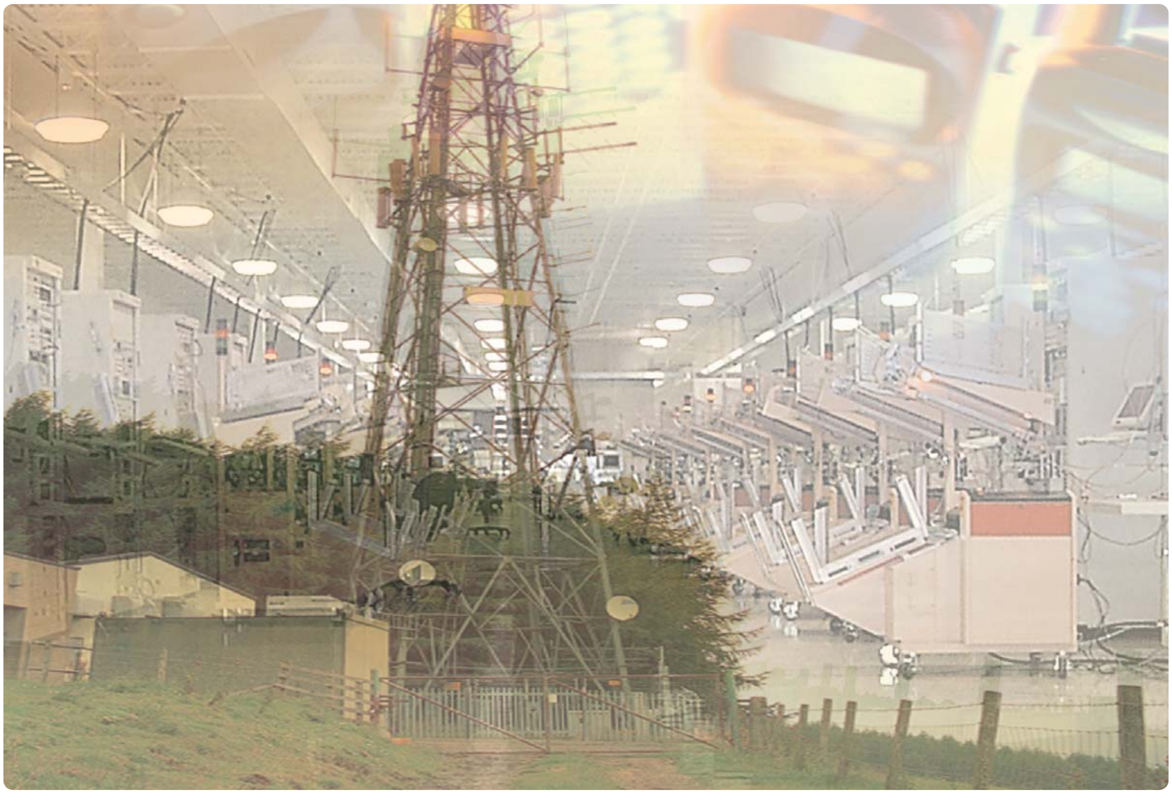
Agilent E4406A
Vector Signal Analyzer

Agilent Technologies

You develop the wireless future...



Fast and accurate measurements

To stay competitive, wireless equipment manufacturers need flexible test equipment capable of testing different formats with little change in set-up. The Agilent E4406A vector signal analyzer (VSA) is the perfect fit, offering the best combination of speed and accuracy for making one-button, standards-based measurements.

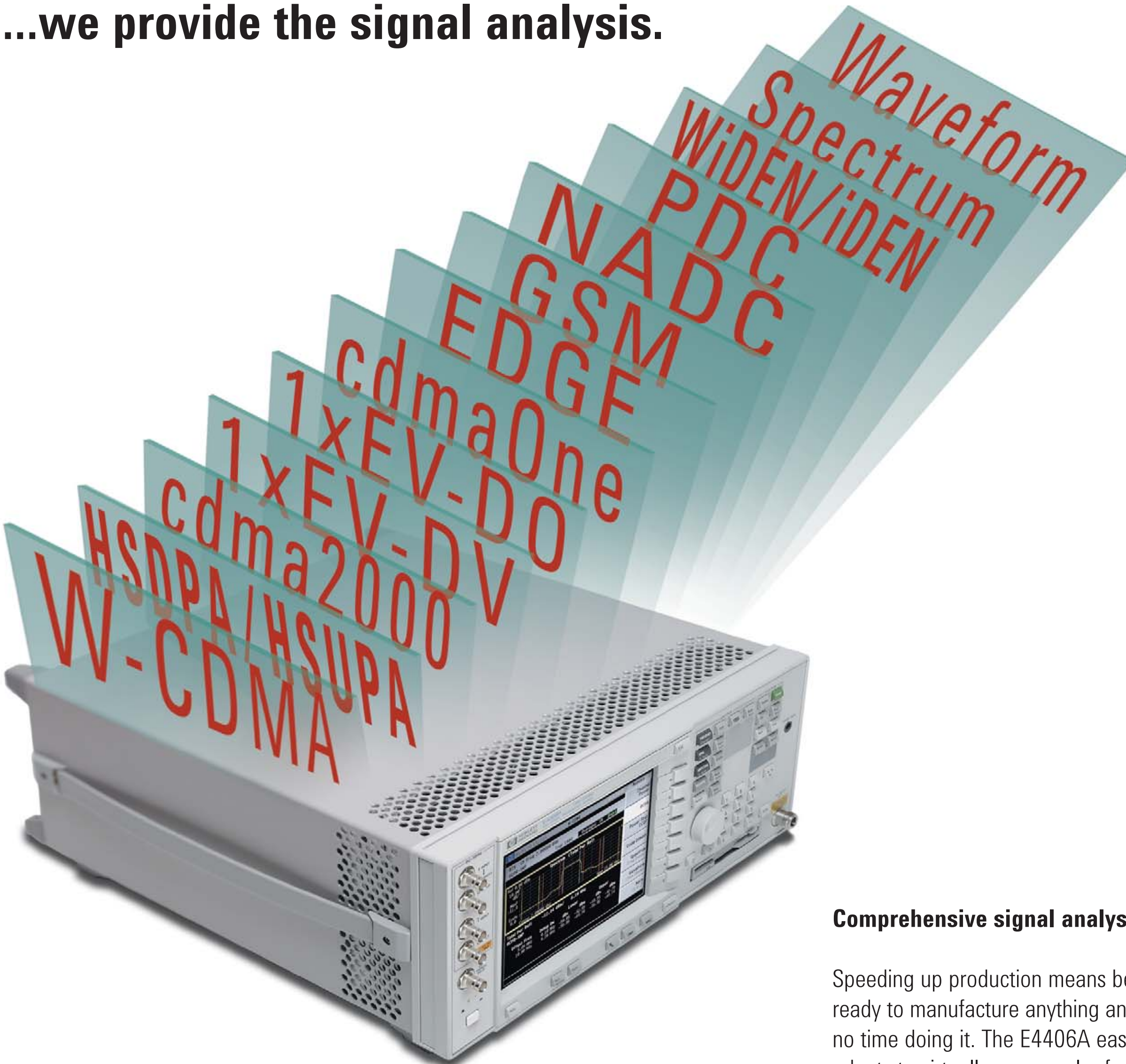
2.5G, 3G, and 3.5G formats

For engineers developing next-generation wireless components and systems, the E4406A provides W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, 1xEV-DO (Rev-0/A), and EDGE/GSM formats. Using one-button measurements, engineers can quickly verify conformance to these new formats. As the standards have evolved, we have continued to enhance existing measurement personalities, and add new ones. The modular architecture of the E4406A makes it simple for you to upgrade and be ready for the latest standards.

Accuracy

Speed

...we provide the signal analysis.



An investment for your future

The number of wireless technologies deployed around the world is growing and the demand for any particular format can change quickly. The E4406A offers format and frequency flexibility.

Easy to use

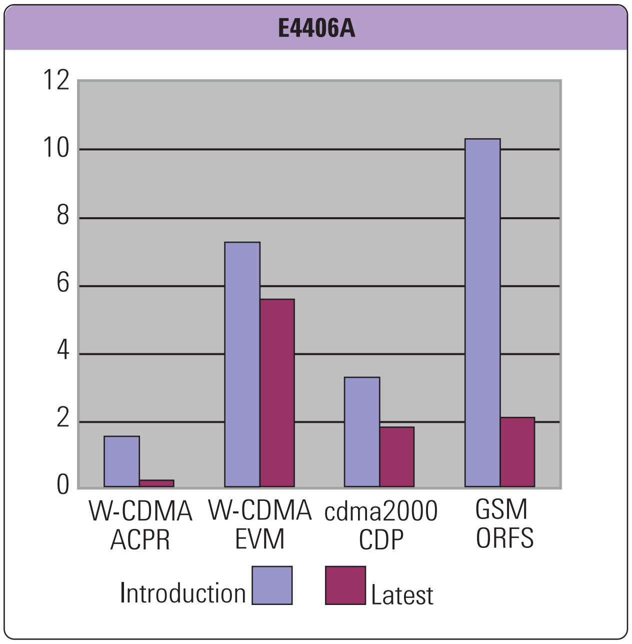
Multi-format

Comprehensive signal analysis

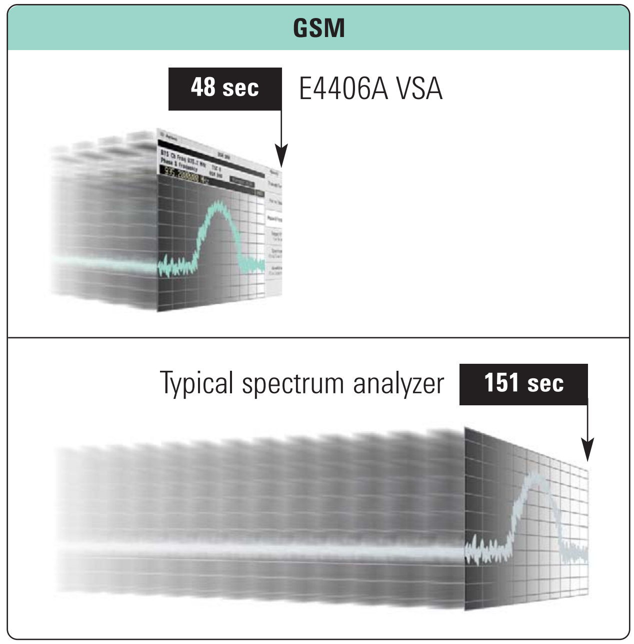
Speeding up production means being ready to manufacture anything and lose no time doing it. The E4406A easily adapts to virtually any popular format:

- W-CDMA
- HSDPA/HSUPA
- cdma2000
- 1xEV-DV
- 1xEV-DO
- cdmaOne
- EDGE
- GSM
- NADC
- PDC
- WiDEN/iDEN
- Spectrum
- Waveform

Built for speed...



