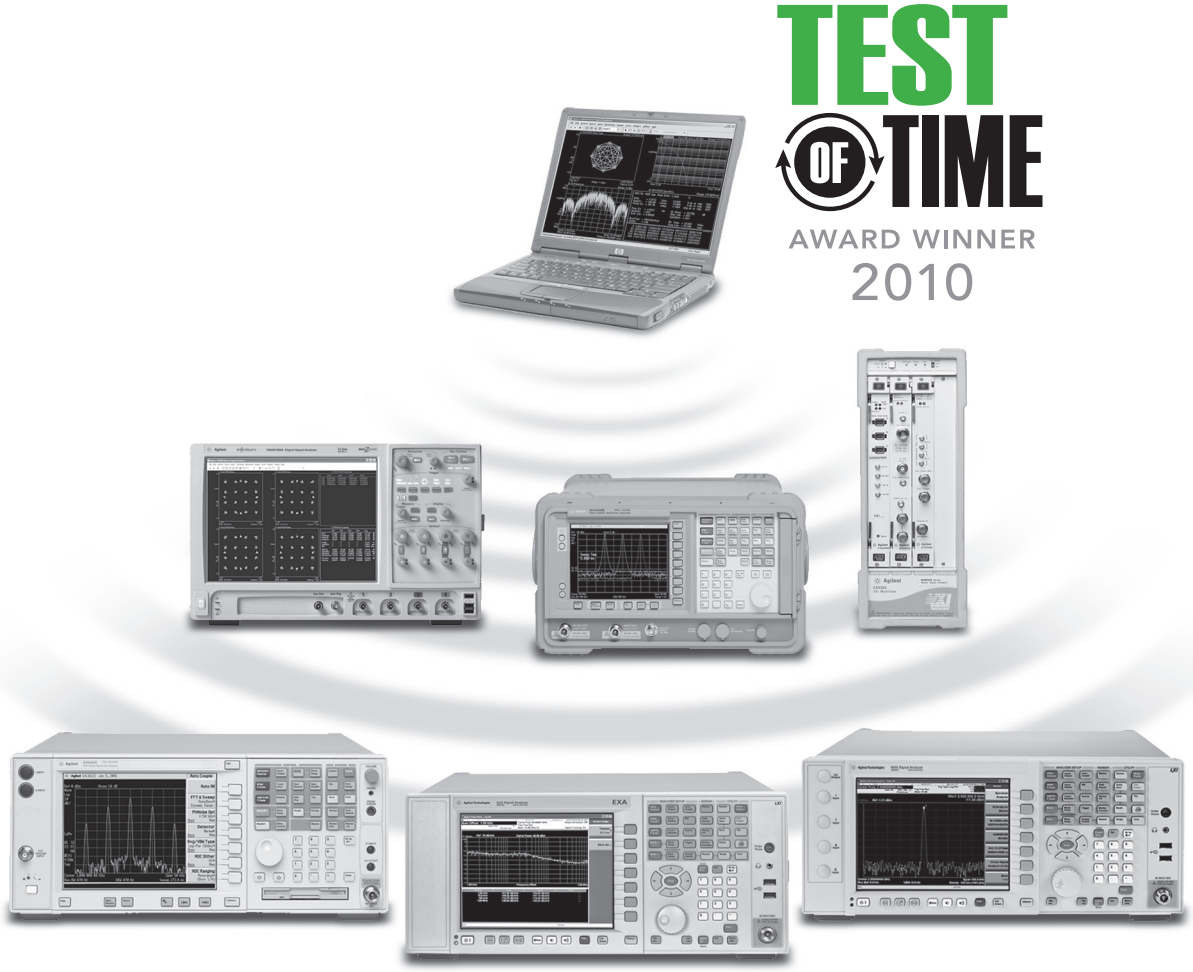
On 1 March 2011, the 89600 VSA software was discontinued.
Agilent will continue to support this product until 31 October 2013.
The recommended replacement is the Agilent 89600B VSA software.

Hardware Measurement Platforms for the Agilent 89600 Series Vector Signal Analysis Software

Data Sheet

TEST OF TIME AWARD WINNER 2010



Agilent Technologies

Introduction

Table of Contents

This data sheet provides performance specifications for the VSA software when making measurements using the spectrum and signal analyzers it supports.

Introduction

The 89600 vector signal analysis software runs on a PC or in PC-based instruments, which allows it to work with a variety of hardware measurement platforms including signal analyzers, spectrum analyzers, logic analyzers, and oscilloscopes, as well as simulation software.

For a complete listing of the platforms that the VSA software works with, go to the table at **www.agilent.com/find/89601A** and click on "300" in the column labeled Platform Connections.

Compatible Measurement Platforms

The 89600 VSA software runs on most Windows® -based PCs, whether in an instrument or standalone. The connection to a measurement platform from an external PC can be via LAN, GPIB, FireWire® (IEEE-1394), or USB.

The following are descriptions of some of the platforms supported by the 89600 software.

VXI-based vector signal analysis systems

Agilent's 89610S, 89611S, 89640S and 89641S vector signal analyzers are VXI-based systems. These versatile systems consist of several VXI modules integrated at the factory. They offer a minimum of 36 MHz of analysis bandwidth and up to 6 GHz tuning range in 4-slot, 6-slot, and 13-slot VXI mainframes. The 89600 VSA software is a standard part of these systems.

Phase-coherent two channel baseband or RF operation is available as an option to the VXI systems.

89650S wide bandwidth vector signal analyzer

The 89650S VSA with high performance spectrum analysis pairs an Agilent high performance PSA series spectrum analyzer with one of its wideband IF options and the 89601/AN. Choose from one of three PSA high performance spectrum analyzers, with frequency coverage up to 26.5 GHz. Two choices of IF options, 40 MHz or 80 MHz, let you pick the performance you need at the most economical price.

PSA Series high-performance spectrum analyzers

The Agilent PSA Series offers high performance spectrum analysis up to 50 GHz with powerful one-button measurements, a versatile feature set, and a leading-edge combination of flexibility, speed, accuracy, and dynamic range. Measurement control is via LAN, USB, or GPIB.

Wideband VSA System

Use the Agilent Infiniium scope and the Agilent E4440A Series performance spectrum analyzer to provide 300 MHz wide bandwidth vector signal analysis to 50 GHz center frequency. The PSA down converts input signals with 3.0 GHz to 50 GHz center frequency to an IF output frequency of 321.4 MHz. The IF signal is then digitized by the Infiniium scope. The 89600 VSA software, running on an external PC or embedded within the Infiniium scope, provides the analysis engine. Broadband calibration over the 300 MHz bandwidth is possible using an external source such as Agilent's MXG, PSG or ESG. For more information, see *Wide Bandwidth Vector Signal Analysis Measurements*, literature publication number 5989-9053EN.

X-Series Signal Analyzers

PXA signal analyzer N9030A
The PXA is the highest performance signal analyzer in the X-Series analyzer family. With frequency ranges up to 26.5 GHz and analysis bandwidth options out to 140 MHz, this advanced analyzer's excellent measurement performance enables detailed analysis of complex signals.

MXA signal analyzer N9020A
The Agilent N9020A MXA's standard analysis bandwidth of 10 MHz can be optionally expanded to 25 MHz, providing a one-box vector signal analyzer with spectrum analysis up to 26.5 GHz.

Compare the signal quality and EVM between RF and analog baseband for modulated signals using the MXA signal analyzer Option BBA analog baseband IQ inputs and the 89600 VSA.

EXA signal analyzer N9010A
Enhance yield and throughput with the excellent speed and accuracy found in Agilent's EXA economy class signal analyzer. Combine the 10 MHz standard (25 MHz optional) analysis bandwidth with versatile measurement capabilities found in the 89600 VSA software to reach new insights faster. Additionally, the Agilent EXA signal analyzer offers modern connectivity (LAN, USB 2.0, etc.) and an open Windows OS to attain and transfer test results quickly and easily.

CXA signal analyzer N9000A
The CXA is a versatile, low-cost tool for essential signal characterization. It helps accelerate product testing and development with frequency ranges to 26.5 GHz and a 10 MHz analysis bandwidth.

ESA-E Series spectrum analyzers

The ESA-E Series general purpose, portable spectrum analyzers offer a wide range of performance, features, and flexibility with up to 26.5 GHz tuning range and 10 MHz of analysis bandwidth. Measurement control is via GPIB.

Compatible Measurement Platforms (continued)

Other measurement platforms
The following high performance products also work with the 89600 VSA software but are not covered in this data sheet.

Infiniium scopes
Combine the 89600 VSA software with Agilent's Infiniium oscilloscopes (most models) to analyze super wide bandwidth signals. The oscilloscopes provide up to 13 GHz of analysis bandwidth and are well suited to digitizing down-converted satellite, LMDS, and MMDS signals. Some wideband signals, such as UWB, can only be analyzed using oscilloscopes. The Infiniium scopes also provide a cost-effective means of doing 4x4 WLAN MIMO or other 4-channel VSA applications. The digitized signals are transferred to the 89600 software, running in the scope or on an external PC, where the frequency, time, and modulation analysis tools of the 89600 can be used to evaluate and troubleshoot the signal. For more information refer to *"Agilent Infiniium Oscilloscopes Performance Guide Using 89600 Vector Signal Analyzer Software"* (publication number 5988-4096EN). Information on UWB can be found in the *"89600 VSA Software Option BHB MB-OFDM Modulation Analysis Technical Overview with Demonstration Guide"* (publication number 5989-5452EN).

InfiniiVision scopes
Combine the affordable 6000 and 7000 InfiniiVision Series oscilloscopes with the power of the 89600 VSA software to perform complex time and frequency analysis plus modulation analysis. Analyze signals up to 1 GHz wide. For more information refer to *"Agilent InfiniiVision 6000 Series Oscilloscopes Performance Guide Using 89600 Vector Signal Analysis Software"* (publication number 5989-4523EN).

Logic analyzers
Use either the 16800 Series, 16900 Series, or 1680/1690 Series of logic analyzers, or the RDX DigRF v4 Test Solution platform to provide digital-based vector signal analysis. The logic analyzer provides the physical connection into your circuit, while the VSA software interprets the data to display and analyze in a wide range of measurements. Instead of taking the IQ data from a logic analyzer and saving it to a file for analysis with user-built routines, you can take advantage of the consistency and robustness of the 89600 VSA software, which can run on an external PC or native to the logic analyzer. For additional information, see *"Agilent Logic Analyzers Performance Guide Using the 89600 Vector Signal Analysis Software"* (publication number 5989-2384EN).

N4010 wireless connectivity test set
The N4010 is a test set designed to quickly and accurately measure emerging wireless connectivity formats in the 2.4 GHz band. The N4010 offers an analysis bandwidth of 40 MHz, making the N4010 an ideal test platform for *Bluetooth*™ and WLAN RF measurements. The N4010 with *Bluetooth* Option 101 is an effective measurement tool for development, integration, pre-qualification, and volume manufacturing. Add the 89600 VSA software to extend the troubleshooting capability or address additional modulation formats.

Agilent LXI spectrum analyzer
Agilent's synthetic instruments offer the highest-performing LAN-based modular instrumentation with the smallest footprint for automated test systems (ATSs). The 89600 VSA software supports the N8201 26.5 GHz Performance Downconverter Synthetic Instrument Module and the N8221 30 MS/s IF Digitizer Synthetic Instrument Module when they are used together to make an LXI (LAN eXtensions for Instrumentation) spectrum analyzer.

Agilent Acqiris digitizers
Choose from the Acqiris product family of 6U PXI/Compact PCI standard digitizers with up to 12 bit, 100 MHz bandwidth or 10 bit-3 GHz bandwidth. The 89600 VSA software supports both 1- and 2-channel configurations. For additional information, see *"Agilent Acqiris Broadband High-Speed Digitizers Using 89600 Vector Signal Analysis Software"* (publication number 5989-7672EN).

Compatible Measurement Platforms (continued)

ADS/SystemVue

The powerful, PC-based 89600 VSA software enables tight, interactive integration with Agilent's Advanced Design System (ADS) or SystemVue RF and microwave design and simulation software to analyze simulation results. The 89600 software can be dynamically linked to any point in the digital model to analyze data by simply dragging the VSA icon to the desired spot in the schematic. The 89600 software can also be used to import real-world signals into ADS/SystemVue simulations using any supported acquisition hardware.

The MathWorks Simulink Model-Based Design software

A VSA blockset providing a VSA sink allows analysis of data from Simulink-based designs. A VSA source lets you take measured data from Agilent equipment and source it into the Simulink design as well.

Signal generators

Any VSA system, with version 3.01 software or later, can control Agilent ESG and PSG Series signal generators. Control of Agilent MXG series signal generators requires version 6.31 or later. This control expands the usefulness of the VSA software for stimulus/response measurements. The 89600 software controls the signal type, frequency, and level features of the signal generator. The software also downloads files to the signal generator arbitrary waveform source to simulate a wide range of digitally modulated signals. The files can be 89600 software signal captures, or even simulated waveforms from ADS/SystemVue design software.

Playback requires that the arbitrary waveform generator be installed in the signal generator. Signal playback bandwidth is limited by the bandwidth of the arbitrary waveform generator.

The signal generator can be controlled via GPIB or LAN.

Compatible Measurement Platforms (continued)

Supported hardware for 89600 VSA software [1]

Description	Models supported	Input channels	Baseband (I/Q)	MIMO
VXI-based VSA	89600S (89610, 89611, 89640, 89641)	1 or 2, baseband and/or RF	Yes, optional; all models	2x2 MIMO for WLAN-HT, Mobile WiMAX ™, LTE, and HSPA+ DL [3]
X-Series analyzers	N9000A, N9010A N9020A, N9030A	1, 2 if N9010 or N9020 (slaved together)	Yes, optional	2x2 MIMO for Mobile WIMAX, LTE, and HSPA+ DL [3] with dual N9020A analyzers
PSA spectrum analyzer	E4440A, E4443A, E4445A, E4446A, E4447A, E4448A	1, 2 if 2 PSA units are slaved together	No	
ESA spectrum analyzer	ESA-E Series	1	No	No
Infiniium oscilloscopes	8064, 8104, 9064, 9104 [4], 9254, 9404, 80204, 80304, 80404, 80604, 80804, 81004, 81204, 81304, 90254, 90404, 90604, 90804, 91204, 91304	1,2,3, 4,	Yes, including dual I+jQ	2x2 Mobile WiMAX; 4x4 MIMO WLAN-HT; 4x4 MIMO LTE
InfiniiVision oscilloscopes	601x, 603x, 703x, 605x, 705x, 610x, 701x, 710x, 6014, 6054, 6104	1, 2, 3, 4 depending on model and options	Yes, for all 2-channel scopes; dual I+jQ with 4-channel models	Baseband WLAN 2x2 MIMO; Baseband WiMAX 2x2 MIMO; Baseband LTE 2x2 MIMO; Baseband HSPA+MIMO 2x2 [3]
Logic analyzer	1680/1690; 16800/16900; RDX	1 VSA channel analysis only	No	No
Agilent Acqiris digitizers	U1066A (DC440, DC438) or U1065A (DC282, DC252, DC222)	1 or 2 depending on model	Yes, for 2 channel models	No
Wireless connectivity test set	N4010	1 or 2	No	2x2 WLAN-HT
Baseband Studio application	N5110 with N5101 or N5102	1	No	No
Baseband Studio for CPRI RE test application	N5120 with N5101 or N5103	1	No	No
LXI spectrum analyzer [2]	N8201 with N8221	1	No	No
Agilent EEsof ADS/SystemVue simulation software	Various	2	Yes	Yes
The Mathworks Simulink Simulation and Model-based Design	Various	2	Yes	No

Supported sources

The 89600 VSA software can control the following sources as well as use them to play back captured recordings. For the most current information regarding models supported and required options, see the **Help** text.

Description	Model	Required Options
ESG signal source	E4438C	001, 002, 601 or 602
MXG signal source	N5182A	651, 652, or 654
PSG signal source	E8267C or E8267D	002, 601 or 602

1. Not all revisions support all hardware. For more information see Appendix B. For the most current list of supported hardware, go to **www.agilent.com/find/89600**.
2. For 89600 software revisions less than 8.xx.
3. Beta.
4. Full rate sample rate = 10 GSa/s.

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

The following specifications describe the warranted performance of standard 89610S, 89611S, 89640S, and 89641S VXI-based vector signal analyzer (VSA) systems integrated by Agilent Technologies.

The performance of 89610S systems is specified in the E8408A [1] four-slot, the E1421B [2] six-slot, and the E8403A [2] 13-slot VXI mainframes. The performance of the 89611S, 89640S, and 89641S systems is specified in the E8408A [1] four-slot, the E1421B [2] six-slot, and the E8403A [2] 13-slot VXI mainframes. These specifications also describe the nominal performance for other, non-standard 89600S configurations.

These specifications describe warranted performance over a temperature range of 20° to 30° C and include a 30-minute warm-up from ambient conditions. Parameters identified as "typical" or "characteristic" are included for informational purposes only and are not warranted. To aid in understanding analyzer performance capabilities, measurement units and specification terms are provided in the glossary at the end of this document.

The Agilent 89600S Series VXI-based VSA systems come standard with two sets of application software: vector signal analysis and spectrum analysis. The vector signal analysis application software is used to analyze complex signals in the time, frequency, and modulation domains. The spectrum analyzer application software emulates a traditional spectrum analyzer, providing fast, high-resolution signal magnitude measurements while sweeping across a user-defined frequency span. Unless otherwise indicated, the specifications in this data sheet apply to both sets of application software.

1. With backplane connector RF shielding (Option E8408-80900) and enhanced current supply (Option E8408-100).
2. With backplane connector RF shielding (Option E1401-80918).

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Frequency	89610S (DC to 40 MHz)	89611S (70 MHz ± 18 MHz)	89640S (DC to 2700 MHz)	89641S (DC to 6000 MHz)
Frequency range				
Spectrum analysis mode				
RF/IF mode	—	Not available	36 to 2700 MHz [1]	36 to 6000 MHz [1]
Baseband mode	DC to 40 MHz	Not available	DC to 36 MHz [2]	DC to 36 MHz [2]
Vector analysis mode				
RF/IF mode	—	52 to 88 MHz [3]	36 to 2700 MHz [1]	36 to 6000 MHz [1]
Baseband mode	DC to 40 MHz	DC to 36 MHz [2]	DC to 36 MHz [2]	DC to 36 MHz [2]
Frequency tuning resolution	1 mHz	1 mHz	1 mHz	1 mHz
Frequency spans				
Spectrum analyzer application	< 1 kHz to 40 MHz	Not available	< 1 kHz to 2.7 GHz	< 1 kHz to 6 GHz
Vector signal analyzer application				
1 channel mode	< 1 Hz to 39.06 MHz	< 1 Hz to 36 MHz	< 1 Hz to 36 MHz	< 1 Hz to 36 MHz
2 channel mode	< 1 Hz to 39.06 MHz	< 1 Hz to 36 MHz	< 1 Hz to 36 MHz	< 1 Hz to 36 MHz
Ch1 + j*Ch2 mode	< 2 Hz to 78 MHz	< 2 Hz to 72 MHz	< 2 Hz to 72 MHz	< 2 Hz to 72 MHz
Frequency points per span				
Spectrum analyzer application	2 to 131,072	Not available	2 to 131,072	2 to 131,072
Vector signal analyzer application				
Calibrated points	51 to 409,601	51 to 409,601	51 to 409,601	51 to 409,601
Displayable points	51 to 524,288	51 to 524,288	51 to 524,288	51 to 524,288
Frequency accuracy	Frequency accuracy is the sum of initial accuracy, aging, and temperature drift.			
Initial accuracy	100 ppb	100 ppb	100 ppb	100 ppb
Aging	1 ppb/day 100 ppb/year	1 ppb/day 100 ppb/year	1 ppb/day 100 ppb/year	1 ppb/day 100 ppb/year
Temperature drift (0° to 50 ° C)	50 ppb	50 ppb	50 ppb	50 ppb

1. Under-range provided to 30 MHz. Specifications are typical for center frequencies below 36 MHz.
2. Over-range provided to 37.11 MHz.
3. The 89611S can be configured to display and accept frequency settings based on the user's RF analysis bandwidth.

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Frequency *(continued)*	**89610S (DC to 40 MHz)**	**89611S (70 MHz ± 18 MHz)**	**89640S (DC to 2700 MHz)**	**89641S (DC to 6000 MHz)**
Frequency stability				
Phase noise				
10 MHz signal (baseband input)				
100 Hz offset	< –108 dBc/Hz	< –108 dBc/Hz	< –108 dBc/Hz	< –108 dBc/Hz
1 kHz offset	< –118 dBc/Hz	< –118 dBc/Hz	< –118 dBc/Hz	< –118 dBc/Hz
> 10 kHz offset	< –120 dBc/Hz	< –120 dBc/Hz	< –120 dBc/Hz	< –120 dBc/Hz
Phase noise				
80 MHz signal (IF input)				
100 Hz offset	—	< –92 dBc/Hz	—	—
1 kHz offset	—	< –102 dBc/Hz	—	—
> 10 kHz offset	—	< –110 dBc/Hz	—	—
Phase noise				
1 GHz signal [1] (RF input)				
> 20 kHz offset	—	—	< –99 dBc/Hz	< –99 dBc/Hz
> 100 kHz offset	—	—	< –110 dBc/Hz	< –110 dBc/Hz

1. < 0.05 Grms random vibration, 5 - 500 Hz.

