

Question: “Why is my SNR result so bad?”

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The SNR result of an ADC or DAC is bad. I expected 60dB SNR of 1 MHz signal at 10 MHz bandwidth but it only has 45dB. What is wrong?

Answer:

There are many parameters that can make SNR look bad. But check these major parameters first.

1. Jitter of clock for ADC and the input waveform. The relation of jitter and SNR is described as follows:

$$\text{SNR [db]} = -20 * \log(2 * \text{PI} * f_{\text{signal}} * \text{Jitter_rms})$$

If the 60dB SNR is required at 1MHz input signal, the clock of ADC must have less than 160ps rms jitter. The same as jitter, input signal jitter must be taken care of. Be careful that total jitter of ADC clock and input signal must be less than 160ps rms.

2. System noise floor. The noise floor of the system affects the SNR. At 10MHz bandwidth, 100nV/root(Hz) floor noise limits the maximum measurable SNR down to 61dB. Therefore, the system floor noise must be far better than 100nV/root(Hz). Related to noise is a noisy power supply or voltage reference for the DUT. Make sure these are stable and well de-coupled.
3. Measurement instrument range for DAC testing. The input signal amplitude and the input range of the measurement instrument must be matched. If the signal amplitude is much smaller than the input range of the measurement instrument, it reduces the SNR results. Also for DAC testing, note that the input ranges of our digitizer are bipolar while many DUTs are unipolar. For example, if your DUT output is 0 to 1V, you will improve your answer by using the digitizer DC offset by -0.5 volts and using the +/- 0.5 V range instead of the +/- 1 V range.
4. DUT board layout. Good layout techniques are critical. Minimize noise at critical points like the input or output analog signals and DUT references.