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

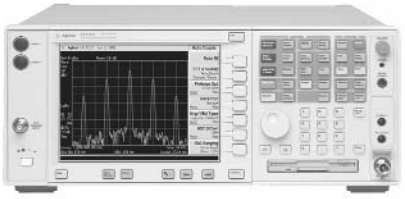
Data Sheet

89600 Vector Signal Analysis Software

89600S VXI-Based Vector Signal Analyzers

PSA Series High Performance Spectrum Analyzers

89650S Wide Bandwidth Vector Signal Analyzer System



MXA Midrange Signal Analyzer

ESA-E Series General Purpose Spectrum Analyzers

E4406A Transmitter Tester

Agilent Technologies

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Introduction

The 89600 Series vector signal analysis software runs on a PC and works with a variety of hardware measurement platforms. These platforms include the 89600 VXI-based vector signal analysis systems, the 89650S vector signal analyzer, the PSA high performance spectrum analyzers, the MXA midrange signal analyzer, the ESA general purpose spectrum analyzers, and the E4406A transmitter tester. These platforms down convert and digitize the signal, provide signal capture capability, and move the data to the PC in a sequential stream of data blocks. The 89600 VSA software processes the data in the time, frequency and modulation domains.

This data sheet will help you select the hardware platform that will best meet your vector signal measurement and analysis needs.

Compatible Measurement Platforms

The 89600 VSA software runs on most Windows-based PCs and connects to the measurement platforms via GPIB, USB, FireWire (IEEE-1394), or LAN. This data sheet documents the performance of the 89600 VSA software configured with Option 300 hardware connectivity, plus listed options, and the VXI, 89650S, PSA, MXA, ESA-E, and E4406A platforms.

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 89601A. 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.

MXA signal analyzer N9020A

The Agilent N9020A MXA signal analyzer's open Windows OS allows you to install the 89600 VSA software internally or on an external PC. The 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.

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.

E4406A VSA transmitter tester

Connect Agilent's E4406A VSA transmitter tester with the 89600 VSA software and you have two high performance instruments: a superior multi-format standards-based transmitter tester and a high performance, flexible digital demodulation and analysis tool.

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 (some 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 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 89601A 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).

Compatible Measurement Platforms (continued)

6000 Series scopes
Combine the affordable 6000 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 6000 Series Oscilloscopes Performance Guide Using 89600 Vector Signal Analysis Software"* (publication number 5989-4523EN).

Logic analyzers
Use either the 16900 Series or 1680/1690 Series of logic analyzers 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).

ADS
The powerful, PC-based 89600 VSA software enables tight, interactive integration with Agilent's Advanced Design System (ADS) 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 simulations using any supported acquisition hardware.

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.

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 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.

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 89600 Series 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	—	< –70dBc	< –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	*Vector analysis*
E4440A	3 Hz to 26.5 GHz	36 MHz to 26.5 GHz
E4443A	3 Hz to 6.7 GHz	36 MHz to 6.7GHz
E4445A	3 Hz to 13.2 GHz	36 MHz 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)

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 typical values, not warranted.

PSA (typical)

Frequency	
Range	10 MHz 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.

PSA (typical) *(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 ≥ –30dBm	< –70 dBc or < –90 dBfs, whichever is greater	
	Range < –30dBm	< –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
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 USB2.0, LAN or GPIB. Unless stated otherwise, these are typical values, not warranted. Please refer to the MXA signal analyzer specification guide for spectrum analysis performance.

MXA (typical)

Frequency

Range	*Minimum frequency*: 10 MHz AC coupled, 20 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	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 (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 to 13.6 GHz (Option P13) –50 dBm to 30 dBm, 3.6 GHz to 26.5 GHz (Option P26)
ADC overload	+2 dBfs

MXA (typical) *(continued)*

Amplitude accuracy				
Absolute amplitude accuracy	*Frequency*	*95% confidence accuracy*		
	< 3.6 GHz	±0.30 dB		
Amplitude linearity	*Level*	*Linearity (specification)*		
	–70 dBfs to 0 dBfs	±0.10 dB		
	< –70 dBfs	±0.15 dB		
IF flatness	*Frequency*	*Span*	*Flatness (specification)*	*Rms (nominal)*
	≤ 3.6 GHz	≤ 10 MHz	±0.40 dB	0.02 dB
	≤ 3.6 GHz	> 10 MHz	±0.45 dB	0.04 dB
	> 3.6 GHz	≤ 10 MHz		0.18 dB (Option B25)
	> 3.6 GHz	> 10 MHz		0.28 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 (nominal) 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	*Frequency*	*Residual*	*Range*	
	200 kHz to 8.4 GHz	–90 dBfs (specification)	≥ –10 dBm	
	8.4 GHz to 26.5 GHz	–90 dBfs (nominal)	≥ –10 dBm	
Image responses	–78 dBc (specification)	10 MHz to 13.6 GHz, < 8 MHz span		
LO related spurious	–70 dBc	10 MHz to 3.6 GHz, f > 600 MHz from carrier		
Other spurious	–70 dBc (specification)	100 Hz < f < 10 MHz from carrier, < 8 MHz span		
	–80 dBc (specification)	f ≥ 10 MHz from carrier, < 8 MHz span		

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 typical values, not warranted.

