The Importance of Oscilloscope Acquisition Rate

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If you ask most engineers to tell you the “banner specs” of their favorite digital oscilloscope, you’ll hear about bandwidth, sample Rate, and memory depth. For many years, these were THE critical figures that would indicate the right scope for the job. For many purposes, however, the oscilloscope’s acquisition rate and blind time are the most important specifications.

A real-time digital oscilloscope starts its acquisition cycle by directly sampling the waveform. The user determines parameters such as sample rate and capture duration (record length). After sampling the signal, all digital oscilloscopes require time for pre-processing, writing to memory, post-processing, display functions and trigger rearm. The Acquisition Rate describes how many times per second the instrument can complete this cycle. In general, the higher the WFM/s the more time the instrument is actively acquiring the signal, and the less time it is spending processing.

In reality, only during a small portion of the entire acquisition cycle is the oscilloscope “seeing” the signal as shown in Figure 1. Despite constant innovation and advancements in processing power, oscilloscopes are still “blind” most of the time. Modern oscilloscopes look to minimize this blind time and increase acquisition rate. But why?

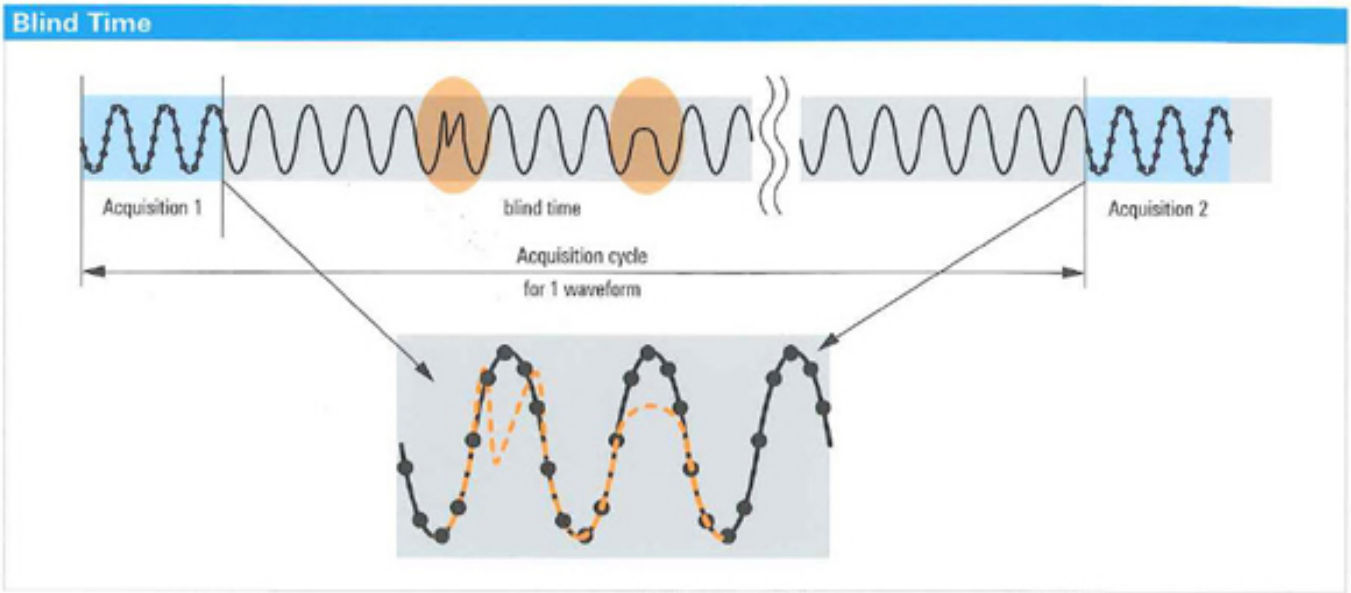

Figure 1.

There are two major benefits to a high acquisition rate: 1) the ability to find and measure infrequently occurring events and 2) faster and more reliable results during compliance and characterization testing.

In cases where there are known signal problems that need to be isolated and caught, the advanced triggering capabilities of today's scopes can be tuned to find what you're looking for...provided you actually know what you're looking for. If the scope has a high enough acquisition rate, you can use a basic trigger (such as an edge trigger) and allow the scope to display any other anomalies that might be present. It's really just a matter of how statistically likely you are to catch a "rare" event in a given period of time. Instruments with less blind and a higher acquisition rate will show these faults more quickly. Figure 2 shows the higher acquisition rate of the R&S RTO lets users catch signal faults faster. Note how measurement time drastically increases at lower acquisition rates.