Resolution bandwidth filtering	**89610S (DC to 40 MHz)**	**89611S (70 MHz ± 18 MHz)**	**89640S (DC to 2700 MHz)**	**89641S (DC to 6000 MHz)**
RBW range	The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence, or enter an arbitrarily chosen bandwidth directly.			
Spectrum analyzer application	1 Hz to > 5 MHz	Not available	1 Hz to > 5 MHz	1 Hz to > 5 MHz
Vector signal analyzer application	< 1 Hz to 10 MHz	< 1 Hz to 10 MHz	< 1 Hz to 10 MHz	< 1 Hz to 10 MHz
RBW shape factor	The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.			

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Amplitude	89610S (DC to 40 MHz)	89611S (70 MHz ± 18 MHz)	89640S (DC to 2700 MHz)	89641S (DC to 6000 MHz)
Input				
Full-scale range				
Baseband mode	–31 dBm to +20 dBm in 3 dB steps	–30 dBm to +20 dBm in 5 dB steps	–30 dBm to +20 dBm in 5 dB steps	–30 dBm to +20 dBm in 5 dB steps
IF/RF mode	—	–45 dBm to +20 dBm in 5 dB steps	–45 dBm to +20 dBm in 5 dB steps	–45 dBm to +20 dBm in 5 dB steps
Maximum safe input level	+24 dBm, ±5 VDC	+20 dBm, ±5 VDC	+20 dBm, ±5 VDC	+20 dBm, ±5 VDC
ADC overload (typical)				
Baseband mode	+10 dBfs	+9 dBfs	+9 dBfs	+9 dBfs
IF/RF mode	—	+10 dBfs	+10 dBfs	+10 dBfs
Input channels				
Standard	1	1	1	1
Optional	2 baseband	2 IF/baseband	2 RF/IF/baseband	2 RF/IF/baseband
Nominal impedance	50 ohms	50 ohms	50 ohms	50 ohms
Connector	BNC	Type N	Type N	Type N
Input coupling				
Baseband mode	AC or DC	AC or DC	AC or DC	AC or DC
IF/RF mode	—	AC	AC	AC
VSWR	Return loss in measurement span			
Baseband mode				
All ranges	1.33:1 (17 dB)	1.5:1 (14 dB)	1.5:1 (14 dB)	1.5:1 (14 dB)
IF/RF mode				
+20 dBm to –20 dBm ranges	—	2.1:1 (9 dB)	1.8:1 (10.7 dB)	2.0:1 (9.5 dB)
–25 dBm to –45 dBm ranges	—	2.1:1 (9 dB)	2.5:1 (7.3 dB)	3.1:1 (5.8 dB)

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Amplitude *(continued)*	**89610S (DC to 40 MHz)**	**89611S (70 MHz ± 18 MHz)**	**89640S (DC to 2700 MHz)**	**89641S (DC to 6000 MHz)**
Amplitude accuracy	Accuracy specifications apply with flat top window selected and are the sum of absolute full-scale accuracy and amplitude linearity.			
Absolute full-scale accuracy Baseband mode, 0° to 50 °C	±0.8 dB	±0.8 dB	±0.8 dB	±0.8 dB
IF/RF mode (≤ 2.7 GHz) 20° to 30 °C	—	±0.8 dB	±2 dB	±2 dB
0° to 50 °C	—	±0.8 dB	±2 dB (typical)	±2 dB (typical)
RF mode (> 2.7 GHz) 20° to 30 °C	—	—	—	±2 dB
0° to 50 °C	—	—	—	±2.25 dB (typical)
Amplitude linearity 0 to –30 dBfs	±0.10 dB	±0.10 dB	±0.10 dB	±0.10 dB
–30 to –50 dBfs	±0.15 dB	±0.15 dB	±0.15 dB	±0.15 dB
–50 to –70 dBfs	±0.20 dB	±0.20 dB	±0.20 dB	±0.20 dB
Amplitude accuracy correction	—	See footnote [1]	—	—
Residual DC (typical, 50 Ω) Baseband mode (Input range > –20 dBm)	< –40 dBfs	< –40 dBfs	< –40 dBfs	<–40 dBfs
Flatness	Frequency response across the measurement span in vector signal analysis mode (included in amplitude specifications)			
IF/RF mode Center frequency ± 10 MHz	—	±0.2 dB (typical)	±0.2 dB (typical)	±0.2 dB (typical)
Center frequency ± 18 MHz	—	±0.2 dB (typical)	±0.2 dB (typical)	±0.3 dB (typical)
Baseband mode	±0.2 dB (typical)	±0.2 dB (typical)	±0.2 dB (typical)	±0.2 dB (typical)
Flatness correction	—	See footnote [2]	—	—

1. External amplitude correction is available to correct for down-converter RF signal path amplitude. The user must provide a calibration trace file. Details are given in the 89611A online Help (under "89611, Setup" in the index).
2. Requires a manual procedure; see Help text. Required for external tuners only.

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Amplitude *(continued)*	**89610S (DC to 40 MHz)**	**89611S (70 MHz ± 18 MHz)**	**89640S (DC to 2700 MHz)**	**89641S (DC to 6000 MHz)**
Channel match	Multiple channels are available as options			
Amplitude match	DC coupled, full-scale, matching input ranges			
Baseband	±0.25 dB	±0.25 dB	±0.25 dB	±0.25 dB
IF/RF		±0.25 dB	±1.2 dB	±1.2 dB[1]
Phase match	10 MHz input, full-scale, matching input ranges			
	±4°	—	—	—
Group delay match	Across measurement span, typical			
Baseband	±2 ns	±2 ns	±2 ns	±2 ns
IF/RF	—	±1.5 ns	±5.0 ns	±5.0 ns [1]
Stability (typical)				
Amplitude	—	0.006 dB/°C	0.006 dB/°C	0.006 dB/°C
Phase, Baseband	—	1.0°/°C	1.0°/°C	1.0°/°C
Phase, IF/RF	—	1.0°/°C	2.0°/°C	2.0°/°C [1]

1. For signal frequencies < 2.7 GHz.

Specifications

89610S, 89611S, 89640S, 89641S vector signal analyzer performance (Option 200)

Amplitude *(continued)*	**89610S (DC to 40 MHz)**	**89611S (70 MHz ± 18 MHz)**	**89640S (DC to 2700 MHz)**	**89641S (DC to 6000 MHz)**
Dynamic range	Dynamic range indicates the amplitude range that is free of erroneous signals within the measurement span.			
Intermodulation distortion	Two input signals, each –6 to –10 dBfs, separation > 1 MHz, specified relative to either signal			
Third-order, IF/baseband mode	< –70 dBc	< –70 dBc	< –70 dBc	< –70 dBc
Third-order, RF mode	—	—	< –70 dBc	< –70 dBc
Harmonic distortion	Single input signal, 0 to -10 dBfs			
IF/baseband mode	< –70 dBc	< –68 dBc	< –68 dBc	< –68 dBc
RF mode	—	< –70 dBc	< –55 dBc (typical)	< –55 dBc (typical)
Spurious responses	Full-scale input signal within analyzer measurement span			
IF/baseband mode	< –68 dBc	< –68 dBc	< –68 dBc	< –68 dBc
RF mode	—	—	< –65 dBc [1] (typical)	< –65 dBc [2] (typical)
	Full-scale input signal outside analyzer measurement span			
IF/baseband mode	< –70 dBc	< –68 dBc	< –68 dBc	< –68 dBc
RF mode		—	< –52 dBc (typical)	< –50 dBc (typical)
Spurious sidebands	Full-scale input signal			
Baseband mode (> 1 kHz offset)	< –70 dBc	< –70 dBc	< –70 dBc	< –70 dBc
RF mode (1 to 3 kHz offset)	—	< –70 dBc	< –65 dBc	< –65 dBc
RF mode (> 3 kHz offset)	—	< –70 dBc	< –70 dBc	< –70 dBc
Residual responses (> 10 kHz)	Input port terminated and shielded			
Baseband and IF/RF modes (maximum of)	–77 dBfs or –100 dBm	–77 dBfs or –100 dBm	–77 dBfs or –100 dBm	–77 dBfs or –100 dBm
Input noise density	Range ≥ –30 dBm			
Baseband mode (> 0.1 MHz)	< –121 dBfs/Hz	< –121 dBfs/Hz	< –121 dBfs/Hz	< –121 dBfs/Hz
IF/RF mode (< 1.2 GHz)	—	< –118 dBfs/Hz	< –116 dBfs/Hz	< –116 dBfs/Hz
RF mode (1.2 to 2.7 GHz)	—	—	< –114 dBfs/Hz	< –114 dBfs/Hz
RF mode (> 2.7 GHz)	—	—	—	< –113 dBfs/Hz
Sensitivity	Most sensitive range			
Baseband mode	< –151 dBm/Hz	< –151 dBm/Hz	< –151 dBm/Hz	< –151 dBm/Hz
IF/RF mode (< 1.2 GHz)	—	< –159 dBm/Hz	< –158 dBm/Hz	< –157 dBm/Hz
RF mode (1.2 to 2.4 GHz)	—	—	< –156 dBm/Hz	< –156 dBm/Hz
RF mode (> 2.4 GHz)	—	—	< –156 dBm/Hz	< –153 dBm/Hz
Phase	Measurements apply to vector signal analyzer function			
Linearity (typical)	Single channel group delay deviation across maximum measurement span [3], using flat-top window			
Baseband mode	±2 ns	±2 ns	±2 ns	±2 ns
IF/RF mode	—	±6 ns	±8 ns (RF)	±8 ns (RF)

1. Typical specification degraded by 10 dB for input frequencies within ±10 MHz of 1890.6 MHz.
2. Typical specification degraded by 10 dB for input frequencies within ±10 MHz of 1890.6 MHz, 2909.4 MHz, 3200.0 MHz, 3709.4 MHz, 3733.3 MHz, 4509.4 MHz, and 5309.4 MHz.
3. ±17 MHz of center frequency (RF, IF), ≤ 35.5 MHz (baseband), ≤ 39.5 MHz (89610S).

Specifications
89650S vector signal analyzer performance (Option 200)

These specifications summarize the performance of the 89650S over 20° to 30° C. Refer to the appropriate PSA series spectrum analyzer and Option 122, 80 MHz bandwidth ADC or Option 140, 40 MHz bandwidth ADC technical data sheets for more detailed information.

89650S

Frequency range	(Pre-selector bypass option recommended above 3 GHz in vector analysis mode only)		
		Spectrum analysis (using PSA)	*Vector analysis*
	E4440A	3 Hz to 26.5 GHz	20 MHz (ac-coupled) or 1 kHz (dc-coupled) to 26.5 GHz
	E4443A	3 Hz to 6.7 GHz	20 MHz (ac-coupled) or 1 kHz (dc-coupled) to 6.7 GHz
	E4445A	3 Hz to 13.2 GHz	20 MHz (ac-coupled) or 1 kHz (dc-coupled) to 13.2 GHz
Frequency spans	*Option 122, 80 MHz IF, all models* < 1 kHz to 80 MHz [1]		*Option 140, 40 MHz IF, all models* < 1 kHz to 40 MHz [1]
Frequency points per span	Calibrated: 51 to 409,601 Displayable: 51 to 524,288		
Input range	–28 dBm to +30 dBm in 2 dB steps (89601A v 5.21 or later) –58 dBm to +30 dBm in 2 dB steps (< 3 GHz, with preamp Option 1DS , 89601A v 5.21 or later) –58 dBm to +30 dBm in 2 dB steps (all frequencies, with preamp Option 110, 89601A v 6.2 or later)		
ADC overload	+9 dBfs at 1 GHz		
Absolute amplitude accuracy	*Option 122, 80 MHz IF, all models* ±0.25 dB, at 50 MHz		*Option 140, 40 MHz IF, all models* ±0.25 dB, at 40 MHz
Amplitude IF response	Deviation from flat response, internal calibration, center frequency > 50 MHz, flat-top window, 10 dB input range, 0 dB IF gain		

Frequency	*Span*	*Option 122, 80 MHz IF, all models, response*	*Option 140, 40 MHz IF, all models, response*
≤ 3 GHz	≤ 30 MHz	±0.57 dB (±0.25 dB, typical)	±0.57 dB (±0.25 dB, typical)
≤ 3 GHz	≤ 40 MHz	NA	±0.75 dB (±0.45 dB, typical)
≤ 3 GHz	≤ 60 MHz	±0.75 dB (±0.45 dB, typical)	NA
≤ 3 GHz	≤ 80 MHz	±0.83 dB (±0.5 dB, typical)	NA
> 3 GHz, pre-selector bypass enabled	30 MHz	±0.18 dB, typical	±0.18 dB, typical
> 3 GHz, pre-selector bypass enabled	40 MHz	NA	±0.6 dB, typical
> 3 GHz, pre-selector bypass enabled	80 MHz	±0.6 dB, typical	NA

1. When operating above 3 GHz center frequency, a YIG-tuned filter (YTF) is normally used to prevent spurious responses due to out-of-span signals and mixer images. The bandwidth of the YTF pre-selector is a function of center frequency and its bandwidth will limit the wideband frequency span. The pre-selector bypass, Option 123, adds a selectable bypass of the YTF pre-selector, enabling full wideband functionality.

Specifications
89650S vector signal analyzer performance (Option 200)

89650S *(continued)*

Amplitude flatness

After extended calibration pre-selector bypass enabled, frequency > 3 GHz

Span	*Option 122, 80 MHz IF, all models, response*	*Option 140, 40 MHz IF, all models, response*
≤ 60 MHz	±0.2 dB, nominal	NA
≤ 36 MHz	NA	±0.2 dB, nominal

Phase linearity

After internal calibration performed

Frequency	*Span*	*Option 122, 80 MHz IF, all models, linearity*	*Option 140, 40 MHz IF, all models, linearity*
≤ 3 GHz	≤ 30 MHz	±1.6º	±1.6º
≤ 3 GHz	≤ 40 MHz	NA	±4.0º
≤ 3 GHz	≤ 60 MHz	±4.0º	NA
> 3 GHz, pre-selector bypass enabled	≤ 30 MHz	±1.0º	±1.0º

3rd order intermodulation distortion

Option 122, 80 MHz IF, all models
≤ 3 GHz, span ≤ 60 MHz, two –9 dBfs tones
< –75 dBc, typical

Option 140, 40 MHz IF, all models
≤ 3 GHz, span ≤ 40 MHz, two –9 dBfs tones
< –75 dBc, typical

Phase noise

Option 122, 80 MHz IF, all models
1 GHz, 10 kHz offset, –106 dBc/Hz

Option 140, 40 MHz IF, all models
1 GHz, 10 kHz offset, –106 dBc/Hz

Memory size

Option 122, 80 MHz IF, all models
128 MSa, complex, 1.34 sec @ full span

Option 140, 40 MHz IF, all models
128 MSa, complex, 1.34 sec @ full span

Specifications
PSA spectrum analyzer performance (Option 200)

These specifications summarize the performance for the PSA spectrum analyzers (without Option 122, 80 MHz bandwidth ADC or Option 140, 40 MHz bandwidth ADC) when used with the 89600 vector signal analysis software. These are nominal values, not warranted.

PSA (nominal)

Frequency	
Range	20 MHz (ac-coupled) or 1 kHz (dc-coupled) to 3 GHz, specified range; 3 GHz to PSA maximum frequency is allowed but not specified
Center frequency tuning resolution	1 mHz
Frequency span	< 10 Hz to 8 MHz
Frequency points per span	Calibrated points: 51 to 409,601 Displayable points: 51 to 524,288
Resolution bandwidth (RBW)	The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.
Range	1 Hz to 2.3 MHz
RBW shape factor	The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input	Full scale, combines attenuator setting and ADC gain [1]
Range	–18 dBm to +22 dBm in 1 dB steps, 89601A v3.00 –30 dBm to +30 dBm in 2 dB steps, 89601A v4.00 –60 dBm to +30 dBm in 2 dB steps, < 3 GHz, with preamp Option 1DS, 89601A v4.00 –60 dBm to +30 dBm in 2 dB steps, (with pre-amp Option 110, 89601A v6.20)
ADC overload	+9 dBfs at 1 GHz

1. PSA ADC gain is set to 6 dB and attenuator is set to [89601A range (in dBm) + 18] dB.

Specifications
PSA spectrum analyzer performance (Option 200)

PSA (nominal) *(continued)*

Amplitude accuracy			
Amplitude linearity	*Range*	*Linearity*	*ADC dither*
	0 to –30 dBfs	±0.03 dB	On
	–30 to –50 dBfs	±0.1 dB	Off
IF Flatness	±0.3 dB		
Sensitivity	At 1 GHz, most sensitive range –152 dBm/Hz, without pre-amp –165 dBm/Hz, with pre-amp Option 1DS or pre-amp Option 110		
Dynamic range			
Third-order intermodulation distortion	*Input range*	*Distortion*	
	Range ≥ –30 dBm	< –70 dBc or < –90 dBfs, whichever is greater	
	Range < –30 dBm	< –68 dBc or < –90 dBfs, whichever is greater	
Noise density at 1 GHz	*Input range*	*Density*	
	> –24 dBm	< –126 dBfs/Hz	
	–44 dBm to –24 dBm	< –122 dBfs/Hz	
IF residual responses	< –70 dBfs		
IF spurious responses	< –70 dBfs		
IF flatness	±0.3 dB		

Specifications
PXA signal analyzer performance (Option 200)

These specifications summarize the performance of the N9030A PXA signal analyzers when used with the 89600 VSA software. More detailed specifications are available in the PXA specification guide. Unless stated otherwise, these are nominal values, not warranted.

Spans above 10MHz require one of the following options: B25 (up to 25 MHz), B40 (up to 40 MHz), or B1X (up to 140 MHz).

Frequency ranges are supported by one of the following options: 503 (up to 3.6 GHz), 508 (up to 8.4 GHz), 513 (up to 13.6 GHz), or 526 (up to 26.5 GHz).

Option	Description
503	Frequency range, 3 Hz to 3.6 GHz
508	Frequency range, 3 Hz to 8.4 GHz
513	Frequency range, 3 Hz to 13.6 GHz
526	Frequency range, 3 Hz to 26.5 GHz
B1X	140 MHz analysis bandwidth
B25	25 MHz analysis bandwidth
B40	40 MHz analysis bandwidth
EA3	Electronic attenuator, 3.6 GHz
P03	Preamp, 3.6 GHz
P08	Preamp, 8.4 GHz
P13	Preamp, 13.6 GHz
P26	Preamp, 26.5 GHz

PXA (nominal)

Frequency		
Range	*Minimum frequency* 10 MHz, AC coupled 3 Hz, DC coupled	*Maximum frequency* 3.6 GHz (Option 503) 8.4 GHz (Option 508) 13.6 GHz (Option 513) 26.5 GHz (Option 526)
Center frequency tuning resolution	10 µHz	
Frequency span	10 MHz (standard) 25 MHz (Option B25) 40 MHz (Option B40) 140 MHz (Option B1X)	
Frequency points per span	Calibrated points: 51 to 409,601 Displayable points: 51 to 524,288	

Specifications
PXA signal analyzer performance (Option 200) *(continued)*

PXA (nominal) *(continued)*

Resolution bandwidth (RBW)

The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.

