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# Agilent
# N7509A Waveform Generation Toolbox

## Product Overview




The Waveform Generation Tool (WGT) provides a simplified interface for baseband modulation of Agilent's wide-bandwidth signal simulation solutions, with up to 1 GHz RF bandwidth for signals in applications such as radar, EW, satellite, and general-purpose RF and microwave. Even the most complex signals are defined and implemented easily through the software interface. Signal types including AM, FM, PM, multi-tone, pulse, chirps, and custom user-defined I/Q waveforms can be defined through basic parameter entry or from files created in MATLAB® or other engineering environments.

For each selection in the main menu, a subsequent screen appears, enabling the user to enter the parameters required to define the waveform and invoke the built-in calibration routines. A display on each sub-panel shows the ideal frequency domain waveform calculated from entered parameters. A simulation mode is provided to enable development and operation without connection to the instrument hardware. A mathematical visual representation of the signal is displayed on the graph.

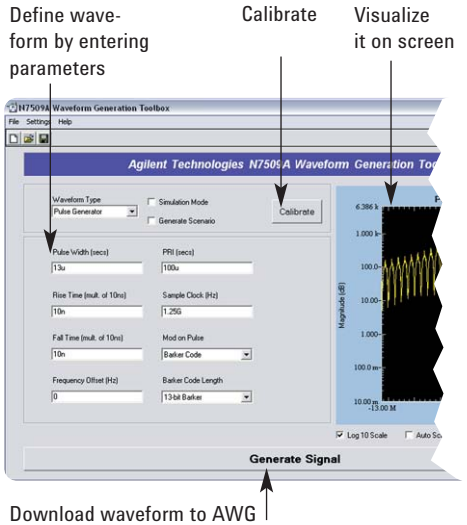



**Figure 1**. Process for creating signals

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## Compatible hardware

The WGT is optimized for wide bandwidth microwave applications. The software runs on a PC and controls the E8267D PSG vector signal generator, in coordination with the dual-channel N6030A arbitrary waveform generator (AWG). With this combination, the WGT can define and download signals up to 1 GHz bandwidth from 3.2 to 44 GHz or 160 MHz bandwidth below 3.2 GHz. A complete system can be configured including the WGT, the PSG, the AWG and optionally other hardware including spectrum analyzers and oscilloscopes for measurement and analysis. For more information, see the N7502A signal simulation system product overview.