Speed enhancements since introduction



Base station transceiver suite of tests

Fast standards-based measurements

As a wireless system or component manufacturer, you are under pressure to increase throughput while minimizing capital investments. Long test times can severely limit your manufacturing throughput, so we designed the E4406A.

Since its introduction, progressive enhancements to the E4406A ensure its performance keeps pace with the ever-increasing need for speed.

Today's E4406A is getting faster than ever. For example, the W-CDMA adjacent channel power ratio (ACPR) measurement is now nearly eight times faster than it used to be. The GSM output radio frequency spectrum (ORFS) is approximately five times faster. The capture length for W-CDMA EVM has increased from 1 to 15 slots, and the 15 slot EVM is 20% faster, as compared to the 1-slot speed when the E4406A was introduced. Other measurements have improved as well.

The E4406A transmitter power calibration uses time record data and built-in algorithms to provide complete transmitter level calibration with incredible speed – with all the accuracy you expect from the affordably-priced E4406A.

In addition to high-speed throughput and accuracy in the manufacturing environment, the E4406A is designed to allow research and development engineers to quickly obtain results with minimal keystrokes.

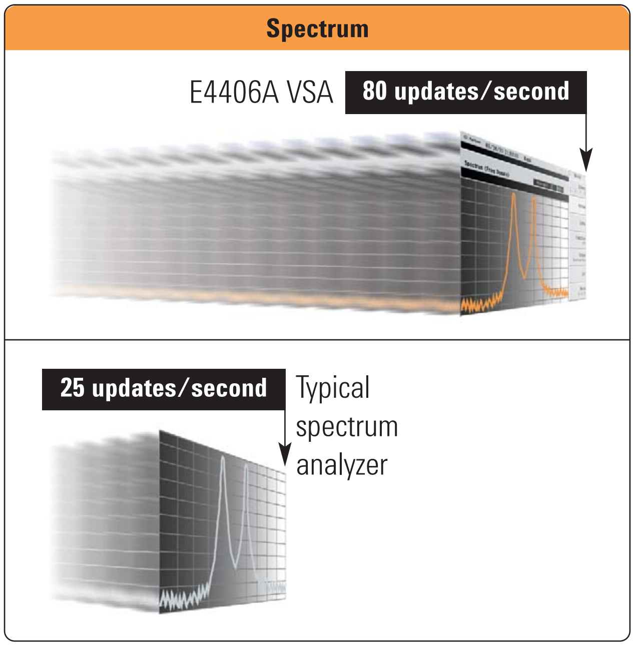
The E4406A delivers a logical user interface and a wealth of quick "one button" measurments, enabling designers to quickly try multiple tests without getting bogged down in crypitic menus. The E4406A interface provides the edge needed to expediently evaluate new designs and successfully meet the demands of today's competitive environment.

Now even faster

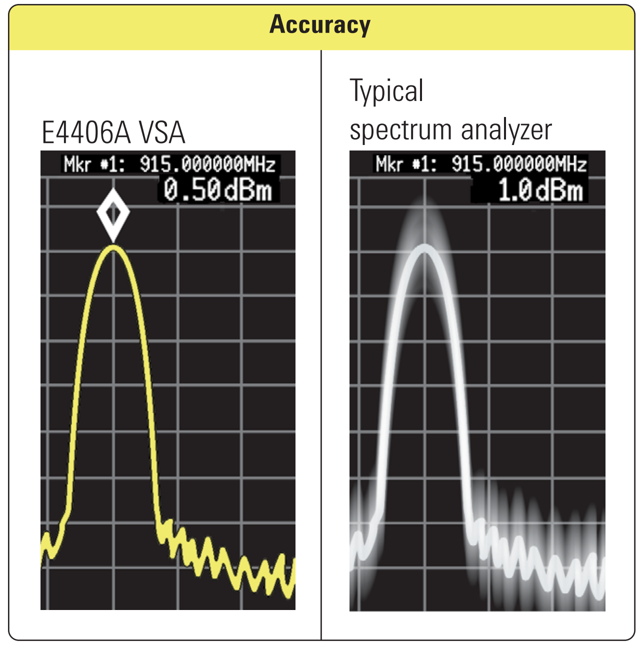
"We have decreased the (transmitter power calibration) test time by 25%."

–Test Systems Designer

...without giving up accuracy.



Narrow span spectrum measurement over GPIB



Absolute level accuracy

Fast spectrum measurements

The E4406A features pre-configured, one-button measurements for many cellular standards and can also be used for narrowband spectrum measurements. Manufacturers can expect to make intermodulation distortion and other amplitude measurements up to three times faster using the E4406A.

Accuracy

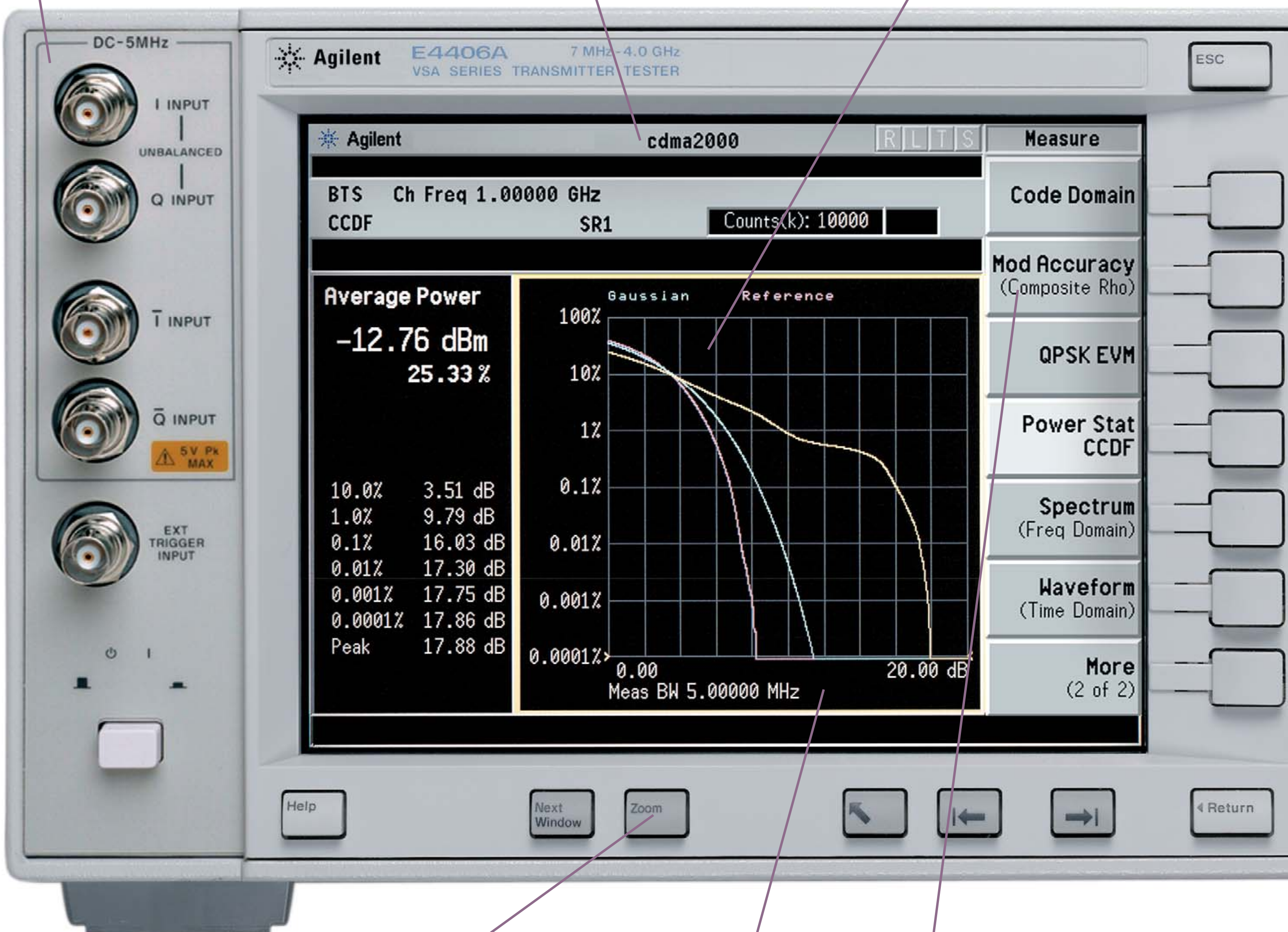
You don't need to reduce measurement speed to get accurate results. Superior absolute level accuracy of ±0.6 dB (±0.4 dB typical) provides unmatched performance and minimizes test uncertainty. Combined with a linearity of ±0.25 dB over a 76 dB range, the E4406A is a state-of-the-art measurement tool.

The E4406A VSA...

