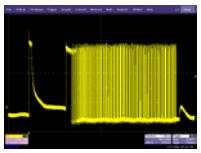

T E C H N I C A L B R I E F

LON_WS304 PERCEIVED NOISE AND MEMORY LENGTH

How do you compare the baseline noise in two different oscilloscopes? If you use a peak-to-peak amplitude measurement of the scopes' baseline, with no signal connected, you have to be very careful. Peak-to-peak measurements of random signals are dependent on the acquired record length. A better figure of merit would be the standard deviation of the sample values in a trace. This is a measurement of the rms noise and is independent of the record length. Figure 1 shows a comparison of both peak-to-peak and rms noise as a function of record length. Note that the peak-to-peak value is very record length dependent.

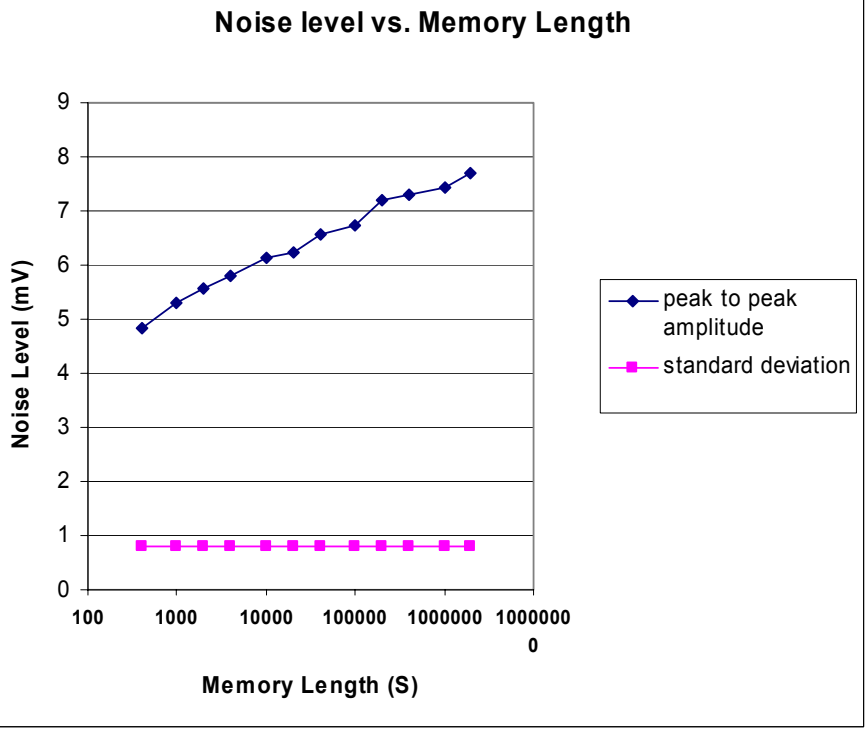

Figure 1. Comparing peak-to-peak and standard deviation (rms) noise levels in a WaveSurfer 454. Note that peak-to-peak noise measurements are highly dependent on the record length of the waveform.

If you choose to use a peak-to-peak measurement, you have to guarantee that the traces you compare include the same number of data points. Figures 2 and 3 show a comparison of noise baseline measurements for a LeCroy WaveSurfer 454 and a Tektronix TDS3054. Note that both oscilloscopes are set to collect 10,000 samples per trace. The TDS 3054 shows slightly higher peak noise for this input sensitivity. In general, the measured noise will vary from range to range, as well as from channel to channel and acquisition to acquisition. As in all measurements of random phenomena, you should use parameter statistics to extract the mean values over many acquisitions.

Another thing to take into account is the trace intensity. The TDS3054 uses a default intensity of about 40%. This tends to hide transient peaks and makes the waveform appear to be less noisy than it

