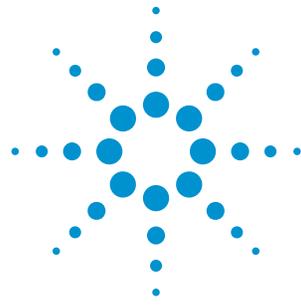
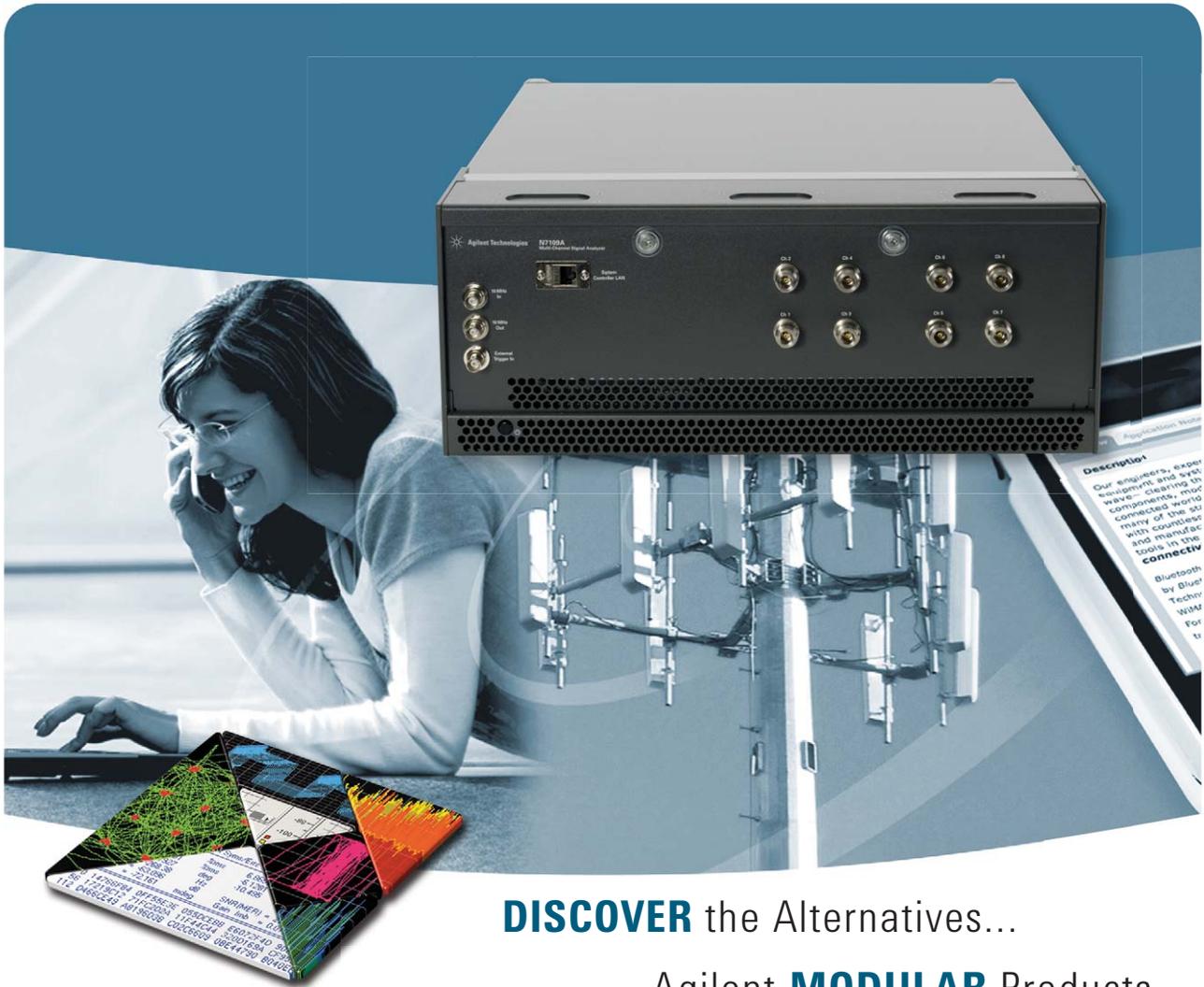


# Agilent N7109A

Multi-Channel  
Signal Analyzer



Data Sheet



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## ADAPT AS MIMO TESTING EVOLVES

### OVERVIEW

In the development of next-generation wireless technologies, MIMO measurements are becoming an essential part of every R&D engineer’s toolkit. From 802.11n to LTE-Advanced and beyond, the Agilent N7109A multi-channel signal analyzer provides excellent MIMO RF performance at attractive price points for two-, four- and eight-channel systems.

