

**Ham 55 – What Is That Noise?**  
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1. *Noise* is any undesirable disturbance. *Signal* is what we want to receive. *Signal-to-Noise* ratio (S/R) is one comparison of the signal to the noise level. If noise is too high, we cannot receive or transmit. That is a pretty simple concept.
2. *Good news:* you do not have to know or do all this. *Bad news:* you do have to learn and do the part that impacts your station. When there is an issue, resolution can be tedious to difficult. Fortunately the cost to correct is generally very low and the correction is usually simple.
3. Noise sources are *atmospheric* or *man-made*. Atmospheric tends to be erratic, while man-made tends to have a repetitious pattern. Atmospheric includes thunderstorms, geomagnetic (aurora), and solar. At this time, solar storms are disrupting satellites, cellular, and causing static on other bands. Line-of-Sight FM is not seriously impacted, but Not-Line-Of-Sight (NLOS) encounters more erratic paths and static. Although anathema for most communications, hams on HF use the noise events to reflect signals.
4. Made-made sources are more of a problem in more-affluent neighborhoods, because of electrical devices. Noise sources we have encountered include wall-wart power, switch-mode-power on everything, electronics, LED lights, Wi-Fi, alarm systems, key fobs, strip heat, microwaves, garage and gate openers, variable speed controls like air conditioner, dishwasher motor, computer, solar panels, loose connections, corrosion, dissimilar metals, and spurious emissions. Any metal that moves, will cause electromagnetic noise. Ignore the equation. It is so the nerds feel good.
5. Russ (N5IRU) recommends this practice. "I would turn off all circuit breakers at the main circuit breaker panel. Transmit and receive on your radio to see if the interference is gone. If you still have interference then you can turn the circuit breakers back on. If your interference has disappeared or at least diminished then you have something in the house causing at least part of your interference. Now you can turn on one circuit breaker at a time and check for interference. Using this method you might be able to narrow it down to a circuit (or more). Now you can check everything on this suspect circuit. Unplug everything possible. Plug items in one at a time and check."  $E = \Delta (\Phi q) / t$
6. Besides neighbors, external noise sources include cell towers, radio towers, commercial equipment, or utilities. Many utilities have an engineer to help resolve their issues, but you must have the issue well defined in terms of frequency, times of occurrence, and what you have done that points to them.
7. Our area has a diverse set of issues which cause us problems, that may not exist in other locations.
  - a. *Building disturbances* come from construction material, construction practices, and size including height.
  - b. *Soil type* may be rocky, sandy river, or dry, all of which changes radio frequency transmissions.
  - c. *Terrain* with many adjoining hills puts dirt in the path, making different routes, causing different times and noise.
8. Often, there is more than one type problem.
  - a. *Intermittent:* The operation may be continuous or sporadic.
  - b. *Directional:* The noise may be from one direction, where turning the problem or your equipment may change it.
  - c. *Remote:* The source may be your local equipment or external.
9. Many of the issues did not exist 10-years ago. This is the new ham world. Ham practices of 5-years ago likely will not fix the problems. Web-sites are usually opinion and seldom physics. Recommendations will likely change over time..
10. The process of finding the source is the real challenge and tedious. Use a portable AM radio tuned off any station as a first pass detector. It may not be same frequency, but noise is often broadband. Look. Think. Hypothesize.
11. There are three routes of noise into a station: Through the air, rf path including coax, and power path.
12. Fortunately, the solutions are the same for every issue. So, a properly installed station may not have or notice issues.
  - a. *Eliminate:* Replace, remove, or move the offending source or your equipment. Radiation signal drops off with the square of distance. If you double the distance, the noise signal will be one-fourth.
  - b. *Block:* Ferrite cores increase impedance to high frequency on conductors, blocking noise from the transceiver.
  - c. *Divert:* Protectors and proper grounding gives a low impedance place for the noise to go.
13. What are station practices that resolve all these issues? Some may be avoided for a while, but these are the fix.
  - a. *Antenna:* A not-line-of-sight (NLOS) compensates for delay times from having multiple signal paths.
  - b. *Coax:* Use low loss to maintain signal. Avoid dissimilar metals to stop crackling. RG-213/U is preferred.
  - c. *Lightning protector:* These shunt atmospheric noise to ground.
  - d. *Radio:* A quality radio processes, filters, and shields the signal. Adequate power is required to increase the signal.
  - e. *Power Supply:* Switched-mode power not designed for ham is a major source of static.
  - f. *Ferrite beads:* Type-31 beads oppose noise. Put 3-5 on coax near the antenna. Run every wire through beads.
  - g. *Ground:* Connect all metal surfaces to the common point ground. Bond it to the earth.
14. Life is good. Enjoy!

