Waveform creation and analysis software for Series 2900 VSGs, Series 2800 VSAs, and MIMO systems

RF/MICROWAVE

290101 v3.0

- **Industry's only fully integrated signal generation and analysis software package**
- **Unique, seamless SISO-to-8×8 MIMO signal creation and measurements**
- **WiMAX 802.16e Wave 2 and WLAN 802.11n signal generation and analysis**
- **WLAN 802.11n channel modeling**
- **Simulation mode for studies without RF instruments**
- **Intuitive, object-oriented graphical user interface**
- **Common user interface for all signal protocol libraries**
- **Calibrated signal impairments**
- **Fading control parameters**
- **Seamless integration and control of Series 2900 RF Vector Signal Generators and Series 2800 Vector Signal Analyzers**
- **Compatible with Windows® XP and Vista**

Available Signal Libraries

- **Mobile Communications (3GPP and 3GPP2 Standards)**
  - **WCDMA**
  - **HSDPA**
  - **HSUPA**
  - **cdmaOne**
  - **cdma2000**
  - **1xEV-DV**
- **Wireless Connectivity**
  - **802.11a-b-g-j-n WLAN (supports MIMO)**
  - **802.16e-2005 mobile WiMAX (supports WiBro)**
  - **802.16e Wave 2 WiMAX MIMO**
- **Digital TV Transmission**
  - **DVB-H**
  - **DVB-T**

SignalMeister™ RF Communications Test Toolkit

Waveform creation and analysis software for Series 2900 Vector Signal Generators, Series 2800 Vector Signal Analyzers, and MIMO systems

The SignalMeister RF Communications Test Toolkit is a next-generation software tool that allows engineers to create and analyze the complex signals used in the most advanced wireless transmission protocols. SignalMeister software generates and analyzes both single-input, single output (SISO) signals and multiple-input, multiple-output (MIMO) signals used in the latest versions of the WLAN and WiMAX protocol standards. In addition to creating high quality signals, the SignalMeister RF Communications Test Toolkit can create impairments to model non-ideal transmitter conditions and real channel conditions such as fading and noise. The SignalMeister software has the unique ability to analyze the transmitted signals, acquiring and demodulating the signals, then computing and displaying a wide range of parametric data. In addition, the SignalMeister toolkit can perform simulation studies without the need to use the actual hardware, which allows researchers and designers to study the impacts of transmitter impairments and channel effects on signal transmissions easily.

This powerful software platform integrates the signal creation libraries of multiple wireless communication standards into a single package. It provides a common look and feel, allowing users to easily create and analyze reference signals from one or more standards in a single development environment. The built-in toolset can be used to modify all signal types, including non-encrypted waveform files produced by other software packages, to support extensive product testing. The PC-based software tool has an intuitive, object-oriented graphical user interface that's easy to learn and use, substantially increasing productivity over the use of traditional software tools.

SignalMeister software is compatible with both Windows XP and Vista and works seamlessly with Keithley's Series 2900 Vector Signal Generators (VSGs), Series 2800 Vector Signal Analyzers (VSAs), and MIMO test systems.

Using a waveform file created using SignalMeister software requires one or more Series 2900 VSGs equipped with an arbitrary waveform generator (ARB) option and a SignalMeister license option that matches the waveform signal standard of the file being used. Analyzing the signals created by the waveform files requires a Series 2800 VSA equipped with the appropriate license options.

APPLICATIONS

- **R&D and design verification**
- **Production verification and test**
- **Mobile handset terminal equipment test**
- **Base station infrastructure test**
- **RFIC device test**
- **Education**

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Ordering Information

290101 SignalMeister (free CD)

Signal Generation Software Licenses: [1]

2900-WCDMA-PC
2900-HSDPA-PC
2900-HSUPA-PC
2900-CDMA-PC
2900-80211-PC [2]
2900-80211-N-PC [2]
2900-80216-E-PC [2]
2900-WLAN-CM-PC
2900-DVB-PC

Required Options (select one):

2900-ARB-20
2900-ARB-40
2900-ARB-80 [3]

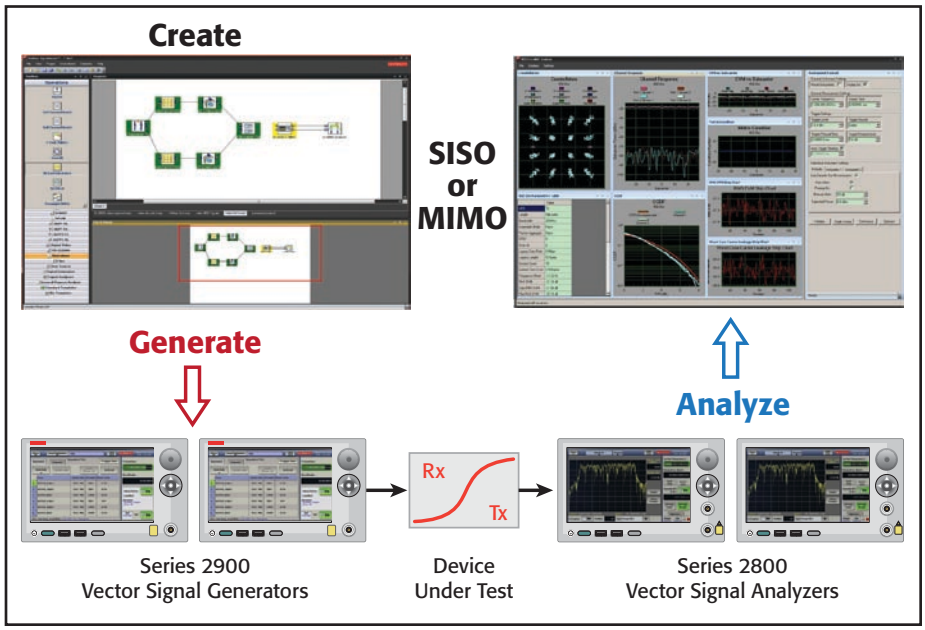
1. A software license is required in the Series 2900 RF Vector Signal Generator with software version 3.11 or higher in order to play SignalMeister waveform files of the applicable signal type.
2. The 2900-80211-PC, 2900-80211-N-PC, and 2900-80216-E-PC require the 2900-ARB-40 or 2900-ARB-80 arbitrary waveform generator license.
3. The Model 2910 is limited to 40MHz bandwidth using option 2900-ARB-80.