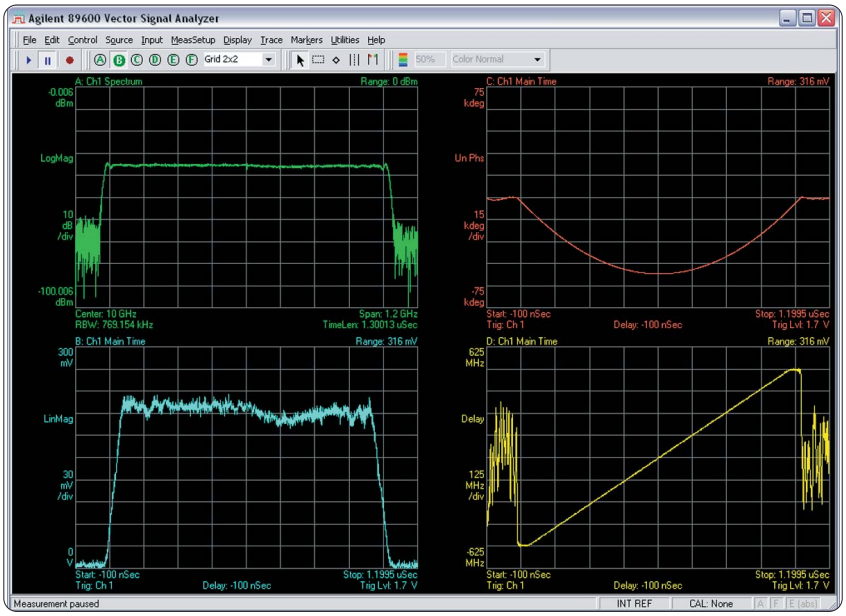



**Figure 2**. Linear chirp with 1 GHz bandwidth signal created by the Waveform Generation Toolbox

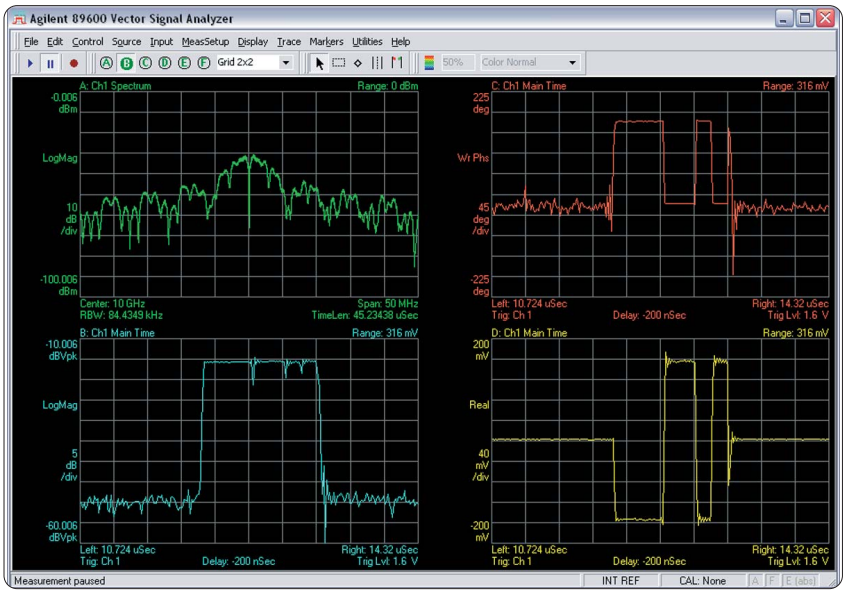



**Figure 3**. Barker-coded radar signal generated with the Waveform Generation Toolbox



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### Sequencing multiple signals

The WGT enables sequencing of multiple signal segments. Segments can be any waveform type, and can be repeated or looped a specified number of times before shifting to the next segment.

### Corrections

In an ideal world, the RF signals at the signal generator's output would have exactly the same amplitude flatness, phase, and group delay as the waveforms that are mathematically defined. However, distortion will inevitably occur as the signal travels through the various analog circuits on the way to the output of the signal source. While this distortion is somewhat manageable in narrowband systems with modulation bandwidths in the tens of megahertz, it dramatically increases in severity as the bandwidth increases. In some radar and ultra-wideband (UWB) systems that have RF bandwidths of 500 MHz or more, the distortions are major impediments to accurate component, subsystem, and system evaluation.