### Product Description

The N7109A combines scalable measurement hardware with the MIMO and multi-channel measurement capabilities of the industry-leading Agilent 89600 VSA software. This combination enables fast, informative measurements on devices ranging from 2x2 to 4x4 to 8x8, including LTE beamforming and a variety of cross-channel characterization measurements.

### Applications

- Wireless communications
- Wideband signal analysis

### Features

- Frequency range per channel: 20 MHz to 6 GHz
- 40 MHz bandwidth per channel (preselected and independently tunable).
- Up to 8 phase synchronous measurement channels for LTE antenna beamforming and a variety of cross-channel measurements—frequency response, cross correlation, coherence, etc.
- Independently tunable measurement channels for LTE-A Carrier Aggregation, simultaneous uplink/down link measurements, and more.
- Correction Wizard provides superb amplitude and phase accuracy at the device-under-test.
- Fully integrates with 89600 VSA software for fastest measurement results.

### Customer values

- Provides early insight into multi-channel/MIMO wireless device designs to stay one step ahead of rapidly evolving standards
- Fastest multi-channel/MIMO measurements minimizes test time and speeds your time-to-results
- Modular platform is expandable as measurement requirements evolve and budgets allow

# ADAPT AS MIMO TESTING EVOLVES

## Make multi-channel and MIMO measurements from 2x2 to 4x4 to 8x8

The basic measurement configuration is shown in the diagram below. Up to eight vector signal generators provide inputs to the MIMO device-under-test (DUT) and an N7109A with two, four or eight channels measures the outputs. The 89600 VSA software runs on the host PC, providing simultaneous signal acquisition and analysis.

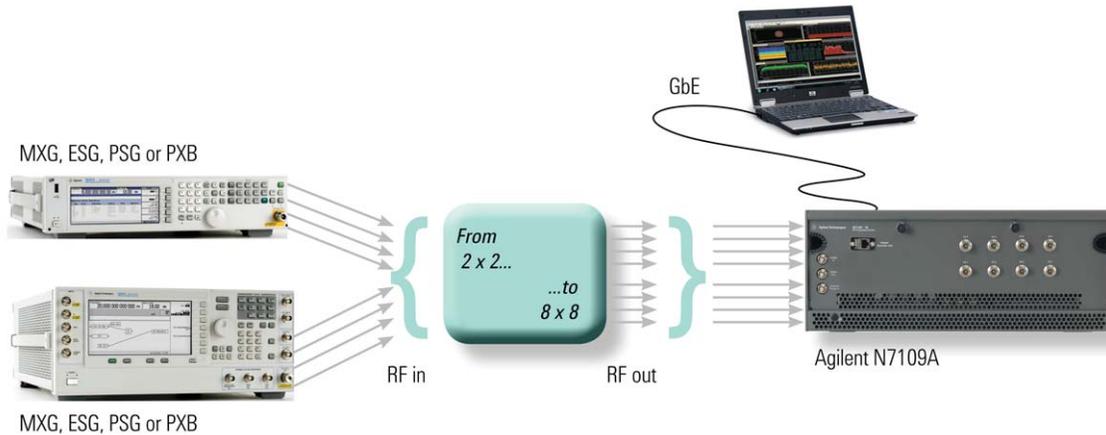


Figure 1. Typical MIMO test setup.

## Apply advanced signal generation

Our range of vector signal generators provides outstanding signal quality at baseband, RF and microwave frequencies, plus arbitrary waveform playback and sophisticated real-time signal generation. Examples include the N5182A MXG, E4438C ESG and E8267D PSG vector signal generators as well as the N5106A PXB baseband generator and channel emulator. Agilent's Signal Studio and SystemVue applications are useful additions for the creation of Agilent-validated and performance-optimized reference signals. These PC-based software applications enable generation of numerous application-specific test signals at baseband, RF and microwave frequencies. Flexible and easy to use, they cut the time you'll spend on signal simulation.