Signal Analysis Software Licenses:

290101-WIMAX
290101-WLAN

Create, Generate, Control, and Analyze – All with the SignalMeister RF Communications Test Toolkit

SignalMeister's waveform creation tools can be used to create a wide range of signals, including WiMAX and WLAN SISO and MIMO signals. Download the signal arbitrary waveform files to Series 2900 VSGs. Generate the signal by controlling the VSGs through the SignalMeister link to the instrument's LXI-LAN interface. Define an analysis block, such as a WiMAX or a WLAN demodulation and parameter computation block. SignalMeister programs the VSA's settings to acquire the data and perform the required operations. Using the VSA's LXI-LAN interface, SignalMeister controls the operation of the analyzer and displays test results. Only one tool is needed to accomplish the full complement of operations needed to test a component, a device, or a system.



Maximizing engineering productivity: create waveforms, generate RF signals with the Series 2900 Vector Signal Generators, control the instruments, and analyze the measurements with a Series 2800 Vector Signal Analyzer—all with SignalMeister.

Block Diagram, Object-Oriented Architecture with One Common Format for All Protocols Maximizes Engineering Productivity

SignalMeister's object-oriented architecture simplifies the creation of both basic and complex signal waveforms. Waveforms can be defined and impairments can be created easily and quickly in an intuitive block diagram format. All signal protocols are created using the same format, so there is only one interface to learn. The same format is used for both SISO and MIMO signal generation and analysis. This common look and feel minimizes the time that must be spent on creating signals and setting up and programming analysis routines. It also maximizes the time available to study results, allowing for significantly higher productivity.

Both generation and analysis signal object elements are located in a toolbox and can be easily dragged into a project work area. In this area, they are connected and defined to create an easily understood block diagram, then one or more signal waveforms are built and downloaded to the signal generator or generators.

Once an ARB generation and analysis build is complete, object elements in the project work area will turn green, yellow, or red to provide immediate user feedback and prevent operator errors. The element will be green if it runs without an error or warning, yellow if there is a warning, or red if it has errors that halt the build. The status area displays any warnings or error messages.

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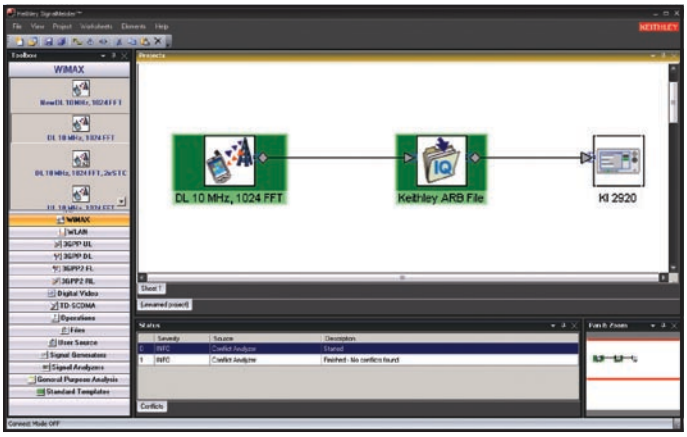
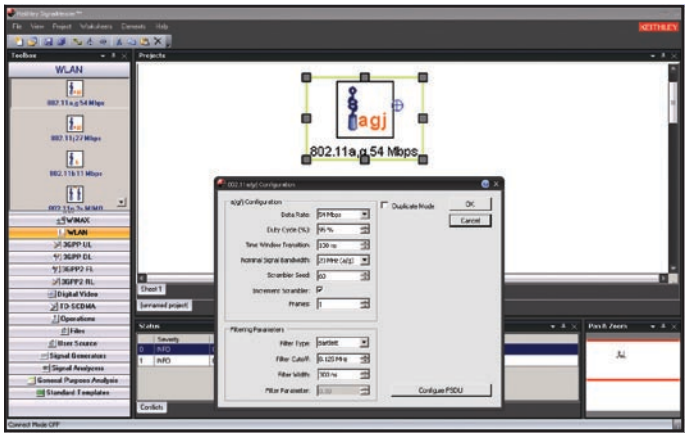


SignalMeister simplifies signal creation using an object-oriented GUI. Colors and status messages give you confidence that the defined signal is valid.