Range

< 1 Hz to > 2.8 MHz (standard)
< 1 Hz to > 7 MHz (Option B25)
< 1 Hz to > 11.5 MHz (Option B40)
< 1 Hz to > 40 MHz (Option B1X)

RBW shape factor

The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input

Full scale, combines attenuator setting and ADC gain

Range

–22 dBm to +30 dBm	2 dB steps, no preamp
–42 dBm to +30 dBm	2 dB steps, with preamp, f < 3.6 GHz
–56 dBm to +30 dBm	2 dB steps, with preamp, f > 3.6 GHz

ADC overload

+2 dBfs

Amplitude accuracy

Absolute amplitude accuracy

Frquency < 3.6 GHz

Span	*95% confidence accuracy*
≤ 10 MHz	0.19 dB
25 MHz to 140 MHz	0.69 dB

Amplitude linearity [1]

±0.1 dB

IF Flatness [2,3]

Span	Frequency	IF frequency response Flatness (typical)	RMS	IF phase linearity Peak-to-peak	RMS
≤ 10 MHz	20 MHz to 3.6 GHz	±0.12 dB	0.02 dB	0.06°	0.012°
	3.6 GHz to 26.5 GHz	±0.12 dB	0.02 dB	0.08°	0.018°
> 10 MHz to 25 MHz	20 MHz to 3.6 GHz	±0.12 dB	0.02 dB	0.14°	0.028°
	3.6 GHz to 26.5 GHz	±0.30 dB	0.015 dB	0.25°	0.043°
> 25 MHz to 40 MHz	30 MHz to 3.6 GHz	±0.25 dB	0.05 dB	0.06°	0.012°
	3.6 GHz to 8.4 GHz	±0.16 dB	0.05 dB	0.30°	0.08°
	8.4 GHz to 26.5 GHz	±0.20 dB	0.1 dB	0.30°	0.08°
> 40 MHz to 80 MHz	100 MHz to 3.6 GHz	±0.15 dB	0.05 dB	1.6°	0.27°
	3.6 GHz to 8.4 GHz	±0.20 dB	0.05 dB	2.2°	0.37°
	8.4 GHz to 26.5 GHz	±0.40 dB	0.05 dB	2.2°	0.37°
> 80 MHz to 140 MHz	100 MHz to 3.6 GHz	±0.25 dB	0.05 dB	1.6°	0.27°
	3.6 GHz to 8.4 GHz	±0.30 dB	0.1 dB	2.2°	0.37°
	8.4 GHz to 26.5 GHz	±0.75 dB	0.1 dB	2.2°	0.37°

Sensitivity

Frequency range 10 MHz to 2.1 GHz, input range –22 dBm

Span	*Sensitivity*
≤ 25 MHz	–152 dBm/Hz
25 MHz to 40 MHz	–144 dBm/Hz
40 MHz to 140 MHz	–149 dBm/Hz

Specifications
PXA signal analyzer performance (Option 200) *(continued)*

PXA (nominal) *(continued)*

Dynamic range

Third-order intermodulation distortion — Two tones, frequency range 10 MHz to 13.6 GHz

Span	*Tone seperation*	*Tone level*	*TOI distortion*
≤ 25 MHz	> 100 kHz	–20 dBfs	–90 dBc
25 MHz to 40 MHz	> 1 MHz	–9 dBfs	–82 dBc
40 MHz to 140 MHz	> 1 MHz	–9 dBfs	–80 dBc

Noise density

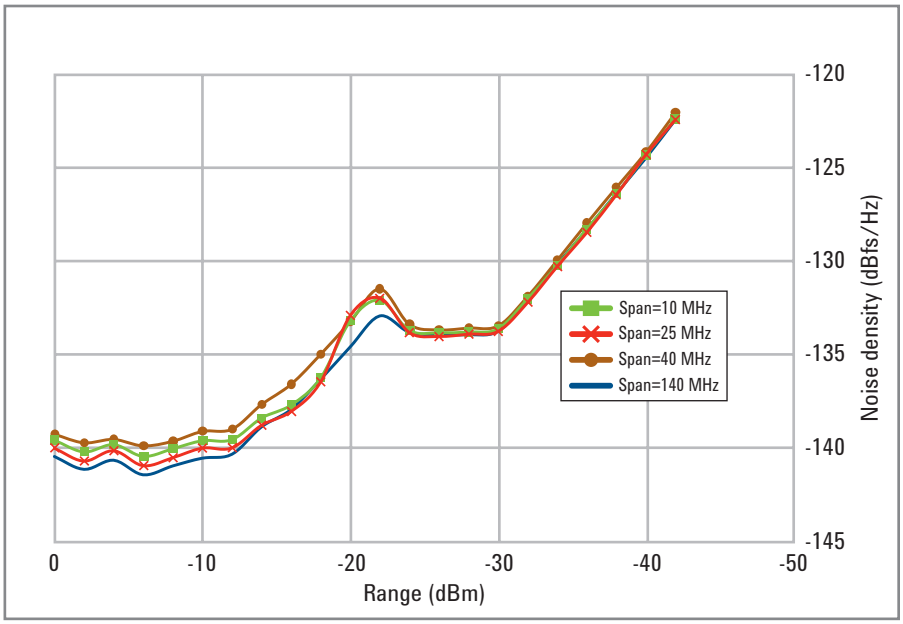


Figure 1. PXA noise density (nominal, 1.8GHz).

Spurious [5]

Residual responses	–100 dBm	
Image responses	–78 dBc (specification) –70 dBc	10 MHz to 13.6 GHz, < 8 MHz span Span 10 MHz to 25 MHz
LO related spurious	–73 dBc (specification)	10 MHz to 3.6 GHz; f > 600 MHz from carrier
Other spurious responses	–80 dBc (specification) –80 dBc [4] –75 dBc [4]	10 MHz to 8.4 GHz; f ≥ 10 MHz from carrier, < 8 MHz span SFDR for signal frequency within ±12 MHz of center, span 25 MHz to 40 MHz SFDR for signal frequency within ±12 MHz of center, span 40 MHz to 140 MHz

1. Specification, reference level is input signal of -25 dBm at a range setting of 0 dBm.
2. Specification assumes preselector bypasss (Option MPB) is installed and enabled.
3. Specification assumes use of DC coupling for center frequencies < 250 MHz.
4. Degrade by 3 dBc for signal frequency and response anywhere within span.
5. Summary listing. Consult the N9030A PXA specifications guide for a full listing of spurious performance data.

Specifications
MXA signal analyzer performance (Option 200)

These specifications summarize the performance for the N9020A MXA signal analyzer and apply to both an 89600 VSA installed inside the MXA, as well as one used with an external PC controller connected via LAN. Unless stated otherwise, these are nominal values, not warranted. Please refer to the MXA signal analyzer specification guide for spectrum analysis, baseband (BBIQ) performance, and Option B25 specifications.

MXA (nominal)

Frequency			
Range	*Minimum frequency*	*Maximum frequency*	
	10 MHz AC coupled	3.6 GHz (Option 503)	
	20 Hz DC coupled	8.4 GHz (Option 508)	
		13.6 GHz (Option 513)	
		26.5 GHz (Option 526)	
	DC	40 MHz (Option BBA)	
Center frequency tuning resolution	1 mHz		
Frequency span			
(I only, Q only)			
	Standard base instrument	10 Hz to 10 MHz	
	Option B25	10 Hz to 25 MHz	
	Option S40	10 Hz to 40 MHz	
(I+jQ)			
	Standard base instrument	10 Hz to 20 MHz	
	Option B25	10 Hz to 50 MHz	
	Option S40	10 Hz to 80 MHz	
(2-channel with 89601A VSA software)			
	Standard base instrument	10 Hz to 10 MHz per channel	
	Option B25	10 Hz to 25 MHz per channel	Zoom, complex data
		10 Hz to 20 MHz per channel	Baseband
	Option S40	10 Hz to 40 MHz per channel	Zoom, complex data
		10 Hz to 20 MHz per channel	Baseband
Frequency points per span	Calibrated points: 51 to 409,601 Displayable points: 51 to 524,288		

Specifications
MXA signal analyzer performance (Option 200) *(continued)*

MXA (nominal) *(continued)*

Baseband IQ span bandwidth

MXA IF Option	RF BW (for reference)	I+jQ BW (w/ Option BBA)	1 ch BW (w/Option BBA)	2-ch BW (w/ Option BBA)
None	10 MHz	20 MHz	10 MHz	10 MHz
B25	25 MHz	50 MHz	25 MHz	20 MHz [1]
S40	25 MHz	80 MHz	40 MHz	20 MHz [1]

[1] Values are for baseband measurements; values increase to match 1 ch BW for zoom measurements.
Select baseband/zoom on VSA by clicking on MeasSetup>Frequency (tab)>Time Data> then either baseband or zoom.

Baseband IQ center frequency tuning range

MXA Option	I+jQ BW (w/ Option BBA)	1 ch BW (w/ Option BBA)	2 ch BW (w/ Option BBA)
None	±10 MHz	dc-10 MHz	dc-10 MHz
B25	±25 MHz	dc-25 MHz	dc-25 MHz
S40	±40 MHz	dc-40 MHz	dc-40 MHz

Resolution bandwidth (RBW)

The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.

Range

< 1 Hz to > 2.8 MHz (standard)
< 1 Hz to > 7 MHz (Option B25)

RBW shape factor

The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input

Full scale, combines attenuator setting and ADC gain

Range

–20 dBm to 30 dBm (standard)
–40 dBm to 30 dBm, up to 3.6 GHz (Option P03, P08. P13 or P26)
–50 dBm to 30 dBm, 3.6 GHz to 8.4 GHz (Option P08)
–50 dBm to 30 dBm, 3.6 GHz to 13.6 GHz (Option P13)
–50 dBm to 30 dBm, 3.6 GHz to 26.5 GHz (Option P26)
–8 dBm to 10 dBm (Option BBA, 50 ohm input)
–14 dBm to 4 dBm (Option BBA, 1 M ohm input)

ADC overload

+2 dBfs

Specifications
MXA signal analyzer performance (Option 200)

MXA (nominal) *(continued)*

Amplitude accuracy

Absolute amplitude accuracy [1]

Frequency	*95% confidence accuracy*	With Option BBA BBIQ Inputs *Accuracy*
< 3.6 GHz (std)	0.23 dB	+0.07 dB [2]

Amplitude linearity [4]

Level	*Linearity (specification)*	*Level*	*Linearity* [3]
–70 dBfs to 0 dBfs	±0.10 dB	0 to –45 dBfs	±0.10 dB
< –70 dBfs	±0.15 dB	< –45 dBfs	±0.20 dB

IF flatness

Frequency	*Span*	*Flatness (specification)*	*Rms*	With Option BBA BBIQ Inputs *Frequency*	*Flatness*
≤ 3.6 GHz	≤ 10 MHz	±0.40 dB	0.03 dB	0 to 40 MHz	±25 dB
≤ 3.6 GHz	> 10 MHz	±0.45 dB	0.04 dB (Option B25)		
> 3.6 GHz	≤ 10 MHz		0.25 dB		
> 3.6 GHz	> 10 MHz		0.80 dB (Option B25)		

Sensitivity

–151 dBm/Hz 10 MHz to 2.1 GHz, –20 dBm range
–163 dBm/Hz 10 MHz to 2.1 GHz, –40 dBm range (requires P0x preamp option)

Dynamic range

Third-order intermodulation distortion

–90 dBc
Two –20 dBfs tones, 400 MHz to 13.6 GHz, tone separation > 15 kHz

Noise density at 1 GHz

Input range	*Density*
≥ –10 dBm	–140 dBfs/Hz
–20 dBm to –12 dBm	–131 dBfs/Hz
–30 dBm to –22 dBm	–133 dBfs/Hz (requires preamp option)
–40 dBm to –32 dBm	–123 dBfs/Hz (requires preamp option)

Residual responses

–100 dBm

Image responses	–78 dBc (specification) 10 MHz to 13.6 GHz, < 8 MHz span
LO related spurious	–60 dBc (specification) 10 MHz to 3.6 GHz, f > 600 MHz from carrier
Other spurious	–72 dBc (specification) 200 Hz < f < 10 MHz from carrier, < 8 MHz span
	–80 dBc (specification) f ≥ 10 MHz from carrier, < 8 MHz span

Channel Match (Option BBA only)

Amplitude match All ranges; 50 Ω and 1 MΩ inputs; single ended input mode selected; 95% confidence

0 to 10 MHz	±0.04 dB
> 10 MHz to 25 MHz	±0.06 dB
> 25 MHz to 40 MHz	±0.10 dB

Phase match All ranges; 50 Ω and 1 MΩ inputs; single ended input mode selected; 95% confidence

0 to 10 MHz	±0.08°
> 10 MHz to 25 MHz	±0.18°
> 25 MHz to 40 MHz	±0.32°

1. For complete Option BBA BBIQ specifications, see literature part number 5989-6538EN.
2. Measured at -6 dB below max for each range, 250 kHz reference frequency, all ranges, nominal value.
3. With dither turned on.
4. Reference level is input signal of -25 dBm at a range setting of 0 dBm.

Specifications
EXA signal analyzer performance (Option 200)

These specifications summarize the performance for the N9010A EXA signal analyzer and apply to both an 89600 VSA installed inside the EXA, as well as one used with an external PC controller connected via LAN. Unless stated otherwise, these are nominal values, not warranted. Please refer to the EXA signal analyzer specification guide for spectrum analysis performance.

EXA (nominal) Specifications apply to EXA with Option B25, except where noted.

Frequency

Range	*Minimum frequency*: 10 MHz AC coupled, 9 KHz DC coupled *Maximum frequency*: 3.6 GHz (Option 503), 7.0 GHz (Option 507), 13.6 GHz (Option 513), 26.5 GHz (Option 526)
Center frequency tuning resolution	1 mHz
Frequency span	10 MHz (standard) 25 MHz (Option B25)
Frequency points per span	Calibrated points: 51 to 409,601 Displayable points: 51 to 524,288
Resolution bandwidth (RBW)	The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.
Range	< 1 Hz to > 2.8 MHz
RBW shape factor	The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input	Full scale, combines attenuator setting and ADC gain
Range	-20 dBm to 20 dBm, 10 dB steps (standard) -20 dBm to 22 dBm, 2 dB steps (Option FSA or EA3) -40 to 20 dBm, 10 dB steps, up to 3.6 GHz (Option P03) -40 to 22 dBm, 2 dB steps, up to 3.6 GHz (Options P03 and either FSA or EA3)
ADC overload	+2 dBfs

Specifications
EXA signal analyzer performance (Option 200)

EXA (nominal) *(continued)*

Amplitude accuracy				
Absolute amplitude accuracy	*Frequency*	*95% confidence accuracy*		
	< 3.6 GHz	0.27 dB		
Amplitude linearity [1]	*Level*	*Linearity (specification)*		
	–70 dBfs to 0 dBfs	±0.15 dB		
	< –70 dBfs	±0.25 dB		
IF flatness	*Frequency*	*Span*	*Flatness (specification)*	*Rms*
	≤ 3.6 GHz	≤ 10 MHz	±0.40 dB	0.03 dB
	≤ 3.6 GHz	> 10 MHz	±0.45 dB	0.04 dB (Option B25)
	> 3.6 GHz	≤ 10 MHz		0.25 dB
	> 3.6 GHz	> 10 MHz		0.80 dB (Option B25)
Sensitivity	–147 dBm/Hz	10 MHz to 2.1 GHz, –20 dBm range		
	–160 dBm/Hz	10 MHz to 2.1 GHz, –40 dBm range (requires P03 preamp option)		
Dynamic range				
Third-order intermodulation distortion	–82 dBc Two –20 dBfs tones 400 MHz to 13.6 GHz tone separation > 15 kHz			
Noise density at 1 GHz	*Input range*	*Density*		
	≥ –10 dBm	–137 dBfs/Hz		
	–20 dBm to –12 dBm	–127 dBfs/Hz		
	–30 dBm to –22 dBm	–130 dBfs/Hz (requires preamp option)		
	–40 dBm to –32 dBm	–120 dBfs/Hz (requires preamp option)		
Residual responses	–100 dBm			
Image responses	–75 dBc (specification)	10 MHz to 13.6 GHz, < 8 MHz span		
LO related spurious	–60 dBc	10 MHz to 3.6 GHz, f > 600 MHz from carrier		
Other spurious	–68 dBc	200 Hz < f < 10 MHz from carrier, < 8 MHz span		
	–68 dBc (specification)	f ≥ 10 MHz from carrier, < 8 MHz span		

1. Reference level is input signal of -25 dBm at a range setting of 0 dBm.

Specifications
CXA signal analyzer performance (Option 200)

These specifications summarize the performance for the N9000A CXA signal analyzers and apply to both the N9000A CXA signal analyzers, as well as an 89600 VSA installed in the CXA and one used with an external PC controller connected via LAN. Unless stated otherwise, these are nominal values, not warranted. Please refer to the CXA signal analyzers specifications guide for spectrum analysis performance.

Option	Description
503	Frequency range, 9 Hz to 3 GHz
507	Frequency range, 9 Hz to 7.5 GHz
FSA	Fine Step Attenuator
P03	Preamp, 3.0 GHz
P07	Preamp, 7.0 GHz

CXA (nominal)

Frequency

Range

Minimum frequency	*Maximum frequency*
9 kHz	3.0 GHz (Option 503)
9 kHz	7.5 GHz (Option 507)

Center frequency tuning resolution: 1 mHz

Frequency span: 10 MHz

Frequency points per span: Calibrated points: 51 to 409,601
Displayable points: 51 to 524,288

Resolution bandwidth (RBW): The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.

Range: < 1 Hz to 8 MHz

RBW shape factor: The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input: Full scale, combines attenuator setting and ADC gain

Range:
–20 dBm to 20 dBm, 0 to 7.5 GHz
–20 dBm to 22 dBm, 0 to 7.5 GHz (Option FSA)
–40 dBm to 22 dBm, 0 to 3.0 GHz (Option P03)
–20 dBm to 22 dBm, >3.0 GHz to 7.5 GHz (Option P03)
–40 dBm to 22 dBm, 0 to 7.5 GHz (Option P07)

ADC overload: +2 dBfs

Specifications
CXA signal analyzer performance (Option 200)

CXA (nominal) *(continued)*

Amplitude accuracy			
Absolute amplitude accuracy	*Frequency*	*95% confidence accuracy*	
	< 3.0 GHz (standard)	0.60 dB	
Amplitude linearity [1]	*Level*	*Linearity (specification)*	
	–5 dBfs to 0 dBfs	±0.30 dB	
	–70 dBfs to –5 dBfs	±0.15 dB	
IF flatness	*Frequency*	*Flatness (specification)*	*Rms*
	≤ 3.0 GHz	±0.45 dB	0.03 dB
	3.0 GHz to 7.5 GHz		0.25 dB
Sensitivity	–144 dBm/Hz	10 MHz to 2.2 GHz, –20 dBm range	
	–160 dBm/Hz	10 MHz to 2.2 GHz, –40 dBm range (Option P03)	
Dynamic range			
Third-order intermodulation distortion	–66 dBc Two –10 dBfs tones, 400 MHz to 7.5 GHz, tone separation > 100 kHz		
Noise density at 1 GHz	*Input range*	*Density*	
	≥ –10 dBm	–134 dBfs/Hz	
	–20 dBm to –12 dBm	–124 dBfs/Hz	
	–30 dBm to –22 dBm	–130 dBfs/Hz (Option P03/P07)	
	–40 dBm to –32 dBm	–120 dBfs/Hz (Option P03/P07)	
Residual responses	–100 dBm		
Input related spurious	–60 dBc	10 MHz to 7.5 GHz, mixer level ≤ –30 dBm (Input signal ≤ –20 dBfs with input range ≥ –10 dBm)	
Other spurious	–65 dBc	200 Hz < f < 10 MHz from carrier	

1. Reference level is input signal of -25 dBm at a range setting of 0 dBm.

Specifications
ESA-E Series spectrum analyzer performance (Option 200)

These specifications summarize the performance for the ESA-E Series spectrum analyzers when used with the 89600 vector signal analysis software. These are nominal values, not warranted.

ESA [1, 2] (nominal)

Frequency	
Range	AC-coupled range of ESA-E model
Center frequency tuning resolution	1 Hz
Frequency span range	< 50 kHz to 10 MHz, alias protection enabled < 50 Hz to 10 MHz, alias protection disabled, default
Frequency points per span	Calibrated points: 51 to 409,601 Displayable points: 51 to 524,288
Frequency stability (spectral purity)	1 GHz input, > 10 kHz offset
Phase noise	–96 dBc/Hz [2]
Resolution bandwidth (RBW)	The range of available RBW choices is a function of the selected frequency span and the number of calculated frequency points. Users may step through the available range in a 1-3-10 sequence or directly enter an arbitrarily chosen bandwidth.
Range	< 500 Hz to > 2.8 MHz, alias protection enabled < 1 Hz to > 2.8 MHz, alias protection disabled, default
RBW shape factor	The window choices below allow the user to optimize the RBW shape as needed for best amplitude accuracy, best dynamic range, or best response to transient signal characteristics.

	Selectivity	*Passband flatness*	*Rejection*
Flat top	0.41	0.01 dB	> 95 dBc
Gaussian top	0.25	0.68 dB	> 125 dBc
Hanning	0.11	1.5 dB	> 31 dBc
Uniform	0.0014	4.0 dB	> 13 dBc

Input range	–55 dBm to +30 dBm, 1 dB steps, without pre-amp, < 3 GHz –75 dBm to +30 dBm, 1 dB steps, with pre-amp Option 1DS
ADC overload	+5.2 dBfs

1. All RF-related values are using the ESA-E Series RF input and a maximum mixer level of –10 dBm.
2. These features apply using the internal reference or 10 MHz REF IN only. Using EXT REF IN and 10 MHz OUT ports degrades close-in (< 600 Hz) phase noise performance.

