

# DStar DV Sensitivity vs. Analog Sensitivity

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I have heard many conversations about increased range with the DStar system and decided to test this out for myself. The claims of increased range should correlate with the sensitivity of the receiver. I found however that the noise free reception of DStar DV occurs over a larger range than an equivalent strength analog signal.

## FM RECEIVER SENSITIVITY

The sensitivity of an FM receiver is given as the power at the antenna needed to provide a 12 dB SINAD. SINAD pronounced by some as "sine add" and some as "sin add" is the ratio of the signal plus noise, and distortion over the noise, and distortion. When expressed in dB the ratio at sensitivity is 12 dB SINAD. A signal generator is frequency modulated with a 1000 Hz tone (sometimes 1004 Hz) and the modulated R.F. is brought to the antenna port of the FM receiver. The deviation is set for 3.3 kHz. The audio output from the FM receiver is brought to a device to measure SINAD. Sometimes this is a device called a SINADDER, distortion analyzer,

or transmission impairment test set. The R.F. level is adjusted until the instrument measures 12 dB SINAD.

With digital signals SINAD is not a good measurement of sensitivity, because typically the SINAD of a digital receiver is quite high until a certain point where the audio signal disappears. There is no gradual falling off of the signal like there is with analog signals. Figure 1 shows the results of sensitivity tests performed on an ID-800. The ID-800 in wide FM mode is intended for FM transmissions with a 3 to 5 kHz deviation. At the -102 dBm point the analog FM receiver is at its highest SINAD. The 12 dB SINAD of this receiver occurs at -122 dBm. In Digital Voice mode (DV) the signal drops off at -120dBm. This means that the analog FM receiver is about 3 dB better in sensitivity than the DV receiver. 12dB SINAD signals are typically considered difficult copy. What we consider to be a full quieting FM signal is one where the SINAD is nearly 30 dB. The 27 dB SINAD point in Figure 1 occurs when the DV signal stops or

is unintelligible.

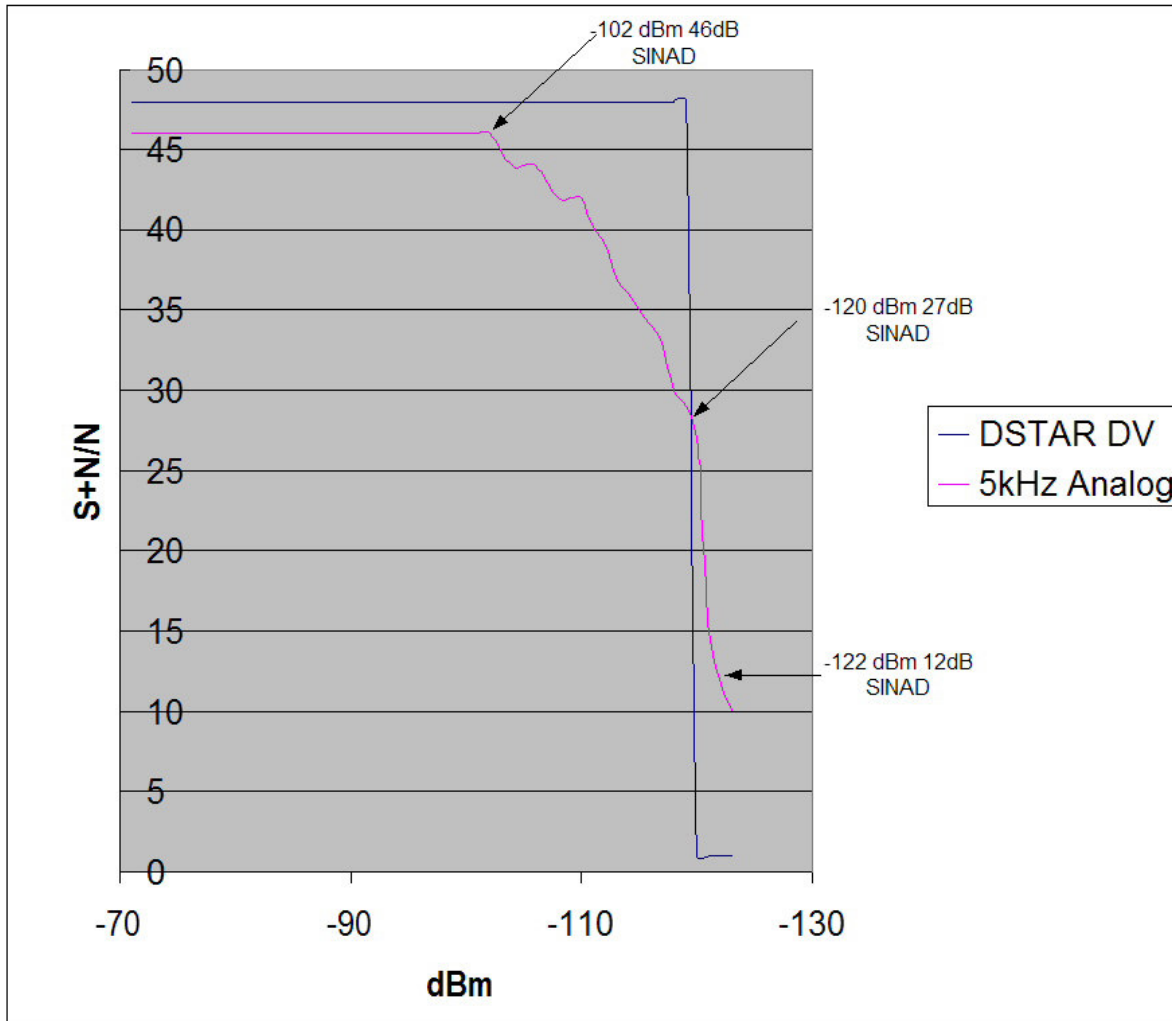
## DV ADVANTAGE

The DV signal has a steady noise level to -119 dBm and drops off at -120 dBm. The analog FM signal SINAD begins to drop at -102 dBm. Between -102 and -119 dBm DV has a SINAD advantage over analog FM. The advantage occurs over a 17 to 18 dB range. When noise free signals are desirable, DStar digital voice can meet this requirement with a 17dB to 18dB increase in the range that noise free operation can occur. For weak signal work, the analog FM signal will prevail.

## CONCLUSION

Trading 2 dB of sensitivity for a 17dB increase in nearly noise free reception is an advantage of DStar over analog FM. When weak signal reception is necessary, the analog signal will provide better performance.

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**FIGURE 1 DSTAR vs. ANALOG FM SENSITIVITY**

## EcomScs

By John Blowsky, KB2SCS

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