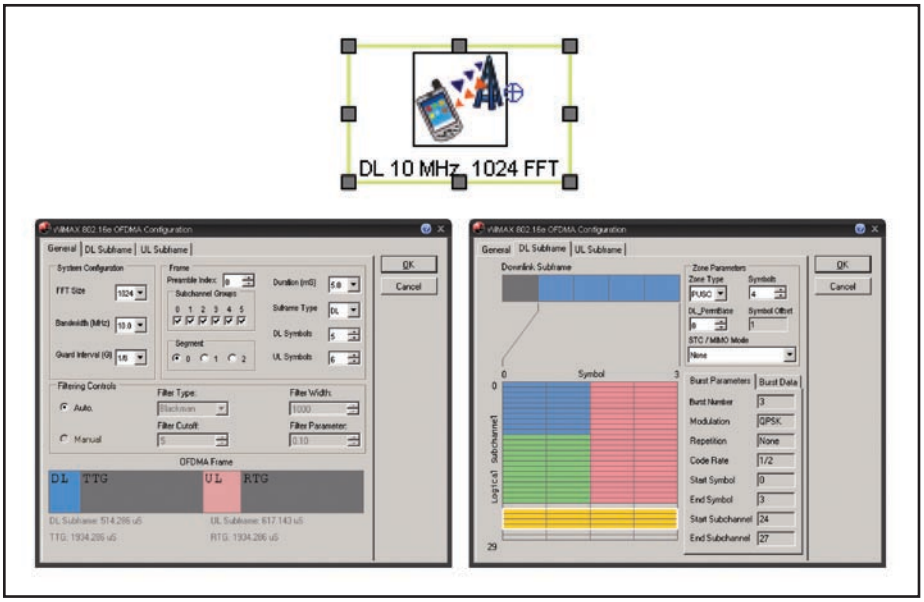


SignalMeister uses definition forms that are logically organized to each unique object. This allows specifying all of the signal parameters for each signal type quickly and easily.

ARB files can be saved on a PC then manually downloaded to Series 2900 RF Vector Signal Generators. Alternatively, the PC on which the SignalMeister software is running can be connected to the VSGs via their LAN or GPIB interfaces and the ARB file directly downloaded to the VSGs' ARB memory. Similarly, the project programs the Series 2800 VSA to perform the required measurements for analysis.

Each object comes with its unique definition form. For example, there are separate signal generation and analysis objects for each wireless standard such as WiMAX 802.16e Wave 2, WLAN 802.11b, 802.11a/g, 802.11j, 802.11n SISO, and 802.11n MIMO. Each form guides the user through the definition of each signal type. Specifying the applicable parameters with the appropriate value ranges the standard allows helps to ensure signals are correctly defined. Signal data can be a series of ones and zeros, various PN sequences, or user data from a text file.

SignalMeister objects, ARB files, and complete signal creation and analysis work projects can be saved and re-used or distributed to other engineers and departments, saving time and increasing productivity. This is especially useful when it's important to control the reference signal definition.



SignalMeister simplifies creation of even the most complex signals. This example shows the General and Downlink Subframe definition forms for an 802.16e mobile WiMAX OFDMA signal. All of the signal parameters, such as the modulation type and the code rate of the individual logical subchannels and symbols, can be specified in the downlink map.

Seamless SISO-to-8×8 MIMO Signal Creation and Measurements

In SignalMeister's object-oriented, block diagram project environment, it's as easy to generate a set of MIMO signals as to generate a SISO signal. And that includes configuring a MIMO signal set as large as an 8×8 configuration. Furthermore, a simple block programs as many as eight VSAs to receive the MIMO signal transmissions. Not only does SignalMeister create all the MIMO signals for the generators and programs the analyzers, the tool programs all the VSGs to be tightly synchronized with each other and with the VSAs for highly synchronized acquisition of the transmitted signals. The intricacies of MIMO signal generation and analysis are entirely transparent to the user. That makes it possible to go from test setup to actual testing of a complex MIMO system in a fraction of the time required with any other methodology.

WiMAX 802.16e Wave 2 and WLAN 802.11n Signal Generation and Analysis

SignalMeister offers a full library of SISO and MIMO WiMAX signals. Use the default program parameters or customize signals by defining

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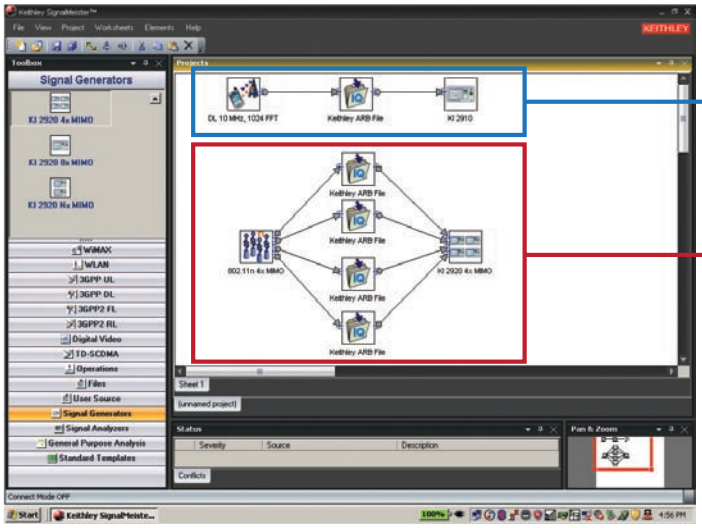
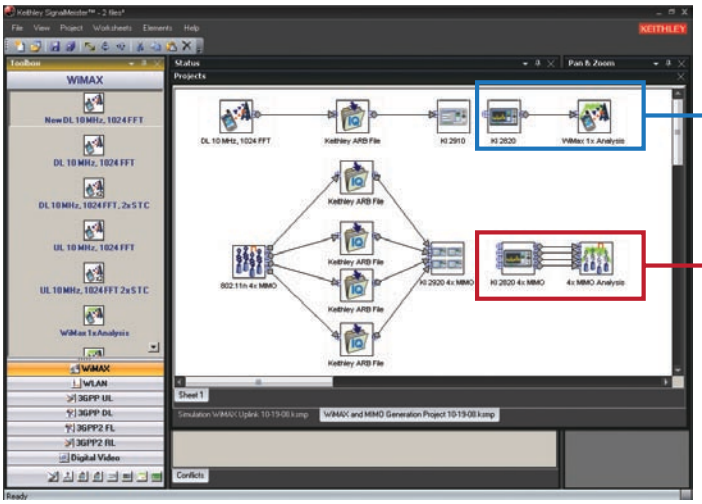


Seamless SISO to MIMO signal generation. Build complex MIMO signals as easily as building a SISO signal.