ESA[1, 2] (typical)

Frequency	
Range	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] (typical) *(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
E4406A transmitter tester performance (Option 200)

These specifications summarize the performance for the E4406A transmitter tester when used with the 89600 vector signal analysis software. These are typical values, not warranted.

E4406A[1] (typical)

Frequency		
Range	*RF* 7 MHz to 314 MHz, 329 MHz to 4 GHz	*Baseband* DC to 5 MHz
Center frequency tuning resolution	*RF* 1 Hz	*Baseband* 1 mHz
Frequency span range	*RF*	*Baseband*
1 channel mode	< 10 Hz to 8 MHz	< 15 Hz to 5 MHz (1 channel active)
2 channel mode	NA	< 10 Hz to 5 MHz (2 channel active)
Ch1 + jCh2 mode	NA	DC to 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	*RF* < 1 Hz to 2.3 MHz	*Baseband* < 1 Hz to 2.876 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 range	Full scale; combines attenuator setting and ADC gain[2]
RF	–18 dBm to +22 dBm in 1 dB steps
Baseband	–5 dBm to +13 dBm in 6 dB steps

1 All RF-related values are using the E4406A with digital IF part number E4440-60025. Refer to the E4406A data sheet for more information.
2 For RF input, E4406A ADC gain is set to +18 dB and attenuator is set to [89601A range (in dBm) + 18] dB.

Specifications
E4406A transmitter tester performance (Option 200)

E4406A[1] (typical) *(continued)*

Amplitude accuracy			
IF Flatness	±0.2 dB RF		
Dynamic range			
Third-order intermodulation distortion	*RF* < –70 dBc or < –90 dBfs, whichever is greater		*Baseband* < –60 dBc
Noise density			
RF	*Range* All	*Density* < –124 dBfs/Hz	
Baseband	*Range* +13 dBm +7 dBm +1 dBm –5 dBm	*Density* –143 dBfs/Hz –142 dBfs/Hz –139 dBfs/Hz –135 dBfs/Hz	

1 All RF-related values are using the E4406A with digital IF part number E4440-60025. Refer to the E4406A data sheet for more information.

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

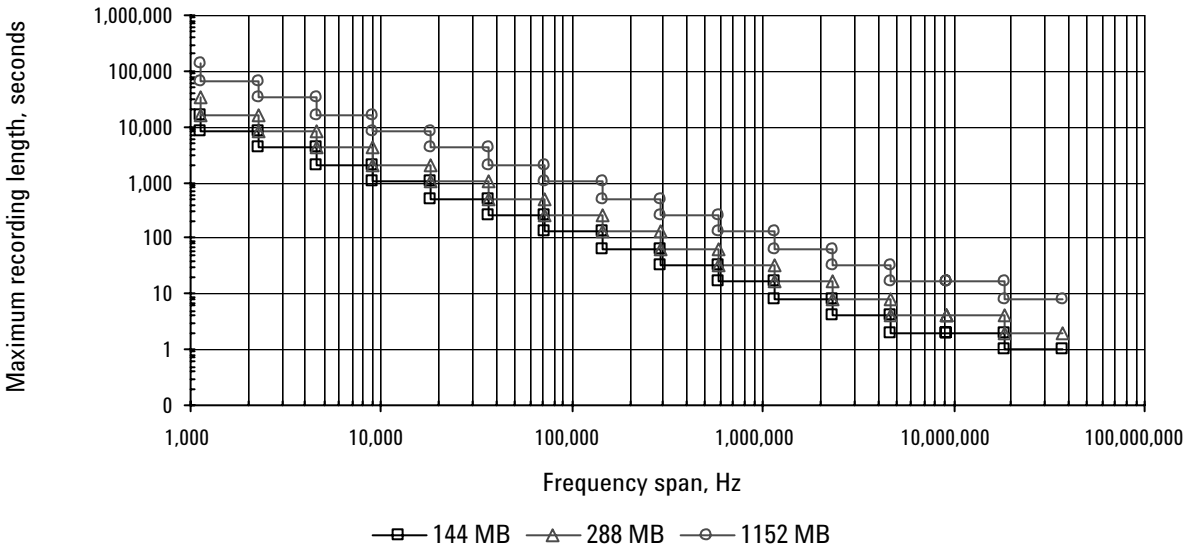

Figure 1. 89610S/89611S/89640S/89641S capture length

Specifications
Time and waveform capture (Option 200)