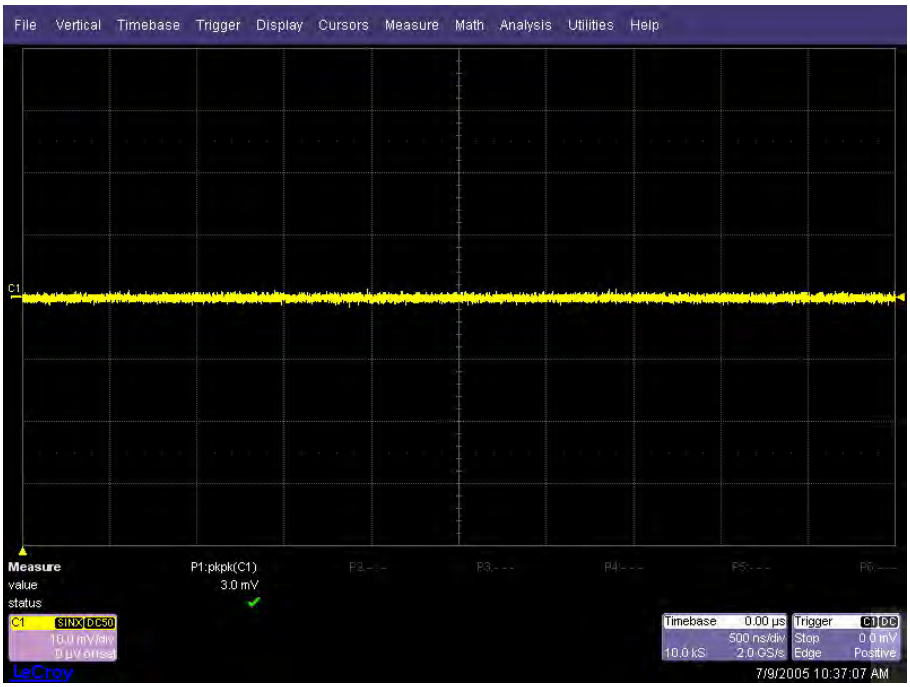

Figure 2. The WaveSurfer shows a peak-to-peak amplitude of 3 mV for a 10,000 point trace.

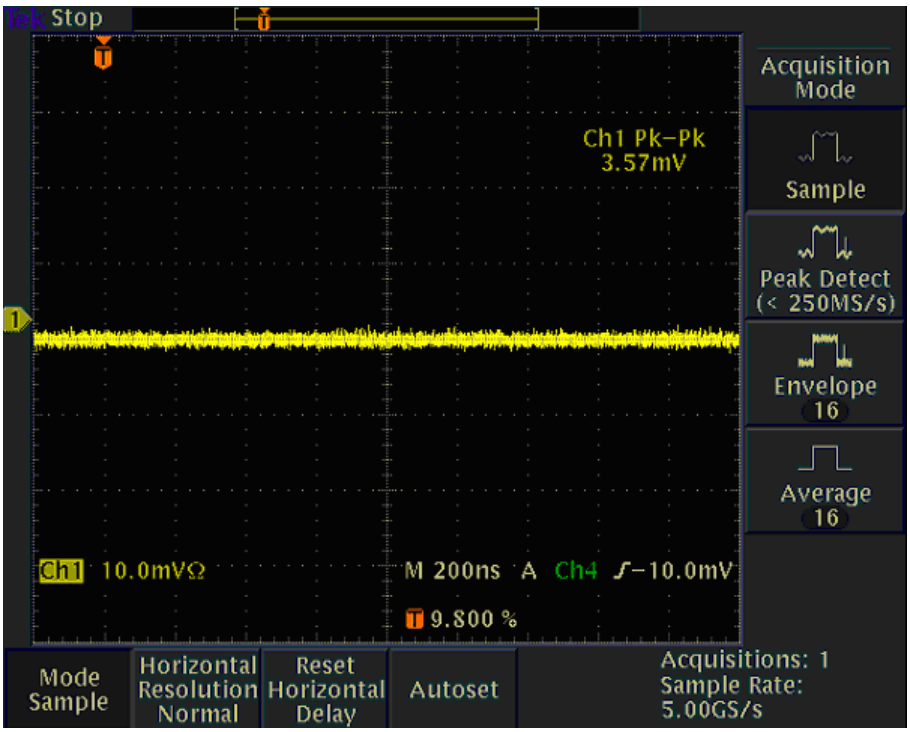

Figure 3. The TDS3054 shows a peak-to-peak amplitude of 3.57 mV for a 10,000 point trace.

actually is. The LeCroy WaveSurfer defaults to maximum trace intensity so you do not miss any important data.

Whenever you make comparisons it is important to make sure that you use setups that provide a fair comparison. You should always try to understand what factors influence the measurement you are making. If you are unsure call the instrument manufacturers and allow them to explain how the measurement is best made.