Seamless SISO to MIMO signal analysis. Analyze complex MIMO transmissions as easily as SISO transmissions.

parameters such as the size of the Fourier Transform, the guard interval, the modulation, and the coding rate for an individual burst. For analysis of the WiMAX transmissions, select displays of the demodulated constellation, EVM vs. Subcarrier, Spectrum Emission Mask, Subcarrier Flatness, and other performance parameters. It's also possible to display WiMAX-standard based computations such as frequency offset, pilot relative constellation error (RCE), and data RCE.

The same extensive capability for WiMAX generation and analysis is also available for WLAN 802.11a, b, g, and j and 802.11n. One block creates a 4×4 MIMO signal set with options to define, for example, signal filtering, the modulation coding state, duty cycle, and the number of transmission frames. For analysis, one block defines a 4×4 MIMO analysis configuration with displays of Matrix Condition, CCDF, and packet frequency variation among others. Complex signals and an extensive set of measurements can be set up easily as SignalMeister performs all the hard work in the background.

Waveform creation and analysis software for Series 2900 VSGs, Series 2800 VSAs, and MIMO systems

RF/MICROWAVE

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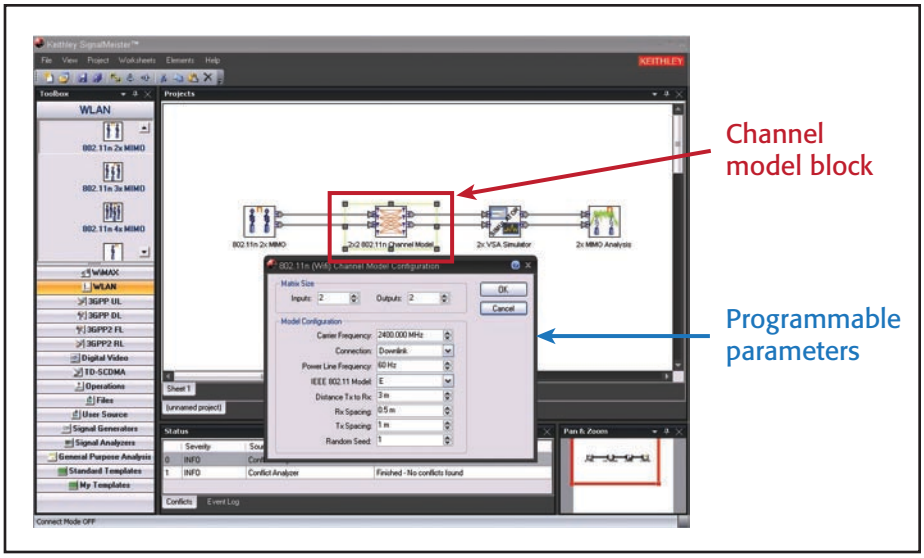
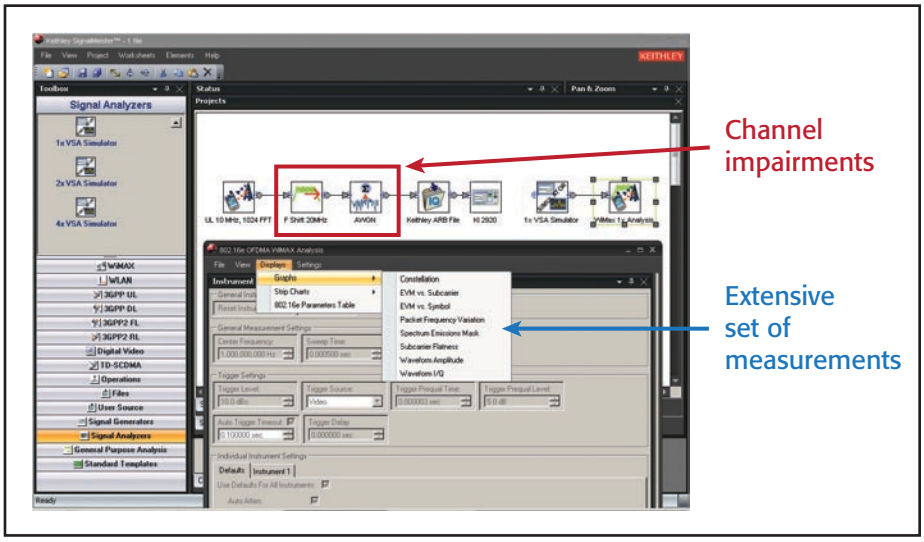
Waveform creation and analysis software for Series 2900 Vector Signal Generators, Series 2800 Vector Signal Analyzers, and MIMO systems

Create any of the 802.11n Channel Models for design development and certification testing.



Quickly and easily simulate channel conditions and measurements without hardware for use in R&D applications and university training programs.



Device and Channel Emulation Including WLAN 802.11n Channel Models

Signal impairments can be easily added to any waveform. Toolbox objects in SignalMeister include I-Q Gain and I-Q Offset. This makes it possible for modulator distortion parameters to be varied either to correct for or to simulate transmitter effects. The AWGN (Arbitrary White Gaussian Noise) object allows the addition of noise to a waveform with or without I-Q distortion impairments to facilitate receiver testing. An undistorted reference signal can be created simultaneously with impaired signals, saving processing time and facilitating quick comparisons between the ideal and impaired signals. Because the object-oriented architecture creates all signals from a common object, any modifications made to the reference signal are also applied to the impaired signals, saving time and eliminating errors.