	89650S
Max capture size	
Bytes	512 MB
Complex samples	128 MSa
Max capture span	80 MHz (Option 122); 40 MHz (Option 140)
Max capture time	1.34 sec (At maximum capture span)

	PSA	MXA
Max capture size		
Complex samples	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	4 MSa
Max capture span	8 MHz	10 MHz (standard) 25 MHz (Option B25)

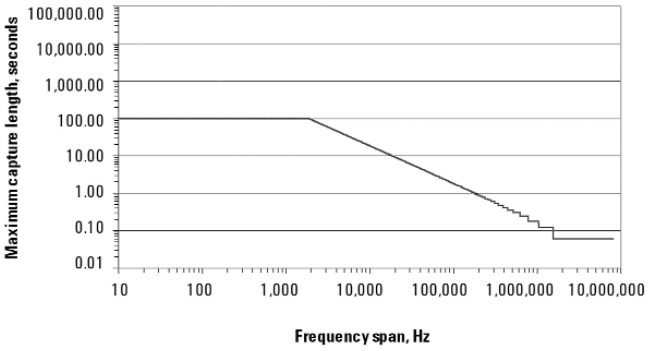

Figure 2. PSA capture length

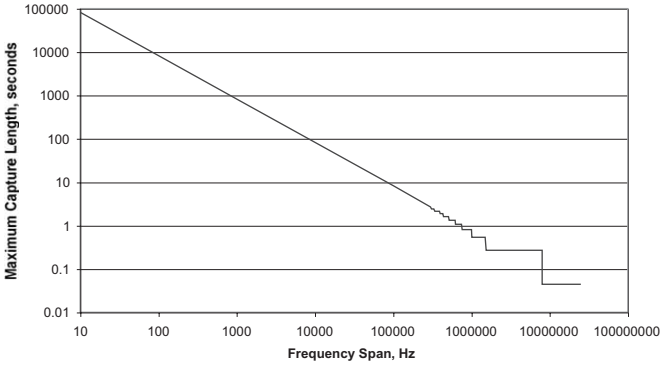

Figure 3. MXA capture length

Specifications
Time and waveform capture (Option 200)

	ESA	E4406A	
Max capture size			
Complex samples		During time capture on spans < 1.55 MHz (< 755 kHz for baseband operation), 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.	
	124,388 Sa	*RF* 900 kSa	*Baseband* 900 kSa (Real samples, per channel)
Max capture span	10 MHz	*RF* 8 MHz	*Baseband* 5 MHz

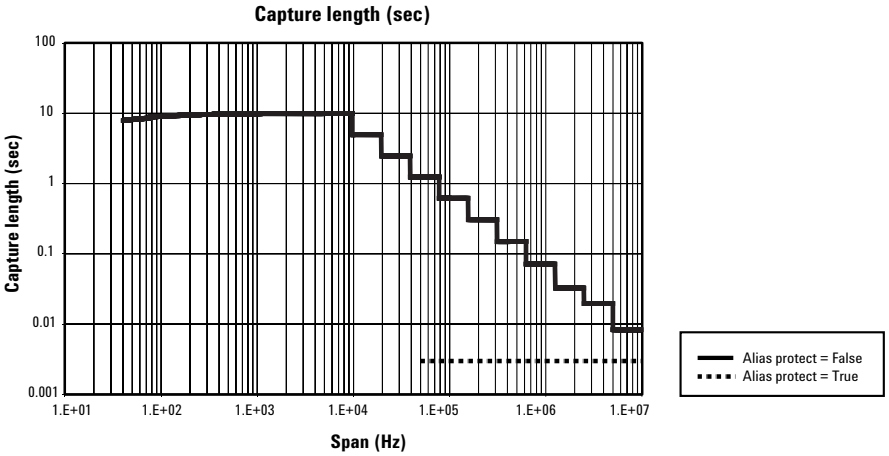

Figure 4. ESA capture length

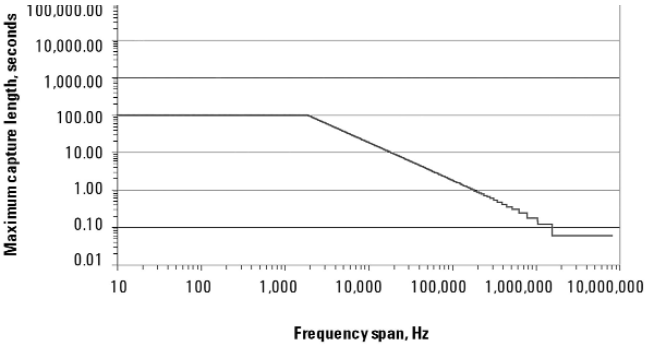

Figure 5. E4406A capture length

Specifications
Analog modulation analysis (part of Option 200)

