Agilent
PSA Series Spectrum Analyzers
1xEV-DO Measurement Personality

Product Overview

The PSA series, Agilent Technologies' highest performing spectrum analyzers, offers advanced and comprehensive RF and microwave measurement capability. The 1xEV-DO measurement personality (Option 204) solves your problems in 1x evolution data only (1xEV-DO) forward link measurements with powerful analysis capability and easy-to-use functions. That means you can accelerate your development schedule to quickly obtain manufacturing efficiency.

Agilent Technologies

Bring your 1xEV-DO forward link products to market faster

The PSA series of high-performance spectrum analyzers provides exceptional levels of speed, accuracy, flexibility, and dynamic range. It also offers the most complete and easy-to-use, one-button RF power measurements, equipped with format-based setups for popular communications standards.

- Expand design possibilities with powerful measurement capability and flexibility.
- Expedite troubleshooting and design verification with numerous features and an intuitive user interface.
- Streamline manufacturing with speed, reliability, and ease-of-use.
- Improve yields with highly accurate measurements and operator-independent results.
- Simplify test systems with digital demodulation, RF power measurements, spur searches, and general high-performance spectrum analysis in one analyzer.

The PSA, with the optional 1xEV-DO measurement personality, is a transmitter tester for base stations. The application is designed specifically for forward link signals.

- Enable quick and easy verification of 1xEV-DO signals, such as active/idle slots of base stations in both RF measurements and signal modulation analysis.
- Meet aggressive time-to-market goals in base station manufacturing with 3GPP2 standard compliant tests.

The Agilent PSA 1xEV-DO measurement personality is designed for:

- service providers (R&D, incoming quality assurance)
- access network (AN) manufacturers
- base station power amplifier (PA) manufacturers
- 1xEV-DO repeater station manufacturers

Perform the following conformance tests in 3GPP2 with the 1xEV-DO measurement personality:

- frequency tolerance (mod accuracy)
- pilot channel time tolerance (mod accuracy)
- waveform quality (mod accuracy)
- total power (power versus time)
- pilot/MAC power (power versus time)
- code domain power
- conducted spurious emissions (spurious emissions and ACP)
- occupied bandwidth

With the 1xEV-DO measurement personality you can perform the conformance tests listed above.

1xEV-DO measurements

The 1xEV-DO personality is designed with flexibility in mind to support the unique time division multiplex (TDM) format of the 1xEV-DO forward link signal.

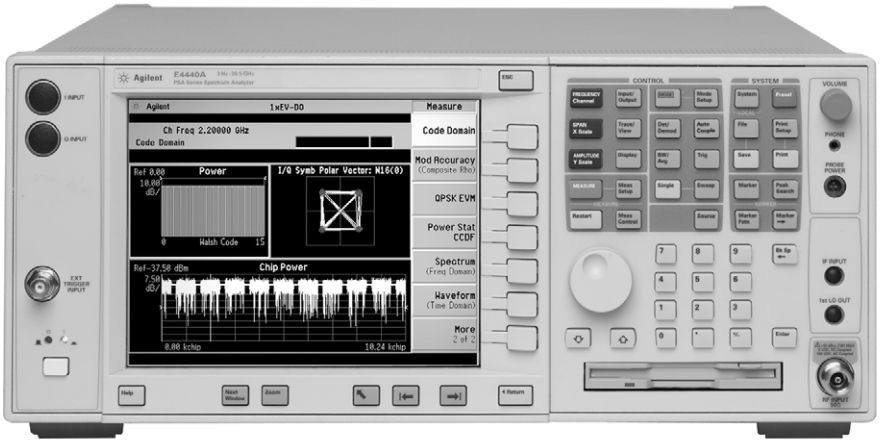
Channel power

Power versus time

Occupied bandwidth

Spurious emission and ACP

Code domain analysis



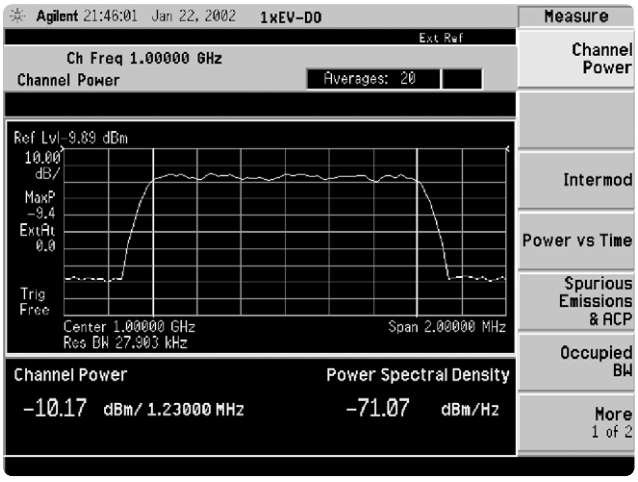
Modulation accuracy

QPSK EVM

Power statistics (CCDF)