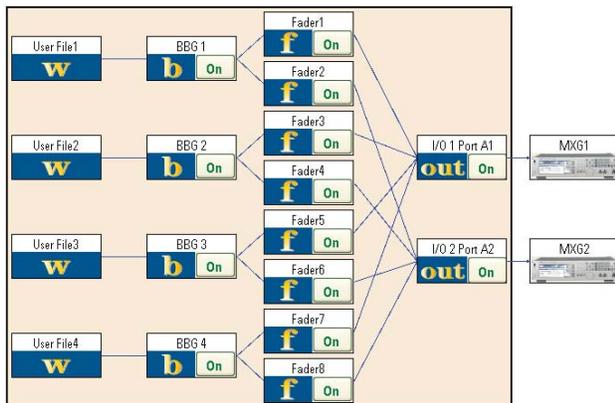


Figure 2. SystemVue signal generation project

## Get fast, flexible measurements

The N7109A is a modular, compact measurement platform. You can configure a system with one, two or four N7130A two-channel receiver modules that provide 40 MHz analysis bandwidth from 20 MHz to 6 GHz. Each channel can be independently tuned and includes a built-in preamp and multiple fixed pre-selectors, to optimize off-the-air measurements.

Processing power comes from integrated CPU and FPGA modules. These combine to deliver onboard data reduction, fast measurements and, with the Gigabit Ethernet PC link, rapid data transfers. Even a fully loaded eight channel configuration fits into a 19-inch mainframe that's rack mountable and just 4U high. We also include a front cover that simplifies signal connections, provides additional RF shielding, and ensures proper measurement calibration.

# SEE THROUGH THE COMPLEXITY



The 89600 VSA software is a window into what is happening inside complex wireless devices. It is equipped to measure more than 70 signal standards and modulation types, including LTE (FDD/TDD), W-CDMA HSPA+, GSM/EDGE Evolution, 802.16 OFDMA and ultra-wideband (UWB) MB-OFDM.

The 89600's 20:20 trace/marker capability lets you open new windows into what's happening. Pinpoint problems with arbitrary arrangement and flexible sizing of up to 20 measurement traces at once. Isolate the sources of unexpected signal interactions with up to 20 markers per trace, and activate trace-to-trace coupling of markers. To help you capture and analyze random or transient events, the 89600 also provides multi-domain digital-persistence and cumulative-history displays.

## Keep up with rapidly evolving standards

The N7109A combined with the latest 89600 VSA software releases helps you keep pace with rapidly evolving measurements standards, such as LTE-Advanced. New measurement capabilities included in the 89600 VSA software version 15 and later include:

- Phase synchronous measurements now up to 8-channels for LTE beamforming and a variety of cross-channel measurements (frequency response, cross correlation, coherence, etc).
- Independent center frequency tuning for LTE-A Carrier Aggregation, simultaneous uplink/downlink measurements, and more.
- Correction Wizard to provide superb amplitude and phase accuracy at the device under test.

# Typical Performance Characteristics (20°-30°)

Frequency	
<b>Frequency coverage</b>	20 MHz to 6 GHz
Center frequency tuning range	40 MHz to 6 GHz
Vector signal analyzer	1 Hz to 40 MHz (1-8 channels)
Center frequency resolution	10 mHz
<b>Frequency accuracy</b>	
Initial accuracy	± 0.04 ppm (typical)
Initial accuracy	± 0.2 ppm (guaranteed)
Aging	0.01 ppm per year
<b>Phase noise</b>	
	≤ 3.5GHz > 3.5GHz
> 10 kHz offset	-97 dBc/Hz -93 dBc/Hz
> 100 kHz offset	-96 dBc/Hz -92 dBc/Hz
> 1 MHz offset	-112 dBc/Hz -112 dBc/Hz
Third-order intercept (TOI, in band)	+6 dBm (-20 dBm range, pre-amp on); +28 dBm (+5 dBm range)