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

	89610S/11S/40S/41S (typical)
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 (typical, 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 (typical)
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 signal analyzer

	MXA (typical)		
AM demodulation	Span ≤ 12 MHz		
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±1%		
Harmonic distortion	–60 dBc relative to 100% modulation index		
Spurious	–60 dBc relative to 100% modulation index		
Cross demodulation	< 0.3% AM on an FM signal with 50 kHz modulation rate, 200 kHz deviation		
PM demodulation			
Demodulator bandwidth	Same as selected measurement span		
Modulation index accuracy	±0.5°, deviation < 180°, modulation rate ≤ 500 kHz		
Harmonic distortion	–60 dBc		
Spurious	–60 dBc, span ≤ 12 MHz		
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	*Modulation rate*	*Deviation*	*Distortion*
	≤ 50 kHz	≤ 200 kHz	–60 dBc
	≤ 500 kHz	≤ 2 MHz	–55 dBc
Spurious	*Modulation rate*	*Deviation*	*Distortion*
	≤ 50 kHz	≤ 200 kHz	–50 dBc, span ≤ 12 MHz
	≤ 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		

Specifications
Analog modulation analysis (part of Option 200)

ESA-E Series spectrum analyzers

	ESA (typical)
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
Analog modulation analysis (part of Option 200)

E4406A transmitter tester

	E4406A (typical)
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
Vector modulation analysis (Option AYA)

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

	89610S/11S/40S/41S (typical)		89650S (typical)	
Accuracy	Formats other than FSK, 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, 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 (typical)	89650S (typical)
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)

Specifications
Vector modulation analysis (Option AYA)

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)		MXA (typical)	
Accuracy	Formats other than FSK, 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, 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	
Residual EVM	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz	*EVM* < 0.5% rms < 0.5% rms < 1.0% rms	*Span* ≤ 100 kHz[1] ≤ 1 MHz ≤ 10 MHz ≤ 22 MHz[2] ≤ 25 MHz[2]	*EVM* 0.50% rms 0.50% rms 1.00% rms 1.20% rms 1.50% rms
Magnitude error	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz	*Error* 0.5% rms 0.5% rms 1.0% rms	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 10 MHz ≤ 22 MHz[2] ≤ 25 MHz[2]	*Error* 0.30% rms 0.50% rms 1.00% rms 1.00% rms 1.20% rms
Phase error	For modulation formats with equal symbol amplitudes *Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz	 *Error* 0.3° rms 0.4° rms 0.6° rms	 *Span* ≤ 100 kHz[1] ≤ 1 MHz ≤ 10 MHz ≤ 22 MHz[2] ≤ 25 MHz[2]	 *Error* 0.3° rms 0.4° rms 0.6° rms 0.8° rms 1.0° rms
Frequency error	Added to frequency accuracy if applicable			
	Symbol rate/500,000			
I-Q/origin offset	–60 dB or better			

1 1.0% rms EVM and 0.8 deg RMS phase error for frequency > 3 GHz.
2 Without Option B25, span is restricted to ≤ 10 MHz.

Specifications
Vector modulation analysis (Option AYA)

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)	MXA (typical)
Video modulation formats		
Residual EVM 8/16 VSB	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, α = 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, α = 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, α = 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, α = 0.15, frequency < 3.6 GHz, 8 MHz span, full-scale signal, range ≥ –30 dBm, result length = 800, averages = 10

Specifications
Vector modulation analysis (Option AYA)

ESA spectrum analyzers and E4406A transmitter tester

	ESA (typical)		E4406A (typical)	
Accuracy	Formats other than 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		Formats other than FSK, 8/16VSB, 16/32 APSK, and OQPSK; Conditions: Full scale signal, fully contained in the measurement span, random data sequence, range ≥ –18 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	
Residual EVM	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz	*EVM* < 1.2% rms < 0.4% rms < 1.8% rms	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz[1]	*EVM* < 0.5% rms < 0.5% rms < 1.0% rms
Magnitude error	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 10 MHz	*Error* 0.6% rms 0.6% rms 1.3% rms	*Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz[1]	*Error* 0.3% (baseband) 0.5% rms (RF) 0.5% rms 1.0% rms
Phase error	For modulation formats with equal symbol amplitudes *Span* ≤ 100 kHz ≤ 1 MHz ≤ 10 MHz	 *Error* 0.7% rms 0.5% rms 0.8% rms	For modulation formats with equal symbol amplitudes *Span* ≤ 100 kHz ≤ 1 MHz ≤ 8 MHz[1]	 *Error* 0.3° rms 0.4° rms 0.6° rms
Frequency error	Added to frequency accuracy if applicable		Added to frequency accuracy if applicable	
	Symbol rate/500,000		Symbol rate/500,000	
I-Q/origin offset	–57 dB or better		–60 dB or better	

