpoint the source of the noise, then have it corrected by a lineman. Do not thump the power poles with a sledge hammer, as some have done, in an effort to locate the noise source. A loose insulator could fall on you and cause bodily harm. The thumping could also disrupt the power service in your neighborhood. The power company folks take a very dim view (pun not intended!) of such actions.

You may, however, be of service in locating the noisy pole by tracking the noise with a transistor AM radio and noting where it peaks. This will help the troubleshooter to locate the noise source more quickly.

■ Station Ground Important

Unwanted noise can be eliminated more effectively if the station receiver is connected to a quality earth ground. The short connecting lead between the receiver and the ground terminal the better. This minimizes inductance in the lead, the former

of which introduces unwanted ac/RF resistance and degrades the quality of the grounding. A wide connecting strap is best, such as the shield braid from RG-8 coax cable, in order to further minimize inductance.

The cold-water pipe system can serve as a suitable grounding point if copper plumbing exists. Four 8-foot ground rods driven into the soil near the radio room are effective also. They should be spaced three feet apart, in a square, and joined by RG-8 shield braid or some other wide conductor.

■ Closing Comments

The process of eliminating man-made noise is anything but casual. There may be two or more "noise generators" in your home, and this will require the process of elimination. Furthermore, your neighbor may have an appliance or furnace that is causing pulse noise. This requires a tactful approach on your part if you want him or her to allow you to install a noise suppressor in his home.

Note

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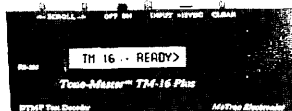
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