Intermodulation distortion

Spectrum and waveform

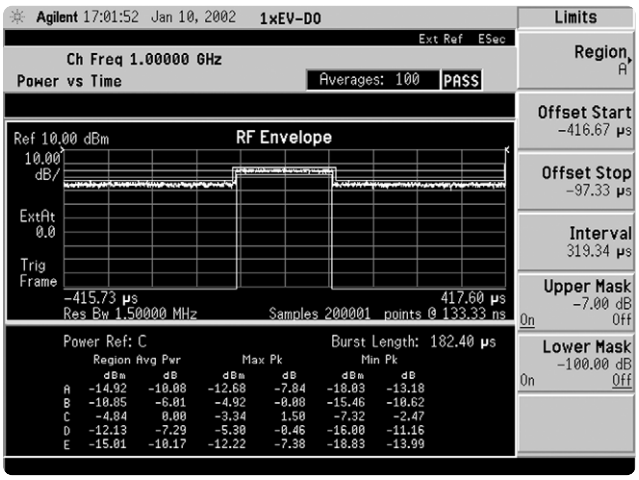


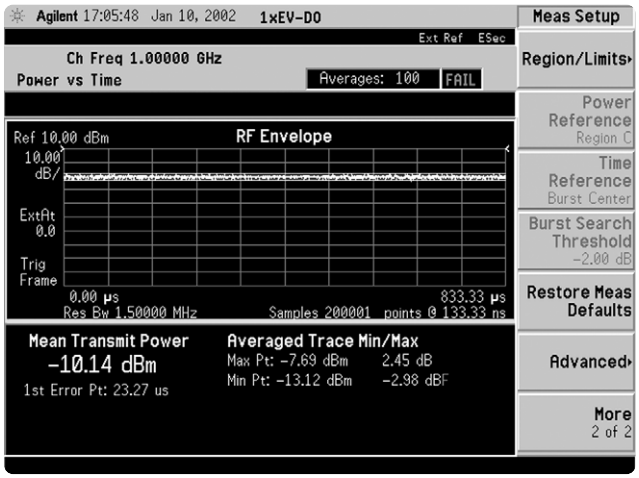
Channel power

The channel power measurement determines the total RMS power in a user-specified bandwidth. The power spectral density (PSD) is also displayed in dBm/Hz.

Control the following channel power measurement parameters:

- integration bandwidth (defaults to 1.23 MHz)
- channel power span (defaults to 2 MHz)
- number of trace averages (defaults to 20)
- data points displayed (64 to 65536, defaults to 512)



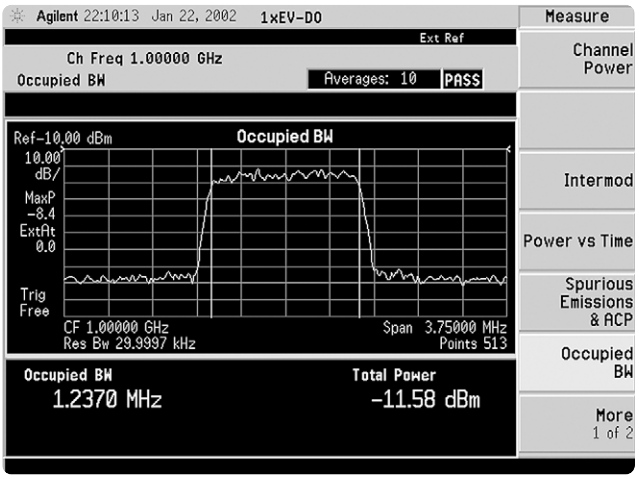


Power versus time (PvT)

Power versus time (PvT) is a key measurement for 1xEV-DO signals. 3GPP2 C.S0032 defines “total power” and “pilot/MAC channel power”. Measurement of the burst signal is necessary in the transmitter test for 1xEV-DO idle slot. Active slot also can be measured in PvT.

