



USB oscilloscopes add waveform generators

Martin Rowe - June 17, 2016



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It's not uncommon to see USB and bench oscilloscopes that include an AWG (arbitrary waveform generator). Generally, oscilloscopes will use either a traditional sampling architecture or a DDS (direct-digital synthesis) architecture. TiePie Engineering, a manufacturer of USB oscilloscopes, claims to have something slightly different.

TiePie Engineering's latest model, HS5-540, uses what the company calls CDS (Constant Data Size) architecture. It's closer to a traditional sampling AWG than to a DDS architecture. But, it differs in that its clock can change frequency to change sampling rate up to 240 Msamples/s. Sampling AWG's may use a fixed clock frequency and then change sample rate by dividing the clock. In its recent product release, TiePie stresses how the CDS architecture differs from DDS, but I asked how it also differs from a traditional sampling AWG.



"The CDS technology is different from a traditional non-DDS AWG, in the area of the sampling clock generation," said TiePie's Erik Tigchelaar. "Our clock can be set at any frequency and can be changed with very small steps and has very little jitter, making it possible to generate very accurate and stable signals." Jitter is specified as less than 50 ps rms.

The image below shows how skipping clock signals with a DDS AWG can result in missing samples. The lower trace shows spike that a DDS architecture might miss.



The table below provides some AWG basic specs for the HS5-540.

Total Harmonic Distortion	0.04 %
Jitter	20 ps
Signal frequency range	40 MHz
Memory size	64 Mbytes
Rise time	8 ns

The HS5-540 is, of course, an oscilloscope.

- Sample rate: 500 Msamples/s in 8 bit or 12-bit mode
- Resolution: 8, 12, 14, or 16 bits (sample rate slows as resolution increases)
- Analog bandwidth: 250 MHz
- Channels: 2

Base price: €1346 (about \$1518) TiePie Engineering, [HS5 product page](#). TiePie Engineering's other HS5 models now also feature the CDS architecture.

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- [USB instrument is an entire test bench](#)
- [The Art of Waves: Images on an oscilloscope](#)

- [USB Oscilloscopes from Pro to Hobbyist](#)