Tips for Reducing Noise on Your Ham Radio Receiver – Part 1

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A common complaint among HF operators is too much receiver noise. This can make it hard to understand desired signals. We would like to have as large a signal-to-noise ratio (SNR) as possible especially for SSB. CW and many digital modes (like FT8, RTTY, PSK31, etc.) are able to reliably receive signals even with a low to very low SNR. This is because the operator or software can focus on one or a few tones to decode the signals. Of course, CW is dependent on the operator's hearing ability while the others strictly depend on digital signal processing.

Every receiver will have a "noise floor". That is the lowest level of noise possible with that receiver. This noise floor is due to electronic and thermal conditions in the receiver itself and cannot be changed. Fortunately, the noise floor of modern receivers is so low that it would almost never be the cause of audible noise loud enough to interfere with HF reception.

Generally, there are two classes of external noise: man-made and atmospheric. Man-made noise has become a much bigger problem due to the large number of modern electronic devices in the typical home. The most common offenders are "wall warts" and other switch-mode power supplies, solar panel controllers, LED lighting, plasma TVs, direct-drive motors in washers and dryers, etc. Man-made noise can also be produced by arcing of electric utility lines. This is mainly due to poor or corroded connections or insulator breakdown. Solving electric utility noise is not discussed in this article other than to say it will require the cooperation of the utility provider and some are more willing to help than others.

Atmospheric noise is caused by primarily caused by lightning. When a thunderstorm is nearby, you distinctly hear the noise "crashes" created by each lightning strike. Due to the sensitivity of modern radios, if you have a decent antenna, lightning will be heard from thousands of miles away. These distant strikes blend together to result in a lower level, but more or less constant background noise or "static". Atmospheric noise is particularly problematic on the "low bands", that is 160M, 80M, 60M and 40M. Astronomical noise emanates from the Sun, Jupiter and the center of the Milky Way galaxy among other heavenly bodies. These types of noise are picked up on the antenna, and you will need to use good operating techniques and noise reduction as discussed below to reduce these noise sources.

The noise from the many possible man-made sources could be received by your antenna like atmospheric noise or picked up on the coax braid. The noise on the braid travels on the outside of the braid to your receiver. You can unscrew the ground ring from your antenna to radio connector (usually a PL-259 for HF radios) leaving the center pin in place. Note the noise level and then touch the ground ring to the radio jack and see if the noise increases. If so, you have noise on the outside of the coax shield. RF chokes (ferrites) can help reduce this noise from whatever

sources are causing it. Palomar Engineers is a great source for ferrites and data / information to use them properly.

If the noise is being received by your antenna, then more drastic measures are needed. One way to quickly determine how much noise is emitted from your home electronics is to operate your radio using a battery and note the noise level audibly and on the S-meter. Then turn off the main breaker in your home and without changing the radio settings, note the audible noise level and S-meter reading again. A drop in the noise and meter reading corresponds to the noise level produced by the electronics in your home at that time. If the noise level has become very low with the main breaker off, then you can turn breakers on one at a time to determine which circuit or circuits have noisy devices. For items like washers and dryers, this method is not appropriate, and you will need to run the appliance through all of its cycles to verify if it is a noise source. You could also use Tiny SA Ultra with the external antenna to try and pinpoint the culprit if it is not obvious.

If you can live without the offending device(s) or move it (them) further from the shack antenna that may solve the problem. If you (or your family) cannot do without the offending device, then ferrites placed on all cables to / from the device and on all cables to / from your radio may reduce or eliminate the noise.

One other solution to reduce all kinds of noise is to use a low-noise antenna. These antennas are typically on or close to the ground and used for receiving only. Loop on ground and Beverage antennas are typical of this type. Loop on ground are quite small and easily fabricated, but Beverage antennas require lots of room (1.5 to 2 wavelengths long is typical, so ~500-ft. for 80M) and a control scheme to take advantage of directionality. While these antennas are low-noise, they also have lower signal levels. I did not have much success trying a loop on ground antenna for 40M and 80M. The third type of low-noise antenna is the magnetic loop. These can be receive-only or also transmit. The transmitting ones are quite expensive. These loops typically have a narrow bandwidth and are directional. They are compact and can be setup in small spaces like an apartment balcony. I have had good success using a receive-only magnetic loop (see my previous articles on SDRs).

To reduce noise in your station, you should have a good grounding system. Many books have been written on this topic, so I can only cover the high-points in this article. A great book on this topic has been published by the ARRL. A good ground system should have a single-point ground. All equipment in the shack should be attached directly to a copper bar, tubing or plate. The copper bar or tubing is then attached to a buried vertical ground rod (8' – 10' copper-clad steel or galvanized). The ground should be as close to the shack as possible. The antenna feedlines should also be attached to this rod via good-quality (Alpha Delta, Polyphaser or Morgan Systems) lightning arrestors. A bare, buried copper wire should connect the utility ground rod to this single-point shack rod. All connections should be large gauge (6 AWG or larger) stranded copper wire or tinned copper braid (1/2" – 1"). I like to use solid wire for utility bonding as it is more robust for burial. All connections should be mechanical – no solder.

That's plenty of info to digest for this month. Next month, I will talk about operating your radio and possibly accessories for reduced noise.