The following parameters can be changed if desired:

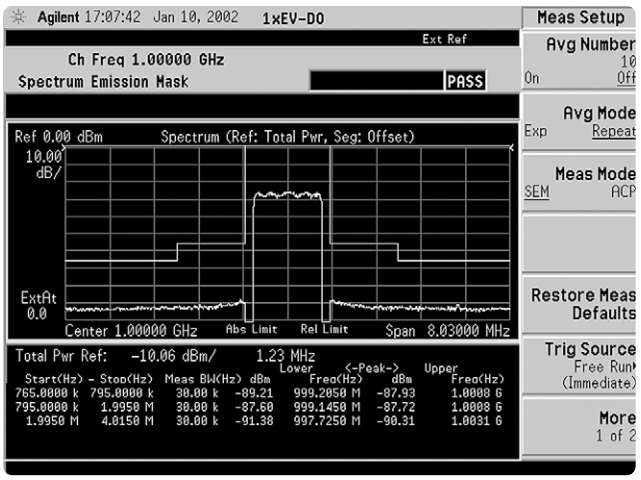
- select slot type as idle slot (pilot/MAC) or active slot (pilot/MAC/data)
- define limit to create limit line time mask
- use automatic burst detection without time-gating
- set flexible burst search threshold
- select trigger, either external trigger or frame trigger by EvenSec clock input
- choose number of trace averages (defaults to 100 times)
- choose the view of burst center and rise and fall, or any part of burst signal
- turn on/off limit line mask on display

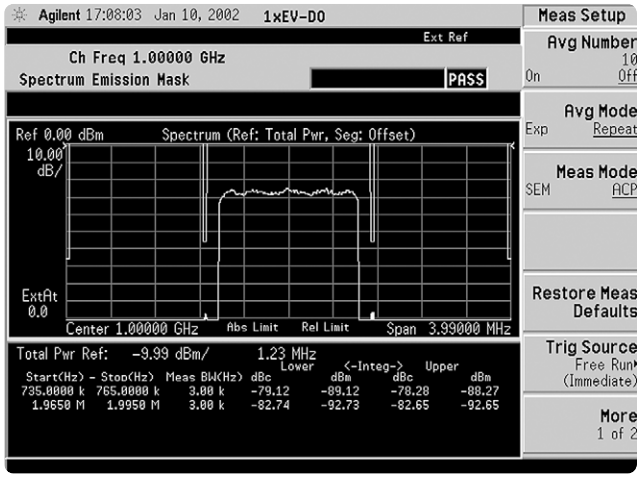


Occupied bandwidth

The standards recommended by the 3GPP2 for 1xEV-DO have occupied bandwidth (OBW) requirements for the two band classes. Effectively, OBW determines the frequency bandwidth that contains 99 percent of the total radiated power.

- specify the resolution bandwidth (defaults to 30 kHz) and the span (defaults to 3.75 MHz)
- customize a simple PASS/FAIL limit test (defaults to 1.48 MHz)
- choose number of averages (defaults to 10)

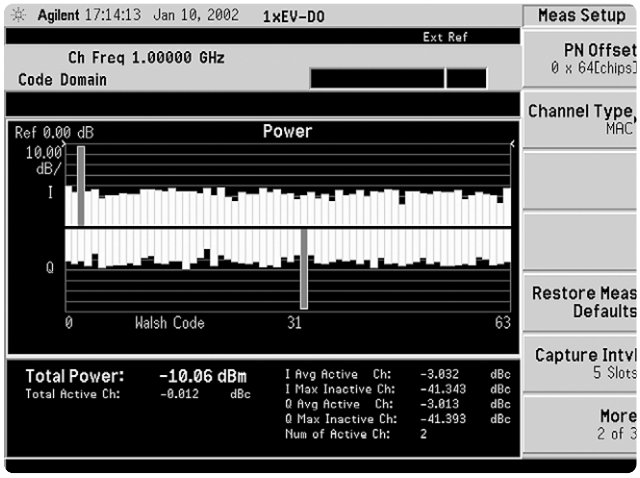


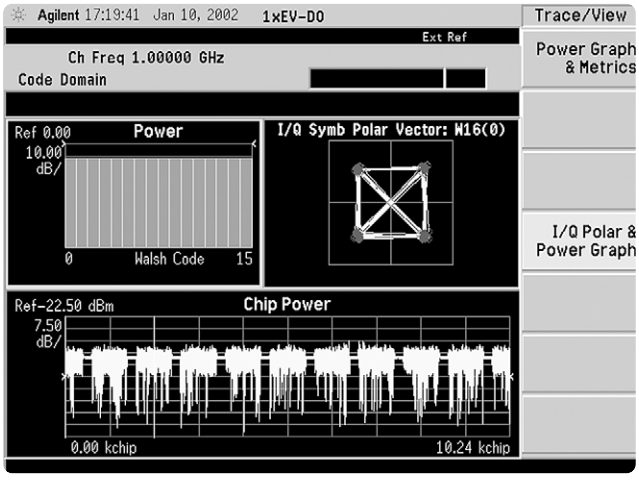


Spurious emissions and ACP

The 1xEV-DO ACP (adjacent channel power) measurement is defined in the 3GPP2 standard as a type of spurious emissions measurements. You can see SEM (spectrum emission mask) or ACP in this measurement by loading the offset/limit settings defined in 3GPP2. In addition, you can modify the measurement conditions and displays.

