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# Differences Between Spectral Integral SNR Test (SpISNR) and Spectral SNR Test (SpAnSNR)

There are some differences between SpISNR and SpAnSNR measurements, which can be seen as a 2-3 dB difference between SpISNR and SpAnSNR test results.

The Spectral Integral SNR test is the newer test, which was introduced in WITE32 version 2.65. It has broader functionality, and it is recommended for use instead of Spectral SNR test.

The older Spectral SNR test is deprecated. Guzik does not recommend using it.

This article describes the differences between these two measurements.

## Difference 1

In the Spectral Integral SNR test  $SpISNR = 20 * \log_{10} (V_{\text{signal}} / V_{\text{noise}})$ .

$V_{\text{signal}}$  may be defined in different ways depending on the test options:

- 1) As the signal amplitude (TAA 0-to-peak)
- 2) As the amplitude of the main harmonic component
- 3) As the square root of the sum of squared amplitudes of harmonic components

$V_{\text{noise}}$  is equal to  $\sqrt{\text{noise\_power}}$ . Noise power is obtained by integrating the power of the noise spectral components across the frequency range.

If the signal is a sine wave, then all 3 definitions of  $V_{\text{signal}}$  give the same result.

Note that in case (1) this is consistent with Guzik definition of SNR in the plain (non-spectral) SNR test:

$$20 * \log_{10} ( TAA / RMS\_noise ),$$

but in case (3) is approximately 3 dB higher than

$$10 * \log_{10} ( \text{signal\_power} / \text{noise\_power} ),$$

which is the result of the old Spectrum Analyzer SNR test.

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## **Difference 2**

Another difference between these tests is that SpAnSNR uses a fixed signal rejection range – the size of the spectral vicinity of signal harmonic components, which is excluded from noise RMS measurements. SpISNR allows controlling it. If noise is low, the standard value may be too small and some signal power would be counted as noise. To be sure that rejection range in the SpISNR is selected properly, use "Plot Spectrum" option. The rejected signal is plotted in red.

## **Difference 3**

In SpAnSNR test the rejected signal is just excluded from the noise computation. In SpISNR some noise power is added instead of rejected signal based on the linear interpolation of the values at the edges of the rejected interval.

## **Difference 4**

In SpAnSNR  $V_{noise}$  at each frequency is computed as the average value of the output of a narrow band filter (Spectrum Analyzer). In SpISNR it is computed as the RMS of this signal, which is a more accurate estimate of the power. In the case of noise measurements the output of the spectrum analyzer is non-constant and RMS may become greater than the average value thus making the resulting SNR value smaller.

## **Difference 5**

The SpISNR test provides plotting of the measured spectrum if the "Plot Spectrum" option is on. Total and partial noise measurements are provided on different plots, the part of the signal rejected during noise measurements is plotted in red. This greatly facilitates interpretation of results. Also, if a problem with the SpISNR test arises, the plot may help Guzik customer support to resolve the issue.