SignalMeister's Channel Model objects allow users to perform fading simulations by changing the phase and amplitude of reference signal waveforms for single-channel systems up through 8×8 MIMO channel systems. Multiple waveforms can be created and downloaded into the signal generator's

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ARB memory and run using the ARB Sequence feature for performing quasi-real-time fading simulation testing.

Specifically for performance verification and WLAN standard compliance certification, SignalMeister has 802.11n channel models, A–F. Signals can be programmed to be either uplink or downlink. Parameters such as carrier frequency, transmission distance, and spacing between antennas can be programmed for thorough testing of a WLAN 802.11n chipset or device.

Non-encrypted binary I-Q files, in either double-precision or single-precision, created from other software packages, such as MATLAB® or LabVIEW®, can be imported into the SignalMeister work project area. These files are compatible with and can be connected to other SignalMeister objects, such as AWGN, I-Q Gain and Offsets, and Channel Models from the Operations toolbox. Additional toolbox operations include a Re-sampling object and Invert-Q object. This allows creating new waveforms from existing work, saving development time.

Conduct Simulations to Make Faster Design Decisions or for Cost-Effective Engineering Training

The SignalMeister software's integration of signal generation and analysis allows performing studies using the software's simulation mode. Test transmitter performance with various modulator impairments, and test the performance of a receiver when it must detect a signal distorted by a channel. SignalMeister makes it possible to create signals, create transmitter impairments and channel models, and obtain measurements without instrumentation. The simulation mode is an excellent method to determine the limits of a design. The simulation mode is also an excellent training vehicle for learning about wireless communication in academic settings.

Scalable SISO–MIMO Instrument Control

The SignalMeister software has the capability to view and control both Series 2900 VSGs and Series 2800 VSAs via their LXI interfaces. For example, the signal generator's RF frequency and output power amplitude can be changed or other signal waveforms in the generator's ARB memory can be selected and run. The signal analyzer's display can also be viewed on the PC and measurement control settings changed. Thus, test waveforms can be quickly downloaded directly to the signal generator and then verified nearly instantly with the signal analyzer, reducing the cycle times of signal creation or device testing or both.

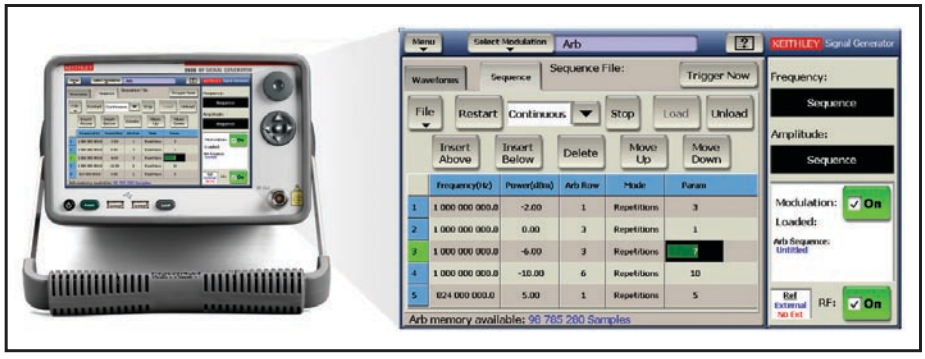
The enhanced analysis capability of SignalMeister includes much more than just access to the Series 2800 VSAs' displays. The WIMAX and WLAN analysis routines allow simultaneous display of numerous graphs, strip charts, and computed parameters.

Whether working with traditional SISO communication or new MIMO communication systems, SignalMeister can be readily scaled up to the requirements for synchronizing all VSGs together and all VSAs together. In addition, SignalMeister downloads the multiple signals to the appropriate generators and processes and presents all the data from each of the analyzers. That means testing a MIMO system is no more complex than testing a SISO signal. SignalMeister makes it easy to expand systems from SISO to up to 8×8 MIMO systems all within the same software environment.

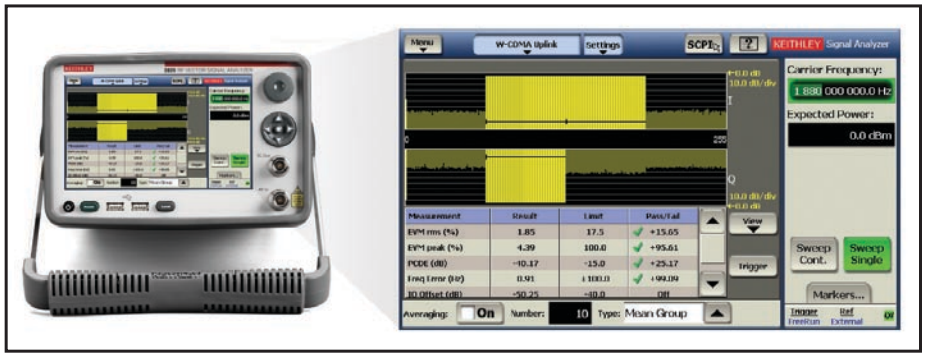
Series 2900 RF Vector Signal Generators

Waveform files created with SignalMeister work seamlessly with Series 2900 RF Vector Signal Generators. This is an industry-leading instrument platform with a DSP-based software-defined radio (SDR) architecture designed for testing modern RF communications devices and equipment. They have excellent amplitude accuracy and repeatability and high modulation quality, making them today's instrument of choice for automated testing in R&D and production applications.