- perform both SEM and ACP
- optimize measurement set-up for both active and idle slot
- select channels segment as pilot #1 (first half slot) and pilot #2 (second half slot) by pre-defined offset/interval
- view table and spectrum formats
- measure the total power in dBm or the PSD in dBm/Hz
- select the average or peak detector (defaults to average)
- choose offset frequency, reference bandwidth, and limit values
- customize reference channel span, step frequency and resolution bandwidth

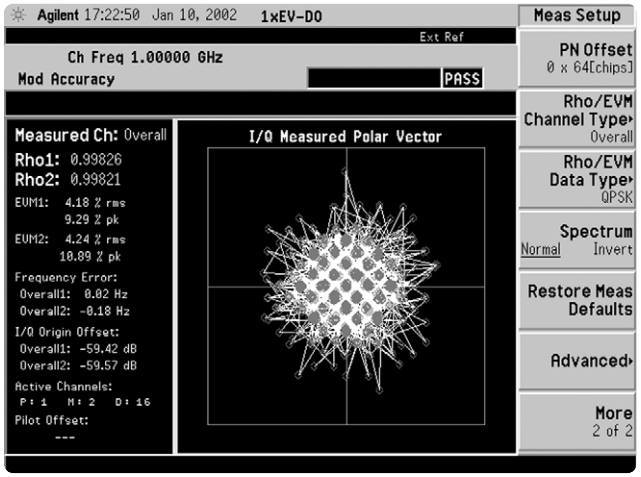


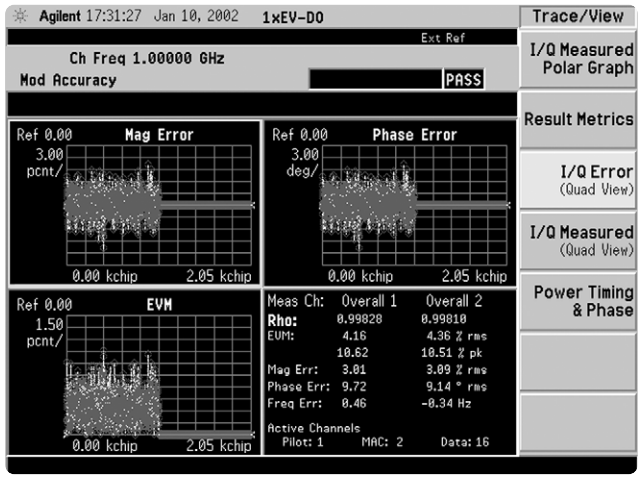


Code domain analysis

The code domain analysis measurement provides a variety of data display options. Code domain power analysis measures the distribution of signal power across the set of code channels, normalized to the total signal power. This measurement helps to verify that each code channel is operating at its proper level and to identify problems throughout the transmitter design from coding to the RF section. System imperfections, such as amplifier non-linearity, will present themselves as an undesired distribution of power in the code domain.

- measure both idle slot and active slot without trigger
- select channel mode for pilot, MAC or data
- display code domain power with symbol constellation
- specify Hadamard or bit-reverse code order demodulation algorithms
- use the active channel identification feature or manually set the code channel power threshold level
- customize the capture interval (1 to 32 power control groups [PCG])
- move the analysis window by varying the measurement interval and offset
- select PN (pseudonoise sequence) offset
- take advantage of multiple result views:
  - ~ code power and symbol rates bar graph and table
  - ~ IQ symbol polar vector and chip power plot

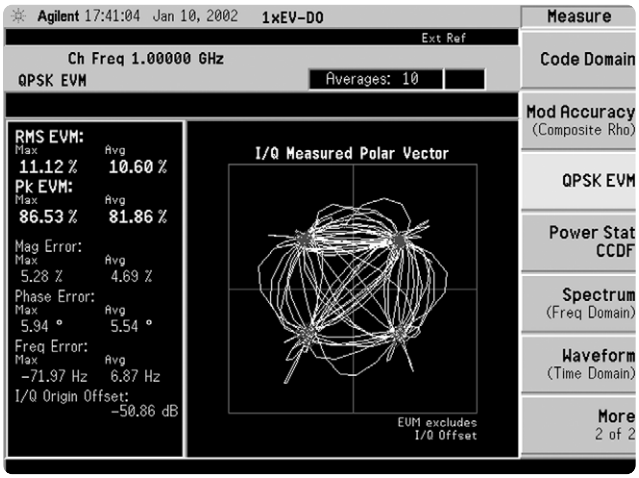




Modulation accuracy (composite rho)

An important measure of modulation accuracy for 1xEV-DO signals is rho. Rho is the ratio of the correlated power to the total power. It allows you to verify the overall modulation accuracy for a transmitter, regardless of the channel configuration, as long as pilot channel is present.

