Curing Radio Noise

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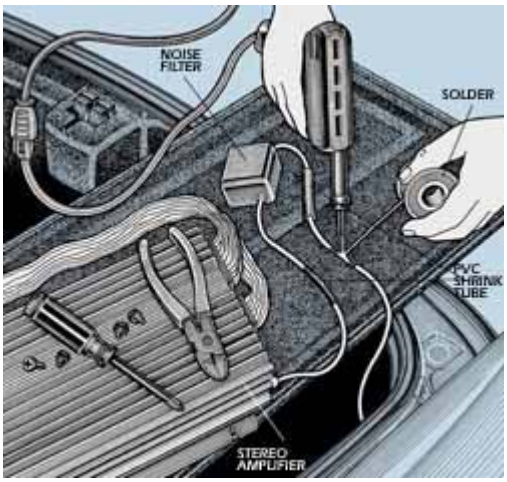
You're looking forward to the chance to listen to the ballgame, having just dropped your purple-haired teenage daughter off at her first semester at college. A lot of ballgames, actually, now that you don't have to listen to her headbanger music, with its shrieking vocals and droning guitars. But instead of the first inning, you hear what sounds like some awful guitar note--and it changes pitch as you speed up and slow down, turning to a maniacal rhythmic clicking as you wait for a traffic light to change. There's no tape in the player. What you have here is radio frequency interference (RFI).



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This stereo power amp is getting an in-line noise filter added to its power lead. Solder and PVC shrink tube make for a noisefree, high-current splice.

Finding The Source

There are three classes of RF noise--constant, intermittent and engine-speed following. Our hapless father's problem was in the latter category--his noise varied up and down in pitch and volume as his engine sped up and slowed down. This type of noise is caused by something that varies its speed with the engine. Likely culprits include the ignition, the alternator or even a fuel injector. Constant-speed noises are usually caused by an electric motor--most likely the electric fuel pump found in the tank of most modern vehicles which runs at a constant speed anytime the engine is running. An electric fan motor will also run at a constant speed--until you change the fan setting or turn it off. Intermittent noises are easier to associate with a source, such as an electric seat adjuster or a power-window motor. In other words, even though the noise comes from a radio speaker, it may be caused by any manner of device anywhere on your vehicle.

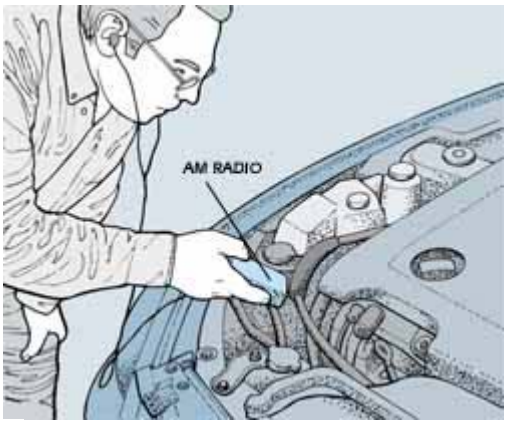
Constants

The one motor that's guaranteed to be on whenever the car is

running is the fuel pump's, and unfortunately it's usually buried inside the fuel tank. Here's one sure way to tell. Turn the key to the Run position without starting the car. The pump should run for 2 or 3 seconds. Then, when the computer senses that the engine isn't running, it will shut off the pump to prevent spilling fuel and draining the battery. Other almost-constants are heater fans, wipers and electric radiator-cooling fans.

Engine-Speed Noises
Candidates here include the alternator/voltage regulator, a faulty fuel injector and the ignition system.

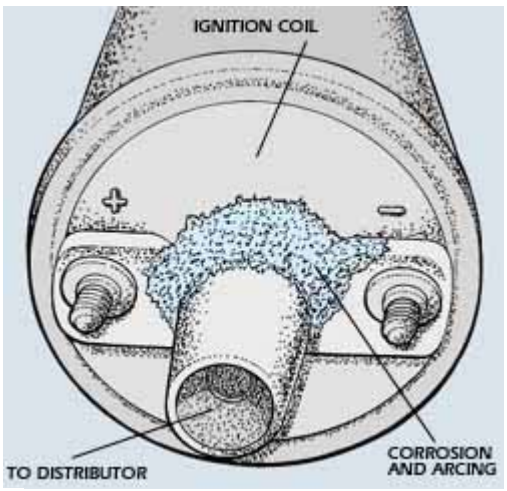
Geiger Counter Test
Here's our favorite low-tech tool for hunting down and killing wild noises--a cheap AM radio. Tune it to an empty channel around 1400 kHz, crank up the volume in your headset, and use the radio to sniff out the noise. These cheapo radios use a ferrite-bar antenna that has good reception along its side, but poor reception along its length. Once you find the noise within a few feet, turn the radio 90° to minimize the noise. The top of the radio will point at the source like a gunsight.