Specifications
ESA-E Series spectrum analyzer performance (Option 200)

ESA [1, 2] (nominal) *(continued)*

Amplitude accuracy	Nominal values, flat-top window, apply between 30 MHz and 3 GHz
Absolute full-scale accuracy	±1.5 dB
IF Flatness	±0.2 dB, frequency response across the measurement span included in amplitude accuracy value
Sensitivity	At 1 GHz, most sensitive range With preamp, < –158 dBm/Hz Without preamp, < –144 dBm/Hz
Dynamic range	Nominal values; apply between 30 MHz and 3 GHz; indicates amplitude range that is free of erroneous signals within the measurement span
Third-order intermodulation distortion	–55 dBc Two signals in span, each –6.5 dBfs to –10 dBfs: separation > 100 kHz; referenced to either signal
Noise density	< –120 dBfs/Hz [3] > –20 dBm range, at 1 GHz
IF residual responses	–90 dBm, alias protection = on < –60 dBfs or < –90 dBm, alias protection = off
IF spurious responses	< –45 dBc, applies to signals that are band-limited in the analysis span

1. All RF-related values are using the ESA-E Series RF input and a maximum mixer level of –10 dBm.
2. These features apply using the internal reference or 10 MHz REF IN only. Using EXT REF IN and 10 MHz OUT ports degrades close-in (< 600 Hz) phase noise performance.
3. Noise and sensitivity are degraded by approximately 3 dB x $\log_2$ (10 MHz/span) when the alias protection parameter is set to false.

Specifications
Time and waveform capture (Option 200)

	89610S/11S/40S/41S 89600S-144	89610S/11S/40S/41S 89600S-288	89610S/11S/40S/41S 89600S-120
Max capture size			
Bytes	144 MB	288 MB	1152 MB
Complex samples			
Span ≤ 18.55 MHz	24 MSa	48 MSa	192 MSa
Span > 18.55 MHz	48 MSa	96 MSa	384 MSa
Max capture span	36 MHz	36 MHz	36 MHz
Max capture time	At maximum capture span		
Span ≤ 18.55 MHz	0.5 s	1.01 s	4.04 s
Span > 18.55 MHz	1.01 s	2.02 s	8.08 s

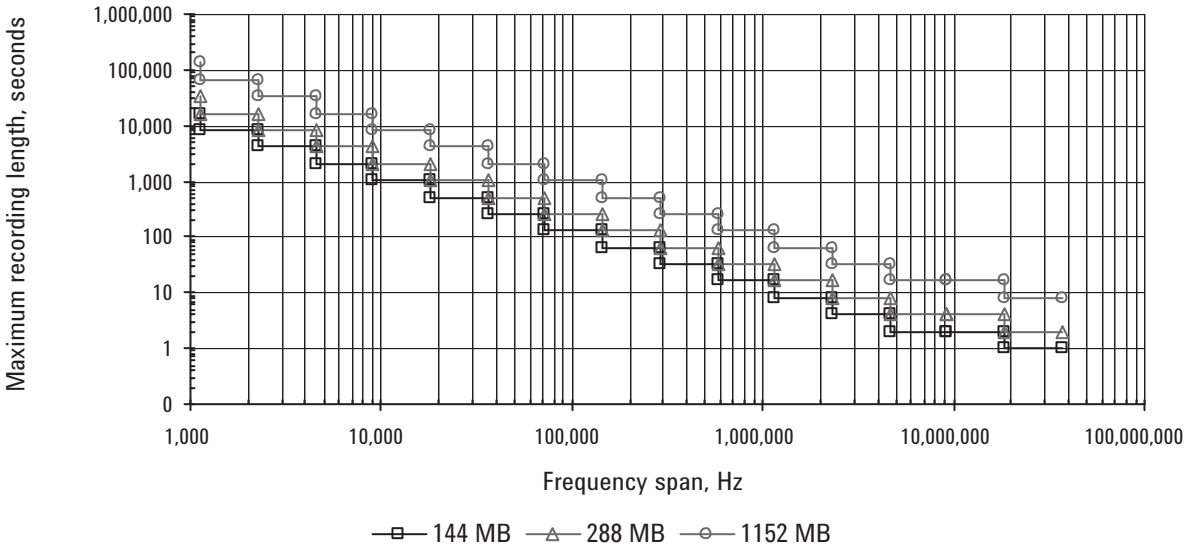


Figure 2. 89610S/89611S/89640S/89641S capture length.

Specifications

Time and waveform capture (Option 200)

	89650S
Max capture size	
Bytes	512 MB
Complex samples	134 MSa
Max capture span	80 MHz (Option 122); 40 MHz (Option 140)
Max capture time	1.34 sec (At maximum capture span)

	PSA	MXA	EXA
Max capture size			
Complex samples	For the 8 MHz (std) maximum time capture span: During time capture on spans < 1.55 MHz, the analyzer is set to the cardinal span that equals or exceeds the currently displayed span. For spans ≥ 1.55 MHz, the analyzer is set to 8 MHz.		
	900 kSa (standard) 127.9 MSa (Options 122, 140)	4 MSa (RF) 500 MSa (w/ Opt BBA)	4 MSa
Max capture span	8MHz (std) 40 MHz (Option 140) 80 MHz (Option 122)	10 MHz (standard) 20 MHz (Option BBA) 25 MHz (Option B25) 50 MHz (Options BBA, B25) 80 MHz (Options S40, BBA)	10 MHz (standard) 25 MHz (Option B25)
Max capture time (at max capture span)	60 ms (standard) 2.5 sec (Option 140) 1.28 sec (Option 122)	266.6 msec (standard) 88.8 msec (Option B25) 20 sec (BBIQ, Option BBA) 8 sec (Options B25, BBA) 5 sec (Options S40, BBA)	266.6 msec (standard) 88.8 msec (Option B25)

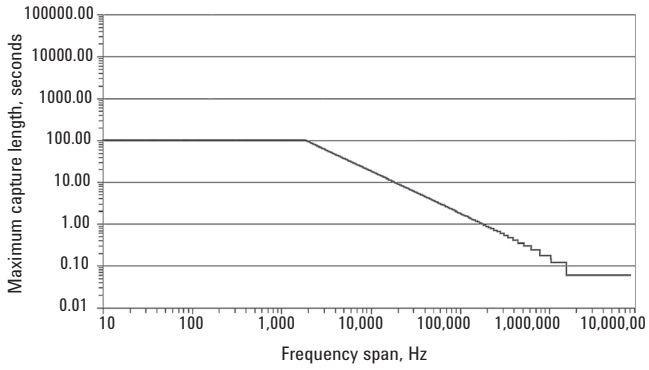


Figure 3a. PSA capture length vs. span (std).

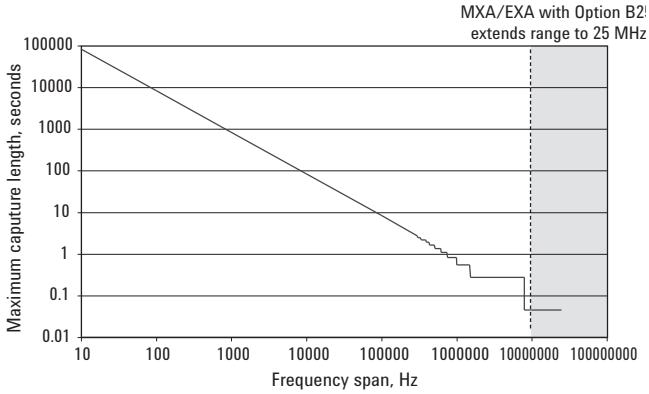


Figure 4a. MXA (RF mode) and EXA capture length vs. span.

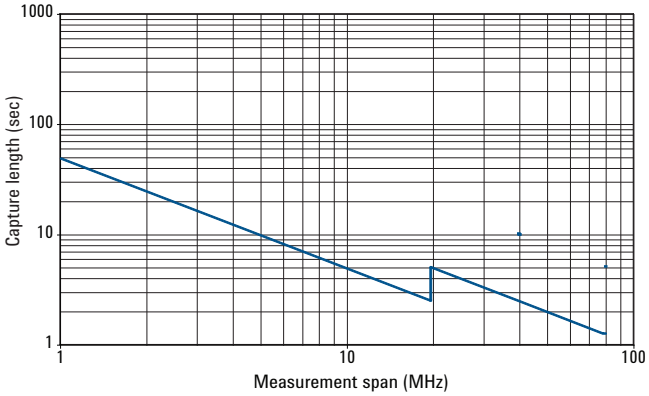


Figure 3b. PSA capture length vs. span (Options 122, 140).

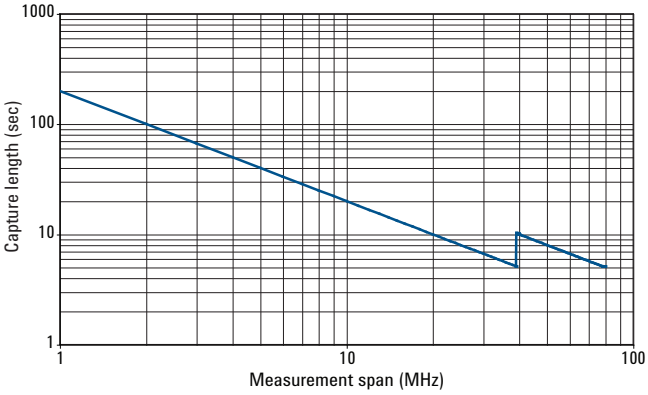


Figure 4b. MXA (BBIQ mode) capture length vs. span.

Specifications
Time and waveform capture (Option 200)

	ESA	PXA	
Max capture size			
Complex samples	124,388 Sa	32 bits	512 MSa
		64 bits	256 MSa
Max capture span	10 MHz	10 MHz (standard)	
		25 MHz (Option B25)	
		40 MHz (Option B40)	
		140 MHz (Option B1X)	
Max capture time (at max capture span)	8 msec	(complex samples, 32 bit)	
		10 MHz (standard)	40 sec
		25 MHz (Option B25)	16 sec
		40 MHz (Option B40)	10 sec
		140 MHz (Option B1X)	2.86 sec

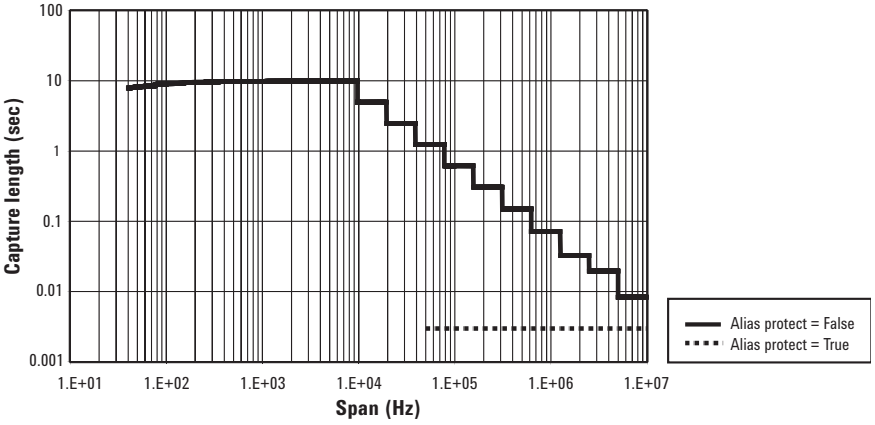


Figure 5. ESA capture length vs. span.

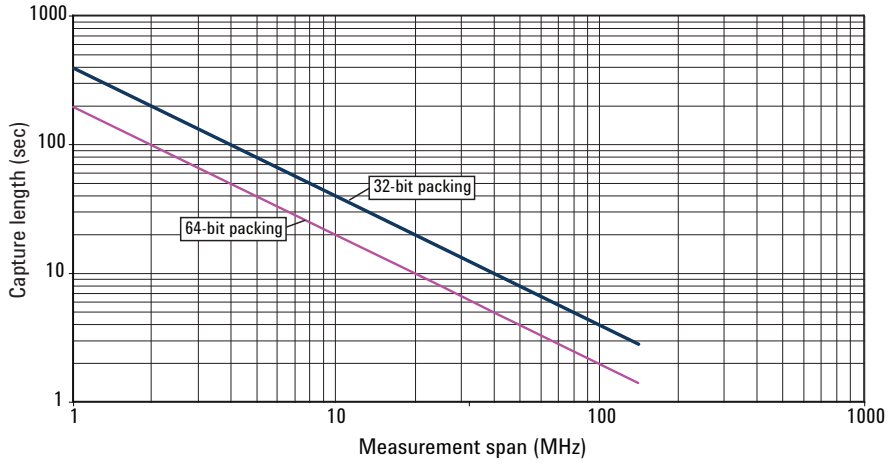


Figure 6. PXA capture length vs. span.

Specifications
Analog modulation analysis (part of Option 200)

89610S, 89611S, 89640S, 89641S vector signal analyzers

	89610S/11S/40S/41S (nominal)
AM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±1% Modulation ≤ 1 MHz
Harmonic distortion	Modulation index ≤ 95% *Modulation bandwidth* *Distortion* ≤ 100 kHz –60 dBc > 100 kHz and ≤ 1 MHz –55 dBc
Spurious	Relative to 100% modulation index *Modulation bandwidth* *Distortion* ≤ 100 kHz –60 dBc > 100 kHz and ≤ 1 MHz –55 dBc
Cross demodulation	< 0.3% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation, cardinal spans
PM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±0.5° Deviation < 180°, modulation rate ≤ 500 kHz
Harmonic distortion	Deviation ≤ 180° *Modulation bandwidth* *Distortion* ≤ 50 kHz –60 dBc ≥ 50 kHz and ≤ 500 kHz –55 dBc
Spurious	Relative to 180° deviation *Modulation bandwidth* *Distortion* ≤ 50 kHz –60 dBc ≥ 500 Hz and ≤ 500 kHz –55 dBc
Cross demodulation	< 1° PM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz
FM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±0.1% of span Deviation ≤ 2 MHz, modulation rate ≤ 500 kHz
Harmonic distortion	Cardinal spans *Modulation rate* *Deviation* *Distortion* ≤ 50 kHz ≤ 200 kHz –60 dBc ≤ 500 kHz ≤ 2 MHz –55 dBc
Spurious	Cardinal spans *Modulation rate* *Deviation* *Distortion* ≤ 50 kHz ≤ 200 kHz –50 dBc ≤ 500 kHz ≤ 2 MHz –45 dBc
Cross demodulation	< 0.5% of span of FM on 80% modulation index AM signal, modulation rate ≤ 1 MHz

Specifications
Analog modulation analysis (part of Option 200)

89650S vector signal analyzer

	89650S (nominal, all PSA models, including both Options 140 and 122)		
AM demodulation	Modulation rate ≤ 1 MHz, modulation index < 95%		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±1%		
Dynamic range	–60 dBc 100% modulation index		
Cross demodulation	< 0.3% AM on an FM signal with 10 kHz modulation rate, 200 kHz deviation, cardinal spans		
PM demodulation	Modulation rate ≤ 1 MHz, deviation ≤ 180º		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±3º		
Dynamic range	–60 dBc		
Cross demodulation	< 1º PM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz		
FM demodulation	Modulation rate ≤ 250 kHz, deviation ≤ 1 MHz		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±1% of span		
Dynamic range	–60 dBc		
Spurious	*Modulation rate* ≤ 500 kHz	*Deviation* ≤ 2 MHz	*Distortion* –55 dBc
Cross demodulation	< 0.5% of FM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz		

Specifications
Analog modulation analysis (part of Option 200)

PSA spectrum analyzers

	PSA (nominal)
AM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±1%
Dynamic range	60 dB (100%) for a pure AM signal
Cross demodulation	< 0.3% AM on an FM signal with 10 kHz modulation, 200 kHz deviation
PM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±3º
Dynamic range	60 dB (rad) for a pure PM signal
Cross demodulation	< 1% PM on an 80% AM signal
FM demodulation	
Demodulator bandwidth	Same as selected measurement span
Modulation index accuracy	±1% of span
Dynamic range	60 dB (Hz) for a pure FM signal
Cross demodulation	< 0.5% of span FM on an 80% AM signal

Specifications
Analog modulation analysis (part of Option 200)

MXA, EXA, CXA, and PXA signal analyzers

	MXA (nominal)	EXA (nominal)	PXA (nominal)
AM demodulation	Span ≤ 12 MHz ; carrier ≤ -17 dBfs	Span ≤ 12 MHz; carrier ≤ –17 dBfs	Carrier ≤ –17 dBfs
Demodulator bandwidth	Same as selected measurement span	Same as selected measurement span	Same as selected measurement span
Modulation index accuracy	±1%	±1%	±1%
Harmonic distortion	–60 dBc relative to 100% modulation index	–55 dBc relative to 100% modulation index	–50 dBc relative to 100% modulation index
Spurious	–60 dBc relative to 100% modulation index	–60 dBc relative to 100% modulation index	–60 dBc relative to 100% modulation index
Cross demodulation	< 0.3% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation	< 0.5% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation	< 1.1% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation
PM demodulation	Deviation < 180º, modulation rate ≤ 500 kHz	Deviation < 180º, modulation rate ≤ 500 kHz	Deviation < 180º, modulation rate ≤ 500 kHz
Demodulator bandwidth	Same as selected measurement span, except as noted	Same as selected measurement span, except as noted	Same as selected measurement span
Modulation index accuracy	±0.5º	±0.5º	±0.5º
Harmonic distortion	–60 dBc	–55 dBc	–55 dBc
Spurious	–60 dBc, span ≤ 12 MHz	–60 dBc	–60 dBc
Cross demodulation	1º PM on an 80% modulation index AM signal, 1º PM on an 80% modulation index AM signal,	80% modulation index AM signal, modulation rate ≤ 1 MHz Span < 10 MHz 1º PM Span > 10 MHz 1.5º PM (Opt B25)	80% modulation index AM signal, modulation rate ≤ 1 MHz CF < 3 GHz 1º PM CF > 3 GHz 1.3º PM
FM demodulation			
Demodulator bandwidth	Same as selected measurement span	Same as selected measurement span	Same as selected measurement span
Modulation index accuracy	Same as selected measurement span modulation rate ≤ 500 kHz	±0.1% of span, deviation < 2 MHz, modulation rate ≤ 500 kHz	±0.1% of span, deviation < 2 MHz, modulation rate ≤ 500 kHz

Harmonic distortion	*Modulation rate*	*Deviation*	*Distortion*	*Modulation rate*	*Deviation*	*Distortion*	*Modulation rate*	*Deviation*	*Distortion*
	≤ 50 kHz	≤ 200 kHz	–60 dBc	≤ 50 kHz	≤ 200 kHz	–50 dBc	≤ 50 kHz	≤ 200 kHz	–50 dBc
	≤ 500 kHz	≤ 2 MHz	–55 dBc	≤ 500 kHz	≤ 2 MHz	–45 dBc	≤ 500 kHz	≤ 2 MHz	–45 dBc
Spurious	*Modulation rate*	*Deviation*	*Distortion*	*Modulation rate*	*Deviation*	*Distortion*	*Modulation rate*	*Deviation*	*Distortion*
	≤ 50 kHz	≤ 200 kHz	–50 dBc, span ≤ 12 MHz	≤ 50 kHz	≤ 200 kHz	–50 dBc	≤ 50 kHz	≤ 200 kHz	–50 dBc
	≤ 500 kHz	≤ 2 MHz	–45 dBc	≤ 500 kHz	≤ 2 MHz	–45 dBc	≤ 500 kHz	≤ 2 MHz	–45 dBc
Cross demodulation	< 0.5% of span of FM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz			< 0.5% of span of FM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz			< 0.5% of span of FM on an 80% modulation index AM signal, modulation rate ≤ 1 MHz		

Specifications
Analog modulation analysis (part of Option 200)

MXA, EXA, CXA, and PXA signal analyzers (continued)

	CXA (nominal)		
AM demodulation	Carrier ≤ –17 dBfs		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±1%		
Harmonic distortion	–50 dBc relative to 100% modulation index		
Spurious	–60 dBc relative to 100% modulation index		
Cross demodulation	< 1.1% AM on an FM signal with 50 kHz modulation rate and 200 kHz deviation		
PM demodulation	Deviation < 180°; modulation rate ≤ 500 kHz		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±0.5°		
Harmonic distortion	–55 dBc		
Spurious	–60 dBc		
Cross demodulation	80% mod index AM signal; mod rate ≤ 1 MHz		
	CF < 3 GHz	1° PM	
	CF > 3 GHz	1.3° PM	
FM demodulation			
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±0.1% of span; deviation < 2 MHz; modulation rate ≤ 500 kHz		
Harmonic distortion	*Modulation rate*	*Deviation*	*Distortion*
	≤ 50 kHz	≤ 200 kHz	–50 dBc
	≤ 500 kHz	≤ 2 MHz	–45 dBc
Spurious	*Modulation rate*	*Deviation*	*Spurious*
	≤ 50 kHz	≤ 200 kHz	–50 dBc
	≤ 500 kHz	≤ 2 MHz	–45 dBc
Cross modulation	< 0.5% of span of FM on an 80% modulation index AM signal; modulation rate ≤ 1 MHz		

Specifications
Analog modulation analysis (part of Option 200)

ESA-E Series spectrum analyzers

	ESA (nominal)
AM demodulation	
Modulation index accuracy	±1%
Dynamic range	55 dB (100%) for a pure AM signal (distortion) 45 dB (100%) for a pure AM signal (spurious)
Cross demodulation	< 0.5% AM on an FM signal with 10 kHz modulation, 200 kHz deviation
PM demodulation	
Modulation index accuracy	±3º
Dynamic range	55 dB (rad) for a pure PM signal
Cross demodulation	< 1% PM on an 80% AM signal
FM demodulation	
Modulation index accuracy	±1% of span
Dynamic range	50 dB (Hz) for a pure FM signal (distortion) 45 dB (Hz) for a pure FM signal (spurious)
Cross demodulation	< 0.5% of span FM on an 80% AM signal

Specifications
Vector modulation analysis (Option AYA)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)		89650S (nominal)	
Accuracy	Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK. Full-scale signal, fully contained in the measurement span, baseband [1], IF, or RF inputs, random data sequence, range ≥ –25 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10		Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK. Full-scale signal, fully contained in the measurement span, random data sequence, range ≥ –20 dBm, start frequency ≥ 15% of span, alpha/BT > 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10	
Residual errors	Results = 150 symbols		Results = 150 symbols	
Residual EVM	*Span*	*EVM*	*Span*	*EVM*
	≤ 100 kHz	< 0.5% rms	≤ 100 kHz	0.5% rms
	≤ 1 MHz	< 0.5% rms	≤ 1 MHz	0.5% rms
	≤ 10 MHz	< 1.0% rms	≤ 10 MHz	1.0% rms
	> 10 MHz	< 2.0% rms	≤ 28 MHz	1.2% rms
			≤ 36 MHz	1.6% rms
			≤ 80 MHz	2.5% rms
Magnitude error	*Span*	*Error*	*Span*	*Error*
	≤ 100 kHz	0.3% rms	≤ 100 kHz	0.3% rms
	≤ 1 MHz	0.5% rms	≤ 1 MHz	0.5% rms
	≤ 10 MHz	1.0% rms	≤ 10 MHz	1.0% rms
	> 10 MHz	1.5% rms	≤ 28 MHz	1.2% rms
			≤ 36 MHz	1.5% rms
			≤ 80 MHz	2.5% rms
Phase error	For modulation formats with equal symbol amplitude			
	Span	*Error*	*Span*	*Error*
	≤ 100 kHz	0.3° rms	≤ 100 kHz	0.3º rms
	≤ 1 MHz	0.4° rms	≤ 1 MHz	0.4º rms
	≤ 10 MHz	0.6° rms	≤ 10 MHz	0.6º rms
	> 10 MHz	1.2º rms	≤ 28 MHz	0.8º rms
			≤ 36 MHz	1.2º rms
			≤ 80 MHz	1.5º rms
Frequency error	Symbol rate/500,000 (Added to frequency accuracy if applicable)		Symbol rate/500,000 (Relative to frequency standard)	
I-Q/origin offset	–60 dB		–60 dB	

1. For I+jQ analysis, user must compensate for I/Q delay of each channel. For information on using calibration constants, please see topic "calibration constants" in Help text.