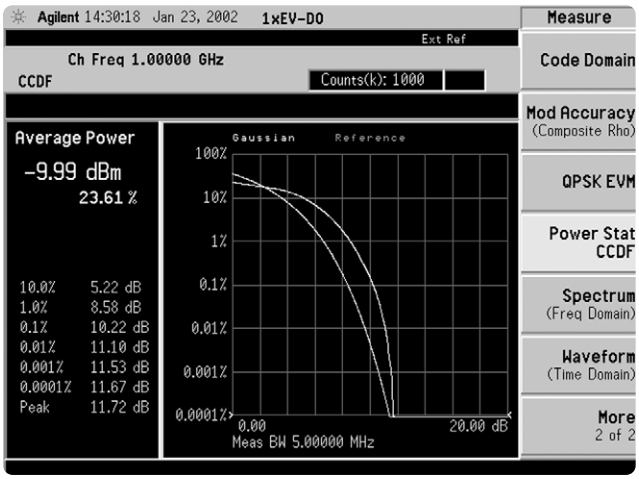
- measure both idle slot and active slot without trigger
- analyze each channel part of pilot/MAC/data in time division multi-plexed (TDM)
- select modulation type for data part in QPSK/8PSK/16QAM to measure overall-1 and overall-2 simultaneously
- switch between scrambled and de-scrambled chips in display
- measure EVM, three types of rho (pilot, overall-1, overall-2), frequency error, magnitude error, phase error, IQ origin offset and pilot offset simultaneously
- customize limits for RMS EVM, peak EVM, rho, frequency error, timing error, phase error and pilot offset
- read power, timing error, and phase error of data channels
- select PN offsets
- view I/Q polar constellation and magnitude error, phase error, and EVM plots
- choose to include or exclude the I/Q origin offset in the EVM calculation



QPSK EVM

The QPSK EVM measurement is used to obtain an indication of the modulation quality at the chip level for each part of pilot, MAC or data. It can detect baseband filtering, modulation, and RF impairments, but does not detect spreading or scrambling errors.

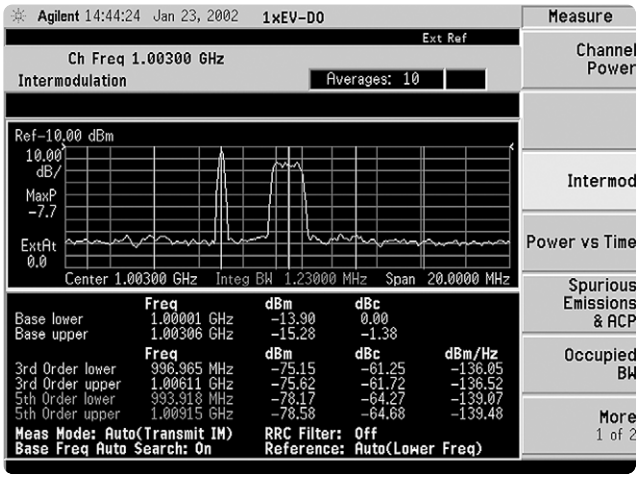
- select measure segment as pilot/MAC/data with preset measurement interval and offset
- view I/Q polar vector diagram or magnitude error, phase error, and EVM plots



Power statistics (CCDF)

The complementary cumulative distribution function (CCDF) is a plot of peak-to-average power ratio versus probability. It is often used to show compression and expansion of a signal by non-linear operation of amplifiers.

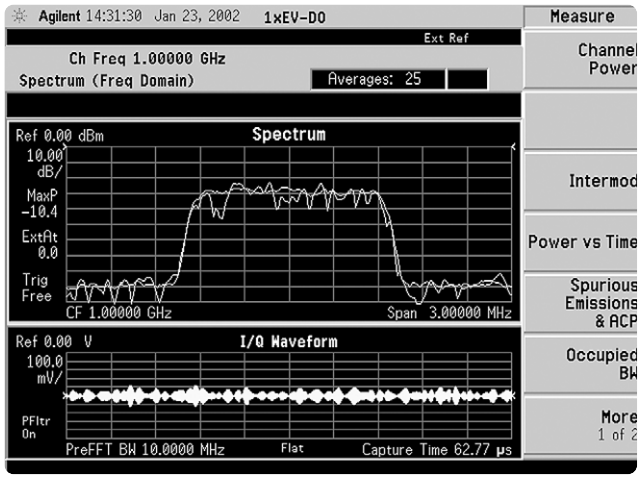
- customize measurement bandwidth (defaults to 5 MHz)
- specify measurement interval
- set a reference trace or compare
- take advantage of the 0.1 dB histogram resolution



Intermodulation distortion

The harmonic distortion of a system is an indication of the linearity of its components. This measurement quantifies the third and fifth harmonic distortion components of two continuous wave (CW) signals or of a 1xEV-DO modulated signal and a CW signal.

