Generating a Waveform with Many Points
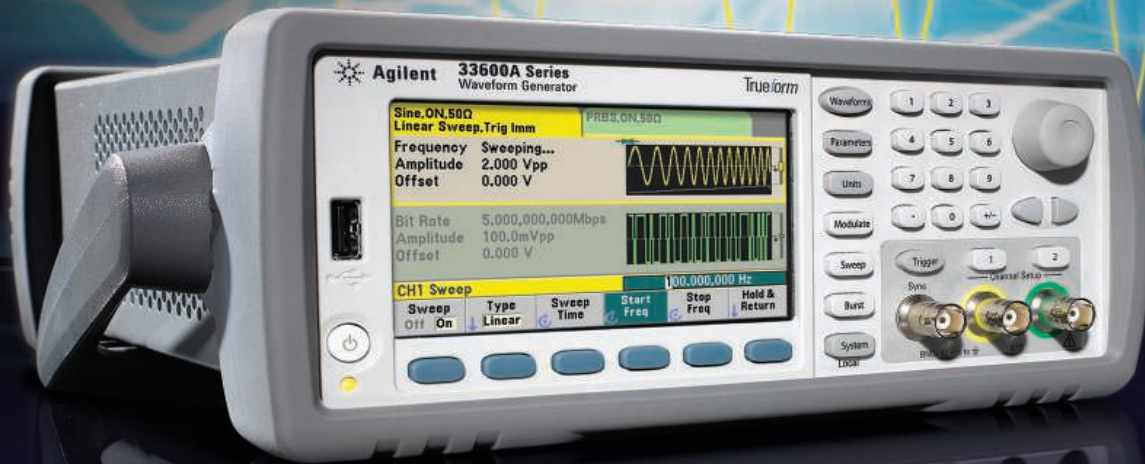
With **True*form***
TECHNOLOGY

Test Challenge Examples:	How True*form* Can Help:
• Creating long non-repeating signals • Creating signals requiring fine time resolution • Simulating a digital data protocol • Simulating a digitally modulated carrier	• Deep waveform memory • 1 GSa/s arb sampling rate • Trueform waveform generator accuracy • Ample onboard memory to store waveforms

Memory depth in your waveform generator might not be something that you've spent a lot of time thinking about. However, today's designs require increasingly complex waveforms that often stretch beyond current generators memory depth. Trueform waveform generators offer the most waveform memory depth in their class.

See our test challenges to learn how Trueform waveform generators can provide you the memory depth you need to output long or complex waveforms.

Anticipate ___*Accelerate* ___*Achieve*

Agilent Technologies

Long non-repeating signals

If you want your generator to produce long custom signals that don't repeat, then you are going to need more waveform memory. These signals might not be very complex, but their non-repeating nature requires a lot of samples. Some conventional bench Direct Digital Synthesizer (DDS) generators offer only 128 KSa of waveform memory. In contrast, the 33600A Series Trueform waveform generators offer 4 MSa per waveform, with optional upgrades for up to 64 MSa of waveform memory. That means that with a Trueform waveform generator your signal can be 500 times longer than with a conventional DDS generator.

Simulating a serial digital protocol

If you are simulating a complex digital data signal with lots of bits, such as a USB data transfer, the need for deeper waveform memory is easy to understand. Each bit in your signal is expressed as one or more samples in your generator's waveform memory. The more data in your signal, the more waveform memory you need. The Trueform waveform generators' deeper memory option can help you reproduce your signals fully, without the need to compromise on their length. Moreover, with less than 1 ps of cycle-to-cycle jitter, you can be assured that the timing of your signal has maintained its integrity.

Simple signals requiring a lot of time resolution

Another scenario where longer waveforms are useful is when you need to have a very fine time resolution. Your signal might be as simple as a square wave, but to test your device you might need a very short voltage drop requiring 1 ns of resolution. The 33600A Series Trueform waveform generators feature a 1-GSa/s arbitrary waveform capability. Additionally, a patented sampling technology that never adds or skips points in your waveform—a common weakness in traditional DDS-based generators—guarantees that your voltage drop will be reproduced.