Many different signal waveforms can reside simultaneously in the Series 2900 Vector Signal Generator's large ARB memory. Switching between any two waveforms takes less than 3ms using a SCPI command and is nearly instantaneous using the ARB Sequence mode. This results in ultra-fast test times when testing RF devices requires using multiple test signals.



Once SignalMeister has downloaded waveforms to a Series 2900 RF Vector Signal Generator, its fast waveform switching time and the ARB Sequencing mode allow reducing test times of devices and equipment that require testing with multiple waveforms.



Series 2800 Vector Signal Analyzers can perform signal demodulation and analysis internally, such as demodulation of a WCDMA transmission (shown here) or upload data for processing and analysis in SignalMeister.

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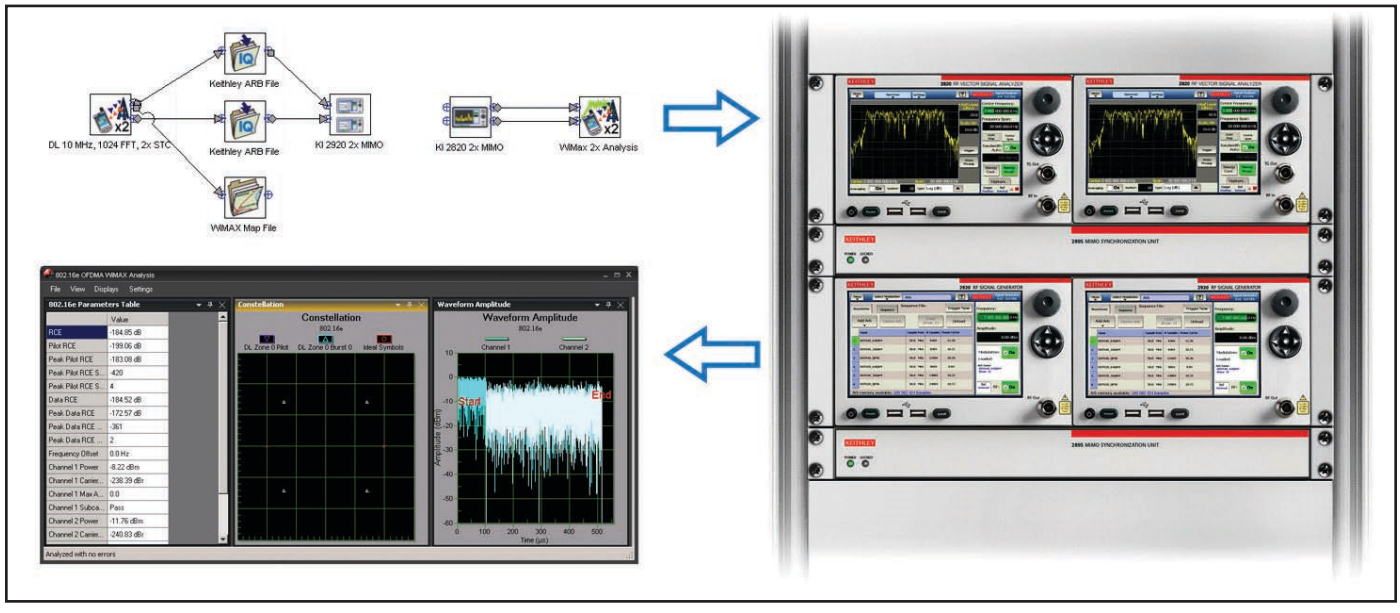
The Model 2920 Vector Signal Generator has the synchronization required for MIMO communication systems testing. The outputs of multiple Model 2920s can be locked to within 1ns timing offset.

Series 2800 RF Vector Signal Analyzers

SignalMeister controls the operation of and uploads data from Series 2800 VSAs, which are based on the same innovative, DSP-based software-defined radio (SDR) architecture used for the Series 2900 Vector Signal Generators. The Series 2800 VSAs feature wide signal bandwidths of up to 40MHz to enable analysis of the new wide bandwidth signals used in the wireless standards such as WLAN, WiMAX, and next-generation wireless standards. With excellent accuracy and a noise floor down to 1466dBm/Hz, the Series 2800 VSAs have all the capability needed to test today's and tomorrow's wireless components and devices. Even for complex measurements, test results are available quickly. The Series 2800 VSAs have a sweep update rate of up to 650MHz/s with a 1kHz resolution bandwidth. Many analysis options are available to be installed in the instrument to eliminate time-consuming transfers of large amounts of data for external analysis. Thus, the Series 2800s are excellent for reducing test time in production test systems.

Like the Model 2920 VSG, the Model 2820 VSA has the synchronization capability necessary for MIMO testing. The time record offset between samples from multiple Model 2920s is within 250ps. Thus, Model 2820 VSAs combined with Model 2920 create high quality measurements for MIMO testing.

Refer to the Series 2900, Series 2800, and the MIMO datasheets for more detailed product information on the instruments and specifications.



SignalMeister easily creates MIMO signal streams and analyzes MIMO transmissions by synchronizing all hardware. User interaction is not required. SignalMeister implements from 2×2 up to 8×8 MIMO systems.

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Specifications (Characteristic Data)

Signal Generation

2900–WCDMA–PC SignalMeister License for W–CDMA FDD Up and Down Links

2900 HSDPA–PC SignalMeister License for W–CDMA HSDPA

2900 HSUPA–PC SignalMeister License for W–CDMA HSUPA

FREQUENCY RANGE: 1800–2200MHz.

