How to Measure Antenna Noise Gain

Antenna noise gain measures how much band noise exceeds internal receiver noise. A transceiver typically has the option of using no preamp, plus a preamp and often preamp 2. When it is appropriate to use a preamp is easily determined by measuring Antenna Noise Gain. Initially this needs to be done with a meter, but once the operator becomes familiar with the concept, this can be quickly checked by ear.

The only test equipment needed is an analog AC voltmeter with a dB scale. This could be a 50 year old Triplett 630na or a Simpson 260 VOM. Hewlett Packard made many analog AC voltmeters that are available on eBay for less than $100. My favorite is an HP 400EL that is in this price range.

Attach your AC dB meter to your speaker or headphones output. (You also want to be able to hear the audio.) This measurement can be made in SSB or CW mode. The bandwidth of the filter doesn't matter because you are going to be comparing receiver noise to band noise. That said, start out with a 2.4 kHz bandwidth for now.

You also need a dummy load or a 50-ohm termination that could be attached to a receive-only antenna port if that option exists on your radio. The radio just needs to see 50 ohms for part of this measurement. The termination or dummy load could be on an external antenna switch like those from Alpha Delta.

With you voltmeter reading speaker or headphones level audio, switch to your dummy load or termination and adjust your AF gain so the dB meter reads -10 dB on receiver noise only. Next switch to your antenna and see how much the noise measured by your meter goes up. Start with no preamp, and then you can later measure with your preamps.

If the Antenna Noise Gain, tuned to a dead spot on the band (no signals), goes up 10 dB you don't need a preamp. If you Antenna Noise Gain only increases 3 dB, your receiver is contributing half the noise and the other half is band noise. That is not desirable. The absolute minimum Antenna Noise Gain that is acceptable is 6 dB, but you would prefer 8 to 10 dB. (15 or 20 dB is excessive, and will be discussed later.)

If you have a directional antenna, rotate it to the quietest direction and make your measurements at that azimuth. Let's assume your 10m Antenna Noise Gain is only 6 dB with no preamp, then make the same measurement with preamp 1. Note: You will likely have to reset your -10 dB reference level when making the measurement with a preamp.

If you actually have a 10 dB antenna noise gain with no preamp on the upper HF bands, no preamp is needed or desired. Note: Atmospheric band noise will change from day to day. If the band is really dead with not even FT8 signals audible (28.074 MHz USB on 10m), this is your worst-case band noise measurement. When the band is open, band noise goes up at least in some directions. My noisiest direction is typically southeast towards the Caribbean and my quietest direction is usually northwest to JA and Alaska. (My QTH is in Colorado.)

Most of the time, you will be interested in Antenna Noise Gain on the upper HF bands. You will be determining whether a preamp is recommended on a given band. Do not fall into the trap thinking that a preamp is always better than no preamp. It is not.

Now consider what is recommended on the lower HF bands when no preamp is needed. Example: Assuming you are listening on your transmit antenna, no preamp at night on 160, 80 or 40 meters is ever needed. Receivers are too sensitive on the low bands since all radios have enough sensitivity for 10 meters let alone 6 meters.

If you are using a non-SDR superhet radio, likely your S meter reads upscale at night on the lower HF bands. If the AGC is running on band noise, that is not an advantage. Many transceivers have 6, 12 and 18 dB attenuator options. Select an attenuator setting that has no S meter movement at all on band noise. Make your Antenna Noise Gain measurement with this setting and it very likely will be more than 10 dB.

In a noisy urban environment here is what was measured on 20 meters. 12 dB attenuation showed no S meter movement on an IC-7610, yet the Antenna Noise Gain was 18 dB. With 18 dB of attenuation the noise gain was 12 dB. Urban band noise levels can easily be 15 to 20 dB higher than quiet rural locations. This was not the case 50 years ago.

The bottom line is only use a preamp when it is needed, and select attenuation when appropriate on the lower HF bands.

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