Amplitude	
<b>Full scale accuracy</b>	± 1.5 dB
<b>Flatness, VSA mode</b>	
Over full IF	±1.5 dB
<b>Dynamic range</b>	
Residual responses:	< -90 dBm or -70 dBfs, whichever is larger (except ≤ -75 dBm or -25 dBfs on -50 dBm range)
Sidebands (1 kHz to 1.5 MHz)	< -67 dBc
Sidebands (1.5 MHz to 20 MHz)	< -58 dBc
Input-related spurious responses	< -40 dBc
Cross channel isolation	-70 dB
<b>Input sensitivity Ranges</b>	
≥ -40 dBm	-149 dBm/Hz (≤ 5.7 GHz), -147 dBm/Hz (> 5.7 GHz)
-50 dBm range	-152 dBm/Hz (≤ 5.7 GHz), -151 dBm/Hz (> 5.7 GHz)
<b>Phase Group delay linearity</b>	± 6 ns typical, single-channel variation after calibration (half peak-to-peak), CF ± 19 MHz

RF Input	
<b>Input channels</b>	Two, four, or eight
<b>Full scale range</b>	+10 dBm to -50 dBm in 1-dB attenuator steps
<b>Maximum safe input level</b>	+20 dBm, 50 Vdc
<b>Nominal impedance</b>	50 Ω
<b>Connector</b>	Type-N on front panel cover.
<b>Input coupling</b>	AC
<b>VSWR (0.02 - 6.0 GHz, -20 dBm range)</b>	
20 MHz – 1 GHz	2:1
>1 GHz	3:1

External Reference & Trigger	
<b>External frequency reference input</b>	
Input frequency	10 MHz
Lock range	±50 ppm
Capture range	±10 ppm
Impedance	50 Ω
Connector types	BNC (front)
<b>External frequency reference output</b>	
Output frequency	10 MHz
Output amplitude	≥ 6 dBm
Impedance	50 Ω
Connector types	BNC (front)
<b>External trigger input</b>	
Impedance	3 kΩ
Connector types	BNC (front)

# Typical Performance Characteristics (20°-30°) *continued*

## Cross-Channel Tracking

*Within same 2-ch tuner, or adjacent tuners, with tuners locked together referenced to channel 1.*

<b>Amplitude match</b>	±1.0 dB typical
<b>Group delay match</b>	± 7 nsec typical ± 14 nsec guaranteed

## Time Capture Memory

### Time capture memory and record length

132 MSa (64 MSa in 1- or 2-ch mode, 32 MSa in 4- or 8-ch mode)

### Recording length

Span/bandwidth	1- or 2-ch mode	4- or 8-ch mode
40 MHz	1.3 s	0.65 s
20 MHz	2.6 s	1.3 s
10 MHz	5.2 s	2.6 s

## MIMO

### Typical EVM and measurement update speed performance

*Using Agilent 89600B VSA software, HP EliteBook 8540p PC w/2.67 GHz i7 CPU, 8 GB RAM, Windows7, 1 Gb LAN.*

802.11n, 2x2, 20 MHz BW @ 2.4 GHz	< -45 dB (0.5%), 0.1 seconds/update
802.16e WiMAX, 2x2, 10 MHz BW @ 2 GHz	< -42 dB (0.8%), 0.2 seconds/update
LTE, 2x2, 5 MHz BW @ 1 GHz	< -44 dB (0.6%), 0.4 seconds/update
LTE, 2x2, 5 MHz BW @ 2 GHz	< -44 dB (0.6%), 0.4 seconds/update
LTE, 2x2, 20 MHz BW @ 1 GHz	< -45 dB (0.5%), 1.8 seconds/update
LTE, 2x2, 20 MHz BW @ 2 GHz	< -45 dB (0.5%), 1.8 seconds/update
LTE, 2x2, 20 MHz BW @ 5.8 GHz	< -42 dB (0.8%), 1.8 seconds/update
LTE, 4x4, 5 MHz BW @ 1 GHz	< -43 dB (0.7%), 1.5 seconds/update
LTE, 4x4, 5 MHz BW @ 2 GHz	< -43 dB (0.7%), 1.5 seconds/update
LTE, 4x4, 20 MHz BW @ 1 GHz	< -42 dB (0.8%), 1.5 seconds/update
LTE, 4x4, 20 MHz BW @ 2 GHz	< -42 dB (0.8%), 1.5 seconds/update