A cheap AM radio makes a good Geiger counter-style device for hunting down RFI. Here, we're looking for an alternator with a bad diode. Mind your fingers.

Making Sure
Find some way of disconnecting the source of the RFI and check to see if the noise ceases. This will be difficult in the case of the fuel pump or ignition, but you can pull the belt off the alternator. (Don't disconnect the alternator electrically--the back EMF [voltage] may smoke the diodes.) If you think it's a fuel injector, try disconnecting it from the harness.

Plugged Up
Virtually all cars today use resistor-type plug cables if they use spark plug wires at all. If your vehicle is more than a few years old, degraded cables may be the source of the problem. Remove and replace the cables one at a time, clean them of grease and dirt with mild detergent, and check the connections to the ends. Now get out your ohmmeter and measure the cables' resistance along their length--they should measure approximately 10,000 ohms per foot. Resistance in the megohms or single digits may well be the source of not only your RFI, but a nagging misfire. Replace any suspect wires with factory or high-quality aftermarket wires. Check the plugs, coil and any distributor for evidence of carbon tracking or arcing as well.

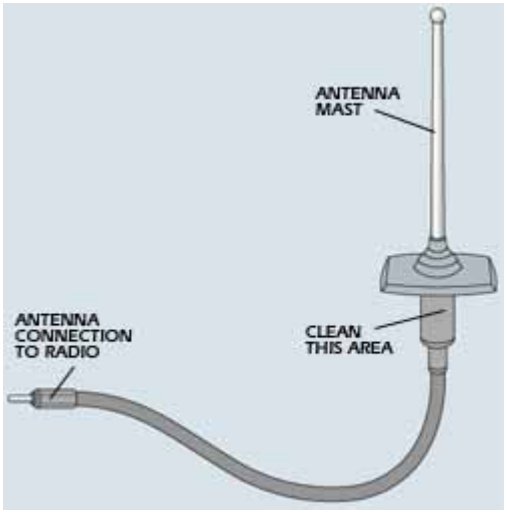


Carbon tracking in the ignition system is a noise source.

Intermittents
These noises are easy to associate with the source. Any RFI that sounds only when one window is going up or down will be easy to blame on the window motor.

Which Way Home?

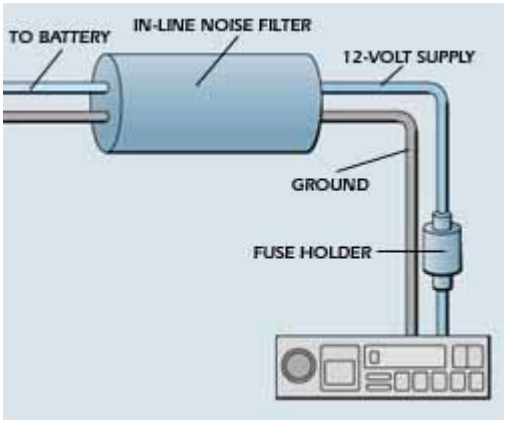
Now that you've pinpointed the noise, what can be done about it? It depends on whether your RFI source is broadcasting or cabling the noise to your radio. This matters because the cure is different. Try pulling your radio's antenna lead out. If the noise goes away or is substantially quieter, it's coming in through the antenna. If the noise stays the same or gets louder, it's coming in along the 12-volt power cables.



Be sure both ends of the antenna are properly grounded and corrosion-free.

Try removing the antenna from the fender and cleaning the fender sheetmetal and the antenna mount. Clean down to the shiny metal, using sandpaper to remove any corrosion. Smear the area lightly with Vaseline or dielectric grease, and reattach. This will provide a proper ground at the antenna. Be sure the radio chassis is properly grounded to the car body. Aftermarket installations are more likely to have a radio that's grounded only by the shield in the antenna co-ax. A simple wire added between the component's metal case and the car's sheetmetal will often eliminate any RFI.