Specifications
Vector modulation analysis (Option AYA)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)	89650S (nominal)
Video modulation formats		
Residual EVM 8, 16 VSB	≤ 1.5%, SNR ≥ 36 dB, symbol rate = 10.762 MHz, alpha = 0.115, IF or RF inputs, 7 MHz span, full-scale signal, range ≥ –25 dBm, result length = 800, averages = 10	≤ 1.5%, SNR ≥ 36 dB, symbol rate = 10.762 MHz, alpha = 0.115, 7 MHz span, full-scale signal, range ≥ –20 dBm, result length = 800, averages = 10
Residual EVM 16, 32, 64, 128, 256, 512, or 1024 QAM	≤ 1.0%, SNR ≥ 40 dB, symbol rate = 6.9 MHz, alpha = 0.15, IF or RF inputs, 8 MHz span, full-scale signal, range ≥ –25 dBm, result length = 800, averages = 10	≤ 1.0%, SNR ≥ 40 dB, symbol rate = 6.9 MHz, alpha = 0.15, 8 MHz span, full scale signal, range ≥ –20 dBm, result length = 800, averages = 10
Residual EVM 16, 32 APSK	Symbol rate = 25 MHz, alpha = 0.35, IF or RF inputs, full-scale signal within 1 range step, range ≥ –25 dBm, result length = 180, averages = 10	
	≤ 0.63%, SNR (MER) ≥ 42 dB (For EQ ON and settled, with span = 36 MHz)	≤ 0.5%, SNR (MER) ≥ 44 dB (For EQ ON and settled, with span = 36 MHz)
	≤ 2.0%, SNR (MER) ≥ 32 dB (For EQ OFF and span = 36 MHz)	≤ 1.25%, SNR (MER) ≥ 36 dB (For EQ OFF, span = 36 MHz, and Option 123 Preselector Bypass required above 3 GHz)

GSM/EDGE/EDGE Evolution mode formats

		89650S, PSA w/ Opt 122 or 140 (nominal)
Accuracy		Signal within 2 dB of full scale signal range; span = 1 MHz; RMS averages = 20
EVM		≤ 0.25%
Frequency accuracy		≤ 0.5 Hz
Frequency lock range		± 400 kHz

Specifications
Vector modulation analysis (Option AYA)

PSA spectrum analyzers, MXA, EXA, CXA, and PXA signal analyzers

	PSA (nominal)		MXA (nominal)		EXA (nominal)		CXA (nominal)		PXA (nominal)	
Accuracy	Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal, fully contained in the measurement span, frequency < 3 GHz, random data sequence, range ≥ –24 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10		Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal, fully contained in the measurement span, frequency < 3.6 GHz, random data sequence, range ≥ –30 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10; Results apply for Option BBA BBIQ options except as noted		Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal, fully contained in the measurement span, frequency < 3.6 GHz, random data sequence, range ≥ –30 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10		Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal; fully contained in the measurement span; frequency < 3.6 GHz; random data sequence; range ≥ –30 dBm; start frequency ≥ 15% of span; alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK); and symbol rate ≥ 1 kHz. For symbol rates <1 kHz; accuracy may be limited by phase noise. Averaging = 10.		Formats other than FSK, CPM(FM), 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal; fully contained in the measurement span; frequency < 3.6 GHz; random data sequence; range ≥ –30 dBm; start frequency ≥ 15% of span; alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK); and symbol rate ≥ 1 kHz. For symbol rates <1 kHz; accuracy may be limited by phase noise. Averaging = 10.	
Residual errors	Result = 150 symbols averages = 10		Result = 150 symbols averages = 10		Result = 150 symbols averages = 10		Result = 150 symbols averages = 10		Result = 150 symbols averages = 10	
Residual EVM	*Span*	*EVM*	*Span*	*EVM*	*Span*	*EVM*	*Span*	*EVM*	*Span*	*EVM*
	≤ 100 kHz	< 0.5% rms	≤ 100 kHz [1]	0.50% rms	≤ 100 kHz [1]	0.50% rms	≤ 100 kHz	0.50% rms	≤ 100 kHz	0.50% rms
	≤ 1 MHz	< 0.5% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms
	≤ 8 MHz	< 1.0% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms
			≤ 22 MHz [2]	1.20% rms	≤ 22 MHz [2]	1.20% rms				
			≤ 25 MHz [2]	1.50% rms	≤ 25 MHz [2]	1.50% rms				
Magnitude error	*Span*	*Error*	*Span*	*Error*	*Span*	*Error*	*Span*	*Error*	*Span*	*Error*
	≤ 100 kHz	0.5% rms	≤ 100 kHz	0.30% rms	≤ 100 kHz	0.30% rms	≤ 100 kHz	0.30% rms	≤ 100 kHz	0.30% rms
	≤ 1 MHz	0.5% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms	≤ 1 MHz	0.50% rms
	≤ 8 MHz	1.0% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms	≤ 10 MHz	1.00% rms
			≤ 22 MHz [2]	1.00% rms	≤ 22 MHz [2]	1.00% rms				
			≤ 25 MHz [2]	1.20% rms	≤ 25 MHz [2]	1.20% rms				
Phase error	For modulation formats with equal symbol amplitudes									
	Span	*Error*	*Span*	*Error*	*Span*	*Error*	*Span*	*Error*	*Span*	*Error*
	≤ 100 kHz	0.3° rms	≤ 100 kHz [1]	0.3° rms	≤ 100 kHz [1]	0.3° rms	≤ 100 kHz	0.7° rms	≤ 100 kHz	0.7° rms
	≤ 1 MHz	0.4° rms	≤ 1 MHz	0.4° rms	≤ 1 MHz	0.4° rms	≤ 1 MHz	0.8° rms	≤ 1 MHz	0.8° rms
	≤ 8 MHz	0.6° rms	≤ 10 MHz	0.6° rms	≤ 10 MHz	0.6° rms	≤ 10 MHz	0.8° rms	≤ 10 MHz	0.8° rms
			≤ 22 kHz [2]	0.8° rms	≤ 22 kHz [2]	0.8° rms				
			≤ 35 kHz [2]	1.0° rms	≤ 35 kHz [2]	1.0° rms				
Frequency error	Added to frequency accuracy if applicable									
	Symbol rate/500,000									
I-Q/origin offset	–60 dB or better						–60 dB or better		–60 dB or better	

1. Requires phase noise optimization hardware parameter to be set to < 20 kHZ.
2. Requires Option B25.

Specifications
Vector modulation analysis (Option AYA)

PSA spectrum analyzers, MXA, EXA, CXA, and PXA signal analyzers

	PSA (nominal)	MXA (nominal) [1]	EXA (nominal)	CXA (nominal)	PXA (nominal)
Video modulation formats					
Residual EVM 8/16 VSB	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, a = 0.115, frequency < 3 GHz, 7 MHz span, full-scale signal, range ≥ –24 dBm, result length = 800, averages = 10	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, a = 0.115, frequency < 3.6 GHz, 7 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, a = 0.115, frequency < 3.6 GHz, 7 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz; alpha = 0.115; frequency < 3.0 GHz; 7 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz; alpha = 0.115; frequency < 3.6 GHz; 7 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10
Residual EVM 16, 32, 64, 128, 256, 512, or 1024 QAM	≤ 1.0% (SNR ≥ 40 dB) Symbol rate = 6.9 MHz, a = 0.15, frequency < 3 GHz, 8 MHz span, full-scale signal, range ≥ –24 dBm, result length = 800, averages = 10	≤ 1.0% (SNR ≥ 40 dB) Symbol rate = 6.9 MHz, a = 0.15, frequency < 3.6 GHz, 8 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.0% (SNR ≥ 40 dB) Symbol rate = 6.9 MHz, a = 0.15, frequency < 3.6 GHz, 8 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.0% (SNR ≥ 36 dB) Symbol rate = 6.9 MHz, alpha = 0.15, frequency < 3 GHz, 8 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10	≤ 1.0% (SNR ≥ 40 dB) Symbol rate = 6.9 MHz; alpha = 0.15; frequency < 3.6 GHz; 8 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10

GSM/EDGE/EDGE Evolution mode formats

	PSA (standard)	MXA	EXA	CXA	PXA
Accuracy	Signal within 2 dB of full scale signal range; span = 1 MHz; RMS averages = 20				
EVM	≤ 0.25%	≤ 0.5% (≤0.4%) [2]	≤ 0.5% [3]	≤ 0.5%	≤ 0.25%
Frequency accuracy	≤ 0.5 Hz	≤ 1 Hz (≤0.2 Hz) [2]	≤ 1 Hz [3]	≤ 1 Hz	≤ 0.5 Hz
Frequency accuracy	± 400 kHz	± 400 kHz (± 400 kHz) [2]	± 400 kHz [3]	± 400 kHz	± 400 kHz

1. Results apply for Option BBA BBIQ inputs as well.
2. MXA Option BBA result.
3. Results valid for EXA with Option B25.

Specifications
Vector modulation analysis (Option AYA)

ESA spectrum analyzers

	ESA (nominal)	
Accuracy	Formats other than CPM(FM), FSK, 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal, fully contained in the measurement span, frequency between 30 MHz and 3 GHz, random data sequence, range ≥ –20 dBm, start frequency ≥ 15% of span, alpha/BT ≥ 0.3 (0.3 to 0.7 for OQPSK), and symbol rate ≥ 1 kHz. For symbol rates < 1 kHz, accuracy may be limited by phase noise. Averaging = 10	
Residual errors	Result = 150 symbols averages = 10	
Residual EVM	*Span*	*EVM*
	≤ 100 kHz	< 1.2% rms
	≤ 1 MHz	< 0.4% rms
	≤ 8 MHz	< 1.8% rms
Magnitude error	*Span*	*Error*
	≤ 100 kHz	0.6% rms
	≤ 1 MHz	0.6% rms
	≤ 10 MHz	1.3% rms
Phase error	For modulation formats with equal symbol amplitudes	
	Span	*Error*
	≤ 100 kHz	0.7% rms
	≤ 1 MHz	0.5% rms
	≤ 10 MHz	0.8% rms
Frequency error	Added to frequency accuracy if applicable	
	Symbol rate/500,000	
I-Q/origin offset	–57 dB or better	

1. For RF only, ≤ 5 MHz for baseband.

Specifications
Vector modulation analysis (Option AYA)

ESA spectrum analyzers

	ESA (nominal)
Video modulation formats	
Residual EVM 8/16 VSB	≤ 1.7% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, α = 0.115, frequency < 3 GHz, 8 MHz span, full-scale signal, range ≥ –24 dBm, result length = 800, averages = 10
Residual EVM 16, 32, 64, 128, 256, 512, or 1024 QAM	≤ 1.5% (SNR ≥ 36 dB) [1] Symbol rate = 6.9 MHz, α = 0.15, 8 MHz span, full-scale signal, range ≥ –18 dBm, result length = 800, averages = 10

1. 16, 32, 64, 128, 256 QAM only.

Specifications
W-CDMA/HSPA+ modulation analysis (Option B7U, B7N)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)	89650S (nominal)
Signal playback		
Result length	1 to 64 slots	1 to 64 slots
Capture length	Gap free analysis at 0% overlap; 5 MHz span 144 MB memory 3,000 slots 288 MB memory 6,000 slots 1152 MB memory 24,000 slots	Gap free analysis at 0% overlap; 5 MHz span > 15,000 slots
Accuracy	Input range within 5 dB of total signal power	Total signal power within 5 dB of full scale
Code domain		
CDP accuracy	±0.3 dB Spread channel power within 20 dB of total power	±0.3 dB Spread channel power within 20 dB of total power
Symbol power versus time	±0.3 dB Spread channel power within 20 dB of total power averaged over a slot	±0.3 dB Spread channel power within 20 dB of total power averaged over a slot
Composite EVM		
EVM floor (pilot only)	≤ 1.5%	≤ 1.5%
EVM floor (test model 1 with 16 DPCH signal)	≤ 1.5%	≤ 1.5%
EVM floor (test model 5 with 8 HSPDSCH with 30 DPCH, HSPA enabled)	≤ 1.5%	≤ 1.5%
Frequency error		
Lock range (CPICH synch type)	±500 Hz	≤ 500 Hz
Accuracy	±10 Hz	≤ 10 Hz

Specifications
W-CDMA/HSPA+ modulation analysis (Option B7U, B7N)

PSA spectrum analyzers, MXA, EXA, and PXA signal analyzers

	PSA (nominal)	MXA (nominal) Includes Option BBA as noted	EXA (nominal)	PXA (nominal)
Signal playback				
Result length	1 to 64 slots	1 to 64 slots	1 to 64 slots	1 to 64 slots
Capture length Gap free analysis at 0% overlap; 5 MHz span	88 slots	> 390 slots > 59,997 slots with Opt. BBA (BBIQ only)	> 390 slots	>60,000 slots
Accuracy	Input range ≥ –24 dBm, within 5 dB of total signal power, frequency < 3 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz
Code domain CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power averaged over a slot	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Composite EVM EVM floor (pilot only)	≤ 1.5%	≤ 1.5%[1]	≤ 1.5%	≤ 1.5%
EVM floor (test model 1 with 16 DPCH signal)	≤ 1.5%	≤ 1.5%	≤ 1.5%	≤ 1.5%
EVM floor (test model 5, 8 HSDPSCH with 30 DPCH, HSPA enabled)	≤ 1.5%	≤ 1.5%	≤ 1.5%	≤ 1.5%
Frequency error Range (CPICH sync type)	±500 Hz	±500 Hz	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz	±10 Hz	±10 Hz

1. Results apply to MXA with Option BBA.

Specifications
W-CDMA/HSPA+ modulation analysis (Option B7U, B7N)

ESA spectrum analyzers

	ESA (nominal)
Signal playback	
Result length	1 to 27 slots [1]
Capture length Gap free analysis at 0% overlap; 5 MHz span	27 slots [1]
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz
Code domain	
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power averaged over a slot	±0.3 dB
Composite EVM	
EVM floor (pilot only)	≤ 1.6%
EVM floor (test model 1 with 16 DPCH signal)	≤ 1.6%
EVM floor (test model 5, 8 HSDPSCH with 30 DPCH, HSPA enabled)	≤ 1.6%
Frequency error	
Range (CPICH sync type)	±500 Hz
Accuracy	±10 Hz

1. Alias protect = false; 11 slots when alias protect = true.

Specifications
cdma2000/1xEV-DV modulation analysis (Option B7T, B7N)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)		89650S (nominal)	
Signal playback				
Result length	*Forward link* 1 to 64 PCGs	*Reverse link* 1 to 48 PCGs	*Forward link* 1 to 64 PCGs	*Reverse link* 1 to 48 PCGs
Capture length	Gap free analysis at 0% overlap; 2.6 MHz span 144 MB memory 288 MB memory 1152 MB memory	 3,200 PCGs 6,400 PCGs 25,600 PCGs	Gap free analysis at 0% overlap; 2.6 MHz span > 16,000 PCGs	
Accuracy	Input range within 5 dB of total signal power		Total signal power within 5 dB of full scale	
Code domain CDP accuracy	±0.3 dB Spread channel power within 20 dB of total power		±0.3 dB Spread channel power within 20 dB of total power	
Symbol power versus time	±0.3 dB Spread channel power within 20 dB of total power averaged over a PCG		±0.3 dB Spread channel power within 20 dB of total power averaged over a PCG	
Composite EVM EVM floor (pilot only)	≤ 1.5%		≤ 1.5%	
EVM floor (9 active channels)	≤ 1.5%		≤ 1.5%	
EVM floor (16-QAM, F-DPCH with 15 codes, 1xEV-DV enabled)	≤ 1.5%		≤ 1.5%	
Frequency error Lock range	±500 Hz		±500 Hz	
Accuracy	±10 Hz		±10 Hz	

Specifications
cdma2000/1xEV-DV modulation analysis (Option B7T, B7N)

PSA spectrum analyzers, MXA, EXA and PXA signal analyzers

	PSA (nominal)	MXA (nominal) Includes Option BBA as noted	EXA (nominal)	PXA (nominal)
Signal playback				
Result length	*Forward link* 1 to 64 PCG *Reverse link* 1 to 48 PCG	*Forward link* 1 to 64 PCG *Reverse link* 1 to 48 PCG	*Forward link* 1 to 64 PCG *Reverse link* 1 to 48 PCG	*Forward link* 1 to 64 PCG *Reverse link* 1 to 48 PCG
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	94 PCG	> 400 PCG > 111,200 PCG with Opt BBA (BBIQ only)	> 400 PCG	> 110,000 PCG
Accuracy	Input range ≥ –24 dBm, within 5 dB of total signal power, frequency < 3 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz	Input range ≥ –30 dBm, within 5 dB of total signal power, frequency < 3.6 GHz
Code domain CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power averaged over a slot	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Composite EVM EVM floor (pilot only)	≤ 1.5%	≤ 1.5% [1]	≤ 1.5%	≤ 1.5%
EVM floor (9 active channels)	≤ 1.5%	≤ 1.5%	≤ 1.5%	≤ 1.5%
EVM floor (16 QAM, F-PDCH with 15 codes, 1xEV-DV enabled)	≤ 1.5%	≤ 1.5%	≤ 1.5%	≤ 1.5%
Frequency error Lock range	±500 Hz	±500 Hz	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz	±10 Hz	±10 Hz

1. Results apply to MXA with Option BBA.

Specifications
cdma2000/1xEV-DV modulation analysis (Option B7T, B7N)

ESA spectrum analyzers

	ESA (nominal)
Signal playback	
Result length	*Forward link* 1 to 24 PCGs [1] *Reverse link* 1 to 24 PCGs [1]
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	24 PCG [1]
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz
Code domain	
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power averaged over a slot	±0.3 dB
Composite EVM	
EVM floor (pilot only)	≤ 1.6%
EVM floor (9 active channels)	≤ 1.6%
EVM floor (16 QAM, F-PDCH with 15 codes, 1xEV-DV enabled)	≤ 1.6%
Frequency error	
Lock range	±500 Hz
Accuracy	±10 Hz