Baseband measurements with balanced/unbalanced multiple impedance inputs

Focused applications including EDGE, GSM, W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, 1xEV-DO, cdmaOne, NADC, and PDC, as well as narrow-span spectrum and waveform analysis

Large, high-resolution, color display makes viewing multiple traces easy



Zoom feature allows users to display selected measurement windows

One-button, standards-based measurements

Automatic alignment ensures accurate measurement results

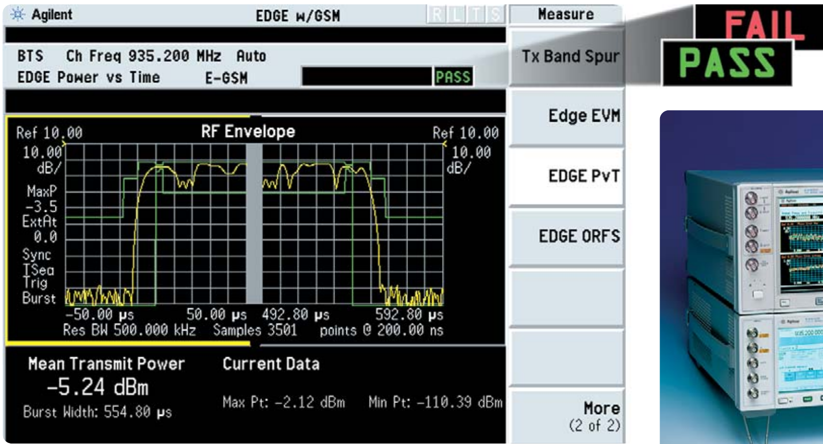
...comprehensive signal analysis.

Intuitive key strokes

High-speed 10baseT LAN, parallel, and GPIB ports provide speed and flexibility when communicating with the outside world

Built-in floppy disk drive provides PC compatibility and data archiving

Designed for manufacturing...



Transmitter and receiver testing

In combination with the Agilent E4438C ESG vector signal generator, the E4406A offers base station receiver and transmitter testing for major 2G, 2.5G, 3G, and 3.5G wireless formats. The E4406A combined with an E4438C is a test solution that provides the required flexibility, without compromising accuracy, for maximum throughput in base station production with the ability to migrate to new formats.

Standards compliance

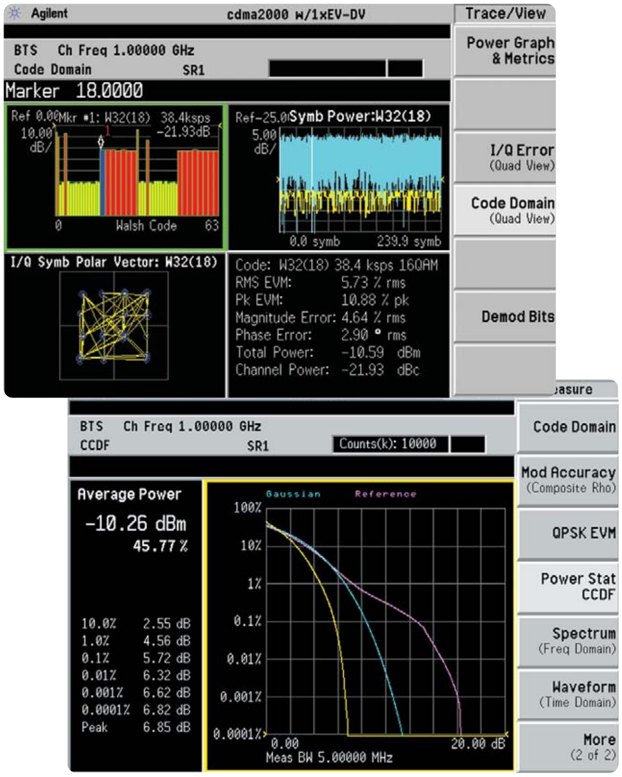
In manufacturing, you need straightforward pass/fail verification of critical specifications. With built-in test limits you don't have to keep track of every standard. The E4406A performs tests to the requirements of current industry standards with free, easy-to-install, firmware updates.

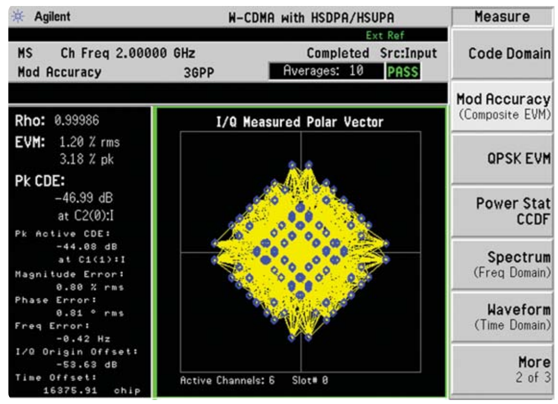
Speed and throughput

In the world of high-speed manufacturing every millisecond counts. Identify your throughput restrictions and if measurement speed is creating a bottleneck, consider the significant speed advantage of the E4406A.

Manufacturing

...and product development.





Verify next-generation designs

For R&D engineers developing next-generation wireless components and systems, the E4406A is a low-cost tool that quickly verifies conformance. Your investment is secure because the E4406A has a modular architecture – making it easy to upgrade to the latest standards.

Characterize using leading test methods

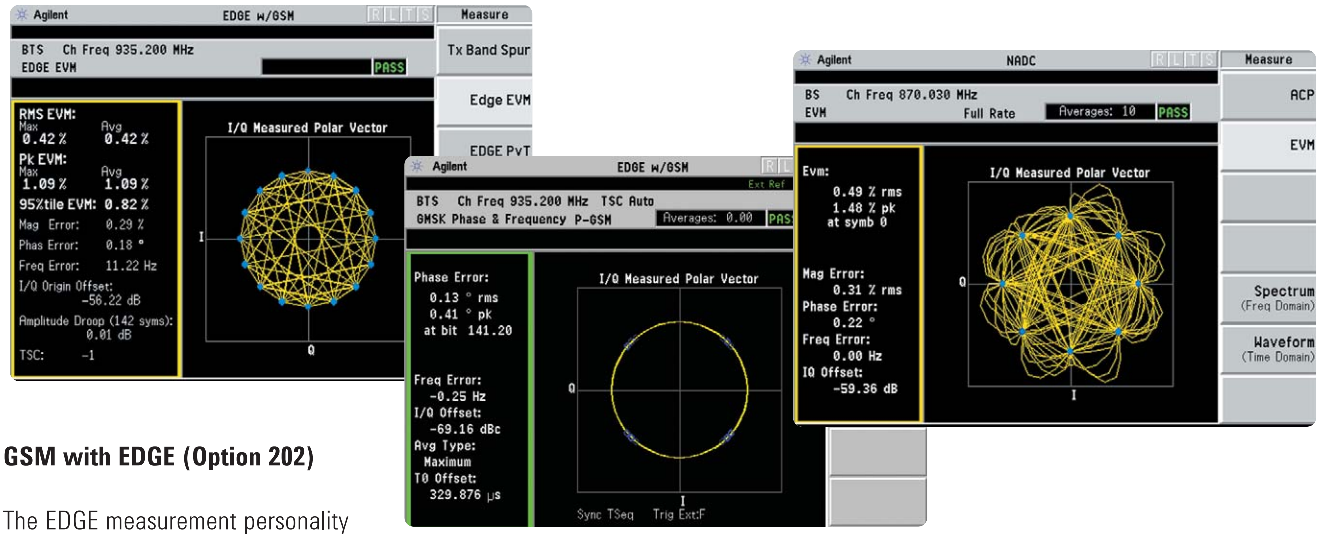
Digital modulation presents new challenges to amplifier manufacturers. Designers need effective methods to quickly characterize digital signals. The E4406A's complementary cumulative-distribution function (CCDF) is useful for determining a signal's power statistics, revealing the power peaks relative to the average power for assessing linearity requirements.

Flexible power measurements

Multicarrier power amplifier (MCPA) designers are faced with new measurement challenges. Designers must characterize intermodulation distortion at many frequency offsets and evaluate the effects of different modulation formats over a wide dynamic range. The E4406A features a fully-configurable ACP measurement that can test up to five frequency offsets and be optimized for dynamic range or speed.

Development

TDMA measurement personalities...



GSM with EDGE (Option 202)

The EDGE measurement personality performs the latest standards-based measurements, for both BTS and MS, including:

- Error vector magnitude (EVM)
- Multi-slot power versus time (PvT)
- Output RF spectrum (ORFS)
- Trigger to T0 offset in PFER
- IQ offset
- Channel plans for 400, 800, 900, 1800, 1900 MHz
- GSM measurements from Option BAH

The EVM measurement features a unique algorithm to simultaneously display the EVM numerical results and the EDGE constellation diagram using the industry-specified measurement filter.

GSM (Option BAH)

The GSM measurement personality lets you quickly perform measurements to the latest ETSI standards with:

- Mean transmitter carrier power
- Multi-slot PvT
- ORFS
- Phase and frequency error (PFER)
- IQ offset
- Transmitter band spurious
- Channel plans for 400, 700, 800, 900, 1800, 1900 MHz

The personality features easy channel and timeslot selections, configurable PvT masks, and a typical ORFS dynamic range of 90 dB.

NADC and PDC (Option BAE)

Both the North American Digital Cellular (NADC) and Personal Digital Cellular (PDC) measurement personalities are included in this option. The NADC measurements are structured according to the IS-136 TDMA standard. Measurements included in this option are:

- ACP
- EVM
- Occupied bandwidth (for PDC)

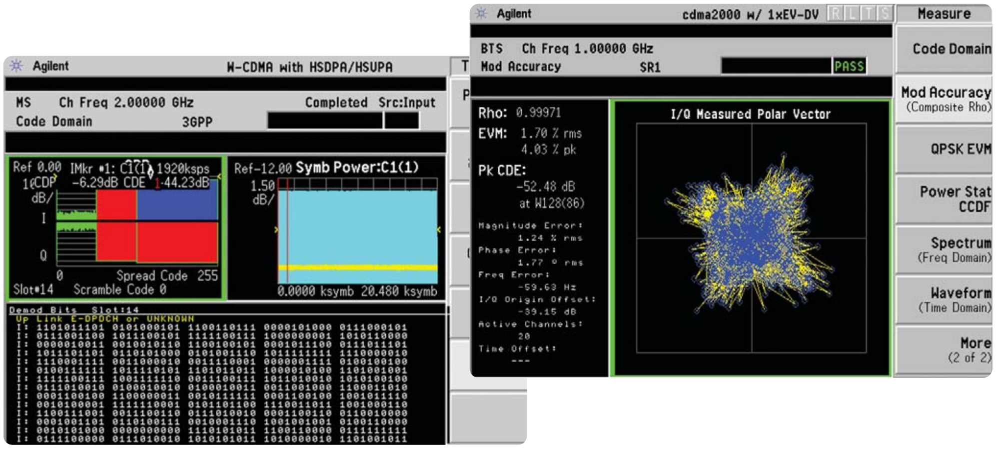
The personalities feature base station and mobile radio mode set-ups, as well as sync word search capability.