Generating an eye-pattern stimulus

You need a signal simulating a digitally modulated carrier for wireless data transmission. The digital signal needs lots of memory because it has some connection protocol requiring many bits of data, and it takes many samples of memory to simulate each bit of data in the over-the air signal. Trueform waveform generators are ideal for this scenario, featuring a 14-bit amplitude resolution, deep memory and high signal integrity to represent over-the-air signals at very low Error Vector Magnitude (EVM).

Deeper Memory

Whether it is your hard drive, or your smart phone, it's likely you've seen the benefits of having more memory. The same holds true for waveform generators. More waveform memory allows you to re-create longer signals and gives you more control over the time resolution of your signal.

Consider a time resolution example in which a square wave with a very short glitch is required to simulate voltage dips in your modeled system (**Figure 1**). With the signal's time resolution of 1 ns, we extract how a deeper memory translates into time. A 1-GSa/sec sampling rate is needed for this type of resolution. If your generator only has 128 KSa of waveform memory, your signal's length would be limited to 128 µs. In contrast, with the 64-MSa waveform memory available from the 33600A Series Trueform waveform generator, your signal could be up to 64 ms —500 times as long. A longer signal could help ensure that your Device-Under-Test (DUT) has enough setup and hold time to detect your signal level.
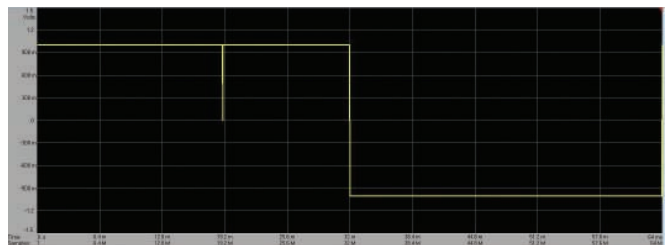

Figure 1. *Square wave with short duration voltage drop.*

Another limitation of the DDS generator has to do with reproducing arbs. Since DDS is a fixed clock technology, it needs to add or skip points to meet the sampling rate and the output frequency that you define. This results in transitions being skipped, often unpredictably or at random, and can result in your voltage drop characteristic being skipped with your DDS generator. The reason why DDS skips and adds points is beyond the scope of this paper; however, you can refer to Trueform Waveform Generation Technology 5991-0852EN

Trueform technology is also an excellent signal-generation technique for digital signal simulation. Not only does the deeper memory depth help ensure you have enough waveform points to simulate your long digital signal, but the performance is unmatched by DDS generators in the same price range. DDS generators sometimes have a weakness that introduces one sample period of jitter when transitioning using fast edges (slower edged signals like sine waves are not affected). This means that 1-GSa/sec DDS-based generators can introduce up to 1 ns of jitter on your signal. Trueform's patented technology does not have this issue. It is specified to have less than 1 ps of jitter even on fast edges, which is up to 1000 times better on arbitrary waveforms.
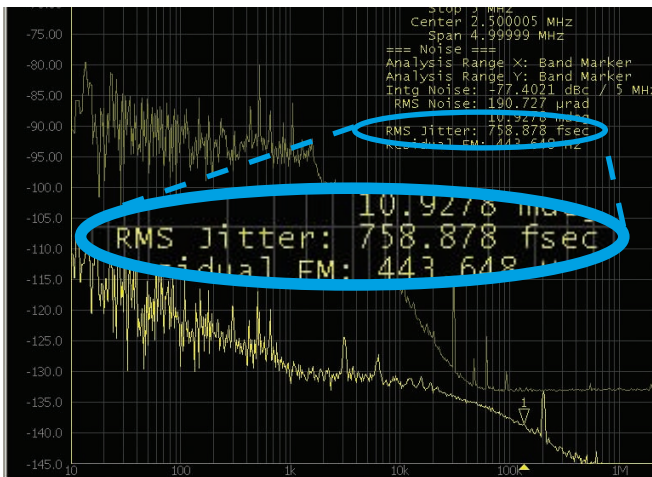