1 For RF only, ≤ 5 MHz for baseband.

Specifications
Vector modulation analysis (Option AYA)

ESA spectrum analyzers and E4406A transmitter tester

	ESA (typical)	E4406A (typical)
Video modulation formats		Applies for RF and composite I+jQ modes only
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	≤ 1.5% (SNR ≥ 36 dB) Symbol rate = 10.762 MHz, α = 0.115, 7 MHz span, full-scale signal, range ≥ –18 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	≤ 1.0% (SNR ≥ 40 dB) 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/HSDPA (Option B7U, B7N) modulation analysis

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

	89610S/11S/40S/41S (typical)	89650S (typical)
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, HSDPA enabled)	≤ 1.5%	≤ 1.5%
Frequency error		
Lock range (CPICH synch type)	±500 Hz	≤ 500 Hz
Accuracy	±10 Hz	≤ 10 Hz

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

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)	MXA (typical)
Signal playback		
Result length	1 to 64 slots	1 to 64 slots
Capture length Gap free analysis at 0% overlap; 5 MHz span	88 slots	> 390 slots
Accuracy (typical)	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
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 averaged over a slot	±0.3 dB	±0.3 dB
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, 8 HSDPSCH with 30 DPCH, HSDPA enabled)	≤ 1.5%	≤ 1.5%
Frequency error Range (CPICH sync type)	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz

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

ESA spectrum analyzers and E4406A transmitter tester

	ESA (typical)	E4406A (typical)
Signal playback		
Result length	1 to 27 slots[1]	1 to 64 slots[2]
Capture length Gap free analysis at 0% overlap; 5 MHz span	27 slots[1]	88 slots[2]
Accuracy (typical)	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz	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 averaged over a slot	±0.3 dB	±0.3 dB
Composite EVM EVM floor (pilot only)	≤ 1.6%	≤ 1.5%
EVM floor (test model 1 with 16 DPCH signal)	≤ 1.6%	≤ 1.5%
EVM floor (test model 5, 8 HSDPSCH with 30 DPCH, HSDPA enabled)	≤ 1.6%	≤ 1.5%
Frequency error Range (CPICH sync type)	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz

1 Alias protect = false; 11 slots when alias protect = true.
2 43 slots maximum for channel 1, baseband mode.

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

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

	89610S/11S/40S/41S (typical)		89650S (typical)	
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 (Option B7T, B7N) modulation analysis

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)	MXA (typical)
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
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	94 PCG	> 200 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
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 averaged over a slot	±0.3 dB	±0.3 dB
Composite EVM		
EVM floor (pilot only)	≤ 1.5%	≤ 1.5%
EVM floor (9 active channels)	≤ 1.5%	≤ 1.5%
EVM floor (16 QAM, F-PDCH 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 (Option B7T, B7N) modulation analysis

ESA spectrum analyzers and E4406A transmitter tester

	ESA (typical)	E4406A (typical)
Signal playback		
Result length	*Forward link* 1 to 24 PCGs[1] *Reverse link* 1 to 24 PCGs[1]	*Forward link, RF* 1 to 64 PCG *Reverse link, RF* 1 to 48 PCG *1 channel, baseband* 1 to 22 PCG *2 channels, baseband* 1 to 46 PCG
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	24 PCG[1]	*RF* 94 PCG *1 channel, baseband* 22 PCG *2 channels, baseband* 46 PCG
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz	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 averaged over a slot	±0.3 dB	±0.3 dB
Composite EVM EVM floor (pilot only)	≤ 1.6%	≤ 1.5%
EVM floor (9 active channels)	≤ 1.6%	≤ 1.5%
EVM floor (16 QAM, F-PDCH with 15 codes, 1xEV-DV enabled)	≤ 1.6%	≤ 1.5%
Frequency error Lock range	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz

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

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

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

	89610S/11S/40S/41S (typical)		89650S (typical)	
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 (Option B7W, B7N) modulation analysis

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)	MXA (typical)
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	65 slots	> 300 slots
Accuracy	Input range ≥ –24 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
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 (Option B7W, B7N) modulation analysis

