Oscilloscope Selection Tip 5:
Waveform Update Rate

Part 5 of a 12-part series

Tip 5 *Select a scope that has a fast enough waveform update rate to capture random and infrequent events to help you debug your designs faster.*

With more than 1,000,000 waveforms per second, Agilent's 3000 X-Series oscilloscopes provide the fastest waveform update rates in the oscilloscope industry. And at over 50,000 waveforms per second, Agilent's 2000 X-Series scopes are the fastest in their class by orders of magnitude.

Although often overlooked when evaluating performance of various oscilloscopes for purchase, waveform update rates can be extremely important — sometimes just as important as the traditional banner specifications including bandwidth, sample rate, and memory depth. Even though a scope's waveform update rate may appear fast when viewing repetitively captured waveforms on your scope's display, "fast" is relative. For example, a few hundred waveforms per second will certainly appear lively, but statistically speaking this can be very slow if you are attempting to capture a random and infrequent event that may happen just once in a million occurrences of a signal.

When you debug new designs, waveform and serial bus decode rates can be critical — especially when you are attempting to find and debug infrequent or intermittent problems. These are the toughest kinds of problems to solve. Faster waveform and decode update rates improve the scope's probability of capturing illusive events and serial bus communication errors.

All oscilloscopes have an inherent characteristic called "dead-time" or "blind time". This is the time between each repetitive acquisition of the scope when it is processing the previously acquired waveform. Unfortunately, oscilloscope dead-times can sometimes be orders of magnitude longer than acquisition times. During the oscilloscope's dead-time, any signal activity that may be occurring will be missed as shown in Figure 1.

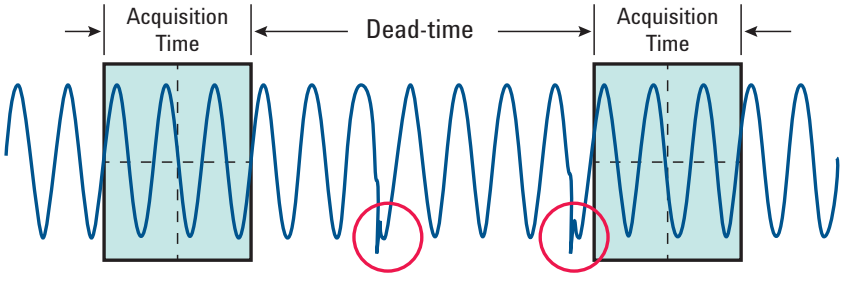

Figure 1. Oscilloscope dead-time versus display acquisition time.

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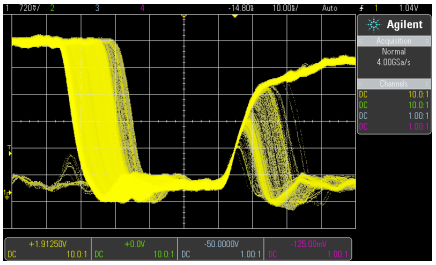

Figure 2. The Agilent MSO/DSO3000 X-Series oscilloscope reliably captures the infrequently occurring metastable state while updating at 1,000,000 waveforms per second.

Because of oscilloscope dead-time, capturing random and infrequent events with a scope becomes a gamble — much like rolling dice. The more times you roll the dice, the higher the probability of obtaining a specific combination of numbers. Likewise, the more often a scope updates waveforms for a given amount of observation time, the higher the probability of capturing and viewing an elusive event — one that you may not even know exists.

In Figure 2 we show an Agilent 3000 X-Series scope capturing an infrequent metastable state (glitch) that occurs approximately 5 times per second. With a maximum waveform update rate of more than 1,000,000 waveforms per second, this scope has a 92% probability of capturing this glitch within 5 seconds. In this example, the scope captured the metastable state several times.

Other scopes in this class may update waveforms only 2000 to 3000 times per second. This means that these scopes would have less than a 1% probability of capturing and displaying an infrequent glitch such as this within 5 seconds. To learn more about oscilloscope waveform update rates and how to compute statistical glitch capture probabilities, refer to Agilent's application note titled, "Evaluating Oscilloscopes for Best Waveform Update Rates" (publication # 5989-7885EN).

Fastest Waveform Update Rates without Compromise in Agilent InfiniiVision 2000 and 3000 X-Series Oscilloscopes

If you are in the market today to purchase your next oscilloscope, Agilent Technologies' newest 2000 and 3000 X-Series oscilloscopes come in various bandwidth models ranging from 70 MHz up to 500 MHz. The entry-level InfiniiVision 2000 X-Series scopes can update waveform faster than 50,000 waveforms per second, which is the fastest for this class and price range of oscilloscope by orders of magnitude.

The higher performance InfiniiVision 3000 X-Series scopes can provide over 1,000,000 waveforms per second to give the highest level of confidence that you aren't missing anything.

And with Agilent's exclusive MegaZoom technology, the InfiniiVision 2000 and 3000 X-Series scopes are able to maintain these fast waveform update rates even when using digital channels of acquisition (MSO models), as well as when decoding serial buses. Other scope's update rates degrade significantly when using additional channels of acquisition and/or serial bus decoding.

To learn more about Agilent's InfiniiVision 2000 and 3000 X-Series oscilloscope and mixed signal oscilloscopes, go to www.agilent.com/find/2000X-Series or www.agilent.com/find/3000X-Series.

Product specifications and descriptions in this document subject to change without notice.

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