## System Environmental Characteristics

<b>Operating temperature range</b>	+15° C to +45° C
<b>Storage temperature range</b>	-40° C to +70° C
<b>Humidity</b>	Maximum 95% at +40° C, non-condensing
<b>Maximum altitude</b>	3000 meters.
<b>Line input power requirements</b>	100 VAC to 240 VAC nominal (±10%) < 400 W typical (800 W maximum). 50/60/400 Hz nominal (47 Hz to 440 Hz)
<b>Warm-up time</b>	30 minutes
<b>Calibration interval</b>	2 years, return to factory calibration
<b>Safety standards</b>	IEC 61010-1:2001 / EN 61010-1:2001 Canada: CAN/CSA-C22.2 No. 61010-1-04 USA: ANSI/UL 61010-1:2004
<b>EMC standards</b>	Tested for Compliance with European EMC Directive 2004/108/EC. IEC 61326-1:2005 / EN 61326-1:2006 CISPR 11, Group 1, Class A ICES/NMB-001 This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
<b>Mechanical</b>	
Operating vibration	5 – 500 Hz, 0.21 gRMS random, 0.5 g (0 to peak) swept sine
Non-operating vibration	5 – 500 Hz, 2.10 gRMS random
Transportation shock	30 g, 6.8 m/s, trapezoidal pulse 7.6 in. x 19 in. x 20 in.
Overall dimensions	19.3 cm x 48.26 cm x 50.8 cm <i>H x W x D (with bottom feet &amp; front panel cover)</i>
<b>Weight</b>	Up to 20.7 kg depending on configuration
<b>Chassis Cooling</b>	< 30°C 26 liters/sec (55 CFM) > 30°C up to 60 liters/sec (127 CFM)
Airflow is front to rear, except for rear right-side power supply inlet. Blocking front side inlets limits maximum temperature to 40°C.	



## Definitions for specifications

*Specifications describe the warranted performance of calibrated instruments that have been stored for a minimum of 2 hours within the operating temperature range of +15 °C to +45 °C, unless otherwise stated, and after a 45 minute warm-up period. Data represented in this document are specifications unless otherwise noted.*

*Characteristics describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values.*

- *Typical describes characteristic performance, which 80% of instruments will meet when operated over a 20 °C to 30 °C temperature range. Typical performance is not warranted.*
- *Nominal describes representative performance that is useful in the application of the product when operated over a 20 °C to 30 °C temperature range. Nominal performance is not warranted.*

*Note: All graphs contain measured data from several units at room temperature unless otherwise noted.*

# Ordering and Configuration

## Hardware

Model	Description
N7109A	Multi-Channel Signal Analysis System
N7109A-C02	Two-channel system (includes one each)
N7125A	Mainframe
N7130A	6 GHz tuner module
N7140A	CPU module
N7145A	FPGA module
N7109A-C04	Four-channel system (includes one each)
N7125A	Mainframe
N7130A	6 GHz tuner modules (includes 2)
N7140A	CPU module
N7145A	FPGA modules
N7109A-C08	Eight-channel system (includes one each)
N7125A	Mainframe
N7130A	6 GHz tuner modules (includes 4)
N7140A	CPU module
N7145A	FPGA modules (includes 2)
N7109AF-4CH	Factory upgrade from 2-channels to 4-channels (requires system return to Everett, WA)
N7109AF-8CH	Factory upgrade from 4-channels to 8-channels (requires system return to Everett, WA)

## Accessories

Software, example programs, and product information on CD (included)	
Y1161A	Rack mount kit (optional ordered separately)

## Related Products

Model	Description
N5182A	MXG RF Vector Signal Generator
E4438C	ESG Vector Signal Generator
E8267D	PSG Vector Signal Generator
N5106A	PXB Baseband Generator and Channel Emulator
SystemVue	Agilent SystemVue Software
VSA Software	Agilent 89600 Vector Signal Analysis Software