ESA spectrum analyzers and E4406A transmitter tester

	ESA (typical)	E4406A (typical)
Signal playback		
Result length	*Forward link* 1 to 18 slots[1] *Reverse link* 1 to 18 slots[1]	*Forward link* 1 to 64 slots *Reverse link* 1 to 64 slots
Capture length Gap free analysis at 0% overlap; 1.5 MHz span	18 slots[1]	70 slots
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz	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	≤ 1.6%	≤ 1.5%
Frequency error Lock range	±500 Hz	±500 Hz
Accuracy	±10 Hz	±10 Hz

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

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

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

	89610S/11S/40S/41S (typical)	89650S (typical)
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 (Option B7X, B7N) modulation analysis

PSA spectrum analyzers and MXA signal analyzer

	PSA (typical)	MXA (typical)
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	10 sub-frames	> 50 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
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 (Option B7X, B7N) modulation analysis

ESA spectrum analyzers and E4406A transmitter tester

TD-SCDMA	**ESA (typical)** Alias protect = false	**E4406A (typical)**
Signal playback		
Result length	1 to 5 sub-frames[1]	1 to 8 sub-frames
Capture length Gap free analysis at 0% overlap; 1.6 MHz span	5 sub-frames[1]	10 sub-frames
Accuracy	Input range within 5 dB of total signal power, between 30 MHz and 3 GHz	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	±25 Hz	±25 Hz

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

Specifications
WLAN modulation analysis (Option B7R)

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

IEEE 802.11a/g OFDM	89610S/11S/40S/41S (typical)	89650S (typical)	MXA (typical)
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
Capture length	Gap free analysis at 0% overlap; 31.25 MHz span 144 MB memory: 1.0 s 288 MB memory: 2.0 s 1152 MB memory: 8.0 s	Gap free analysis at 0% overlap; 31.25 MHz span 3.3 s	Gap free analysis at 0% overlap; 25 MHz span (Option B25) 44 msec
Accuracy	20 averages	20 averages	20 averages, input range ≥ –30 dBm and within 2 dB of full scale, input range ≥ –20 dBm for frequency > 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	≤ –45 dB
Equalizer training = chan est. seq.	≤ –43 dB	≤ –45 dB	≤ –43 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
Lock range	±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

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 (typical)**	**89650S (typical)** Pre-selector bypass enabled above 3 GHz, requires Option E444xA-123 where x = 0,3,5	**MXA (typical)**
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 (20 ms)	Auto detect or adjustable from 1 to 370741 chips (33.7037 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)
	144 MB memory 1.0 s 288 MB memory 2.0 s 1152 MB memory 8.0 s	3.0s	44 ms
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
Center frequency	89640S and 89641S: 2.4 GHz 89611S: 70 MHz 89610S: 21.4 MHz	2.4 GHz	2.4 GHz
Residual EVM	≤ 2% All modulation formats, 10 averages	≤ 1.0% ≤ 0.5% with equalizer enabled; all modulation formats, 10 averages, reference filter = transmit filter	≤ 1.5% ≤ 0.5% with equalizer enabled; reference filter = transmit filter = Gaussian with BT = 0.5
Frequency error	Relative to frequency standard	Relative to frequency standard	Relative to frequency standard
Lock range	±2.5 MHz	±2.5 MHz	±2.5 MHz
Frequency accuracy	±8 Hz	±8 Hz	±8 Hz

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

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

	89610S/11S/40S/41S (typical)			89650S (typical)		
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 spectrum analyzers and MXA signal analyzer

	PSA (typical)		MXA (typical)	
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		*BW = span* 7 MHz 10 MHz 20 MHz[1]	*Result length* 1105 symbol times 1594 symbol times 1745 symbol times
Capture length	Gap free analysis at 0% overlap; 8 MHz span 59 msec		*Span* 8 MHz > 8 MHz[1]	*Capture length* 266 msec 44 msec
Accuracy				
Residual EVM	20 averages; input range within 5 dB of full scale		20 averages; input range within 5 dB of full scale. Using > 30 kHz phase noise optimization mode.	
Equalizer training = chan est. seq. and data	*Signal bandwidth* 7 MHz	*EVM* ≤ –49 dB	*Signal bandwidth* 20 MHz[1] 7 MHz	*EVM* ≤ –46 dB ≤ –48 dB[2]
Equalizer training = chan est. seq. only	*Signal bandwidth* 7 MHz	*EVM* ≤ –47 dB	*Signal bandwidth* 20 MHz[1] 7 MHz	*EVM* ≤ –45 dB ≤ –47 dB[3]
Frequency error				
Lock range	*Signal bandwidth* 7 MHz	*Range* ±33.75 kHz	*Signal bandwidth* 20 MHz[1] 7 MHz	*Range* ±135 kHz ±47.25 kHz
Frequency accuracy	±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.