1. For alias protect = false, 5 PCGs with alias protect = true.

Specifications
1xEV-DO modulation analysis (Option B7W, B7N)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)		89650S (nominal)	
Signal playback				
Result length	*Forward link* 1 to 64 slots	*Reverse link* 1 to 64 slots	*Forward link* 1 to 64 slots	*Reverse link* 1 to 64 slots
Capture length	Gap free analysis at 0% overlap; 1.5 MHz span 144 MB memory 5,000 slots 288 MB memory 10,000 slots 1152 MB memory 40,000 slots		Gap free analysis at 0% overlap; 1.5 MHz span > 20,000 slots	
Accuracy	Input range within 5 dB of total signal power		Total signal power within 5 dB of full scale	
Code domain CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB		±0.3 dB	
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB		±0.3 dB	
Composite EVM EVM floor	≤ 1.5%		≤ 1.5%	
Frequency error Lock range	±500 Hz		±500 Hz	
Accuracy	±5 Hz		±5 Hz	

Specifications
1xEV-DO modulation analysis (Option B7W, B7N)

PSA spectrum analyzers, MXA, EXA, and PXA signal analyzers

	PSA (nominal)	MXA (nominal) Includes Option BBA as noted	EXA (nominal)	PXA (nominal)
Signal playback				
Result length	*Forward link* 1 to 64 slots *Reverse link* 1 to 64 slots	*Forward link* 1 to 64 slots *Reverse link* 1 to 64 slots	*Forward link* 1 to 64 slots *Reverse link* 1 to 64 slots	*Forward link* 1 to 64 slots *Reverse link* 1 to 64 slots
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	65 slots	> 300 slots > 499,100 slots with Opt. BBA (BBIQ only)	> 300 slots	> 80,000 slots
Accuracy	Input range ≥ –24 dBm, within 5 dB of total signal power	Input range ≥ –30 dBm, within 5 dB of total signal power	Input range ≥ –30 dBm, within 5 dB of total signal power	Input range ≥ –30 dBm, within 5 dB of total signal power
Code domain CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Composite EVM EVM floor	≤ 1.5%	≤ 1.5% [1]	≤ 1.5%	≤ 1.5%
Frequency error Lock range	±500 Hz	±500 Hz	±500 Hz	±500 Hz
Accuracy	±5 Hz	±5 Hz	±5 Hz	±5 Hz

1. Results apply to MXA with Option BBA.

Specifications
1xEV-DO modulation analysis (Option B7W, B7N)

ESA spectrum analyzers

	ESA (nominal)
Signal playback	
Result length	*Forward link* 1 to 18 slots [1] *Reverse link* 1 to 18 slots [1]
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	18 slots [1]
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz
Code domain	
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB
Composite EVM	
EVM floor	≤ 1.6%
Frequency error	
Lock range	±500 Hz
Accuracy	±10 Hz

1. For alias protect = false, 3 slots for alias protect = true.

Specifications
TD-SCDMA modulation analysis (Option B7X, B7N)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)	89650S (nominal)
Signal playback		
Result length	1 to 8 sub-frames	1 to 8 sub-frames
Capture length	Gap free analysis at 0% overlap; 1.6 MHz span 144 MB memory 1,600 sub-frames 288 MB memory 3200 sub-frames 1152 MB memory 12,800 sub-frames	Gap free analysis at 0% overlap; 1.6 MHz span > 6500 sub-frames
Accuracy	Input range within 5 dB of total signal power	Input range within 5 dB of total signal power
Code domain		
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB
Composite EVM		
EVM floor	≤ 1.5%	≤ 1.5%
Frequency error		
Lock range	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz

Specifications
TD-SCDMA modulation analysis (Option B7X, B7N)

PSA spectrum analyzers, MXA, EXA, and PXA signal analyzers

	PSA (nominal)	MXA (nominal) Includes Option BBA as noted	EXA (nominal)	PXA (nominal)
Signal playback				
Result length	1 to 8 sub-frames	1 to 8 sub-frames	1 to 8 sub-frames	1 to 8 sub-frames
Capture length Gap free analysis at 0% overlap; 1.6 MHz span	10 sub-frames	> 50 sub-frames > 26,200 sub-frames with Opt. BBA (BBIQ only)	> 50 sub-frames	> 25,000 sub-frames
Accuracy	10 MHz to 3 GHz, input range ≥ –24 dBm and within 5 dB of total signal power	10 MHz to 3.6 GHz, input range > –30 dBm and within 5 dB of total signal power	10 MHz to 3.6 GHz, input range > –30 dBm and within 5 dB of total signal power	10 MHz to 3.6 GHz, input range > –30 dBm and within 5 dB of total signal power
Code domain				
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB	±0.3 dB [1]	±0.3 dB	±0.3 dB
Composite EVM				
EVM floor	≤ 1.5%	≤ 1.5% [1]	≤ 1.5%	≤ 1.5%
Frequency error				
Lock range	±500 Hz	±500 Hz	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz	±10 Hz	±10 Hz

1. Results apply to MXA with Option BBA.

Specifications
TD-SCDMA modulation analysis (Option B7X, B7N)

ESA spectrum analyzers

TD-SCDMA	**ESA (nominal)** Alias protect = false
Signal playback	
Result length	1 to 5 sub-frames [1]
Capture length Gap free analysis at 0% overlap; 1.6 MHz span	5 sub-frames [1]
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz
Code domain	
CDP accuracy Spread channel power within 20 dB of total power	±0.3 dB
Symbol power versus time Spread channel power within 20 dB of total power	±0.3 dB
Composite EVM	
EVM floor	≤ 1.5%
Frequency error	
Lock range	±500 Hz
Accuracy	±25 Hz

1. Requires frequency span ≤ 2.5 MHz, sub-frame start boundary. Drops to 2 sub-frames for two frame start boundary.

Specifications
LTE FDD modulation analysis (Option BHD)

89650S vector signal analyzer, PSA, MXA, EXA, and PXA signal analyzers and Infiniium 90000 Series oscilloscopes (MIMO)

	89650S, PSA with Option 122/140	PSA (standard) (nominal)	MXA [1] (nominal)	EXA [1] (nominal)	PXA (nominal)
Signal playback			7.68 MHz analyzer bandwidth		
Result length	100 slots = 5 frames	98 slots	100 slots = 5 frames	100 slots = 5 frames	100 slots = 5 frames
Capture length					
Gap free analysis at 0% overlap	6.5 sec	59 ms	260 ms 3.8 sec (20 MHz/100 RB LTE bandwidth. 30.72 MHz analyzer span) with Opt. BBA and Opt. B25 or S40 (BBIQ only)	260 ms	8.3 sec (20 MHz/100 RB LTE bandwidth. 30.72 MHz analyzer span)
Accuracy			Downlink or uplink signal; input signal near full range as given below, 20 averages		
Range	Input range within one input attenuator step (2 dB) of total signal power	Input range within one input attenuator step (2 dB) of total signal power	Input range = 0 dBm, within 1 range step of overload	Input range = 0 dBm, within 1 range step of overload	Input range = 0 dBm, within 1 range step of overload
Residual EVM			Overall EVM and Data EVM, using 3GPP standard-defined EVM calculations		
Downlink					
Signal bandwidth					
5 MHz	–52 dB	–52 dB	–48 dB/–48 dB [2]	–45 dB	–51 dB
10 MHz	–51 dB	—	–48 dB/–46 dB [2]	–44 dB	–50 dB
20 MHz	–49 dB	—	–47 dB/–42 dB [2]	–44 dB	–49 dB
Uplink					
Signal bandwidth					
5 MHz	–53 dB	–53 dB	–49 dB/–49 dB [2]	–45 dB	–53 dB
10 MHz	–54 dB	—	–49 dB/–46 dB [2]	–45 dB	–53 dB
20 MHz	–53 dB	—	–49 dB/–42 dB [2]	–45 dB	–53 dB
Frequency error (relative to frequency standard)					
Lock range			±2.5 x subcarrier spacing = 37.5 kHz for default 15 kHz subcarrier spacing		
Accuracy			±1 Hz		

MIMO specifications

		MXA [3]	EXA [3]	90000 Series Infiniium oscilloscope
Measurement conditions		700 MHz center frequency, -10 dBm range		
MIMO configuration		2x2 spatial multiplexing	2x2 spatial multiplexing	4x4 spatial multiplexing
Bandwidth				
5 MHz	Overall EVM	-48 dB	-45 dB	-36 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB
10 MHz	Overall EVM	-48 dB	-45 dB	-36 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB
20 MHz	Overall EVM	-47 dB	-44 dB	-35 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB

1. Option B25 required for spans > 10 MHz.
2. With Option BBA BBIQ inputs.
3. In dual slaved configuration to provide 2-channel measurements.

Specifications
LTE TDD modulation analysis (Option BHE)

89650S vector signal analyzer, PSA, MXA, EXA, PXA, and ESA signal analyzers

	89650S, PSA with Option 122/140 (nominal)	PSA (standard) (nominal)	MXA [1] (nominal)	EXA [1] (nominal)	PXA (nominal)
Signal playback			7.68 MHz analyzer bandwidth		
Result length	100 slots = 5 frames	98 slots	100 slots = 5 frames	100 slots = 5 frames	100 slots = 5 frames
Capture length					
Gap free analysis at 0% overlap	6.5 sec	59 ms	260 ms 3.8 sec (20 MHz/100 RB LTE bandwidth. 30.72 MHz analyzer span) with Opt. BBA and Opt. B25 or S40 (BBIQ only)	260 ms	8.3 sec (20 MHz/100 RB LTE bandwidth. 30.72 MHz analyzer span)
Accuracy	*Downlink or uplink signal; input signal near full range as given below, 20 averages*				
Range	Input range within one input attenuator step (2 dB) of total signal power	Input range within one input attenuator step (2 dB) of total signal power	Input range = 0 dBm, within 1 range step of overload	Input range = 0 dBm, within 1 range step of overload	Input range = 0 dBm, within 1 range step of overload
Residual EVM	Overall EVM and Data EVM, using 3GPP standard-defined EVM calculations				
Downlink					
Signal bandwidth					
5 MHz	–52 dB	–52 dB	–49 dB/–49 dB [2]	–45 dB	–53 dB
10 MHz	–50 dB	—	–47 dB/–47 dB [2]	–45 dB	–51 dB
20 MHz	–47 dB	—	–45 dB/–42 dB [2]	–41 dB	–49 dB
Uplink					
Signal bandwidth					
5 MHz	–53 dB	–53 dB	–49 dB/–48 dB [2]	–45 dB	–52 dB
10 MHz	–52 dB	—	–49 dB/–46 dB [2]	–45 dB	–52 dB
20 MHz	–50 dB	—	–48 dB/–42 dB [2]	–45 dB	–52 dB
Frequency error (relative to frequency standard)					
Lock range	±2.5 x subcarrier spacing = 37.5 kHz for default 15 kHz subcarrier spacing				
Accuracy	±5 Hz (DL), ±1 Hz (UL)				

MIMO specifications

		MXA [3]	EXA [3]	90000 Series Infiniium oscilloscope
Measurement conditions		700 MHz center frequency, -10 dBm range		
MIMO configuration		2x2 spatial multiplexing	2x2 spatial multiplexing	4x4 spatial multiplexing
Bandwidth				
5 MHz	Overall EVM	-48 dB	-45 dB	-36 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB
10 MHz	Overall EVM	-49 dB	-45 dB	-35 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB
20 MHz	Overall EVM	-48 dB	-45 dB	-35 dB
	Inter-channel time offset	±25 ns	±25 ns	±1 ns
	Inter-channel frequency offset	±0.1 Hz	±0.1 Hz	±0.1 Hz
	Inter-channel power deviation	±1 dB	±1 dB	±1 dB

1. Option B25 required for spans > 10 MHz.
2. With Option BBA BBIQ inputs.
3. In dual slaved configuration to provide 2-channel measurements.

Specifications
WLAN modulation analysis (Option B7R)

	89610S/11S/40S/41S (nominal)	89650S (nominal)	MXA (nominal)	EXA with Option B25 (nominal)	PXA (nominal)
1EEE 802.11a/g OFDM			Includes Option BBA as noted		
Signal playback					
Result length	Auto detect or adjustable from 1 to 1367 symbol times	Auto detect or adjustable from 1 to 1367 symbol times	Auto detect or adjustable from 1 to 1367 symbol times	Auto detect or adjustable from 1 to 1367 symbol times	Auto detect or adjustable from 1 to 1367 symbol times
Capture length	Gap free analysis at 0% overlap; 31.25 MHz span	Gap free analysis at 0% overlap; 31.25 MHz span	Gap free analysis at 0% overlap; 25 MHz span (Option B25)	Gap free analysis at 0% overlap; 25 MHz span, 44 msec	Gap free analysis at 0% overlap; 31.25 MHz span, (Option B40)
	144 MB memory: 1.0 s	3.3 s	44 msec		6.7 sec
	288 MB memory: 2.0 s 1152 MB memory: 8.0 s		With Opt. BBA and Opt. B25 or S40 (BBIQ only): 6.7 sec IEEE 802.11a/g OFDM 13.4 sec IEEE 11p DSRC		
Accuracy	20 averages	20 averages	20 averages, input range ≥ –30 dBm and within 2 dB of full scale, input range ≥ –20 dBm for freq > 3.6 GHz		
Center frequency	89641S: 5.8 GHz 89640S and 89641S: 2.4 GHz 89611S: 70 MHz 89610S: 21.4 MHz	2.4 GHz, 5.8 GHz		2.4 GHz, 5.8 GHz	
Residual EVM					
Equalizer training = chan est. seq. and data	≤ –45 dB	≤ –47 dB ≤ –46 dB (Opt B25)	≤ –45 dB ≤ –46 dB (Opt B25) ≤ –44 dB (Opt BBA)	≤ –46 dB	≤ –47 dB
Equalizer training = chan est. seq.	≤ –43 dB	≤ –45 dB ≤ –44 dB (Opt B25)	≤ –43 dB ≤ –44 dB (Opt B25) ≤ –41 dB (Opt BBA)	≤ –44 dB	≤ –45 dB
Frequency error					
Carrier spacing	312 kHz 1.4 MHz max, user settable	312 kHz 1.4 MHz max, user settable	312 kHz 1.4 MHz max, user settable	312 kHz 1.4 MHz max, user settable	312 kHz 1.4 MHz max, user settable
Lock range	±624 kHz ±2 x sub-carrier spacing	±624 kHz ±2 x sub-carrier spacing	±624 kHz ±2 x sub-carrier spacing	±624 kHz ±2 x sub-carrier spacing	±624 kHz ±2 x sub-carrier spacing
Frequency accuracy	±8 Hz	±8 Hz	±8 Hz	±8 Hz	±8 Hz

Specifications
WLAN modulation analysis (Option B7R)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers and MXA signal analyzer

IEEE 802.11b/g DSSS	89610S/11S/ 40S/41S (nominal)	89650S (nominal)	MXA (nominal) Includes Option BBA as noted	EXA with Option B25 (nominal)	PXA (nominal)
Signal playback					
Result length	Auto detect or adjustable from 1 to 275,000 chips (25 ms)	Auto detect or adjustable from 1 to 220,000 chips (25 ms)	Auto detect or adjustable from 1 to 370741 chips (33,7037 ms)		Auto detect or adjustable from 1 to 269,000 chips (24.4 ms)
Capture length	Gap free analysis at 0% overlap; 34,375 MHz span	Gap free analysis at 0% overlap; 34,375 MHz span	Gap free analysis at 0% overlap; 25 MHz span (Option B25)		Gap free analysis at 0% overlap; 34,375 MHz span (Option B40)
	144 MB memory: 1.0 s	3.0 s	44 ms		6.1 sec
	288 MB memory: 2.0 s 1152 MB memory: 8.0 s				
Accuracy	Input range within 5 dB of total signal power	Total power within 2 dB of full scale	Total power within 2 dB of full scale		Total power within 2 dB of full scale
Center frequency	89640S and 89641S: 2.4 GHz 89611S: 70 MHz 89610S: 21.4 MHz	2.4 GHz	2.4 GHz		2.4 GHz
Residual EVM	≤ 2%	≤ 1.0%	≤ 1.5% [1]		≤ 1.0%
	All modulation formats, 10 averages	≤ 0.5% with equalizer enabled; all modulation formats, 10 evarages, reference filter = transmits filter	≤ 0.5% [1] with equalizer enabled; reference filter = transmit filter = Gaussian with BT = 0.5		≤ 0.5% with equalizer enabled; all modulation formats, 10 evarages, reference filter = transmits filter = Gaussian with BT = 0.5
Frequency error	Relative to frequency standard				
Lock range	±2.5 MHz				
Frequency accuracy	±8 Hz [1]				

1. Results also apply to MXA with Option BBA.

Specifications
IEEE 802.16-2004 OFDM modulation analysis (Option B7S)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)			89650S (nominal)		
Signal playback						
Result length	Auto detect or adjustable from 1 to 1745 symbol times			Auto detect or adjustable from 1 to 1392 symbol times		
Capture length	Gap free analysis at 0% overlap			Gap free analysis at 0% overlap		
	Span	*Memory*	*Max length*	*Span*	*Memory*	*Max length*
	12.5 MHz	144 MB	2 s	12.5 MHz	512 MB	2.9 s
		288 MB	4 s			
		1152 MB	16 s			
	36 MHz	144 MB	1 s	36 MHz	512 MB	4.1 s
		288 MB	2 s			
		1152 MB	8 s			
Accuracy						
Center frequency	89640S and 89641S: 2.7 GHz 89641S: 3.5 GHz, 5.8 GHz 89611S: 70 MHz 89610S: 18 MHz			2.7 GHz, 3.5 GHz, 5.8 GHz		
Residual EVM	20 averages; input range within 5 dB of full scale			20 averages; input range within 2 dB of full scale		
Equalizer training = chan est. seq. and data	*Signal bandwidth*	*EVM (RF)*	*EVM (IF/BB)*	*Signal bandwidth*	*EVM*	
	20 MHz	≤ –43 dB	≤ –45 dB	20 MHz	≤ –48 dB	
	7 MHz	≤ –46 dB	≤ –49 dB	7 MHz	≤ –49 dB	
Equalizer training = chan est. seq. only	*Signal bandwidth*	*EVM (RF)*	*EVM (IF/BB)*	*Signal bandwidth*	*EVM*	
	20 MHz	≤ –42 dB	≤ –44 dB	20 MHz	≤ –46 dB	
	7 MHz	≤ –44 dB	≤ –48 dB	7 MHz	≤ –47 dB	
Frequency error						
Lock range	*Signal bandwidth*	*Range*		*Signal bandwidth*	*Range*	
	20 MHz	±135 kHz		20 MHz	±135 kHz	
	7 MHz	±47.25 kHz		7 MHz	±47.25 kHz	
Frequency accuracy	±10 Hz			±10 Hz		

Specifications
IEEE 802.16-2004 OFDM modulation analysis (Option B7S)

PSA and ESA spectrum analyzers

	PSA (nominal)		ESA (nominal)	
Center frequency	2.7 GHz, 3.5 GHz, 5.8 GHz		2.7 GHz, 3.5 GHz. 5.8 GHz	
Signal playback				
Result length	Auto detect or adjustable from 1 to: 1485 symbol times		Auto detect or adjustable from 1 to: (7 MHz) 198 symbol times (10 MHz) 298 symbol times	
Capture length	Gap free analysis at 0% overlap; 8 MHz span 59 msec		Gap free analysis at 0% overlap; 10 MHz span 8 ms	
Accuracy				
Residual EVM	20 averages; input range within 5 dB of full scale		20 averages; input range within 5 dB of full scale	
Equalizer training = chan est. seq. and data	*Signal bandwidth* 7 MHz	*EVM* ≤ –49 dB	*Signal bandwidth* 10 MHz 7 MHz	*EVM* ≤ –40 dB ≤ –42 dB
Equalizer training = chan est. seq. only	*Signal bandwidth* 7 MHz	*EVM* ≤ –47 dB	*Signal bandwidth* 10 MHz 7 MHz	*EVM* ≤ –39 dB ≤ –41 dB
Frequency error Lock range	*Signal bandwidth* 7 MHz	*Range* ±33.75 kHz	*Signal bandwidth* 7 MHz 10 MHz	*Range* ±47.25 kHz ±67.5 kHz
Frequency accuracy	±10 Hz		±10 Hz	

Specifications
IEEE 802.16-2004 OFDM modulation analysis (Option B7S)