- select number of averages (defaults to 10)
- measure two-tone or transmitted intermodulation (IM) distortion
- specify base frequency or have it automatically detected
- apply RRC filtering if desired



Spectrum and waveform

View the frequency spectrum, I/Q waveform or RF envelope (time domain) of a 1xEV-DO signal.

- take advantage of advanced FFT windowing and filtering options
- control the ADC range

Key specifications[1]

	E4443A/E4445A/E4440A	E4446A/E4448A
Frequency range	3 Hz to 6.7/13.2/26.5 GHz	3 Hz to 44/50 GHz
Speed		
Sweep time, span ≥ 10 Hz	1 ms to 2000 s	1 ms to 2000 s
Sweep time span = 0 Hz	1 µs to 6000 s	1 µs to 6000 s
Local measurement update rate	≥ 50 measurements/sec	≥ 50 measurements/sec
Remote measurement update rate	≥ 22 measurements/sec	≥ 22 measurements/sec
Resolution		
Resolution bandwidth range, swept and FFT	1 Hz to 3 MHz (10% steps), 4, 5, 8 MHz	1 Hz to 3 MHz (10% steps), 4, 5, 8 MHz
Variable sweep (trace) point range	101 to 8192	101 to 8192
Phase noise at 1 GHz		
10 kHz offset	-114 dBc/Hz -117 dBc/Hz (typical)	-114 dBc/Hz -117 dBc/Hz (typical)
1 MHz offset	-144 dBc/Hz -148 dBc/Hz (nominal)	-144 dBc/Hz -148 dBc/Hz (nominal)
10 MHz offset	-151 dBc/Hz -157 dBc/Hz (nominal)	-151 dBc/Hz -157 dBc/Hz (nominal)
Residual FM	< (1 Hz x N^2) p-p in 1 s	< (1 Hz x N^2) p-p in 1 s
Dynamic range		
Displayed average noise level (DANL)		
10 MHz to 3 GHz	-152 dBm	-151 dBm
3 GHz to 20 GHz	-146 dBm	-144 dBm
20 GHz to 26.5 GHz	-143 dBm	-140 dBm
26.5 GHz to 44 GHz	N.A.	-131 dBm
44 GHz to 50 GHz	N.A.	-126 dBm
Preamplifier (DANL) - 10 MHz to 3 GHz	-166 dBm	-164 dBm
1 dB gain compression		
200 MHz to 3 GHz	+3 dBm (+7 dBm nominal)	+3 dBm (+7 dBm nominal)
Input attenuator range	0 to 70 dB in 2 dB steps	0 to 70 dB in 2 dB steps
TOI - 1.7 GHz to 3.0 GHz	+17 dBm (+19 dBm typical)	+18 dBm (+21 dBm typical)
SHI - 400 MHz to 1.25 GHz	+52 dBm	+51 dBm
ACPR, W-CDMA (5 MHz offset)		
Dynamic range	-74.5 dB (typical)	-74.5 dB (typical)
Dynamic range w/noise correction	-81 dB (typical)	-81 dB (typical)
Accuracy		
Absolute amplitude accuracy	±(0.24 dB + frequency response) ±(0.06 dB + frequency response), (typical)	±(0.24 dB + frequency response) ±(0.06 dB + frequency response), (typical)
95% confidence, 3 Hz to 3 GHz	±0.24 dB	±0.24 dB
Frequency response, 3 Hz to 3 GHz	±0.38 dB (±0.10 dB typical)	±0.38 dB (±0.10 dB typical)
Frequency accuracy at 1 GHz and a stable temperature	±100 Hz	±100 Hz
Span accuracy	±0.2% + $\frac{\text{span}}{\text{sweep points - 1}}$	±0.2% + $\frac{\text{span}}{\text{sweep points - 1}}$
W-CDMA ACPR accuracy (5 MHz offset)		
Mobile station	±0.12 dB	±0.12 dB
Base station	±0.22 dB	±0.22 dB
Warranty	3 years (standard)	3 years (standard)

1. See PSA series spectrum analyzers data sheet for more specification details (literature number 5980-1284E).
2. N is harmonic mixing mode.

1xEV-DO measurement personality

The following specifications are nominal for models E4446A and E4448A.