WiDEN/iDEN (Option HN1)

The WiDEN/iDEN measurement personality performs measurements to the Motorola WiDEN/iDEN specialized mobile radio format.

- Occupied bandwidth (OBW)
- ACPR
- Transmitter bit error rate (BER)
- Power vs. time (PvT)

... and CDMA measurement personalities.



W-CDMA (Option BAF)

The complexity of W-CDMA demands the flexibility and depth of demodulation capability provided by this personality. Perform the following measurements on the HPSK uplink or downlink QPSK signals:

- Code domain
- QPSK EVM
- Modulation accuracy (composite rho and EVM)
- Channel power
- Adjacent channel power leakage ratio (ACLR)
- Power control
- PvT
- Intermodulation distortion
- Multicarrier power
- Spectrum emission mask
- OBW
- CCDF

This personality has the ability to automatically determine active channels, to synchronize with any W-CDMA channel, to display code domain power in a multi-rate view, and to demodulate down to the symbol level. Variable capture intervals and pre-defined test models enable the user to perform fast, accurate measurements for manufacturing or in-depth analysis for R&D.

HSDPA/HSUPA (Option 210)

Option 210 adds the following capabilities to W-CDMA Option BAF for HSDPA and HSUPA signal analysis for both downlink and uplink.

- Code domain analysis
  - Pre-defined test model 5
  - HS-PDSCH 16QAM/QPSK auto detection
  - Demodulation bits in binary/ hexadecimal format
  - Adaptive modulation and coding support
  - HS-DPCCH power β
  - E-DPCCH/E-DPDCH power β
  - E-DPCCH in SF2 auto detection
- Modulation accuracy
  - Composite EVM for HSDPA/HSUPA signals

cdma2000 (Option B78)

The cdma2000 measurement personality offers the logical upgrade path from IS-95 to IS-2000 testing. Measurements support the forward and reverse links.

- Code domain
- QPSK EVM
- Modulation accuracy (composite rho and EVM)
- Channel power
- ACPR
- Intermodulation distortion
- Spectrum emission mask
- OBW
- CCDF

Advanced code domain analysis algorithms display Walsh codes for either Hadamard or OVSF coding schemes in a multi-rate view. Other capability includes code domain error, symbol EVM, symbol power versus time, active channel identification, variable PN offset, quasi-orthogonal functions and demodulated symbol bit displays after de-spreading.

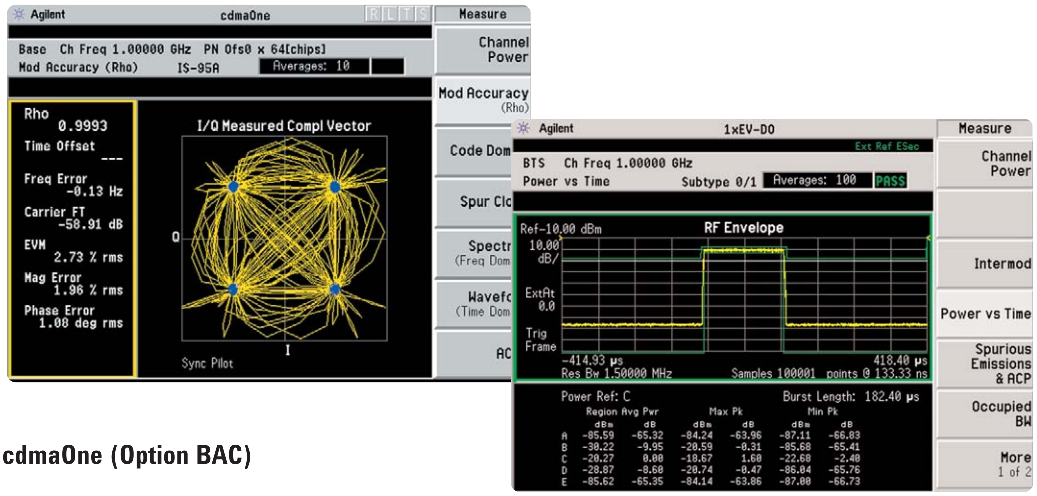
1xEV-DV (Option 214)

This option provides modulation analysis functionalities for 1xEV-DV to cdma2000 Option B78.

- Code domain analysis
  - Auto-detection of modulation scheme 16QAM/8PSK/QPSK
  - Manual assigning of modulation scheme for adaptive modulated signal
  - Demodulated bits in binary/ hexadecimal format
- Modulation accuracy
  - EVM and Rho measurements for 1xEV-DV signals

3G 3.5

Expanding measurement potential...



cdmaOne (Option BAC)

Built on Agilent's pioneering efforts in CDMA measurement techniques, this personality provides quick and easy measurement set-ups for the TIA/EIA-95, J-STD-008, IS-97D, and IS-98D band classes:

- Modulation accuracy (rho)
- Code domain
- Channel power
- ACPR
- Close-in spurious

2.5G

1xEV-DO (Option 204)

With digital demodulation analysis, the 1xEV-DO measurement personality provides the most comprehensive, easy-to-use, 1xEV-DO measurement solution available in an analyzer. This personality, which performs measurements for both forward link and reverse link signals, provides key transmitter measurements for analyzing systems based on 3GPP2 1xEV-DO Revision-0 and Revision-A

Forward link
- Channel power
- Power versus time mask
- Spurious emissions and ACP
- Intermodulation distortion
- OBW
- Code domain
- Modulation accuracy (waveform quality)
- QPSK EVM
- Power statistics (CCDF)

Reverse link
- Code domain
- Modulation accuracy (waveform quality)

For forward link, the PvT mask and spurious emissions/ACP measurements support both the idle slot (burst signal) and active slot (full power signal). With the auto-burst search function, you can see the standard-based time mask for the 1xEV-DO idle slot in PvT. Code domain, modulation accuracy, and QPSK EVM can also measure Pilot, MAC, Preamble, and Data in QPSK/8PSK/16QAM modulation. Designed with flexibility in mind, this personality supports the unique 1xEV-DO forward link signals' feature of time divisions multiplex (TDM). For reverse link, code domain, and modulation accuracy provide powerful modulation analysis functions for transmitter tests.

3G

...tailored to user requirements.

IQ inputs (Option B7C)

Capitalize on the E4406A's demodulation capabilities by extending the measurement range to baseband. The baseband IQ input option enables engineers to measure the complete signal path of a receiver or transmitter and directly compare signals both before and after frequency conversion and IQ (de)modulation.

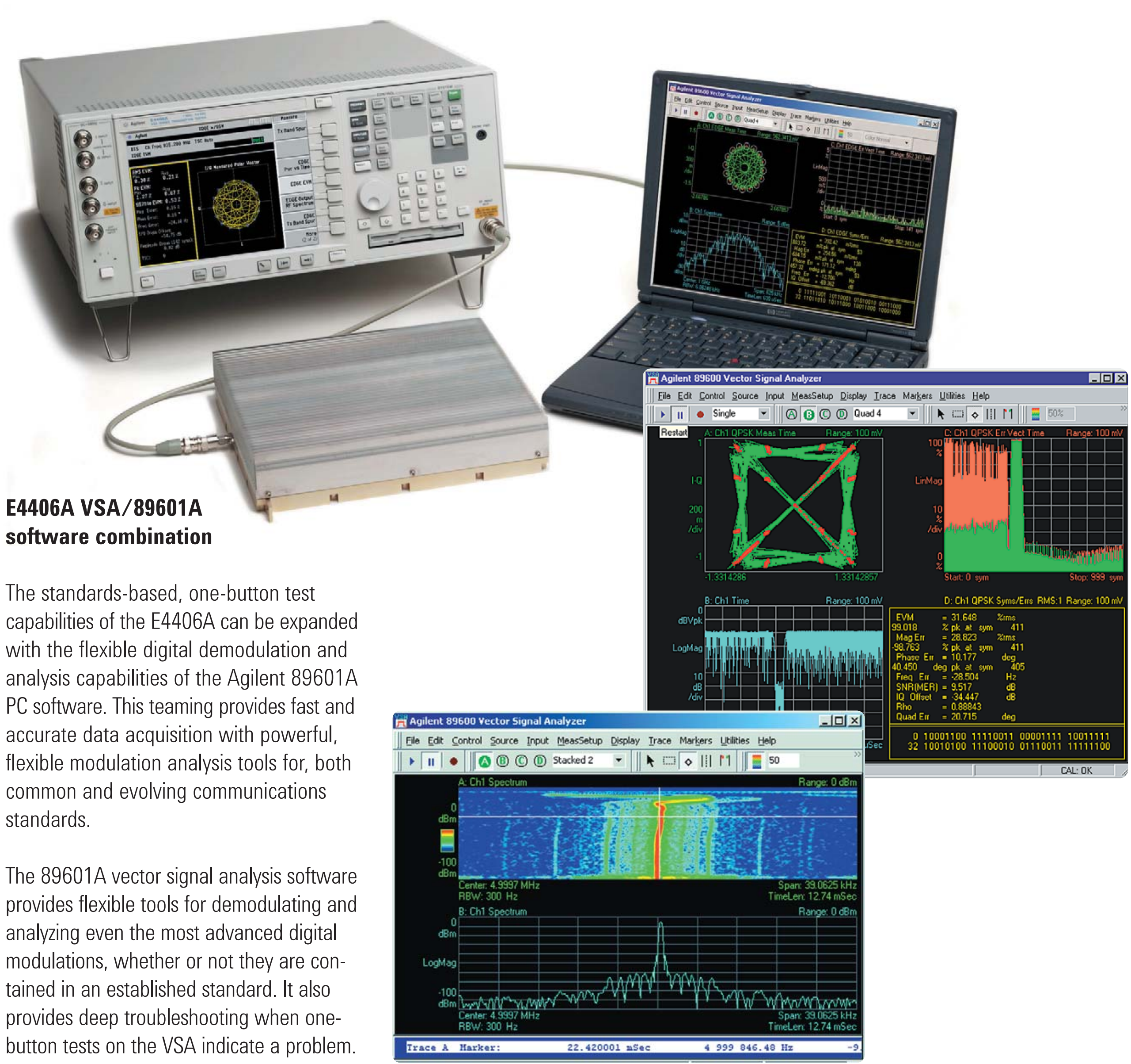
Ideally suited for R&D engineers and manufacturing environments, this option allows measurement of baseband I and Q signals in either balanced or unbalanced systems. Input configurations include 50-ohm unbalanced, 600-ohm balanced, and 1 M-ohm balanced or unbalanced – enabling a variety of systems to be directly tested without cumbersome and error-inducing conversion networks.