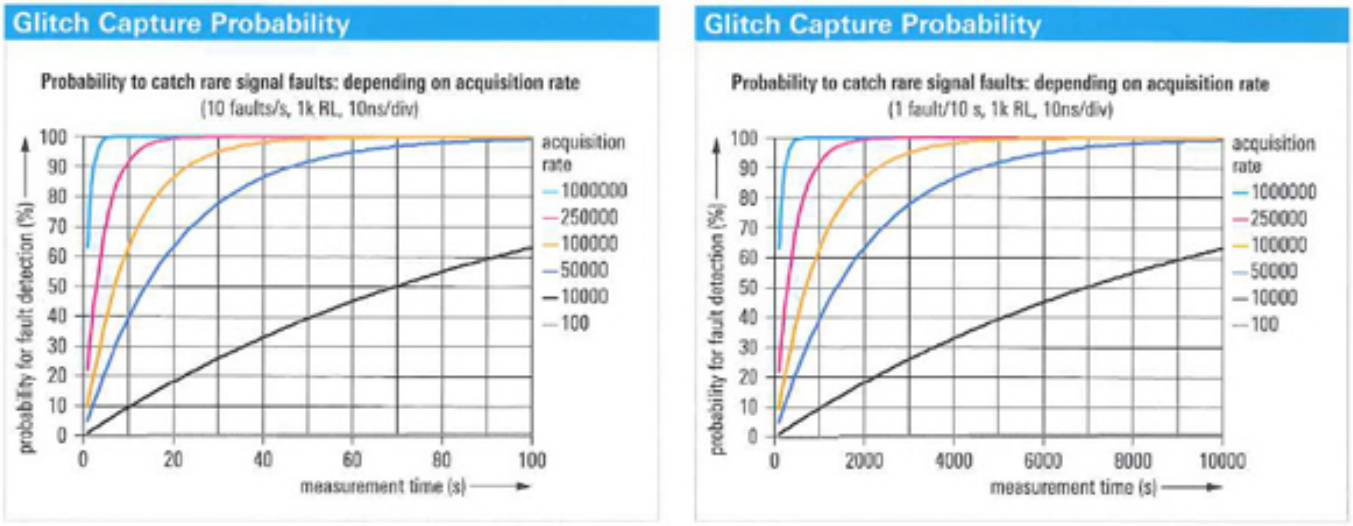

Figure 2.

To illustrate the point about compliance and characterization testing, let's consider a mask pass/fail test. For this test, let the instrument run for some period of time and expect there will not be any failures in that time. From here, it is simply a matter of test time. The instrument with a higher acquisition rate will get to statistically significant amount of data much more quickly.

To return to my opening comments, if acquisition rate is such an important spec, why is it misunderstood and under-appreciated? It may have something to do with the way high-acquisition rate has been implemented so

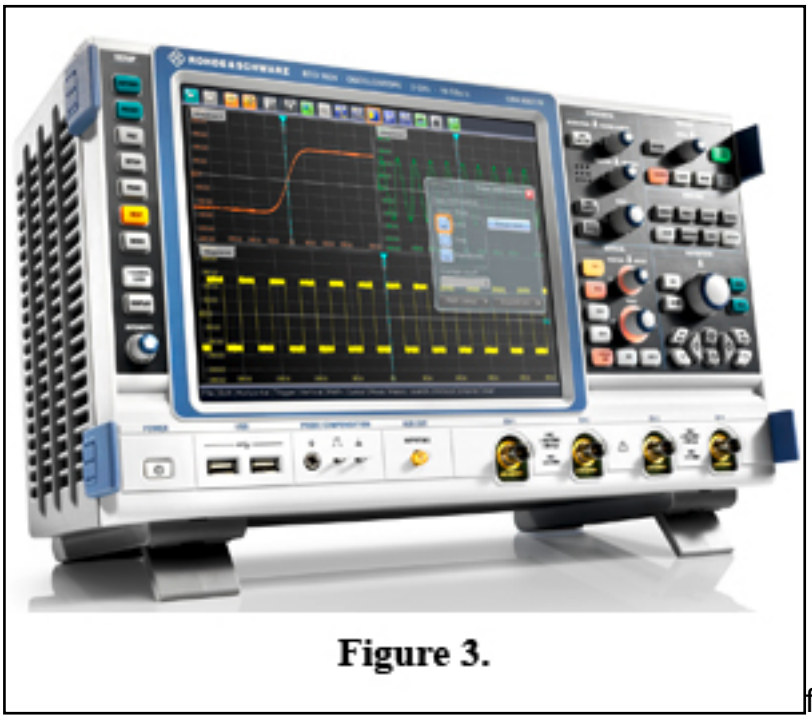

Figure 3.

far. Until recently, the industry-best acquisition rates were only available in special instrument modes. The user had to remember to “push the button.” If the user turned on cursors, masks, measurements, math, etc, the instrument immediately drops out of its fast acquisition mode. In other words, high capture rates aren’t used that often because they CAN’T be used that often. When engineers get the benefit of a high capture rate all the time, they can start to capture and see much more.

The recently launched R&S RTO (Figure 3) line of oscilloscopes from Rohde and Schwarz has an industry-best acquisition rate of over 1,000,000 waveforms per second. The parallel processing of the newly designed processing ASIC enables industry best throughput even when performing complex measurements. The value of acquisition rate will be truly realized when engineers have tools that let them make full use of all the measurement and analysis functions of their instrument while maintaining an acquisition rate that lets them do their job quickly and with high confidence.