

## Sierra Nevada Corporation Looks to Tektronix to Simulate the Latest Radar Systems



### Solution Summary

Challenge	New signal types were rapidly outstripping the capabilities of existing simulation equipment making it difficult to create realistic RF waveforms that model the behavior of the latest radar systems
Solution	Using the Tektronix Arbitrary Waveform Generator (AWG710) allowed Sierra Nevada to test their sensor systems under a wide range of pulse shapes and patterns that more closely modeled the behavior of modern radar
Benefits	Flexibility to generate signal output at the most commonly used IF frequency of 1 GHz eliminated the complexity of external up-conversion equipment while successfully generating very realistic patterns of multiple radar scenarios

With today's rapid advances in radar technology, developing and manufacturing highly specialized and innovative electronic products to detect radar signals takes leading-edge technology and tools. This is an ongoing challenge for Sierra Nevada Corporation, headquartered in Sparks, Nevada, as they develop the latest in sophisticated reconnaissance systems.

Sierra Nevada Corp., a rapidly growing defense electronics engineering and manufacturing company, builds a number of different types of Electronic Intelligence (ELINT) systems for detecting and analyzing radar type signals. To integrate new types of sensors and develop new algorithms that address the latest radar systems, Sierra ran into a major stumbling block:

new signal types were rapidly outstripping the capabilities of their existing simulation equipment. Sierra Nevada has found the Tektronix Arbitrary Waveform Generator (AWG710) of tremendous value in their testing of increasingly complex radar technology. In fact, the AWG710 has become part of their official test environment for exercising all their equipment.

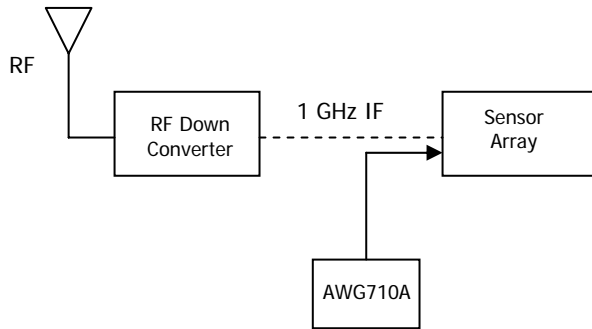
Unlike traditional analog radar first developed in the 1940's with simple pulse patterns over narrow RF bandwidths, modern digital radars often utilize staggeringly complex pulse patterns that can be agile in multiple domains at the same time (pulse rate, pulse width, and pulse-to-pulse frequency changes). Also, radar pulses themselves can be modulated in the amplitude, frequency and/or phase domains as well as spread spectrum techniques (such as CHIRP) that allow instantaneous frequency diversity.

Recognizing the need to develop new modeling tools to address the demands of modern radar detection, Sierra Nevada launched an internal effort to update their signal simulation equipment. They began by creating updated waveforms and algorithms using a software simulation program, but then quickly realized that the digitally rendered waveform files output by the software were virtually identical to the waveform files used by the AWG710. Rather than testing their systems with simulated digital waveforms in a lab, the AWG710 enabled Sierra Nevada to leverage their work from the simulated model and apply it to a real-world test environment.

"We were thrilled when we realized we could run tests using real hardware rather than a software-based lab simulation. With the hardware-based approach, we're able to work out factors that could never be simulated in a lab," said Peter Hausman, principal systems engineer, at Sierra Nevada. "The AWG710 enabled us to move out of the lab and solve real problems through real-world test scenarios."

With sampling rates up to 4 GS/s, the AWG710 also provided Sierra Nevada with the unique capability of directly generating signal output at their most commonly used IF frequency of 1 GHz. This eliminated the added complexity of external up-conversion equipment and enabled Sierra Nevada to evaluate their sensor systems directly – and under a very wide range of pulse shapes and patterns that more closely modeled the behavior of

modern radar systems. The functionality of the AWG710 arbitrary wave generator enables the simulation of multiple radar systems by allowing flexibility and speed in the waveforms generated.



“The AWG710 enabled us to create scenarios five to 10 times more complex than we were able to do in the past,” Hausman said. “We’ve just been astounded by how much we can get from the tool.”

With today's faster engineering life cycles necessary to achieve faster time to market, easily and effectively testing designs with real world signals and characteristics has become an important issue.

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In addition to having an immediate impact on the quality of their testing, the AWG710 also accelerated the overall test process. “Using the AWG710 allowed our work on the algorithms and testing to go much faster,” Hausman said. A graphical user interface and built-in custom waveform creation and editing tools make it easy to design new signals, or to import mathematical formulas from third-party development tools like MatLab.

Sierra Nevada developed a unique technique for generating complex pulse patterns using the AWG710. Because of the high degree of pulse-to-pulse agility being modeled, Sierra Nevada developed a method whereby each individual pulse of simulated radar was output into a unique waveform file. They filled the gaps between pulse events by repeating a single noise waveform file for the appropriate length of time (pulse repetition interval), which allowed them to conserve total memory on the AWG710 for use on only the pulse events and enabled very realistic pattern generation of multiple radar scenarios.

Sierra Nevada is also using an AWG710 to test their radar detection systems against simultaneous multiple

radar systems, a level of complexity seen commonly in real-world scenarios. The company recently conducted a product demonstration for a customer and used two AWG710 units to generate some of the most complex radar scenarios possible. As a result, Sierra Nevada was able to showcase the performance of their sensors in detecting and analyzing signals under extreme conditions. “We made full use of both units,” Hausman noted.

As a result of the success Sierra Nevada has had with the AWG710, it has also become a standard signal generation tool for their customers. A customer recently used a unit to support a live test, placing an AWG710 on the ground and evaluating the performance of their detection systems on aircraft passing overhead.

The AWG710 is used to replicate standard, marginal and erroneous mixed signal conditions that designers often encounter. The instrument features a sampling rate of 4.0 GS/s with 8-bit vertical resolution and comes standard with 16 MB of memory, which is expandable to 32 MB. It has one channel with complementary output and two variable level and delay markers. Its unique real-time sequencer allows an infinite string of test signals and conditions for continuous operation.

The recently introduced AWG710B extends to 4.2 GS/s and delivers excellent signal fidelity with ultra high-speed mixed signal simulation, a powerful sequencing capability and digital logic outputs to solve the most difficult measurement challenges. It offers 64MB of optional memory and a removable hard drive for instances when data security is a priority. Additionally, the AWG710B has a master/slave synchronization capability, affording users with a multi-channel solution.