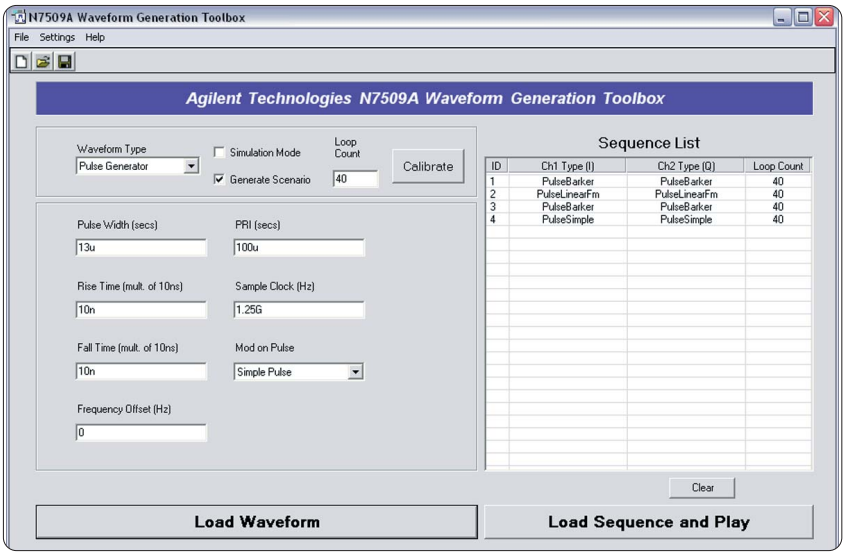



**Figure 4**. Generate scenario mode

The N7509A WGT offers corrections for two sources of distortion in wideband signals. The Calibrate button in the parameter entry forms performs a DC calibration of the I/Q modulator in an E8267D PSG. This minimizes the LO feed-through of the E8267D on the generated signal. This button may be pressed at any time without adversely affecting the generated signal to minimize this unwanted distortion product.

The WGT also manages the corrections for the baseband signal generated by the N6030A AWG. The roll-off characteristic of the sample-and-hold of the digital-to-analog converter (DAC) and the response of its reconstruction filters are automatically corrected using a digital filter with a predetermined set of coefficients. This filter is applied using digital signal processing (DSP) techniques to any waveform during the generation process. To select the application of this filter, access the Settings menu and select Enable ARB Corrections. Neither of these corrections requires additional measuring equipment.



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Sources of impairment that are not corrected include LO quadrature skew and gain imbalance between the I and Q signal paths due to differing electrical lengths and voltages. These phenomena generate image responses in the upconverted signal. Additional measuring equipment is required to correct for these impairments. For complete correction and improved accuracy, including I/Q imbalance, use Signal Studio software and a PSA microwave spectrum analyzer. Signal Studio applications include multi-tone, pulse building, fading, and waveform streaming.

**System Requirements**
This application must be installed on a PC running the Microsoft Windows® XP Professional operating system, or Microsoft Windows 2000 with the .NET Framework installed. The application requires that the MATLAB run-time libraries be installed (included). There should be at least 240 MB of disk space available to accommodate both the application and the MATLAB run-time libraries.

This application is capable of generating large waveforms. For this reason it is recommended that the host computer have a 2.4 GHz (or higher) Pentium 4 processor, and at least 512 MB of RAM.

**Software Downloads**
The N7509A WGT can be downloaded from the Agilent web at **www.agilent.com/find/signalsimulation**. Without a license, the software can be run in simulation mode, including visual representation of the waveforms. Upon purchase of a license, the full functionality is available, including access to binary files and automatic waveform downloading.

**System State Files**
At any time, the system state can be saved to and restored from "system state" files. The system state is a snapshot of the values of all the variables in the application. These variables include the waveform generator parameters and application settings.

**Waveform Types and Parameters**
The Waveform Type selector allows the user to select from the following list of waveform generators, custom download and the RF source controller:

- AM generator
- FM generator
- PM generator
- Multi-tone generator
- Pulse generator
- Chirp generator
- Custom download
- RF source control

**Warranty information**
Agilent provides a 1-year return-to-Agilent warranty on custom systems. Warranty extensions and custom repair strategies are available to meet your specific requirements.

**System Specifications**
Your system specifications will be dependent on system configuration, including the building blocks you chose and your specific requirements.



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**Ordering information**
Contact your Agilent representative.

**Web Resources**
For additional product information, visit:
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**Related Agilent literature**

- *N7502A Signal Simulation System*
  Product overview
  5989-1827EN

- *N7502A Signal Simulation System*
  Configuration Guide
  5989-2914EN

- *N6030A Arbitrary Waveform Generator*
  Technical overview
  5989-1457EN

- *E8267D PSG Vector Signal Generator*
  Data Sheet
  5989-0697EN

- *Infiniium Oscilloscopes and 89601A Vector Signal Analysis Software*
  Data sheet
  5989-0947EN

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Printed in USA, May 18, 2005
5989-3080EN



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