MXA, EXA, and PXA signal analyzers

	MXA (nominal) Includes Option BBA, B25 as noted		**EXA (nominal)** Includes Option B25 as noted		**PXA (nominal)**	
Center frequency	2.7 GHz, 3.5 GHz, 5.8 GHz		2.7 GHz, 3.5 GHz, 5.8 GHz			
Signal playback						
Result length	*BW = span*	*Result length*	*BW = span*	*Result length*	Auto detect or adjustable from 1 to 1680 symbol times	
	7 MHz	1105 symbol times	7 MHz	1105 symbol times		
	10 MHz	1594 symbol times	10 MHz	1594 symbol times		
	20 MHz [1]	1745 symbol times	20 MHz [1]	1745 symbol times		
Capture length					Gap free analysis at 0% overlap	
	Span	*Capture length*	*Span*	*Capture length*	*Span*	*Max length*
	7 MHz, 10 MHz	266 msec	7 MHz, 10 MHz	266 msec	12.5 MHz	16.7 s
	> 20 MHz [1]	88 msec	20 MHz [1]	88 msec	18 MHz	11.6 s
	50 MHz [4]	8.2 sec			36 MHz	5.8 s
Accuracy						
Residual EVM	20 averages; input range within 2 dB of full scale. Using > 30 kHz phase noise optimization mode.		20 averages; input range within 2 dB of full scale. Using > 30 kHz phase noise optimization mode.		20 averages; input range within 2 dB of full scale. range ≥ –20 dBm	
Equalizer training = chan est. seq. and data	*Signal bandwidth*	*EVM*	*Signal bandwidth*	*EVM*	*Signal bandwidth*	*EVM*
	20 MHz [1]	≤ –45 dB [5]	20 MHz [1]	≤ –45 dB	20 MHz	≤ –48 dB
	7 MHz	≤ –48 dB [2, 5]	7 MHz	≤ –48 dB	7 MHz	≤ –49 dB
Equalizer training = chan est. seq. only	*Signal bandwidth*	*EVM*	*Signal bandwidth*	*EVM*	*Signal bandwidth*	*EVM*
	20 MHz [1]	≤ –45 dB (≤ –42 dB) [5]	20 MHz [1]	≤ –45 dB	20 MHz	≤ –46 dB
	7 MHz	≤ –47 dB[3] (≤ –45 dB) [5]	7 MHz	≤ –47 dB	7 MHz	≤ –47 dB
Frequency error						
Lock range	*Signal bandwidth*	*Range*	*Signal bandwidth*	*Range*	*Signal bandwidth*	*Range*
	20 MHz [1]	±135 kHz	10 MHz	±67.5 kHz	20 MHz	±135 kHz
	7 MHz	±47.25 kHz	7 MHz	±47.25 kHz	7 MHz	±47.25 kHz
Frequency accuracy	±10 Hz		±10 Hz		±10 Hz	

1. Span > 10 MHz requires Option B25.
2. Degraded by up to 3 dB for 3.0 GHz < frequency < 3.6 GHz.
3. Degraded by up to 4 dB for 3.0 GHz < frequency < 3.6 GHz.
4. With Opt. BBA and Opt. B25 or S40 (BBIQ only)
5. Results apply to MXA with Option BBA.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers and the MXA, EXA, and PXA signal analyzers

	89610S/11S/40S/41S (nominal)	89650S (nominal)	MXA (nominal)	EXA (nominal)	PXA (nominal)
Range	Input range within one input attenuator step (5 dB) of total signal power	Input range within one input attenuator step (2 dB) of total signal power	Input range ≥ –30 dBm, within 2 dB of full scale	Input range ≥ –30 dBm, within 2 dB of full scale	Input range within one input attenuator step (2 dB) of total signal power
FFT size	128, 512, 1024, 2048	128, 512, 1024, 2048	128, 512, 1024, 2048	128, 512, 1024, 2048	128, 512, 1024, 2048
Bandwidth	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 14 MHz, 15 MHz, 17.5 MHz, 20 MHz, 28 MHz	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 14 MHz, 15 MHz, 17.5 MHz, 20 MHz, 28 MHz	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 15 MHz [1], 17.5 MHz[1], 20 MHz [1]	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 15 MHz [1], 17.5 MHz [1], 20 MHz [1]	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, 14 MHz, 15 MHz, 17.5 MHz, 20 MHz, 28 MHz
Signal playback					
Result Length	15 frames, 5 msec frame length and span = 10 MHz	13 frames, 5 msec frame length and span = 10 MHz	15 frames, 5 msec frame length and span = 10 MHz	15 frames, 5 msec frame length and span =10 MHz	15 frames, 5 msec frame length and span =10 MHz
Capture Length Gap free analysis	144 MB (Opt 144) 2 sec 288 MB (Opt 288) 4 sec 1152 MB (Opt 120) 16 sec	2.9 sec	80 msec (17.5 MHz span) [1] 260 msec (10 MHz span) with Opt. BBA (BBIQ only): 11.8 sec (17.5 MHz span) 5 sec (80 MHz span-requires Opt. S40, BBA)	80 msec (17.5 MHz span) [1] 260 msec (10 MHz span)	*Span* / *Length* 10 MHz / 21.4 s 17.5 MHz (Opt B25) / 11.9 s

1. Requires Option B25 for bandwidth above 10 MHz to 25 MHz.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers (continued)

		89610S/11S/40S/41S (nominal)			89650S (nominal)
Accuracy (typical) [1]					
Center frequency		89640S and 89641S: 2.7 GHz 89641S: 3.5 GHz 89611S: 70 MHz 89610S: 21.4 MHz			2.7 GHz, 3.5 GHz
Residual EVM		20 averages; RCE and Data RCE			
Uplink		With equalizer = chan est seq and pilots or equalizer = chan est seq and data. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.			
Signal BW	*Zone*	*RF*	*IF*	*BB*	
5 MHz	PUSC, OPUSC	–49 dB	–49 dB	–49 dB	–50 dB
10 MHz	PUSC, OPUSC	–48 dB	–48 dB	–48 dB	–50 dB
20 MHz	PUSC, OPUSC	–47 dB	–47 dB	–47 dB	–50 dB
Downlink		With equalizer training = chan est seq and data. Degrades by 3 dB for equalizer training = chan est seq. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.			
Signal BW	*Zone*	*RF*	*IF*	*BB*	
5 MHz	PUSC, FUSC	–49 dB	–49 dB	–49 dB	–50 dB
10 MHz	PUSC, FUSC	–47 dB	–47 dB	–47 dB	–49 dB
20 MHz	PUSC, FUSC	–46 dB	–46 dB	–46 dB	–49 dB
Frequency error (relative to frequency standard)					
Lock range		Lock range depends on zone type, BW, BW Ratio, and FFT Size			
UL-PUSC, UL-OPUSC		±1.45 x Subcarrier spacing [2, 3] = ±16 kHz, BW = 10 MHz			
DL-PUSC, DL-FUSC, DL/UL AMC		±4.35 x Subcarrier spacing [2] = ±48 kHz, BW = 10 MHz			
Accuracy		Uniform analysis or burst analysis with > 25% subchannels occupied ±0.5 ppm (relative to signal bandwidth)			

1. RCE/Data RCE/Unmodulated RCE computed per IEEE 802.16e 8.4.12.3.1 (for DL), IEEE 802.16e 8.4.12.3.2 (for UL).
2. Subcarrier spacing = (BW * BW Ratio) / FFT Size.
3. Reduced to +/- 0.5 x subcarrier spacing if any data bursts use Collaborative Spatial Multiplexing.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

MXA and EXA signal analyzers (continued)

		MXA (nominal) Includes Option BBA as noted	**EXA (nominal)** Includes Option B25 as noted	**PXA (nominal)**
Accuracy (typical) [1, 3, 6]				
Center frequency		2.7 GHz, 3.5 GHz	2.7 GHz, 3.5 GHz	2.7 GHz, 3.5 GHz
Residual EVM		20 averages; RCE and Data RCE		20 averages; RCE and Data RCE; Range = –10 dBm
Downlink		With equalizer training = chan est seq and data. Degrades by 3 dB for equalizer training = chan est seq. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.		
Signal BW	*Zone*			
5 MHz	PUSC, FUSC	≤ –46 dB (≤ 50 dB) [5]	≤ –44 dB	–51 dB
10 MHz	PUSC, FUSC	≤ –45 dB (≤ 48 dB) [5]	≤ –43 dB	–50 dB
20 MHz	PUSC, FUSC	≤ –44 dB (≤ 45 dB) [5]	≤ –42 dB	–49 dB
Uplink		With equalizer = chan est seq and pilots or equalizer = chan est seq and data. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.		
Signal BW	*Zone*			
5 MHz	PUSC	≤ –45 dB (≤ -50 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–51 dB
	OPUSC	≤ –44 dB (≤ -50 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–50 dB
10 MHz	PUSC	≤ –44 dB (≤ -48 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–50 dB
	OPUSC	≤ –43 dB (≤ -48 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–49 dB
20 MHz	PUSC	≤ –43 dB (≤ -45 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–49 dB
	OPUSC	≤ –42 dB (≤ -45 dB) [5]	≤ –42 dB (–40 db for freq > 3.0 GHz)	–48 dB
Frequency error (relative to frequency standard)				
Lock range		Lock range depends on zone type, BW, BW Ratio, and FFT Size		
UL-PUSC, UL-OPUSC		±1.45 x Subcarrier spacing [2, 4] = ±16 kHz, BW = 10 MHz		
DL-PUSC, DL-FUSC, DL/UL AMC		±4.35 x Subcarrier spacing [2] = ±48 kHz, BW = 10 MHz		
Accuracy		Uniform analysis or burst analysis with > 25% subchannels occupied ±0.5 ppm (relative to signal bandwidth)		

1. RCE/Data RCE/Unmodulated RCE computed per IEEE 802.16e 8.4.12.3.1 (for DL), IEEE 802.16e 8.4.12.3.2 (for UL).
2. Subcarrier spacing = (BW * BW Ratio) / FFT Size.
3. Using < 20 kHz phase noise optimization mode.
4. Reduced to ± 0.5 x subcarrier spacing if any data bursts use Collaborative Spatial Multiplexing.
5. Results apply to MXA with Option BBA.
6. Option B25 required for spans > 10 MHz.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

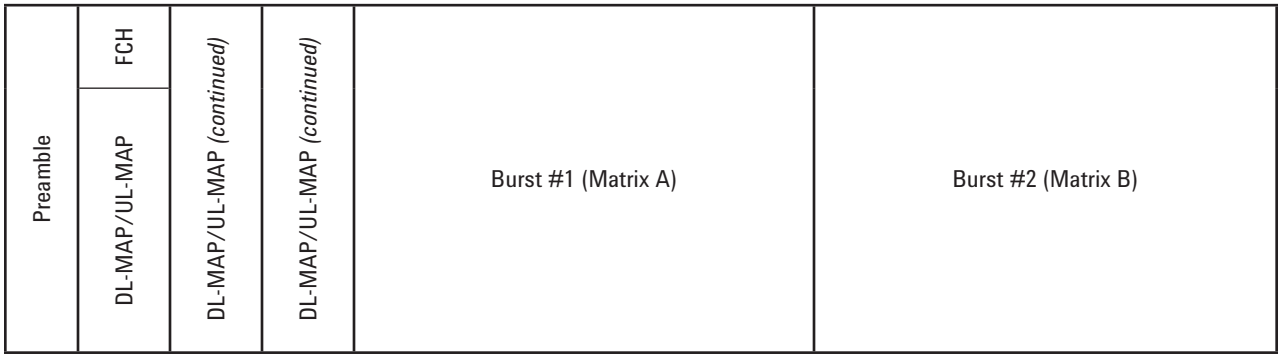
2-channel MIMO specifications

MXA and EXA signal analyzers, 90000 Series Infiniium oscilloscopes, 89641S/89640S VXI-based analyzers [4]

Measurement conditions

Accuracy (nominal)	
Center frequency	2.5 GHz, –10 dBm range
Residual EVM	Data RCE, 10 symbol DL-PUSC zone with 2-antenna STC/MIMO; Span = BW = 10 MHz; Default parameters; Matrix decoder enabled or disabled; 100% subchannels occupied with 64 QAM data; Single Matrix A or Matrix B burst; 10 averages;

Measurements performed on zone #2 and zone #3. Zone #1 and the preamble were transmitted by Antenna 0, while zone #2 and zone #3 were transmitted by both Antenna 0 and Antenna 1.



	MXA	**EXA**	**90000 Series Infiniium oscilloscopes [3]**	**89641A/89640S VXI-based VSA analyzers**
Residual data RCE	< -45 dB	< -42 dB	< -37 dB	< -44 dB
Ant-1 time offset deviation [1,2]	± < 15 ns	± < 15 ns	± < 50 ps	± < 15 psec
Ant-1 phase offset deviation [1,2]	N/A	N/A	N/A	± < 2 deg
Ant-1 freq offset deviation [1]	± < 1 Hz	± < 1 Hz	± < 2 Hz	± < 1 Hz
Pilot subcarrier power deviation [1]	± < 0.1 dB	± < 0.1 dB	± < 0.05 dB	± < 0.05 dB
Data subcarrier power deviation [1]	± < 0.05 dB	± < 0.05 dB	± < 0.05 dB	± < 0.05 dB

Frequency error (relative to frequency standard)	
Lock range	±4.35 x subcarrier spacing = ±48 kHz @ BW=10 MHz
Accuracy	±0.5 ppm (relative to signal BW)

1. Deviation metrics are nominal variation observed for above configuration with 10 acquisitions per averaged measurement.
2. MXA and EXA 2-channel RF configuration has channel 2 to channel 1 delay jitter of +/- < 60 ns on acquisition-by-acquisition basis.
3. For a list of supported scopes, see *Infiniium Performance Guide Using 89600 VSA*, Literature part number 5988-4096EN.
4. MXA and EXA are in dual slaved configuration; 89640S/89641S VXI based analyzers are in 2-RF channel configuration.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

ESA spectrum analyzers

	ESA (nominal)
Range	Input range within one input attenuator step (1 dB) of total signal power and ≥ –20 dBm
FFT size	128, 512, 1024, 2048
Bandwidth	1.25 MHz, 3.5 MHz, 4.375 MHz, 5 MHz, 7 MHz, 8.75 MHz
Signal playback	
Result length	1 frame at 3.8 msec frame length
Frame length	Adjustable to 4.1 ms, Span =10 MHz (to 8.1 ms using triggering with pulse search disabled)
Capture length @ 10 MHz span	Gap free analysis at 0% overlap 0.008 sec
Accuracy (typical) [1]	
Center frequency	2.7 GHz, 3.5 GHz
Residual EVM	(20 averages); RCE and Data RCE
Downlink (5, 7, 8.75, and 10 MHz signal bandwidth)	With equalizer training = chan est seq and data. Degrades by 3 dB for equalizer training = ch est sequence. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.
PUSC	–43 dB
FUSC	–43 dB
Uplink (5, 7, 8.75, and 10 MHz signal bandwidth)	With equalizer = chan est seq and pilots, or equalizer = chan est seq and data. Span = BW. Uniform analysis or burst analysis with > 25% subchannels occupied.
PUSC	–43 dB
OPUSC	–43 dB
Frequency error (relative to frequency standard)	
Lock range	Lock range depends on zone type, BW, BW Ratio, and FFT Size
UL-PUSC, UL-OPUSC	±1.45 x Subcarrier spacing [2]
DL-PUSC, DL-FUSC, DL/UL AMC	±4.35 x Subcarrier spacing [2]
Accuracy	Uniform analysis or burst analysis with > 25% subchannels occupied ±0.5 ppm (relative to signal bandwidth)

1. RCE/Data RCE/Unmodulated RCE computed per IEEE 802.16e 8.4.12.3.1 (for DL), IEEE 802.16e 8.4.12.3.2 (for UL).
2. Subcarrier spacing = (BW * BW Ratio) / FFT Size.

Specifications
IEEE 802.11n MIMO modulation analysis (Option B7Z)

89610S, 89611S, 89640S, 89641S, 89650S vector signal analyzers

	89610S/11S/40S/41S (nominal)	89650S (nominal)
Measurements	1 or 2 channel	1 channel only
Signal playback		
Result length	Auto detect or adjustable from 1 to > 5000 symbol times	Auto detect or adjustable from 1 to > 3000 symbol times
Capture length	Gap free analysis at 0% overlap; max span *Memory* / *Max length* 144 MB / 1 s 288 MB / 2 s 1152 MB / 8 s	Gap free analysis at 0% overlap; 40 MHz span *Memory* / *Max length* 512 MB / 3.3 s
Accuracy	20 averages	20 averages
Center frequency	89640S and 89641S: 2.4 GHz 89641S: 5.8 GHz 89611S: 70 MHz 89610S: 20 MHz	2.4 GHz, 5.8 GHz
Residual EVM	Input range within 5 dB of full scale	Input range within 2 dB of full scale
Equalizer training = chan. est. seq only	*Signal bandwidth* / *EVM (RF)* / *EVM (IF)* / *EVM (BB)* 20 MHz / ≤ –41 dB[1] / ≤ –42 dB / ≤ –42 dB 40 MHz / ≤ –39 dB[1] / ≤ –40 dB / ≤ –38 dB	*Signal bandwidth* / *EVM* 20 MHz / ≤ –46 dB 40 MHz / ≤ –45 dB
Equalizer training = chan. est. seq and data	*Signal bandwidth* / *EVM (RF)* / *EVM (IF)* / *EVM (BB)* 20 MHz / ≤ –43 dB [2] / ≤ –43 dB / ≤ –43 dB 40 MHz / ≤ –40 dB [1] / ≤ –41 dB / ≤ –39 dB	*Signal bandwidth* / *EVM* 20 MHz / ≤ –46 dB 40 MHz / ≤ –45 dB
Frequency error Lock range	±2 x Subcarrier Spacing = ±625 kHz (at default subcarrier spacing)	±2 x Subcarrier Spacing = ±625 kHz (at default subcarrier spacing)
Frequency accuracy	±10 Hz	±10 Hz

1. Degrade by 2 dB at 5.8 GHz center frequency.
2. Degrade by 3 dB at 5.8 GHz center frequency.

Specifications
IEEE 802.11n MIMO modulation analysis (Option B7Z)

Infiniium Oscilloscopes

Models	**80000, 90000 Series only.** For a complete listing of supported models, see *Agilent Infiniium Performance Guide Using 89600 VSA Software*, literature part number 5988-4096EN.		
Measurements	1, 2, 3, or 4 channel		
Signal playback			
Result length	Auto-detect or manually adjustable		
Capture length	Depends on model, memory option, and sampling mode. See *Agilent Infiniium Performance Guide Using 89600 VSA Software*, literature part number 5988-4096EN for complete documentation.		
Accuracy	Input range within 2 dB of full scale on all input channels. RMS averaging with average count = 20. At least 16 data symbols analyzed in each burst. Analyzer span set to default .		
		Signal BW	
		20 MHz (31.25 MHz span)	40 MHz (62.5 MHz span)
Equalizer training = chan. est. seq. only	2.4 GHz center frequency (User rate mode = 10 GHz)	–41 dB	–40 dB
	5.8 GHz center frequency (User rate mode = 20 GHz)	–38 dB	–37 dB
Equalizer training = chan. est. seq and data	2.4 GHz center frequency (User rate mode = 10 GHz)	–43 dB	–42 dB
	5.8 GHz center frequency (User rate mode = 20 GHz)	–41 dB	–40 dB
Frequency lock range	±2 x Subcarrier Spacing = ±625 kHz at default subcarrier spacing		
Frequency accuracy	±1 kHz		

Specifications
General

89610S, 89611S, 89640S, 89641S

	89610S/11S/40S/41S
Hardware interfaces (characteristic)	
External trigger input	BNC, 1 kΩ impedance
External frequency reference Output 10 MHz	> 3 dBm
Input	10 MHz or 13 MHz (±5 ppm), > 0 dBm
Safety and regulatory compliance	
Safety standards	EN 61010-1 (1993)
Radiated emissions	EN 61326-1
Immunity [1, 2]	EN 61326-1
Environmental	
Operating temperature range	Warranted operation: 20° to 30 °C Maximum operation: 0° to 50 °C Storage: –40° to 70 °C
Humidity	10 to 90% at 40 °C
Maximum altitude	3,000 m
Warm up time	30 minutes
Calibration interval	2 year
Power requirements	
47 to 440 Hz operation	90 to 140 Vrms
47 to 66 Hz operation	90 to 264 Vrms
Maximum power dissipation	Mainframe maximum rating
E8408A 4-slot VXI mainframe	280 VA
E8403A 13-slot VXI mainframe	1500 VA
E1421B 6-slot VXI mainframe	450 W
Physical	Using E8408A 4-slot VXI mainframe
Weight	13 kg (29 lb) [5]
Dimensions (H x W x D mm)	With protective bumpers: 388 x 152 x 548 Without protective bumpers: 362 x 133 x 540

1. Use a desktop PC for best immunity to electrostatic discharge.
2. Meets EN 61326-1 EFT performance criteria C (operator intervention may be required after an EFT event).
3. This product conforms to the following EMC immunity standards according to Performance Criteria B:
   IEC 61000-4-3 (Radiated Immunity)
   IEC 61000-4-3 (Conducted Immunity)
4. This product conforms to the following EMC immunity standards according to Performance Criteria C:
   IEC 61000-4-2 (Electrostatic Discharge)
   IEC 61000-4-4 (Electrical Fast Transient/Burst)
   IEC 61000-4-11 (Voltage Dips)
5. 40 kg (87 lb) E8403A 13-slot mainframe with 2 RF channels.