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

ESA spectrum analyzers

	ESA (typical)	
Center frequency	2.7 GHz, 3.5 GHz, 5.8 GHz	
Signal playback		
Result length	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; 10 MHz span 8 ms	
Accuracy		
Residual EVM	20 averages; input range within 5 dB of full scale	
Equalizer training = chan est. seq. and data	*Signal bandwidth* 10 MHz 7 MHz	*EVM* ≤ –40 dB ≤ –42 dB
Equalizer training = chan est. seq. only	*Signal bandwidth* 10 MHz 7 MHz	*EVM* ≤ –39 dB ≤ –41 dB
Frequency error		
Lock range	*Signal bandwidth* 7 MHz 10 MHz	*Range* ±47.25 kHz ±67.5 kHz
Frequency accuracy	±10 Hz	

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

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

	89610S/11S/40S/41S (typical)	89650S (typical)	MXA (typical)
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
FFT size	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]
Signal playback			
Result Length	15 frames @ 5 msec frame length and span = 10 MHz	13 frames @ 5 msec frame length and span = 10 MHz	7 frames @ 5 msec frame length and span 10 MHz
Capture Length			
Gap free analysis at 0% overlap	144 MB (Opt 144) / 288 MB (Opt 288) / 1152 MB (Opt 120)		
@ 17.5 MHz span (10 MHz BW signal)	2 sec / 4 sec / 16 sec	2.9 sec	44 msec

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 and MXA signal analyzer

		89610S/11S/40S/41S (typical)			89650S (typical)	MXA (typical)
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	2.7 GHz, 3.5 GHz
Residual EVM		20 averages; RCE and Data RCE				
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	–46 dB[3]
10 MHz	PUSC, FUSC	–47 dB	–47 dB	–47 dB	–49 dB	–45 dB[3, 4]
20 MHz	PUSC, FUSC	–46 dB	–46 dB	–46 dB	–49 dB	–44 dB[3, 4]
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	–45 dB, –44 dB[5]
10 MHz	PUSC, OPUSC	–48 dB	–48 dB	–48 dB	–50 dB	–44 dB, –43 dB[5]
20 MHz	PUSC, OPUSC	–47 dB	–47 dB	–47 dB	–50 dB	–43 dB, –42 dB[5]
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] = ±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 Degraded by up to 2 dB for 3.0 GHz < frequency < 3.6 GHz.
5 –41 dB, –40 dB for 3.0 GHz < frequency < 3.6 GHz.

Specifications
IEEE 802.16 OFDMA modulation analysis (Option B7Y)

ESA spectrum analyzers

	ESA
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 (typical)	89650S (typical)
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 (1 channel meas. only)	*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	*Carrier spacing* / *Range* 312.5 kHz / ±400 kHz user selected / ±1x carrier spacing	*Carrier spacing* / *Range* 312.5 kHz / ±400 kHz user selected / ±1x carrier 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
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)[3]
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 Electrostatic discharge:
- Performance criteria B (when used with a desktop PC).
- Performance criteria C (when used with a laptop PC may require operator intervention after ESD event).

3 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:

	Desktop	Laptop
CPU	> 600 MHz Pentium® or AMD-K6 (> 2 GHz recommended)	> 600 MHz Pentium or AMD-K6 (> 2 GHz recommended)
Empty slots	1 PCI-bus slot (Two recommended)	1 CardBus Type II slot (Two recommended)
RAM	512 MB (1 GB recommended)	512 MB (1 GB recommended)
Video RAM	4 MB (16 MB recommended)	4 MB (16 MB recommended)
Hard disk space	300 MB available	300 MB available
Operating system	Microsoft® Windows® 2000, SP2, or XP Professional	Microsoft Windows 2000, SP2, or XP Professional
Additional drives	CDROM to load the software; license transfer requires 3.5 inch floppy drive, network access, or USB memory stick	CDROM to load the software; license transfer requires 3.5 inch floppy drive, network access, or USB memory stick
Interface support	LAN, GPIB, USB, or FireWire interface (Hardware platform dependent; see Appendix B)	LAN, GPIB, USB, or FireWire interface (Hardware platform dependent; see Appendix B)

Appendix B
Software and Hardware Feature Availability and Requirements

89600 Series VSA software requirements

89601A VSA software

The 89601A vector signal analysis software requires Option 200, "Basic Vector Analysis," and Option 300, "Hardware Connectivity," to work with any hardware platform. The software version required to work with a specific platform is shown in the following tables:

89600S VXI platforms	89601A version
89610S	1.00 or later
89611S	1.00 or later
89640S	1.00 or later
89641S	1.00 or later