		2910 VSG	2920 VSG
EVM [1]	W–CDMA Downlink	≤0.5%	≤0.4%
	W–CDMA Uplink	≤0.5%	≤0.4%
	HSUPA	≤0.5%	≤0.4%
ACLR [2, 3]	W–CDMA Downlink	Adjacent: <–63 dBc Alternate: <–71 dBc	Adjacent: <–68 dBc Alternate: <–75 dBc
	W–CDMA Uplink	Adjacent: <–62 dBc Alternate: <–71 dBc	Adjacent: <–66 dBc Alternate: <–76 dBc
	HSUPA	Adjacent: <–62 dBc Alternate: <–71 dBc	Adjacent: <–64 dBc Alternate: <–76 dBc

1. RF Amplitude setting: +3dB. CPICH only.
2. RF Amplitude setting (2910): 0dBm. CPICH only. Adjacent spacing 5MHz offset. Alternate spacing 10MHz offset.
3. RF Amplitude setting (2920): –3dBm. CPICH only. Adjacent spacing 5MHz offset. Alternate spacing 10MHz offset.

2900–CDMA–PC SignalMeister License for cdmaOne, cdma2000, and 1xEV–DV Forward and Reverse Links

			2910	2920
RHO [1] (ρ)	cdma2000 Forward Link	800–2025 MHz	≥0.9999	≥0.9999
	cdma2000 Reverse Link	800–2025 MHz	≥0.9998	≥0.9998
ACPR [2, 3]	cdma2000 Forward Link	800–900 MHz	Adjacent: <–72 dBc Alternate: <–88 dBc	Adjacent: <–78 dBc Alternate: <–90 dBc
		1800–1900 MHz	Adjacent: <–68 dBc Alternate: <–86 dBc	Adjacent: <–74 dBc Alternate: <–88 dBc
		1900–2025 MHz	Adjacent: <–67 dBc Alternate: <–84 dBc	Adjacent: <–73 dBc Alternate: <–87 dBc
	cdma2000 Reverse Link	800–900 MHz	Adjacent: <–77 dBc Alternate: <–88 dBc	Adjacent: <–80 dBc Alternate: <–91 dBc
		1800–1900 MHz	Adjacent: <–73 dBc Alternate: <–86 dBc	Adjacent: <–76 dBc Alternate: <–88 dBc
		1900–2025 MHz	Adjacent: <–72 dBc Alternate: <–84 dBc	Adjacent: <–75 dBc Alternate: <–88 dBc

1. RF Amplitude setting: +3dB. Pilot only.
2. RF Amplitude setting (2910): –3dBm. Pilot only. Adjacent spacing 750kHz offset. Alternate spacing 1.98MHz offset.
3. RF Amplitude setting (2920): –1dBm. Pilot only. Adjacent spacing 750kHz offset. Alternate spacing 1.98MHz offset.

2900–80211–PC SignalMeister License for 802.11a, b, g, j WLAN Signals

	Standard	Frequency Band	2910	2920
EVM [1,2,3]	802.11a	5150–5825 MHz		≤–41 dB
	802.11b	2400–2500 MHz	≤–39 dB	≤–38 dB
	802.11g	2400–2500 MHz	≤–39 dB	≤–42 dB
	802.11j	4900–5000 MHz		≤–41 dB
ACP–Adjacent [2, 3]	802.11a	5150–5825 MHz		≤–45 dBc
	802.11b	2400–2500 MHz	≤–36 dBc	≤–36 dBc
	802.11g	2400–2500 MHz	≤–45 dBc	≤–45 dBc
	802.11j	4900–5000 MHz		≤–55 dBc

1. RF amplitude: +3dBm(2910 only).
2. RF amplitude: –1dBm (for 2920 EVM and all ACP data).
3. Signal characteristics: 802.11b: 11Mbps, 50% duty cycle, Gaussian filter; 802.11a,g: 54Mbps, 50% duty cycle, 20MHz bandwidth, Bartlett filter; 802.11j: 27Mbps, 90% duty cycle, 10MHz, Bartlett filter.

2900–80211–N–PC SignalMeister License for 802.11n WLAN Signals

	Signal Bandwidth	Frequency	2910	2920
EVM [1, 2, 3]	20 MHz	2400–2485 MHz	≤–41 dB	≤–43 dB
		5150–5825 MHz		≤–40 dB
	40 MHz	2400–2485 MHz	≤–37 dB	≤–40 dB
		5150–5825 MHz		≤–40 dB

1. RF amplitude (2910): +3dBm.
2. RF amplitude (2920): –1dBm.
3. Signal characteristics: 64QAM modulation, MCS 7, 95% duty cycle, mixed–mode, Bartlett filter.

2900–80216–E–PC SignalMeister License for 802.16e–2005 Mobile WiMAX Signals

		Frequency	2910	2920
SISO	Residual RCE [1, 2, 3]	2300–2500 MHz	≤–44 dB	
		2300–2690 MHz		≤–45 dB
		3400–3800 MHz		≤–44 dB
		4000–4999 MHz		≤–44 dB
		5150–5825 MHz		≤–43 dB
	ACP [1, 2, 3]	2300–2500 MHz	Adjacent: <–50 dBc Alternate: <–50 dBc	
		2300–2690 MHz		Adjacent: <–53 dBc Alternate: <–54 dBc
		3400–3800 MHz		Adjacent: <–51 dBc Alternate: <–53 dBc
		4000–4999 MHz		Adjacent: <–53 dBc Alternate: <–56 dBc
		5150–5825 MHz		Adjacent: <–53 dBc Alternate: <–57 dBc
MIMO (Wave 2)	Residual RCE [2, 3]	2300–2690 MHz		≤–45 dB
		3400–3800 MHz		≤–44 dB
		4000–4999 MHz		≤–44 dB
		5150–5825 MHz		≤–43 dB
	ACP [2, 3]	2300–2690 MHz		Adjacent: <–53 dBc Alternate: <–54 dBc
		3400–3800 MHz		Adjacent: <–51 dBc Alternate: <–53 dBc
		4000–4999 MHz		Adjacent: <–53 dBc Alternate: <–56 dBc
		5150–5825 MHz		Adjacent: <–53 dBc Alternate: <–57 dBc