Applicable in-band 3GPP W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, EDGE/GSM, and Basic mode measurements are supported via RF and IQ inputs, enabling engineers to track down signal degradation both before and after RF/IF conversion.

Additional features include auto calibration of input signals, variable dc offsets and a dc to 5-MHz input frequency range (10 MHz in I + jQ mode).

The data captured via baseband IQ inputs can be easily transfered to 89601A PC software for in-depth analysis.

Coupling speed and power...



E4406A VSA/89601A software combination

The standards-based, one-button test capabilities of the E4406A can be expanded with the flexible digital demodulation and analysis capabilities of the Agilent 89601A PC software. This teaming provides fast and accurate data acquisition with powerful, flexible modulation analysis tools for, both common and evolving communications standards.

The 89601A vector signal analysis software provides flexible tools for demodulating and analyzing even the most advanced digital modulations, whether or not they are contained in an established standard. It also provides deep troubleshooting when one-button tests on the VSA indicate a problem.

Features include variable block size signal acquisition with user-selectable pulse search and synch words, and a user-controllable adaptive equalizer. The software allows you to use variable center frequency, symbol rate, filtering typing and alpha/BT. Supported modulation formats for both continuous and burst carriers include multi-level FSK, BPSK, QPSK, DQPSK, pi/4 DQPSK, 8PSK, multi-level QAM, multi-level VSB or DVBQAM, APSK 16/32, EDGE, and MSK. Most 3G standard formats are also supported, as are ZigBee, TETRA, and more.

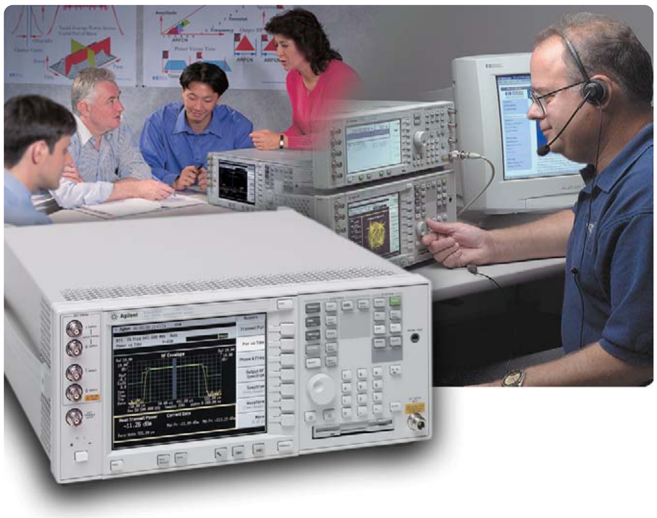
The software also provides signal capture and analysis features, such as the capability to download signal capture files for playback through signal generators, and display high-speed spectrograms.

The 89601A software runs on a PC connected to the E4406A, via LAN or GPIB, and provides hardware control and results displays along with modulation analysis.

...with Agilent's tradition of excellence.

Service and support

The speed and accuracy of the E4406A VSA is only a small part of what you get from Agilent. We strive to provide complete solutions that go beyond our customers' expectations. Only Agilent offers the depth and breadth of enhancements, software, services, connectivity, accessibility, and support to help you reach your measurement objectives. **For more information on the E4406A VSA, including product and application literature, visit our Web site at www.agilent.com/find/vsa**



www. agilent.com/ find/vsa

Pre-sales service
- rentals, leasing, and financing
- application engineering services

Post-sales service
- standard 1-year global warranty
- Worldwide Call Center and Service Center support network
- one-year calibration intervals
- firmware upgrades downloadable from the Web

PC connectivity
- 10 baseT LAN port
- floppy disk drive
- GPIB interface

Peripheral and product interfaces
- baseband IQ inputs
- parallel printer port
- printer support
- VGA monitor output
- Agilent 89601A vector signal analysis software

Training and access to information
- on-site user training
- factory service training
- Web-based support of frequently asked questions: www.agilent.com/find/vsa
- manuals on CD-ROM and on the Web

Software
- SCPI (Standard Commands for Programmable Instruments)
- PC-based performance verification and adjustment software
- IVI COM driver

Ordering information

E4406A vector signal analyzer

Model	Description
E4406A	7 MHz to 4 GHz vector signal analyzer

Option	Description
Digital Demodulation Measurements	
E4406A-202	EDGE with GSM measurement personality
E4406A-204	1xEV-DO measurement personality
E4406A-B78	cdma2000 measurement personality
E4406A-214	1xEV-DV measurement personality[1]
E4406A-BAC	cdmaOne measurement personality
E4406A-BAE	NADC, PDC measurement personality
E4406A-BAF	W-CDMA measurement personality
E4406A-210	HSDPA/HSUPA measurement personality[2]
E4406A-BAH	GSM measurement personality
E4406A-HN1	WiDEN/iDEN measurement personality
Inputs and outputs	
E4406A-300	321.4 MHz IF output
E4406A-B7C	Baseband I/Q inputs
Calibration documentation	
E4406A-UK6	Commercial calibration certificate with test data
Accessories	
E4406A-1CM	Rack mount kit
E4406A-1CN	Handle kit
E4406A-1CP	Rack mount and handle kit
E4406A-1CR	Rack slide kit

1. Requires Option B78.
2. Requires Option BAF.
3. Includes English manual set.

Documentation	
E4406A-ABA	U.S. - English localization
E4406A-AB0[3]	Taiwan - Chinese localization
E4406A-AB1[3]	Korea - Korean localization
E4406A-AB2[3]	China - Chinese localization
E4406A-ABD[3]	German localization
E4406A-ABF[3]	France - French localization
E4406A-ABJ[3]	Japan - Japanese localization
E4406A-0B0[3]	Delete manual set
Additional documentation	
E4406A-OB1	English manual set
E4406A-OBV	Service documentation, component level
E4406A-OBW	Service documentation, assembly level
Warranty and service	
R-51B	Return-to-Agilent warranty and service plan (For warranty and service of 5 years, please order 60 months of R-51B [quantity = 60]. Standard warranty is 12 months.)
Calibration	
R-50C-001	Standard calibration (For 3 years, order 36 months of the appropriate calibration plan shown below. For 5 years, specify 60 months.)
R-50C-002	Standards compliant calibration (For 3 years, order 36 months of the appropriate calibration plan shown below. For 5 years, specify 60 months)

PC software

Model	Description
89601A	Vector signal analysis software

Agilent T&M Software and Connectivity
Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections. Visit
www.agilent.com/find/connectivity
for more information.

Agilent IO Library Suite
Agilent's IO libraries suite ships with the E4406A to help you quickly establish an error-free connection between your PC and instruments - regardless of the vendor. It provides robust instrument control and works with the software development environment you choose. For additional description of Agilent's IO libraries suite features and installation requirements, please go to
www.agilent.com/find/iosuite/data - sheet

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. 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 receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

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 onsite 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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Printed in USA, April 30, 2006
5968-7618E

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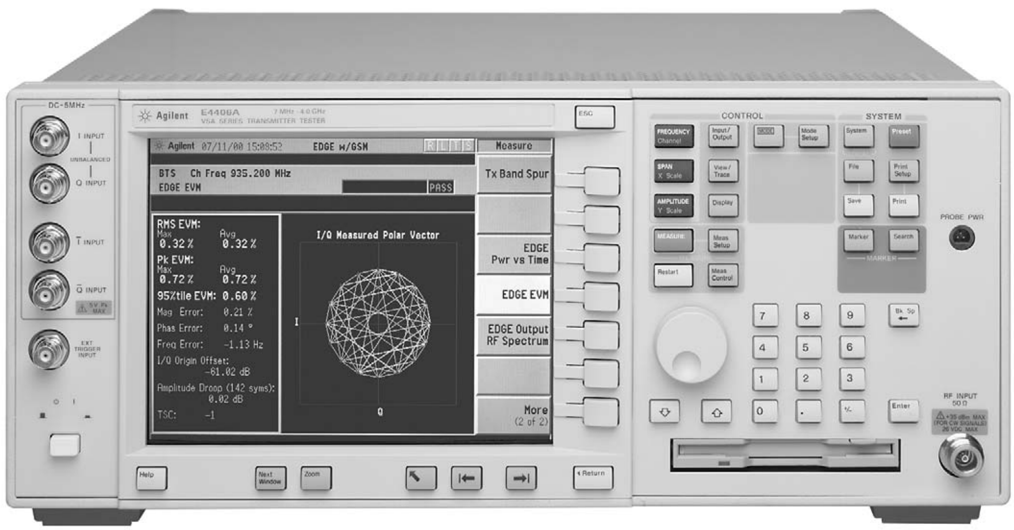
Agilent E4406A Vector Signal Analyzer

Data Sheet



The Agilent Technologies E4406A vector signal analyzer (VSA) is a full-featured transmitter tester designed to meet the test needs of wireless equipment developers and manufacturers. For wireless base station, mobile transmitters and their components, the easy-to-use E4406A provides the best combination of speed and accuracy for a wide range of digital modulation analysis capability. And, with multiformat capability (W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, 1xEV-DO, cdmaOne, EDGE, GSM, NADC, and PDC) the E4406A is the ideal, flexible choice for your production line.