There are two ways to reduce noise: by using an inductance in a power cable to keep the high-frequency noise from traveling, or by using a capacitor to shunt it off to ground harmlessly. Sometimes both ploys are necessary. In fact, most of the electrical motors in your vehicle use some sort of capacitor for noise suppression. Any good car stereo shop or Radio Shack will have the parts you need. The noise filter we show here is one example. It has a large inductance in series with the 12-volt power cable to a buzzing aftermarket stereo, as well as a couple of small capacitors in parallel. The inductance prevents noise from entering the amplifier through the power leads, and the capacitors bypass any leftover noise.



This RFI filter goes in line with both power and ground connections.

Electric motors, as we mentioned, often have a capacitor in parallel with the armature for the purpose of reducing RFI. If the motor's brushes are worn and sparking, the noise may overpower the capacitor's filtering. Most automotive electric motors are not serviceable, and they'll have to be replaced if a simple filter doesn't quiet them.

As we said earlier, fuel pumps are difficult to get to--in most modern cars they are mounted inside the fuel tank. To access the pump, or even the wiring that connects to the pump, it's necessary to drop the tank out from under the car, which is a lengthy, messy and potentially dangerous job ("Replacing Your In-Tank Fuel Pump," Dec. 1997, page 136). On a very few cars, you can access the fuel pump from under the rear seat (check the service manual). Be careful if you attempt to add a filter to the external tank wiring, as the filter itself is large and bulky. You'll need to securely mount

it to the top of the tank to keep it from breaking loose over potholes and bumps.

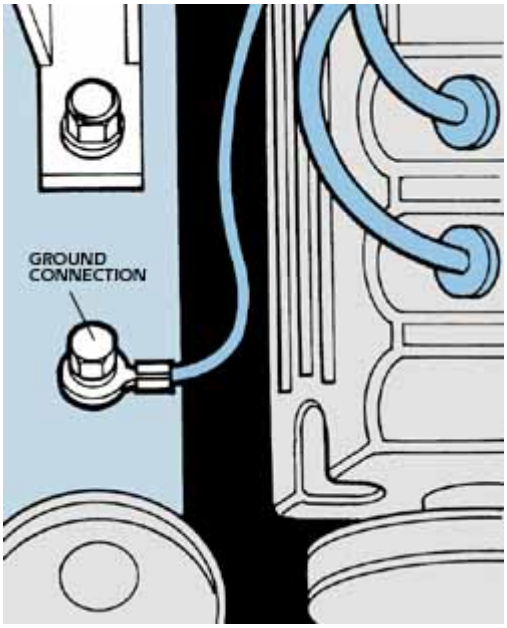
Soldering

One of the most common sources of RFI is poor connections. If you find a poor, corroded connection or a loose electrical joint, don't just crimp the connector tighter onto the wire. Remove the connector and clean the wire. It may be necessary to trim the wire back a few inches to get past any corrosion inside the insulation. There's only one acceptable technique for splicing wires if you're having RFI issues--and the common automotive-style crimp connector isn't it. You'll need a good, clean, high-wattage soldering pencil or gun, rosin-core 60-40 solder and PVC shrink tube.

Start by using proper, stranded automotive-grade wire. Unstranded household wire will fracture and eventually break. Start with wire of at least the same diameter as the wire you're adding to. If you're adding a power cable, a ground connection or a filter, use 12-ga. wire for ultralow resistance. Strip and pre-tin both wires to allow you to twist them together for a sound mechanical connection. Slip a length of PVC shrink tube over one wire, twist together, and solder. Use enough heat and a sparing amount of solder to make a shiny, wet-looking solder joint. Allow the joint to cool without disturbing it. This will prevent the liquid solder from crystallizing as it cools.

Cover the joint with the PVC tubing and shrink the tubing with a heat gun, or carefully with your lighter if you must. If the solder joint you're making will be exposed to the elements, use shrink tube that has waterproofing adhesive inside it to keep corrosion from creeping into your fresh joint. Silicone seal or liquid electrical tape is a good alternative.

Dress any new wires carefully to prevent chafing on corners. Support any components you've added. Remember that even a foot or two of heavy-gauge wire can flex itself to the breaking point if it's unsupported.



Check grounding points by loosening, cleaning and tightening.

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