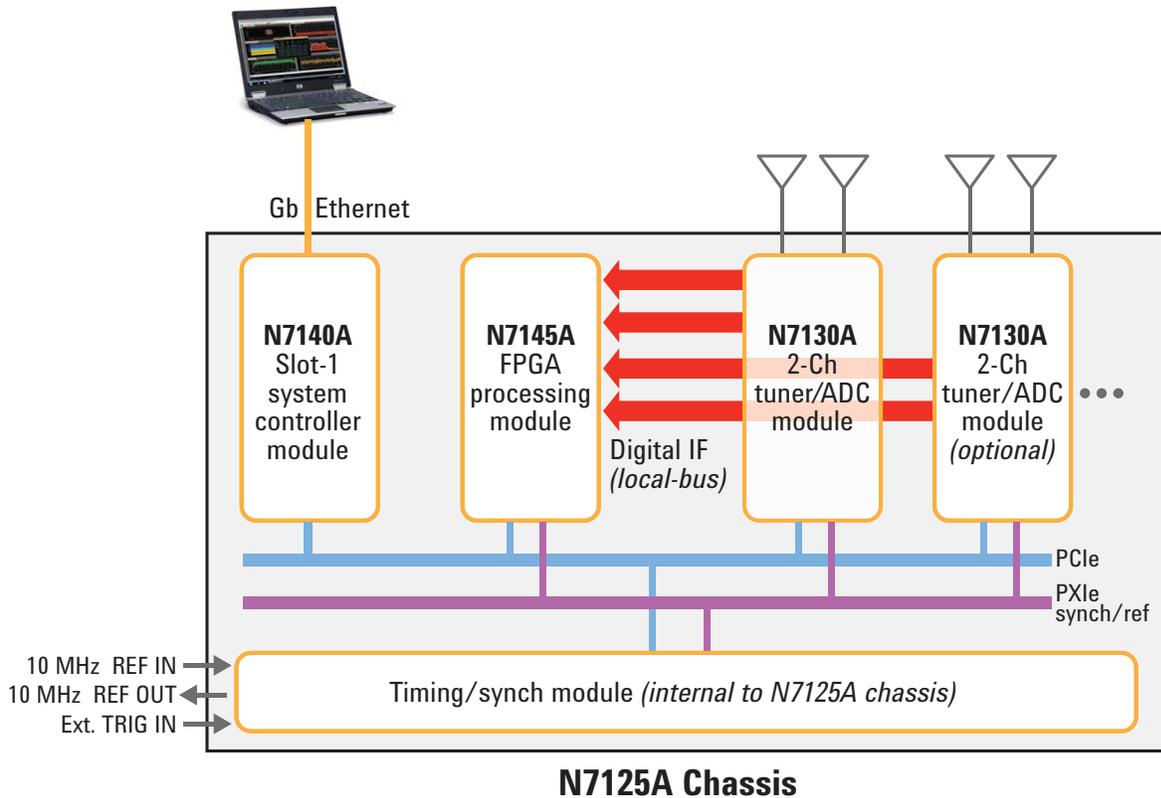


Figure 3. N7109A system architecture.



## PC Requirements

A Windows®-based system host PC (required) is not included with the N7109A. Your PC must include the following:

- A Gigabit Ethernet LAN interface for connection to the N7125A mainframe.
- Sufficient processing power, memory, and disc space for the 89600 VSA software. Please refer to the product configuration guide for detailed requirements.

## Warranty and Calibration

### Advantage Services: Calibration and Warranty

Agilent Advantage Services is committed to your success throughout your equipment's lifetime.

### Warranty<sup>1</sup>

	Standard warranty is 1 year
R-51B-001-3C	1 year return-to-Agilent warranty extended to 3 years
R-51B-001-5C	1 year return-to-Agilent warranty extended to 5 years

1. Options not available in all countries.



Figure 4. N7109A with PC showing 89600 VSA LTE beam forming measurement.



## The Modular Tangram

The four-sided geometric symbol that appears in this document is called a tangram. The goal of this seven-piece puzzle is to create identifiable shapes—from simple to complex. As with a tangram, the possibilities may seem infinite as you begin to create a new test system. With a set of clearly defined elements—hardware, software—Agilent can help you create the system you need, from simple to complex.



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