Easily configure one-button measurements with the simple, straight-forward menu structure and view them on the large, high-resolution color display. With built-in, standards-compliant tests and state-of-the-art digital IF technology, engineers can be confident that test results are accurate. And, when combined with the Agilent ESG series of digital RF signal generators, the E4406A VSA provides a powerful, transmit-receive test solution for wireless-equipment manufacturers.

Frequency

Frequency range

RF input	7 to 314 MHz and 329 MHz to 4 GHz
Baseband IQ inputs	0 Hz to 5 MHz

Frequency spans

Baseband IQ inputs	5 Hz to 5 MHz (Baseband I or Q inputs)
	10 Hz to 10 MHz (Composite I/Q)

Frequency setting resolution

1 Hz

Frequency reference

Accuracy	±[(time since last adjustment x aging rate) + temperature stability + calibration accuracy]
Initial calibration accuracy	±5 x 10^{-8}
Settability	±2 x 10^{-9}
Aging rate	
During any 24 hrs following 24-hr warm-up	±5 x 10^{-10} (nominal)
Per year	±1 x 10^{-7} (nominal)
Temperature stability	±5 x 10^{-8} variation from frequency at +25 °C over the temperature range of 0 to +55 °C
Warm-up time	1 hour (nominal)

Residual responses

RF input

50 Ω input terminated, 0 dB input attenuation, +18 dB ADC gain

20 MHz to 2 GHz	≤ –85 dBm
2 to 4 GHz	≤ –80 dBm

Baseband IQ inputs

50 Ω input terminated

0 to 5 MHz	≤ –90 dBm (typical)[2]

Noise Sidebands (RF Input)

673.6 MHz

Offset	Specifications	Supplemental
100 Hz	≤ –85 dBc/Hz	
1 kHz	≤ –92 dBc/Hz	
10 kHz	≤ –102 dBc/Hz	
100 kHz	≤ –131 dBc/Hz	
600 kHz	≤ –138 dBc/Hz	
1.2 MHz	≤ –141 dBc/Hz	
6.0 MHz	≤ –145 dBc/Hz	
10.0 MHz	≤ –145 dBc/Hz	

960 MHz

Offset	Specifications	Supplemental
100 Hz	≤ –81 dBc/Hz	
1 kHz	≤ –87 dBc/Hz	
10 kHz	≤ –96 dBc/Hz	
100 kHz	≤ –125 dBc/Hz	
600 kHz	≤ –136 dBc/Hz	
1.2 MHz	≤ –140 dBc/Hz	
6.0 MHz	≤ –146 dBc/Hz	
10.0 MHz	≤ –146 dBc/Hz	

1990 MHz

Offset	Specifications	Supplemental
100 Hz	≤ –75 dBc/Hz	
1 kHz	≤ –82 dBc/Hz	
10 kHz	≤ –86 dBc/Hz	
100 kHz	≤ –118 dBc/Hz	
600 kHz	≤ –132 dBc/Hz	
1.2 MHz	≤ –137 dBc/Hz	
6.0 MHz	≤ –141 dBc/Hz	
10.0 MHz	≤ –141 dBc/Hz	

Noise Sidebands[1] (Baseband IQ Inputs)

0 to 5 MHz

Offset	Specifications	Supplemental
1 kHz		≤ –120 dBc/Hz (typical)[2]
10 kHz		≤ –133 dBc/Hz (typical)[2]
100 kHz		≤ –134 dBc/Hz (typical)[2]
1.0 MHz		≤ –135 dBc/Hz (nominal)
5.0 MHz		≤ –135 dBc/Hz (nominal)

1. No DC offset applied
2. 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.

Amplitude

The following amplitude specifications apply for all measurements unless otherwise noted within the measurement specification.

RF input

Maximum measurement power	+30 dBm (1W)
Maximum safe DC voltage	±26 Vdc
Maximum safe input power	+35 dBm (3.16W)

Baseband IQ inputs

Input ranges 50 Ω input impedance	–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm
Input ranges 600 Ω, 1 M Ω input impedance	–18 to 0 dBV in four ranges of 6 dB steps: –18 dBV, –12 dBV, –6 dBV, 0 dBV
Maximum safe voltage	±5 V (DC + AC)

Input attenuator

RF input

Range	0 to +40 dB
Step size	1 dB steps
Accuracy at 50 MHz	±0.3 dB relative to 10 dB attenuation

First LO emission from RF input

$f_{emission}$ = center frequency ±321.4 MHz	≤ (–23 dBm – input attenuation) (nominal)

Third-order intermodulation distortion (RF input)

Input power ≤ +27 dBm, Pre-ADC Filter ON

	Distortion	TOI
Tone separation ≥ 5 MHz, 50 MHz to 4 GHz	< –56 dBc	+18 dBm (+23 dBm, typical)
Tone separation ≥ 50 kHz, 30 MHz to 4 GHz	< –54 dBc	+17 dBm (+21 dBm, typical)

3. 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.

Absolute power measurement accuracy

RF input

+18 to +30 °C

0 to 40 dB input attenuation (–2 to –28 dBm) + attenuation	
810 to 960 MHz	±0.60 dB (±0.4 dB, typical)
1710 to 2205 MHz	±0.60 dB (±0.4 dB, typical)
1428 to 1503 MHz	±0.60 dB (±0.5 dB, typical)
10 dB input attenuation +8 to –18 dBm	
400 to 2205 MHz	±0.75 dB
0 to 20 dB input attenuation (–2 to –28 dBm) + attenuation	
7 to 1000 MHz	±1.0 dB
1000 to 2205 MHz	±1.3 dB
2205 to 4000 MHz	±1.8 dB

Baseband IQ inputs

Input impedance = 50 Ω, all ranges	±0.6 dB (typical)[3]
Input impedance = 600 Ω, all ranges	
0 Hz to 1 MHz	±0.6 dB (typical)[3]
1 to 5 MHz	±2.0 dB (typical)[3]
Input impedance = 1 MΩ, all ranges	
Unbalanced	±0.7 dB (nominal)
Balanced	
0 to 1 MHz	±0.6 dB (nominal)
1 to 5 MHz	±2.0 dB (nominal)

Amplitude accuracy

RF input

(Relative to –2 dBm at the input mixer)

No averaging	
–2 to –78 dBm	±0.25 dB (±0.15 dB, typical)
–78 to –88 dBm	±0.70 dB (±0.40 dB, typical)
–88 to –98 dBm	±1.20 dB (±0.80 dB, typical)
With 10 averages	
–78 to –88 dBm	±0.25 dB (nominal)
–88 to –98 dBm	±0.35 dB (nominal)

(Relative to –12 dBm at the input mixer)

–12 to –62 dBm	±0.15 dB (±0.10 dB, typical)

Amplitude linearity

Baseband IQ inputs

0 to –35 dB below range	±0.17 dB (typical)[4]
–35 to –55 dB below range	±1.0 dB (typical)[4]

Displayed average noise level

RF input

Input terminated in 50 Ω, 0 dB attenuation, 1 kHz RBW, 10 kHz span, +18 dB ADC gain

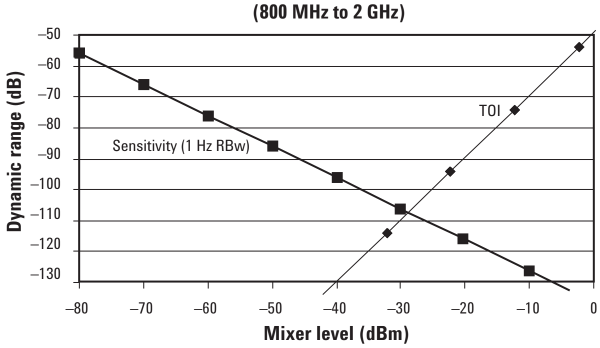
7 to 20 MHz	–103 dBm (–111 dBm, typical)
20 to 2000 MHz	–106 dBm (–111 dBm, typical)
2000 to 2700 MHz	–103 dBm (–108 dBm, typical)
2700 to 4000 MHz	–98 dBm (–104 dBm, typical)

Baseband IQ inputs

Input terminated in 50 Ω, 1 kHz RBW, 1 kHz to 5 MHz

+13 dBm range	–100 dBm, (typical)
+7 dBm range	–105 dBm, (typical)
+1 dBm range	–108 dBm, (typical)
–5 dBm range	–110 dBm, (typical)

Nominal dynamic range (800 MHz to 2 GHz)



DC offset

Baseband IQ inputs

After auto-zero	–55 dB below range, (typical)[4]
Compensation for customer DC offset	≤ ±2.0 Vdc (typical)[4]
Offset accuracy	±2.0% of range (nominal)

Channel match

Baseband IQ inputs

Amplitude match 0 to 5.0 MHz	±0.25 dB (typical)[4]
Phase match 0 to 5.0 MHz	±2.0 degrees (typical)[4]

Crosstalk

Baseband IQ inputs

Input impedance = 50 Ω	< –60 dB (typical)[4]
Input impedance = 600 Ω	< –52 dB (typical)[4]

Common mode rejection

Baseband IQ inputs

600 Ω balanced inputs

0 to 0.5 MHz	< –50 dB (typical)[4]
> 0.5 to 5.0 MHz	< –35 dB (typical)[4]

Measurements

Waveform measurement

Range at RF input	
Maximum	+30 dBm (1 W)
Minimum	Displayed average noise level
Range at IQ input	
Maximum (50 Ω input)	+13 dBm (20 mW)
Maximum (600 Ω, 1 MΩ input)	1 V
Minimum	Displayed average noise level
Sweep time range	
RBW < 7.5 MHz	10 μs to 200 ms
RBW < 1 MHz	10 μs to 400 ms
RBW < 100 kHz	10 μs to 2 s
RBW < 10 kHz	10 μs to 20 s
Time record length	2 to > 900,000 points (nominal)
Resolution bandwidth 1, 1.5, 2, 3, 5, 7.5, 10 sequence, or arbitrary bandwidth (user-definable)	
Gaussian filter	10 Hz to 8 MHz
Flat filter	10 Hz to 10 MHz
Averaging	
Average number	1 to 10,000
Average mode	Exponential, repeat
Average type	Power average (RMS), log-power average (video), maximum, minimum
Displays	
RF input	Signal envelope, I/Q waveform, I/Q polar
Baseband IQ input	Signal envelope, linear envelope, I/Q waveform, I and Q waveform, I/Q polar
Markers	Normal, delta, band power

4. 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.