Channel power

Minimum power at RF input	-74 dBm (nominal)
Absolute power accuracy:	(20 to 30°C)
Attenuation > 2 dB	±0.67 dB (±0.18 dB typical)
Attenuation < 2 dB	±0.76 dB (±0.24 dB typical)
Measurement floor	-85dBm (nominal)
Relative power accuracy:	
Mixer level -52 to -12 dB	±0.08 dB (±0.03 dB typical)

Power vs. time (PvT)

Minimum power at RF input	-73 dBm (nominal)
Absolute power accuracy:	(20 to 30°C)
Attenuation > 2 dB	±0.24 dB (typical)
Attenuation < 2 dB	±0.30 dB (typical)
Measurement floor	-84 dBm (nominal)
Relative power accuracy:	
Fixed channel, fixed input attenuator	
Mixer level -52 to –12 dB*	±0.03 dB (nominal)

Occupied bandwidth

Minimum carrier power at RF input	-40 dBm (nominal)
Frequency resolution	100 Hz
Frequency accuracy	+0.3% (nominal)

Spurious emissions & ACP

Minimum carrier power at RF input	-20 dBm (nominal)
Dynamic range, relative:	
750 kHz offset (30 kHz RBW)	-84.7 dB (-86.4 dB typical)
1980 MHz region (1200 kHz RBW)	-80.7 dB (-83.0 dB typical)
Sensitivity, absolute:	
750 kHz offset (30 kHz RBW)	-97.9 dBm (-99.9 dBm typical)
1980 MHz region (1200 kHz RBW)	-81.9 dBm (-83.9 dBm typical)
Accuracy, relative:	
750 kHz offset	0.14 dB
1980 MHz region	0.56 dB

Code domain

Specification applies at 0 dBm input power	
For pilot, 2 MAC channels,	
and 16 channels of QPSK data	
Relative code domain power accuracy	±0.15 dB

* The relative accuracy is the ratio of the accuracy of amplitude measurements of two different transmitter power levels. Mixer level is defined as the input power minus the attenuation. This specification is equivalent to the difference between two points on the scale fidelity curve shown in the PSA Specifications Guide. Because the error sources of scale fidelity are almost all monotonic with input level, the relative error between two levels is nearly (within 0.01 dB) identical to the "error relative to -35 dBm" specified in the guide.

1xEV-DO measurement personality (continued)

QPSK EVM

Minimum power at RF input	-20 dBm (nominal)
EVM	
Range	0 to 15% (nominal)
Floor	1.5% (nominal)
Accuracy	±1.0% (nominal)
IQ origin offset	
Range	-10 to –50 dBc (nominal)
Frequency error	
Range	±5.0 kHz (nominal)
Accuracy	+/-10Hz (nominal) + (transmitter frequency x frequency reference accuracy)

Modulation accuracy (composite rho)

Specification applies at 0 dBm input power
For Pilot, 12 MAC channels, and 16 channels of QPSK data

Minimum carrier power at RF input	-50 dBm (nominal)
Composite EVM	
Range	0 to 25%
Floor	2.5% (nominal at –45 dBm input power, and ADC gain set to +18dB)
Accuracy	±1.0% (over the range of 5 to 25%)
rho	
Range	0.9 to 1.0
Floor	0.99938 (0.9994 nominal at -45 dBm input power and ADC gain set to +18 dB)
Accuracy	±0.0010 (at rho = 0.99751, EVM 5%) ±0.0044 (at rho = 0.94118, EVM 25%)
IQ origin offset	
Range	-10 to –50 dBc (nominal)
Frequency error	
Range	±600Hz
Accuracy	±1Hz + (transmitter frequency x frequency reference accuracy)

CCDF

Minimum carrier power at RF input	-40 dBm (nominal)
Histogram resolution	0.01 dB

Intermodulation distortion

Input signal must not be bursted	
Minimum carrier power at RF input	-30 dBm (nominal)
Third order intercept (TOI)	
CF = 1 GHz	TOI + 7.2 dB
CF = 2 GHz	TOI + 7.5 dB

Ordering information

PSA series spectrum analyzer

E4443A	3 Hz to 6.7 GHz
E4445A	3 Hz to 13.2 GHz
E4440A	3 Hz to 26.5 GHz
E4446A	3 Hz to 44 GHz
E4448A	3 Hz to 50 GHz

Options

To add options to a product, use the following ordering scheme:

Model	E444xA (x = 0, 3, 5, 6 or 8)
Example options	E4440A-B7J
	E4448A-1DS

Digital demodulation hardware

E444xA-B7J	Digital demodulation hardware (required for digital demodulation measurement personalities)

Digital demodulation measurements

E444xA-BAF	W-CDMA measurement personality
E444xA-202	GSM w/ EDGE measurement personality
E444xA-B78	cdma2000 measurement personality
E444xA-204	1xEV-DO measurement personality
E444xA-BAC	cdmaOne measurement personality
E444xA-BAE	NADC, PCD measurement personality