89650S platform	89601A version
89650S (E4440A, and Option 122 only)	5.21 or later
89650S (E4443A/ E4445A with Option 122)	6.10 or later
89650S (E4440A/E4443A/E4445A with Option 140)	6.10 or later
89650S (E4440A/E4443A/E4445A with Option 110)	6.20 or later

PSA platforms	89601A version
E4440A Option B7J	3.00 or later
E4440A Option 122	5.21 or later
E4440A Option 140	6.10 or later
E4443A Option B7J	6.10 or later
E4443A Option 122	6.10 or later
E4443A Option 140	6.10 or later
E4445A Option B7J	6.10 or later
E4445A Option 122	6.10 or later
E4445A Option 140	6.10 or later
E4446A Option B7J	4.00 or later
E4447A Option B7J	6.10 or later
E4448A Option B7J	4.00 or later
E444x (x = 0,3,5,6,7,8) Option 110	6.20 or later

MXA platform	89601A version
N9020A Option 503, 508, 513, 526	6.31 or later

ESA platforms	89601A version
E4402B	3.01 or later
E4404B	3.01 or later
E4405B	3.01 or later
E4407B	3.01 or later

E4406A platform	89601A version
E4406A	3.00 or later

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

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 89601N12 VSA software also uses a floating license, but this license is valid for one year only.

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 comes standard with these options. The required version of the software is shown in the hardware specific tables.

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.

Models	89601AN, 89601N12 version
89600S (all models)	5.00 or later
89650S (E4440A, and Option 122 only)	5.21 or later
89650S (E4443A/ E4445A with Option 122)	6.10 or later
89650S (E4440A/E4443A/E4445A with Option 140)	6.10 or later
89605S (E4440A/E4443A/E4445A with Option 110)	6.20 or later
PSA (all models except E4447A)	5.00 or later
PSA (E4440A with Option 122)	5.21 or later
PSA (all models with Option 122 except E4440A)	6.10 or later
PSA (all models with Option 140)	6.10 or later
PSA (E4447A)	6.10 or later
PSA (all models with Option 110)	6.20 or later
MXA N9020A	6.31 or later
ESA (all models)	5.00 or later

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.	

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.
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.
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 is installed, providing 25 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	Selectable frequency (1 to 30 MHz)
In addition, 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)

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>82357A</td><td>Available from Agilent.</td></tr>
</table></td></tr>
<tr><td>LAN connection</td><td>Available using the Agilent E2050A 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>

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

E4406A platform

<table>
<tr><td>Configuration requirements</td><td>The E4406A/89600 software combination requires an E4406A transmitter tester and the 89600 vector signal analysis software (each with required options), a PC to run the software, and interface cable.</td></tr>
<tr><td>E4406A requirements</td><td>The E4406A/89600 software combination requires an E4406A with version A.05.32, or later, firmware. Option E4406A-B7C, “I/Q inputs,” is required for baseband measurements.</td></tr>
<tr><td>Software requirements</td><td>See the “E4406A platform” table under “89600 Series VSA software requirements” at the beginning of Appendix B.</td></tr>
<tr><td>PC requirements</td><td>See Appendix A “User-supplied PC requirements.”</td></tr>
<tr><td>PC to E4406A interface</td><td>The E4406A supports both LAN and GPIB I/O. The table shows the interface cards and connection cables that are recommended for the PC.
<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>82357A</td><td>Available from Agilent.</td></tr>
</table></td></tr>
<tr><td>LAN connection</td><td>A cross-over LAN cable (available from Agilent, part number 8120-0545) is recommended.</td></tr>
<tr><td>Feature availability</td><td>When the E4406A 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 will be displayed on the 89600 software GUI</td></tr>
<tr><td>Span</td><td>Only zero-span is available on the E4406A. Maximum span setting in the 89600 VSA software is 8 MHz. Zero span control of the E4406A and the display of its current setting are provided by the 89600 software.</td></tr>
<tr><td>Input attenuator and ADC gain</td><td>Available indirectly through the input range feature of the 89600 software</td></tr>
<tr><td>Triggering</td><td>IF magnitude, external front/rear, hold-off, level, delay, and slope</td></tr>
<tr><td>External reference</td><td>Selectable frequency</td></tr>
<tr><td>Baseband operation (with Option B7C installed)</td><td>Ch1 + jCh2 mode supported via 89600 VSA software.</td></tr>
<tr><td colspan="2">In addition, you can gain immediate, direct access to all of the E4406A transmitter tester’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 swept 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
89600S Vector Signal Analyzer	CD	5980-1989E
89600 Series Vector Signal Analysis Software 89601A/89601AN/89601N12	Data Sheet	5989-1786EN
89600 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 Suite 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:
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