1. RF amplitude setting (2910): +2dBm.
2. RF amplitude setting (2920): –2dBm.
3. Signal Characteristics: DL subframe, 10MHz Bandwidth, 1024 sub–carrier FFT, 1/8, 30 symbol Guard Period, PN9 data.

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Signal Analysis

290101–WLAN SignalMeister License for 802.11a, b, g, j, n Signal Analysis

		Signal Bandwidth	Standard	Frequency	2810/2820 VSA
EVM [1]	SISO	20 MHz	802.11a	5.8 GHz	–41 dB
		20 MHz	802.11b	2.4 GHz	–44 dB
		20 MHz	802.11b	5.8 GHz	–41 dB
		20 MHz	802.11g	2.4 GHz	–43 dB
		10 MHz	802.11j	4.9 GHz	–41 dB
		20 MHz	802.11n	2.4 GHz	–42 dB
		40 MHz	802.11n	5.8 GHz	–40 dB
	MIMO	20 MHz	802.11n	2.4 GHz	–42 dB
		40 MHz	802.11n	5.8 GHz	–40 dB

INPUT POWER: >–20dBm with 2810 or 2820 Expected Channel Power set to the input power level.

SIGNAL CHARACTERISTICS: 802.11n downlink, QAM 64 modulation.

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		Signal Bandwidth	Frequency	2810/2820
Residual [1, 2] RCE	SISO	10MHz	700 MHz	–47 dB
			2.5 GHz	–45 dB
			3.5 GHz	–42 dB
		20MHz	700 MHz	–46 dB
			2.5 GHz	–45 dB
			3.5 GHz	–42 dB
	MIMO (Wave 2)	10MHz	700 MHz	–47 dB
			2.5 GHz	–45 dB
			3.5 GHz	–42 dB
		20MHz	700 MHz	–45 dB
			2.5 GHz	–45 dB
			3.5 GHz	–42 dB

INPUT POWER: >–20dBm with 2810 or 2820 Expected Channel Power set to the input power level.

SIGNAL CHARACTERISTICS: 802.16e downlink, 10MHz bandwidth, 1024 sub–carrier FFT, 1/8 Guard Interval, 64 QAM modulation.

SPECIFICATION DEFINITION

Characteristic (mean or expected value):

Characteristic values are nominal performance that units are expected to have under the following conditions:

- Ambient operating temperature of 23°C, unless otherwise noted.
- After a warm–up time of 30 minutes and self calibration at ambient temperature.

This performance is not warranted.

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KEITHLEY INSTRUMENTS, INC. ■ 28775 AURORA ROAD ■ CLEVELAND, OHIO 44139-1891 ■ 440-248-0400 ■ Fax: 440-248-6168 ■ 1-888-KEITHLEY ■ www.keithley.com

BELGIUM
Sint-Pieters-Leeuw
Ph: 02-3630040
Fax: 02-3630064
info@keithley.nl
www.keithley.nl

CHINA
Beijing
Ph: 8610-82255010
Fax: 8610-82255018
china@keithley.com
www.keithley.com.cn

FINLAND
Espoo
Ph: 09-88171661
Fax: 09-88171662
finland@keithley.com
www.keithley.com

FRANCE
Saint-Aubin
Ph: 01-64532020
Fax: 01-60117726
info@keithley.fr
www.keithley.fr

GERMANY
Germering
Ph: 089-84930740
Fax: 089-84930734
info@keithley.de
www.keithley.de

INDIA
Bangalore
Ph: 080-26771071,-72,-73
Fax: 080-26771076
support_india@keithley.com
www.keithley.com

ITALY
Peschiera Borromeo (Mi)
Ph: 02-5538421
Fax: 02-55384228
info@keithley.it
www.keithley.it

JAPAN
Tokyo
Ph: 81-3-5733-7555
Fax: 81-3-5733-7556
info.jp@keithley.com
www.keithley.jp

KOREA
Seoul
Ph: 82-2-574-7778
Fax: 82-2-574-7838
keithley@keithley.co.kr
www.keithley.co.kr

MALAYSIA
Penang
Ph: 60-4-643-9679
Fax: 60-4-643-3794
chan_patrick@keithley.com
www.keithley.com

NETHERLANDS
Gorinchem
Ph: 0183-635333
Fax: 0183-630821
info@keithley.nl
www.keithley.nl

SINGAPORE
Singapore
Ph: 65-6747-9077
Fax: 65-6747-2991
koh_william@keithley.com
www.keithley.com.sg

SWEDEN
Stenungsund
Ph: 08-50904600
Fax: 08-6552610
sweden@keithley.com
www.keithley.com

SWITZERLAND
Zürich
Ph: 044-8219444
Fax: 044-8203081
info@keithley.ch
www.keithley.ch

TAIWAN
Hsinchu
Ph: 886-3-572-9077
Fax: 886-3-572-9031
info_tw@keithley.com
www.keithley.com.tw

UNITED KINGDOM
Theale
Ph: 0118-9297500
Fax: 0118-9297519
info@keithley.co.uk
www.keithley.co.uk

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