Figure 2. *Femtosecond jitter.*

While this type of performance would normally require a much more expensive instrument, Trueform generators are competitively priced with DDS-based generators.
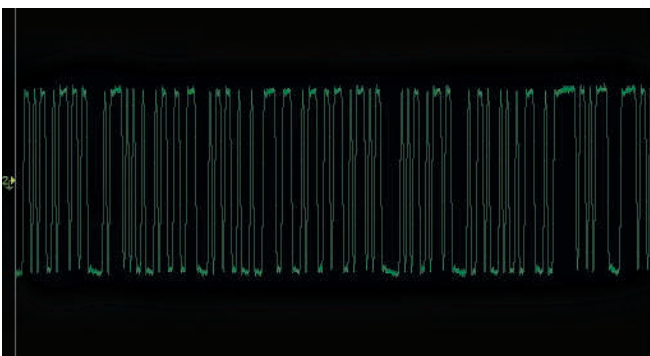

Figure 3. *Arbitrary waveform simulating a digital data signal with many points.*

Measurement Tip:

For digital signals, turning off the filter reduces the number of samples you need to define for a sharp edge. Filtering will soften the edges; however, filter off will let you cleanly define edges with 2 points.

Easier Importing of Arb Signals

Traditionally, moving a signal from your PC to your generator has been a difficult task, often requiring you to write your own code or use proprietary software to move the signal. The 33600A Series Trueform waveform generators now make file I/O easier and the process of moving files to your generator much more intuitive.

Assuming you connect your generator to your PC via USB, you can now simply drag and drop files onto your generator just like you would with a normal USB storage device (e.g., a thumb drive). The instrument shows up in your explorer window like a normal drive, allowing you to read/write to the drive as you usual. The Trueform waveform generators are the first to offer this capability.
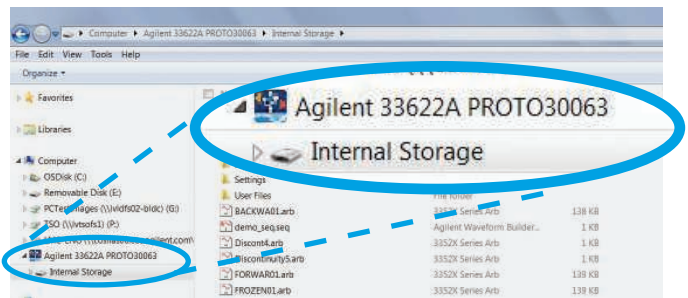

Figure 4. *Windows Explorer with USB connected 33622A.*

A front panel USB drive port is available on the generator as well. You simply plug your USB drive into the generator and move files using the front panel interface.
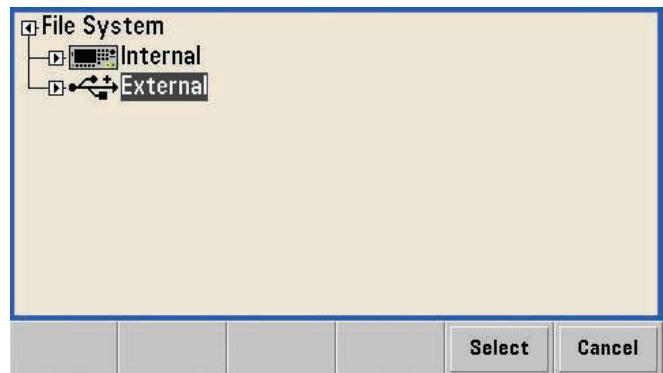

Figure 5. *Front Panel access to USB drive.*

Of course, the Trueform waveform generators also provide the traditional methods of file I/O too. SCPI commands, for example, are still supported for programmatic file moving. Additionally, Agilent Benchlink Waveform Builder Pro enables the easy transfer of arbitrary waveform files using USB, GPIB or LAN.

Summary

Trueform waveform generators offer unmatched performance, usability and innovation at a competitive price. With deeper memory, your signals don't need to be compromised. Trueform performance ensures your signal will be reproduced exactly as designed. And, it's now easier than ever to move files to the Trueform waveform generators. With four models to choose from, you are guaranteed to find the right price point for your project.

See the True*form* waveform generator test challenge web site for additional topics such as:

- Simulating signals with the highest integrity
- Using a waveform generator to generate a PRBS signal
- Effortlessly couple or synchronize two signals on a waveform generator
- Creating a differential signal with a waveform generator
- Be more efficient designing and using your arbitrary waveforms

www.agilent.com/find/trueformTC

For 33600A Series Trueform waveform generator product information visit www.agilent.com/find/33600A

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