Appendix A
User-Supplied PC Requirements

Any laptop or desktop PC may be used to run the 89600 VSA software, as long as it meets or exceeds the following minimum requirements:

Operating system	**Microsoft® Windows XP Professional, Service Pack 2**	**Microsoft Windows Vista Business, Enterprise, or Ultimate**	**Microsoft Windows, Windows 7 Business, Enterprise, or Ultimate**
CPU	> 600 MHz Pentium® or AMD-K6 > 600 MHz (> 2 GHz recommended)	1 GHz 32-bit (x86) (> 2 GHz recommended)	1 GHz 32-bit (x86) (> 2 GHz recommended)
RAM	512 MB (1 GB recommended)	1 GB (2 GB recommended)	1 GB (2 GB recommended)
Video RAM	4 MB (16 MB recommended)	128 MB (512 MB recommended)	128 MB (512 MB recommended)
Hard disk	1 GB available	1 GB available	1 GB available
Additional drives	CD-ROM to load the software; license transfer requires network access or a USB memory stick	CD-ROM to load the software; license transfer requires network access or a USB memory stick	DVD to load the software; license transfer requires network access or a USB memory stick
Interface support	LAN, GPIB, USB, or FireWire[1] interface (VXI HW only)	LAN, GPIB, USB, or FireWire[1] interface (VXI HW only)	LAN, GPIB, USB, or FireWire[1] interface (VXI HW only)

1 For a list of supported IEEE-1394 (FireWire) interfaces, visit **www.agilent.com/find/89600** and search the FAQ's for information on "What type of IEEE-1394 interface can I use in my computer to connect to the 89600S VXI hardware?"

Appendix B
Software and Hardware Feature Availability and Requirements

89600 VSA software requirements
The 89600 Vector Signal Analysis software works with a wide range of hardware. The software must be configured with Option 200, "Basic Vector Analysis," and Option 300, "Hardware Connectivity," to work with any hardware platform. Platform support has increased over time so some older versions of the VSA software may not support newer platforms.

89601AN / 89601N12 VSA software
The 89601AN VSA software offers the same functions and features as the 89601A software; however its license resides on a network server (i.e. floating license) rather than in the PC. This allows one license to be shared between copies of the software being used by different users throughout an organization. The 89601AN vector signal analysis software requires Option 200, "Basic Vector Analysis," and Option 300, "Hardware Connectivity," to work with any hardware platform.

The 89601N12 software offers all of the functions and features available in the 89601AN software including the floating license. It's configuration is fixed, all 89601N options are included for easier ordering and, since its license term is set to 12 months, it is less expensive than a fully configured the 89601AN.

The 89600 VSA software floating license products (89601AN, 89601N12, 89604AN) require loading a vendor daemon on a license server. This server may be the same PC running the client software (89600 VSA software). Full installation instructions and support are provided for compatible operating systems. Compatible server operating systems include: Windows 2000, Windows 2000 Server, Windows XP Pro, and Windows Server 2003. For Agilent EEsof ADS customers utilizing floating licenses, a Sun Solaris-compatible vendor daemon is also available.

Software version and platform firmware information
The software version required to work with a specific platform is available on the web at: **www.agilent.com.** At the web site, in the left search box enter: "measurement hardware front-ends" (be sure to include the quotes). In the right box select "Electronic Test & Measurement", click on **Search.** In the search results select "What Agilent Technologies measurement hardware front-ends are supported by the 89601A/N VSA Software? "

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

89600S VXI platforms

Configuration requirements	The 89600S VXI platforms (89610S, 89611S, 89640S, 89641S) are factory integrated systems and come standard with the 89600 VSA software, the VXI mainframe, and the VXI modules required to make measurements.
VXI requirements	The minimum hardware required is supplied standard as part of the factory integration process.
Software requirements	See the "89600S VXI platforms" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to VXI interface	The connection to the PC is via IEEE 1394 FireWire. See the FAQs at **www.agilent.com/find/89600** for information on *"What type of IEEE 1394 interface can I use?"*
Feature availability	All software and hardware features are available, including the 89600 scalar spectrum application.

89650S platform

Configuration requirements	The 89650S combination comes standard with a PSA Series spectrum analyzer and the 89600 VSA software (each with all required options), and interface cables.
PSA requirements	The 89650S requires your choice of an E4440/E4443/ E4445A PSA spectrum analyzer configured with either Option 122 (80 MHz IF) or Option 140 (40 MHz IF). For detailed configuration information, see *"Agilent 89650S Wideband Vector Signal Analyzer System with High Performance Spectrum Analysis configuration guide,"* publication number 5989-1435EN.
Software requirements	See the "89650S platform" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to PSA interface	The PSA supports LAN I/O. Using a LAN cross-over cable is recommended (available from Agilent, part number 8120-0545, and shipped as part of the 89650S) for the connection. The PSA can also connect to your PC via GPIB, USB, or a LAN to GPIB gateway.
Feature availability	When the PSA is controlled by 89600 software, users have control of the following features of the spectrum analyzer using the software:
Frequency	The center frequency will be displayed on the 89600 software GUI
Span	≤ 80 MHz, Option 122; or ≤ 40 MHz, Option 140
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software
Triggering	IF magnitude, external front/rear, hold-off, level, delay and slope
External reference	Selectable frequency (1 to 30 MHz)
In addition, you can gain immediate, direct access to all of the spectrum analyzer's features by using the disconnect capability on the VSA software's control menu.	
The 89600 software's scalar spectrum application is not supported.	

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

PSA platforms

Configuration requirements	The PSA/89600 software combination requires a PSA Series spectrum analyzer and the 89600 vector signal analysis software (each with required options), a PC to run the software, and interface cables. The following are the detailed configuration requirements for each.
PSA requirements	The PSA/89600 software combination requires a PSA Series spectrum analyzer (model E4440A, E4443A, E4445A, E4446A, E4447A, or E4448A) with Option E44xx-B7J, the digital demodulation hardware, to interface with the 89600 software.
Option 122 80 MHz bandwidth ADC or Option 140 40 MHz bandwidth ADC	May be used in place of Option B7J on the E4440/E4443/E4445A (see 89650S for performance specifications). One of these options is required for operation with Option B7R, WLAN modulation analysis.
Option 123 pre-selector bypass	Recommended when making measurements above 3 GHz.
Option 111 USB interface	Recommended for fastest throughput and measurement speed. See publication number 5989-1435EN, 89650S configuration guide, for more information.
Firmware version A.04 or later	Required in the PSA analyzer.
Software requirements	See the "PSA platforms" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to PSA interface	The PSA supports LAN I/O. Using a LAN cross-over cable is recommended (available from Agilent, part number 8120-0545, and shipped as part of the 89650S) for the connection. The PSA can also connect to your PC via GPIB, USB, or a LAN to GPIB gateway.
Feature availability	When the PSA is controlled by 89600 software, users have control of the following features of the spectrum analyzer using the software.
Frequency	The center frequency will be displayed on the 89600 VSA software GUI.
Span	Only zero-span setting is available on the PSA. Maximum span setting in the 89600 VSA software is 8 MHz (80 MHz with Option 122, E4440/E4443/E4445A only; 40 MHz with Option 140, E4440/E4443/E4445A only). Zero span control of the PSA and the display of its current setting are provided by the 89600 software.
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software
Triggering	IF magnitude, external front/rear, hold-off, level, delay and slope
External reference	Selectable frequency (1 to 30 MHz)
In addition, you can gain immediate, direct access to all of the PSA Series spectrum analyzer's features by using the disconnect capability on the VSA software's control menu.	
The 89600 VSA software's scalar spectrum application is not supported.	
Wideband VSA System	The Agilent PSA can be used with an Agilent Infiniium scope to provide 300 MHz wide bandwidth vector signal analysis to 50 GHz center frequency. The 89600 VSA software, running on an external PC or embedded within the Infiniium scope, provides the analysis engine. Broadband calibration over the 300 MHz bandwidth is possible using an external source such as Agilent's MXG, PSG or ESG. For more information, see *Wide Bandwidth Vector Signal Analysis Measurements*, literature publication number 5989-9053EN.

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

MXA platform

Configuration requirements	The MXA/89600 software combination requires an MXA signal analyzer and the 89600 VSA software with each of the required options. The 89600 VSA software can run both inside the MXA platform or on an external PC connected to the MXA. Installing the 89600 VSA into the MXA platform enables its use with a connected mouse and keyboard via USB2.0. If you prefer to run the 89600 VSA software on a PC connected via LAN, you can also transfer the data from the MXA signal analyzer.
MXA requirements	The MXA signal analyzer requires no options if the span for modulation analysis is below 10 MHz. For wider spans up to 25 MHz, the N9020A MXA needs to have Option B25. For performance improvements, Options P03, P08, P13, and P26 for preamp are available. For baseband analysis, the MXA requires Option BBA. For baseband analysis of 80 MHz (BBIQ mode), the MXA requires Option S40.
Software requirements	See the "MXA" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to MXA interface	The 89600 VSA software can run embedded internally within the MXA. Alternatively, the user may run the software in a remote PC connected to the MXA via LAN. Use of a LAN crossover cable, LAN hub, or LAN switch is required. The 89600 software running inside the MXA can also license the 89601X VXA measurement application featuring hardkey/softkey user interface and SCPI programming. Not all options or option features are available. For a detailed list, see the 89600 SW technical overview, literature part number 5989-1679EN for more information
Feature availability	When the 89600 software is running in the MXA or in a remote PC, users have control of the following features of the spectrum analyzer using the software.
Frequency	The center frequency will be displayed on the 89600 VSA software GUI.
Span	The VSA software places the MXA in zero span. The maximum bandwidth is 10 MHz, unless Option B25 or Option S40 is installed. The VSA software allows arbitrary span analysis with this bandwidth.
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software
Triggering	Slope, level, holdoff delay on external trigger 1 or 2, free run, IF magnitude (video), external TTL
External reference	Selectable frequency (1 to 50 MHz)

When running the 89600 software inside the MXA, you can gain immediate, direct access to all of the MXA signal analyzer's features by pressing **[Mode]** on the MXA, using **Control > Disconnect** on the VSA's command toolbar, or closing the 89600 application. When running the VSA software on a remote PC connected to the MXA, you can use the same disconnect command or close the application.

The 89600 VSA software's scalar spectrum application is not supported.

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

EXA platform

Configuration requirements	The EXA/89600 software combination requires an EXA signal analyzer and the 89600 VSA software with each of the required options. The 89600 VSA software can run both inside the EXA platform or on an external PC connected to the EXA. Installing the 89600 VSA into the EXA platform enables its use with a connected mouse and keyboard via USB2.0. If you prefer to run the 89600 VSA software on a PC connected via LAN, you can also transfer the data from the EXA signal analyzer.
EXA requirements	The EXA signal analyzer requires no options if the span for modulation analysis is below 10 MHz. For wider spans up to 25 MHz, the EXA needs to have Option B25. For performance improvements, Option P03 preamp is available.
Software requirements	See the "EXA" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to EXA interface	The 89600 VSA software can run embedded internally within the EXA. Alternatively, the user may run the software in a remote PC connected to the EXA via LAN. Use of a LAN crossover cable, LAN hub, or LAN switch is required.
Feature availability	When the 89600 software is running in the EXA or in a remote PC, users have control of the following features of the spectrum analyzer using the software.
Frequency	The center frequency will be displayed on the 89600 VSA software GUI.
Span	The VSA software places the EXA in zero span. The maximum bandwidth is 10 MHz. The VSA software allows arbitrary span analysis with this bandwidth.
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software
Triggering	Slope, level, holdoff delay on external trigger 1 or 2, free run, IF magnitude (video), external TTL
External reference	10 MHz
In addition, when running the 89600 software inside the EXA, you can gain immediate, direct access to all of the EXA signal analyzer's features by pressing **[Mode]** on the EXA, using **Control > Disconnect** on the VSA's command toolbar, or closing the 89600 application. When running the VSA software on a remote PC connected to the EXA, you can use the same disconnect command or close the application.	
The 89600 VSA software's scalar spectrum application is not supported.	

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

PXA platform

Configuration requirements	The PXA/89600 software combination requires a PXA signal analyzer and the 89600 VSA software with each of the required options. The 89600 VSA software can run both inside the PXA platform or on an external PC connected to the PXA. Installing the 89600 VSA into the PXA platform enables its use with a connected mouse and keyboard via USB2.0. If you prefer to run the 89600 VSA software on a PC connected via LAN, you can also transfer the data from the PXA signal analyzer.
PXA requirements	The PXA signal analyzer requires no options if the span for modulation analysis is below 10 MHz. For wider spans the PXA needs to have option B25 (25MHz), option B40 (40MHz), or option B1X (140MHz). For performance improvements preamplifier options are available.
Software requirements	See the "89600 Series VSA software requirements" at the beginning of Appendix B
PC requirements	See Appendix A "User-supplied PC requirements."
PC to PXA interface	The 89600 VSA software can run embedded internally within the PXA. Alternatively, the user may run the software in a remote PC connected to the PXA via LAN. Use of a LAN crossover cable, LAN hub, or LAN switch is required.
Feature availability	When the 89600 software is running in the PXA or in a remote PC, users have control of the following features of the spectrum analyzer using the software.
Frequency	The center frequency will be displayed on the 89600 VSA software GUI.
Span	The VSA software places the PXA in zero span. The VSA software allows arbitrary span analysis with this bandwidth.
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software
Triggering	Slope, level, holdoff delay on external trigger 1 or 2, free run, IF magnitude (video), external TTL
External reference	10 MHz

In addition, when running the 89600 software inside the PXA, you can gain immediate, direct access to all of the PXA signal analyzer's features by pressing **[Mode]** on the PXA, using **Control > Disconnect** on the VSA's command toolbar, or closing the 89600 application. When running the VSA software on a remote PC connected to the PXA, you can use the same disconnect command or close the application.

The 89600 VSA software's scalar spectrum application is not supported.

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

CXA platforms

Configuration requirements	The CXA/89600 software combination requires a CXA signal analyzer and the 89600 VSA software with each of the required options. The 89600 VSA software can run both inside the CXA platform or on an external PC connected to the CXA. Installing the 89600 VSA into the CXA platform enables its use with a connected mouse and keyboard via USB2.0. If you prefer to run the 89600 VSA software on a PC connected via LAN, you can also transfer the data from the CXA signal analyzer.
CXA requirements	The CXA signal analyzer requires no options. For performance improvements preamplifier options are available.
Software requirements	See the "89600 Series VSA software requirements" at the beginning of Appendix B.
PC requirements	See Appendix A "User-supplied PC requirements."
PC to CXA interface	The 89600 VSA software can run embedded internally within the CXA. Alternatively, the user may run the software in a remote PC connected to the CXA via LAN. Use of a LAN crossover cable, LAN hub, or LAN switch is required.
Feature availability	When the 89600 software is running in the CXA or in a remote PC, users have control of the following features of the spectrum analyzer using the software.
Frequency	The center frequency will be displayed on the 89600 VSA software GUI.
Span	The VSA software places the CXA in zero span. The VSA software allows arbitrary span analysis with this bandwidth.
Input attenuator, preamp, and IF gain	Available indirectly through the input range feature of the 89600 software.
Triggering	Slope, level, holdoff delay on external trigger 1, free run, IF magnitude (video), external TTL.
External reference	External reference 10 MHz
In addition, when running the 89600 software inside the CXA, you can gain immediate, direct access to all of the CXA signal analyzer's features by pressing [Mode] on the CXA, using Control > Disconnect on the VSA's command toolbar, or closing the 89600 application. When running the VSA software on a remote PC connected to the CXA, you can use the same disconnect command or close the application.	
The 89600 software's scalar spectrum application is not supported.	

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

ESA platforms

Configuration requirements

The ESA/89600 software combination requires an ESA-E Series spectrum analyzer and the 89600 vector signal analysis software (each with required options), a PC to run the software, and interface cables.

When ordering a new ESA-E Series spectrum analyzer

The ESA-E/89600 software combination works with any new ESA-E Series model E4402B, E4404B, E4405B, or E4407B with firmware version A.08.04 or higher.

One of the following option sets must be installed in the ESA-E.

Option	*Description*
COM	Communications test analyzer
A4H	GPIB and Centronic interfaces (default)

or:

Option	*Description*
B7D	Digital signal processing and fast ADC
B7E	RF communication hardware (ID117 or higher required for IF magnitude triggering)
1D5	High stability frequency reference
A4H	GPIB and Centronic interfaces
229*	Modulation analysis personality (version A.02.01 or higher)
231*	89600 VSA link personality (version A.02.00 or higher)

* Ordering at least one option is required.

Using an existing ESA-E Series spectrum analyzer

The following options are needed in an existing ESA-E Series spectrum analyzer for it to work with the 89600 software.

Option	*Description*
B7D	Digital signal processing and fast ADC
B7E	RF communication hardware ID 117 or higher required for IF magnitude triggering
1D5	High stability frequency reference
A4H	GPIB and Centronic interfaces
B72	Increase memory to 16 MB
229*	Modulation analysis personality (version A.02.01 or higher)
231*	89600 VSA link personality (version A.02.00 or higher)

* Ordering at least one option is required.

To find whether these options are in your ESA-E Series spectrum analyzer, press the following buttons on the front panel of the analyzer: **[System] > [More] > [Show System]**.

Software requirements

See the "ESA platforms" table entry under "89600 Series VSA software requirements" at the beginning of Appendix B. Option B7R WLAN modulation analysis is not recommended, as WLAN signals require more analysis bandwidth than the ESA spectrum analyzers provide.

PC requirements

See Appendix A "User-supplied PC requirements."

Appendix B
Software and Hardware Feature Availability and Requirements (continued)

ESA platforms *(continued)*

<table>
<tr><td>PC to ESA interface</td><td>The ESA-E Series spectrum analyzers with Option E440xA-A4H support GPIB I/O. The following interface cards and cables are recommended for connecting the ESA-E to a PC via GPIB.
<table>
<tr><th>Description</th><th>Part number</th><th>Notes</th></tr>
<tr><td>PCMCIA</td><td>778034-02</td><td>For laptop PCs; comes with a two-meter GPIB card GPIB cable. Available from National Instruments.</td></tr>
<tr><td>PCI GPIB interface card</td><td>82350</td><td>For desktop PCs; requires GPIB cable (10833A). Available from Agilent.</td></tr>
<tr><td>One-meter GPIB cable</td><td>10833A</td><td>Available from Agilent.</td></tr>
<tr><td>USB/GPIB</td><td>82357B</td><td>Available from Agilent.</td></tr>
</table></td></tr>
<tr><td>LAN connection</td><td>Available using the Agilent E5810A LAN/GPIB Gateway.</td></tr>
<tr><td>Feature availability</td><td>When the ESA-E is controlled by 89600 software, users have control of the following features via the 89600 software.</td></tr>
<tr><td>Frequency</td><td>The center frequency of the ESA-E is controlled and the 89600 software displays its current setting.</td></tr>
<tr><td>Span</td><td>Only zero-span setting is available on the ESA. Maximum span setting in the 89600 VSA software is 10 MHz. Zero span control of the ESA and the display of its current setting are provided by the 89600 software.</td></tr>
<tr><td>Input attenuation</td><td>Available through input range feature of 89600 software.</td></tr>
<tr><td>Triggering</td><td>IF magnitude, external TTL, level, delay, and slope.</td></tr>
<tr><td>External reference</td><td>10 MHz or 1 to 30 MHz.</td></tr>
<tr><td colspan="2">In addition, you can gain immediate, direct access to all of the ESA series spectrum analyzer’s features by using the disconnect capability on the VSA software’s control menu.</td></tr>
<tr><td colspan="2">The 89600 VSA software’s scalar spectrum application is not supported.</td></tr>
</table>

Glossary

dBc dB relative to largest input signal

dBfs dB relative to full-scale amplitude range setting, where full scale is approximately 10 dB below ADC overload

Fc or fc Center frequency; typically the center of a spectrum trace. This parameter is set in the "Frequency" menu.

FS or fs Full scale; synonymous with amplitude range or input range

ppb Parts per billion

RBW Resolution bandwidth

Related Literature

Publication Title	Publication Type	Publication Number
89600 Series Vector Signal Analysis Software 89601A/89601AN/89601N12	Technical Overview	5989-1679EN
89600 Vector Signal Analysis Software	CD	5980-1989E
89600 Series Vector Signal Analysis Software 89601A/89601AN/89601N12	Data Sheet	5989-1786EN
89600S Series Vector Signal Analyzers, VXI	Configuration Guide	5968-9350E
89650S Wideband Vector Signal Analyzer System with High Performance Spectrum Analysis	Technical Overview	5989-0871EN
89650S Wideband Vector Signal Analyzer System with High Performance Spectrum Analysis	Configuration Guide	5989-1435EN
89607A WLAN Test Suite Software	Technical Overview	5988-9574EN
89604A Distortion Test Software	Technical Overview	5988-7812EN

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at:
www.agilent.com/find/89600

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France	0825 010 700*
	*0.125 €/minute
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Sweden	0200-88 22 55
United Kingdom	44 (0) 118 9276201

For other unlisted Countries:
www.agilent.com/find/contactus

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Product specifications and descriptions in this document subject to change without notice.

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