Spectrum measurement

Range at RF input	
Maximum	+30 dBm (1 W)
Minimum	Displayed average noise level
Range at IQ input	
Maximum (50 Ω input)	+13 dBm (20 mW)
Maximum (600 Ω, 1 MΩ input)	0 dBV
Minimum	Displayed average noise level
Span range	
RF input	10 Hz to 10 MHz
Composite I/Q input	10 Hz to 10 MHz
Baseband I or Q only inputs	10 Hz to 5 MHz
Resolution BW range overall	100 mHz to 3 MHz 1, 1.5, 2, 3, 5, 7.5, 10 sequence or arbitrary bandwidth user-definable
Pre-FFT filter	
Type	Gaussian, flat
BW	Auto, manual 1 Hz to 10 MHz
FFT window	Flat top; (high amplitude accuracy); Uniform; Hanning; Hamming; Gaussian; Blackman; Blackman-Harris; Kaiser-Bessel 70, 90, 110
Averaging	
Average number	1 to 10,000
Average mode	Exponential, repeat
Average type	Power average (RMS), log-power average (video), maximum, minimum, voltage average
Displays	
RF input	Spectrum, linear spectrum, I/Q waveform, spectrum and I/Q waveform, I/Q polar, adjacent channel power, power stat CCDF
Baseband IQ inputs	Spectrum, linear spectrum, I/Q waveform, spectrum and I/Q waveform, I/Q polar, power stat CCDF
Markers	Normal, delta, band power, noise
Measurement resolution	
Displayed	0.01 dB
Remote query	0.001 dB

Trigger

Trigger sources	
RF input	Free run (immediate), video (IF envelope), RF burst (wideband), frame timer, external front, external rear, line
Baseband IQ inputs	Free run (immediate), video (IQ envelope), external front input, external rear input, frame timer, line
Delay range	–500 to +500 ms
Delay accuracy	±33 ns
Delay resolution	33 ns
Trigger slope	Positive, negative
Holdoff range	0 to 500 ms
Holdoff resolution	1 μs

RF burst trigger

Peak carrier power range at RF input	+30 to –40 dBm
Trigger level range	0 to –25 dB (relative to signal peak)
Bandwidth	> 15 MHz (nominal)

Video (IF envelope)

Trigger range	+50 to –200 dBm

W-CDMA (Option E4406A-BAF) HSDPA/HSUPA (Option E4406A-210)

Channel power measurement

The channel power measurement measures the total RMS power in a user-specified bandwidth. The following specifications apply for the default bandwidth of 3.84 MHz for the 3GPP standard.

Minimum power at RF input	–70 dBm (nominal)
Absolute power accuracy, 18 to 30 °C	±0.63 dB (±0.41 dB, typical)
Measurement floor	-73 dBm (nominal)

ACPR measurement (ACLR)

The adjacent channel power ratio (ACPR) measurement measures up to five pairs of offset channels and relates them to the carrier power. The measurement result is a ratio of the channel power to the power in each offset. The results can be displayed as a ratio to the total power in each bandwidth, or as a ration of the power spectral density. Simulated spectrum analyzer mode is for those who are accustomed to spectrum analyzers.

Minimum power at RF input		–27 dBm (nominal)
ACPR accuracy		RRC weighted, 3.84 MHz noise bandwidth
Radio	**Offset frequency**	**Specification**
MS (UE)	5 MHz	±0.20 dB, at ACPR range of –30 to –36 dBc with optimum mixer level
MS (UE)	10 MHz	±0.30 dB, at ACPR range of –40 to –46 dBc with optimum mixer level
BTS	5 MHz	±0.93 dB, at ACPR range of –42 to –48 dBc with optimum mixer level
BTS	10 MHz	±0.82 dB, at ACPR range of –47 to –53 dBc with optimum mixer level
BTS	5 MHz	±0.39 dB, at –48 dBc non-coherent ACPR
Dynamic range		RRC weighted, 3.84 MHz noise bandwidth
Offset frequency		
5 MHz		–68 dB (nominal)
10 MHz		–72 dB (nominal)

For more detail, please refer to the E4406A specifications that can be found at **www.agilent.com/find/vsa**

Power statistics CCDF measurement

The complementary-cumulative distribution function (CCDF) traces provide you with how much time the waveform spends at or above a given power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Minimum power at RF input	–40 dBm, average (nominal)
Histogram resolution	0.01 dB

Code domain measurement

The code domain measurement provides a tremendous amount of information about the in-channel characteristics of the W-CDMA signal. Code domain power (CDP) view directly informs the user of the active channels with their individual channel powers. The CDP view also leads you to symbol rate analysis such as symbol rate EVM and symbol power versus time.

Code domain power 25 to 35°C 95% confidence	
Minimum power at RF input	–70 dBm (nominal)
Relative code domain accuracy	Using Test Model 1 with 32 DPCH signal
±0.015 dB[5]	Code domain power between 0 and –10 dBc
±0.08 dB[5]	Code domain power between –10 and –30dBc
±0.15 dB[5]	Code domain power between –30 to–40dBc
Symbol power vs. time	
Minimum power at RF input	–45 dBm (nominal)
Accuracy	Using Test Model 1 with 32 DPCH signal
±0.10 dB[5]	Code domain power between 0 and –25 dBc
±0.50 dB[5]	Code domain power between –25 to –40dBc
Symbol error vector magnitude	
Minimum power at RF input	–45 dBm (nominal)
Accuracy	Using Test Model 1 with 32 DPCH signal
± 1.0%	Code domain power between 0 and –25 dBc

5. Nominals in using test model 5 with 8 HS-PDSCH.

QPSK EVM measurement

The QPSK EVM measurement measures the modulation quality of QPSK modulated signal. This measurement provides an IQ constellation diagram, error vector magnitude (EVM) in RMS and peak as well as magnitude error versus chip, phase error versus chip, and EVM versus chip.

QPSK EVM	QPSK selected
Minimum power at RF input	–20 dBm (nominal)
EVM	
Operating range	0 to 25% (nominal)
Floor	1.5% (nominal)
Accuracy	±1.0% (nominal) at EVM of 10%
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Frequency error	
Range	±300 kHz (nominal)
Accuracy	±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

QPSK EVM	12.2k RMC selected
Minimum power at RF input	–20 dBm (nominal)
EVM	
Operating range	0 to 20% (nominal)
Floor	1.5% (nominal)
Accuracy	±1.0% (nominal) at EVM of 10%
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Frequency error	
Range	±20 kHz (nominal)
Accuracy	±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

Modulation accuracy measurement (composite EVM)

Composite EVM is a measure of the performance of a W-CDMA transmitter's modulation circuitry. Composite EVM can be measured for a pilot channel along with other channel structures, i.e. multiple traffic channels.

Minimum power at RF input	–70 dBm (nominal)
Composite EVM	Using Test Model 4
Range	0 to 25%[6]
Floor	1.5%[6]
Accuracy	±1.0%[6]
Peak code domain error	Using Test Model 3 with 16 DPCH w/spreading code of 256
Accuracy	±1.0 dB (nominal)
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Frequency error	Specified for CPICH power ≥ –15 dBc
Range	±500 Hz
Accuracy	±2 Hz + (transmitter frequency x frequency reference accuracy)
Time offset	
Absolute frame offset accuracy	±150 nsec
Relative frame offset accuracy	±5.0 ns (nominal)
Relative offset accuracy (for STTD diff mode)	±1.25 nsec

Intermodulation distortion measurement

The intermodulation distortion measurement determines the third order and fifth order intermodulation products caused by nonlinear devices in the transmitter. This measurement is made with two single tones or a single tone and a modulated W-CDMA signal. The results are displayed in relative power to the carrier in dBc or in absolute power in dBm.

Minimum carrier power at RF input	–20 dBm (nominal)

6. Nominals in using test model 5 with 8 HS-PDSCH.

Power vs. time and power control measurement

Absolute power measurement

Using 5 MHz resolution bandwidth

Accuracy	
0 to –20 dBm	±0.7 dB (nominal)
–20 to –60 dBm	±1.0 dB (nominal)

Relative power measurement

Accuracy	
Step range ± 1.5 dB	±0.1 dB (nominal)
Step range ± 3.0 dB	±0.15 dB (nominal)
Step range ± 4.5 dB	±0.2 dB (nominal)
Step range ± 26.0 dB	±0.3 dB (nominal)

Multicarrier power measurement

This measurement is used for adjusting multicarrier power amplifiers to transmit well balanced multiple carriers. The measurement is similar to a combination of those for ACPR and intermodulation distortion product measurements giving in-channel and out-of-channel performance results. The results are displayed for the different frequency offsets either in relative power to the carrier in dBc or in absolute power in dBm.

Minimum carrier power at RF input	–15 dBm (nominal)
ACPR dynamic range, two carriers	RRC weighted, 3.84 MHz noise bandwidth
5 MHz offset	–64 dB (nominal)
10 MHz offset	–68 dB (nominal)
ACPR accuracy, two carriers	
5 MHz offset, –48 dBc ACPR	±0.70 dB (nominal)

Spectrum emission mask measurement

The spectrum emission mask measurement measures the in-channel and out-of-channel spurious emissions to provide useful figures of merit for spectral regrowth and emissions produced by components and circuit blocks. Up to five pairs of offsets/regions can be defined in which the user can specify the start and stop frequencies, resolution bandwidth, and the start and stop amplitudes of the mask.

