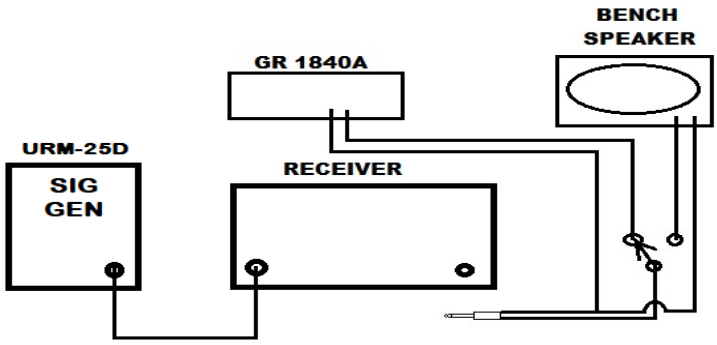
TESTING RECEIVER GAIN, SIGNAL + NOISE to NOISE AGC THRESHOLD AND AGC FIGURE OF MERIT

Receiver gain, signal + noise to noise ratio (s+n:n), agc linearity and agc figure of merit are the prime indicators of receiver performance. These four items can be very difficult to determine accurately without the proper equipment. But it doesn't take much and it is not expensive. First you need a reliable, calibrated signal source. I use a 65-year-old URM-25D. It needs to cover the HF bands and all the IF frequencies. It should have metered output and built in step attenuator capable of delivering from 0.5uv to 100Kuv into a 50Ω load.

In addition to a calibrated signal source, an audio output meter such as the General Radio 1840A (my choice) is all that is needed. There are many audio output meters that are up to the task. The key features are: Internal variable load (at least 3 ohms to 1.5k), variable full-scale power, 2mw to 20w and a meter calibrated in watts and DB. Fully self-contained no power no batteries. Just about everything you need to "test to spec" a receiver is covered with these two test instruments.

For my bench setup I have a standard ¼ inch phone plug which goes to a switch. The switch selects either a speaker or the audio power meter. Most of the equipment I work on (Hallicrafters SR series) has a front panel phone jack that disconnects internal speakers. I have an adaptor phone jack with clip leads for working on various other radios. A side benefit of using an audio power meter with built in load is you do not have to listen to the constant drown of the receiver. Switching in the speaker allows you to quickly find the signal when you change frequencies.



TESTING

I'll give you the processes as they relate to the Hallicrafters SR series receivers. You can figure out the math and apply the process to whatever receiver you wish. ALSO NOTE THE FOLLOWING APPLIES TO HF BAND RECIEVERS.

OK, LETS ADDRESS RERCEIVER GAIN.

This is pretty straight forward. The gain of the SR-400A for example, is stated: *With the audio and RF gain set to max, a signal at the antenna of 1uv will produce a minimum of 500mw audio output.* **You can do the math for 1uv into a 50-ohm load producing 500mw across 3.5ohms and it comes out to 123db gain. This is the minimum acceptable for the SR-400. With the AF and RF gain both at max the typical gain for the 400A is 139.6db. If your unit under test states the gain in DB then you have some math you must sort out and there are many on line calculators that will help you.**

S+N:N TESTING

Once again, I will use the SR-400A. The spec states: Sensitivity -- *1uv or less for 20dB signal to noise ratio.* With 1uv input at the antenna and the receiver properly tuned up, RF gain at max, AF gain set for 500mw audio output. Disconnect the signal generator and the noise level should decrease by at least 20 dm. To be totally correct the receiver should be terminated in 50 ohms when the signal generator is disconnected. I have found it doesn't make much difference.

AGC THRESHOLD

The agc threshold is that point of minimum signal at the antenna where agc starts to maintain a constant audio signal level to the speaker. I start at 5uv for all 60's or later receivers. Peak the receiver, set the RF gain to max, Set the AF gain to 500mw out. Decrease the input signal until the audio power out drops 1dB (down to 400mw or decrease of 20%). That is the agc threshold point.

Some receivers like the SR-400A have an adjustment for setting the threshold. There are differing opinions on where the threshold should be set. In most cases I use 3uv. I want max gain for weak signals and also want the agc to be in the linear range of agc action by 5uv. This is an arbitrary set point. Each manufacturer, engineer and tech have their own opinion. If the manufacturer specifies a set point it is best to use that point for assessing their products performance. When comparing receivers from different manufacturers use whatever set point works best for you.

AGC FIGURE OF MERIT

The agc figure of merit is the span of the input signal where the audio output power remains within a specified limit. In the case of the SR series of receivers that specified limit is *10dB audio change over a signal input range of 60dB.*

If, the receiver gain, the s+n:n, and the agc threshold are all in spec figure of merit will meet spec. If any of the three of those are at fault then the figure of merit will most likely not meet spec. So, the figure of merit is a good way to test the overall performance of a receiver.

For the SR series and most other receivers the spec is: *No more than 10 dB of audio output change from 5uv to 5000uv.*

MINIMUM DISCERNABLE SIGNAL

The only reason I mention the minimum discernable signal (mds) is so you won't think I left it out. The mds is a totally arbitrary and completely unspecific test. It is speculative in nature and indefinite in function. It sounds good in conversation but means very little in valid test specifications.

SUMMATION

Understanding the relationships between the different specifications is key to determining or comparing the overall performance of receivers. Always keep in mind that early receivers, 1950's and before were not built to the established standards of today. One important thing to remember is there was no standard for input Z_o of the receiver and it could vary from 20 to 6000 ohms. So, determining the input power to compute the overall gain can get complicated. From the 60's on "MOST" receivers' input Z_o have been 50 or 300 ohms.

First and foremost, you need to determine what you have and how to properly interface your test instruments to it. Sometimes you just gota do the math.

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