Phase noise measurement

E444xA-226	Phase noise measurement personality

Amplifiers

E444xA-1DS	100 kHz to 3 GHz built-in preamplifier

Inputs and outputs

E4440A-BAB	Replaces type "N" input connector with APC 3.5 connector

Connectivity software

E444xA-230	BenchLink Web Remote Control Software

Code compatibility

E444xA-266	HP 8566B/8568B code compatibility measurement personality

Accessories

E444xA-1CM	Rack mount kit
E444xA-1CN	Front handle kit
E444xA-1CP	Rack mount with handles
E444xA-1CR	Rack slide kit
E444xA-045	Millimeter wave accessory kit

Documentation

E444xA-0B1	Extra manual set including CD ROM

Calibration documentation

E444xA-UK6	Commercial calibration certificate with test data

Warranty and service

For warranty and service of 5 years, please order 60 months of R-51B (quantity = 60). Standard warranty is 36 months.

R-51B	Return-to-Agilent warranty and service plan

Calibration[1]

For 3 years, order 36 months of the appropriate calibration plan shown below. For 5 years, specify 60 months.

R-50C-001	Standard calibration
R-50C-002	Standards compliant calibration
E444xA-0BW	Service manual and calibration software

1. Options not available in all countries.

Product literature

PSA Series - The Next Generation, brochure
literature number 5980-1283E
PSA Series, data sheet
literature number 5980-1284E

Phase Noise Measurement Personality, product overview
literature number 5988-3698EN
W-CDMA Measurement Personality, product overview
literature number 5988-2388EN
GSM with EDGE Measurement Personality, product overview
literature number 5988-2389EN
cdma2000 Measurement Personality, product overview
literature number 5988-3694EN
1xEV-DO Measurement Personality, product overview
literature number 5988-4828EN
cdmaOne Measurement Personality, product overview
literature number 5988-3695EN
NADC/PDC Measurement Personality, product overview
literature number 5988-3697EN
PSA Series Spectrum Analyzers, Option H70, 70 MHz IF Output, product overview
literature number 5988-5261EN

Self-Guided Demonstration for Spectrum Analysis, product note
literature number 5988-0735EN
Self-Guided Demonstration for Phase Noise Measurements, product note
literature number 5988-3704EN
Self-Guided Demonstration for W-CDMA Measurements, product note
literature number 5988-3699EN
Self-Guided Demonstration for GSM and EDGE Measurements product note
literature number 5988-3700EN
Self-Guided Demonstration for cdma2000 Measurements product note
literature number 5988-3701EN
Self-Guided Demonstration for 1xEV-DO Measurements product note
literature number 5988–6208EN
Self-Guided Demonstration for cdmaOne Measurements product note
literature number 5988-3702EN
Self-Guided Demonstration for NADC and PDC Measurements product note
literature number 5988-3703EN

PSA Series Demonstration CD
literature number 5988-2390EN
Optimizing Dynamic Range for Distortion Measurements product note
literature number 5980-3079EN
PSA Series Amplitude Accuracy product note
literature number 5980-3080EN
PSA Series Swept and FFT Analysis product note
literature number 5980-3081EN
PSA Series Measurement Innovations and Benefits product note
literature number 5980-3082EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software, product note
literature number 5988-5015EN
Selecting the Right Signal Analyzer for Your Needs, selection guide
literature number 5968-3413E
8 Hints for Millimeter Wave Spectrum Measurements application note
literature number 5988–5680EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software, product note
literature number 5988-5015EN
89600 series + PSA, 802.11A and HiperLAN2 ODFM Measurements product note
literature number 5988-4094EN
N4256A Amplifier Distortion Test Set product overview
literature number 5988-2925EN
BenchLink Web Remote Control Softeware product overview
literature number 5988-2610EN
HP 8566B/68B Programming Code Compatibility for PSA and ESA-E Series Spectrum Analyzers product overview
literature number 5988-5808EN
IntuiLink Software, Data Sheet
Literature Number 5980-3115EN

For more information on the PSA series, please visit:

www.agilent.com/find/psa

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Get the latest information on the products and applications you select.

Agilent Technologies' Test and Measurement Support, Services, and Assistance
Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise
Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage
Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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(tel) 800 452 4844

Canada:
(tel) 877 894 4414
(fax) 905 282 6495

China:
(tel) 800 810 0189
(fax) 800 820 2816

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82 2) 2004 5004
(fax) (82 2) 2004 5115

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Taiwan:
(tel) 0800 047 866
(fax) 0800 286 331

Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6836 0252
Email: tm_asia@agilent.com

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