Minimum power at RF input	–20 dBm (nominal)
Dynamic range, relative	
2.515 MHz offset	–77.9 dB (–82.8 dB, typical)
1980 MHz region	–72.2 dB (–77.2 dB, typical)
Sensitivity, absolute	
2.515 MHz offset	–88.9 dBm (–93.9 dBm, typical)
1980 MHz region	–72.9 dBm (–77.9 dBm, typical)
Accuracy	
Display = Abs Peak Pwr	±0.60 dB (±0.40 dB, typical)
Display = Rel Peak Pwg	±0.25 dB

Occupied bandwidth measurement

Occupied bandwidth (OBW) measurement measures the frequency bandwidth corresponding to 99 percent of the total transmitted power.

Minimum carrier power at RF input	–20 dBm (nominal)
Frequency resolution	100 Hz
Frequency accuracy	$\frac{1.4\%}{\sqrt{N_{avg}}}$ (nominal)

Conformance with 3GPP TS 25.141 base station requirements for a manufacturing environment

Sub-clause	Name	3GPP required test instrument tolerance	Instrument tolerance interval	Supplemental information
6.2.1	**Maximum output power**	±0.7 dB (95%)	±0.29 dB (95%)	±0.63 dB (100%)
6.2.2	**CPICH power accuracy**	±0.8 dB (95%)	±0.30 dB (95%)	–10 dB CDP
6.3.4	**Frequency error**	±12 Hz (95%)	±10 Hz (100%)	Freq ref locked
6.4.2	**Power control steps**			
	1-dB step	±0.1 dB (95%)	±0.03 dB (95%)	Test Model 2
	0.5-dB step	±0.1 dB (95%)	±0.03 dB (95%)	Test Model 2
	Ten 1-dB steps	±0.1 dB (95%)	±0.03 dB (95%)	Test Model 2
	Ten 0.5-dB steps	±0.1 dB (95%)	±0.03 dB (95%)	Test Model 2
6.4.3	**Power dynamic range**	±1.1 dB (95%)	±0.50 dB (95%)	
6.4.4	**Total power dynamic range**	±0.3 dB (95%)	±0.015 dB (95%)	Ref –35 dBm at mixer
6.5.1	**Occupied bandwidth**	±100 kHz (95%)	±38 kHz (95%)	10 averages
6.5.2.1	**Spectrum emission mask**	±1.5 dB (95%)	±0.59 dB (95%)	Absolute peak
6.5.2.2	**ACLR**			
	5 MHz offset	±0.8 dB (95%)	±0.34 dB (95%)	±0.93 dB (100%)
	10 MHz offset	±0.8 dB (95%)	±0.40 dB (95%)	±0.82dB (100%)
6.7.1	**EVM**	±2.5% (95%)	±1.0% (95%)	Range 15 to 20%
6.7.2	**Peak code domain error**	±1.0 dB (95%)	±1.0 dB (nominal)	

Conditions

25 to 35 °C

Derived tolerances

- 95th percentile
- 100% limit tested

Calibration uncertainties included

cdma2000 (Option E4406A-B78) 1xEV-DV (Option E4406A-214)

Channel power measurement

Range at RF input	+30 to –80 dBm

Absolute power accuracy for in-band signal (excluding mismatch error), 18 °C to 30 °C

+30 to –28 dBm at RF input	±0.6 dB
–28 to –50 dBm at RF input	±0.8 dB
–50 to –80 dBm at RF input	±1.0 dB

ACPR measurement

Power range at RF input	+30 to –20 dBm

Dynamic range (referenced to average power of carrier in 1.25 MHz BW)

Offset frequency	Integ BW	Dynamic range
750 kHz (BTS)	30 kHz	–82 dBc
885 kHz (MS)	30 kHz	–82 dBc
1.98 MHz	30 kHz	–85 dBc
Relative accuracy	±0.9 dB	

Power statistics CCDF measurement

Range at RF input	
Maximum	+30 dBm (average) +40 dBm (peak)
Minimum	–40 dBm (average)

QPSK EVM measurement

Range at RF input	+30 to –20 dBm
EVM	
Range	0 to 25% (nominal)
Floor	1.5% (nominal)
Accuracy	±1.0% (nominal)
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Frequency error	
Range	±500 Hz (nominal)
Accuracy	±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

Code domain measurement

Code domain power	
Power range	Mixer level (RF input power minus attenuation) is between –15 and –5 dBm
Accuracy	QPSK modulated code signal
Relative range	
0 to –10 dBc	±0.015 dB[7]
–10 to –30 dBc	±0.18 dB[7]
–30 to –40 dBc	±0.51 dB[7]
Symbol power vs. time	QPSK modulated code signal
Range at RF input	+30 to –40 dBm
Accuracy	±0.3 dB (spread channel power is within 20 dB of total power; averaged power over a slot)[3]
Symbol error vector magnitude	
Range at RF input	+30 to –20 dBm
Pilot time offset (from even second signal to start PN sequence)	
Range	–13.33 to +13.33 ms
Accuracy	±250 ns
Resolution	10 ns

Intermodulation distortion

Range at RF input	+30 to –20 dBm
Input intermodulation power range	–20 to –65 dBc
Relative accuracy	±1.5 dB
Resolution	0.01 dB display resolution

Spectrum emission mask measurement

Range at RF input	+30 to –20 dBm
Spectrum emission power range	≤ –136 dBc/Hz at 1 MHz offset (nominal)
Relative accuracy	±1.0 dB
Resolution	0.01 dB display resolution

Occupied bandwidth measurement

Range at RF input	+30 to –20 dBm
Frequency	
Resolution	1 kHz
Accuracy	±3 kHz

7. Nominals for 8PSK/16QAM modulated code signal.

Modulation accuracy measurement (composite rho)

Range at RF input	+30 to –50 dBm
EVM	
Range	0 to 25%
Floor	2.0% or less[8]
Resolution	0.01% display resolution
I/Q origin offset	
Range	–10 to –50 dBc
Resolution	0.02 dB display resolution
Frequency error	
Range	±900 Hz
Accuracy	±10 Hz + transmitter accuracy (nominal)
Resolution	±0.01 Hz display resolution
Pilot time offset	
Range	–13.33 to +13.33 ms
Accuracy	±250 ns
Resolution	10 ns
Code domain timing	
Range	±200 ns
Accuracy	±1.25 ns
Resolution	0.1 ns
Code domain phase	
Range	±200 mrad
Accuracy	±10 mrad
Resolution	0.1 mrad

1xEV-DO (Option E4406A-204)

Channel power measurement

1.23 MHz integration BW

Range at RF input	+30 dBm to –80 dBm

Absolute power accuracy for in-band signal (excluding mismatch error), 18 °C to 30 °C

+30 to –28 dBm at RF input	±0.6 dB
–28 to –50 dBm at RF input	±0.8 dB
–50 to –80 dBm at RF input	±1.0 dB

Power statistics CCDF measurement

Range at RF input

Maximum	+30 dBm (average) +40 dBm (peak)
Minimum	–40 dBm (average)

Code domain measurement

For Pilot, 2 MAC channels, 16 channels of QPSK data

Code domain power

Range at RF input	+30 to –50 dBm (nominal)
Accuracy (Pilot, MAC, Data QPSK/Data 8PSK)	±0.3 dB (nominal, spread channel power is within 20 dB of total power)

8. Nominal for 1xEV-DV signal.

QPSK EVM measurement

Range at RF input	+30 to –20 dBm (nominal)
EVM	
Range	0 to 25% (nominal)
Floor	1.5% (nominal)
Accuracy	±1.0% (nominal)
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Frequency error	
Range	±500 Hz (nominal)
Accuracy	±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

Modulation accuracy measurement (waveform quality)

For Pilot, 2 MAC channels, 16 channels of QPSK data

Range at RF input	+30 to –50 dBm (nominal)
EVM	
Range	0 to 25% (nominal)
Floor	2.5% or less (nominal)
Accuracy	±1.0% at the range of 5% to 25%
Rho	
Range	0.9 to 1.0
Floor	> 0.99938 (0.99938 equals 2.5%EVM)
Accuracy	±0.0010 at 0.99751 Rho (5% EVM) ±0.0044 at 0.94118 Rho (25% EVM)
Frequency error	
Range	±400 Hz (nominal)
Accuracy	±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)
Resolution	0.01 Hz display resolution
I/Q origin offset	
Range	–10 to –50 dBc (nominal)
Resolution	0.02 dB display resolution

Power vs. time

Range at RF input	+30 to –80 dBm (nominal)

Absolute power accuracy for in-band signal (excluding mismatch error), 18 °C to 30 °C

+30 to –28 dBm at RF input	±0.6 dB (nominal)
–28 to –50 dBm at RF input	±0.8 dB (nominal)
–50 to –80 dBm at RF input	±1.0 dB (nominal)

Intermodulation distortion

Input signal must not be bursted

Range at RF input	+30 to –20 dBm
Input intermodulation	
Power range	–20 to –65 dBc
Relative accuracy	±1.5 dB
Resolution	0.01 dB display resolution

Spurious emissions & ACP

Range at RF input	+30 to –20 dBm
Spectrum emission	
Power range	–136 dBc/Hz at 1 MHz offset (nominal)
Relative accuracy	±1.0 dB
Resolution	0.01 dB display resolution

Occupied bandwidth measurement

Range at RF input	+30 dBm to –20 dBm
Frequency	
Resolution	1 kHz
Accuracy	±3 kHz at 1 kHz resolution bandwidth

cdmaOne (Option E4406A-BAC)

Channel power measurement

Range at RF input	+30 to –80 dBm	
Integration bandwidth range	1 kHz to 10 MHz (default is 1.23 MHz)	
Absolute power accuracy for in-band signal (excluding mismatch error), 18 °C to 30 °C		
RF input		
+30 to –28 dBm	±0.6 dB	(±0.4 dB, typical)
–28 to –50 dBm	±0.8 dB	(±0.7 dB, typical)
–50 to –80 dBm	±1.0 dB	(±0.9 dB, typical)
Relative power accuracy (same channel, different transmit power, input attenuator fixed) input level change		
0 to –76 dB	±0.2 dB	(±0.1 dB, typical)

Code domain measurement (base station)

Range at RF input	+30 to –30 dBm
Measurement interval range	0.25 to 30 ms
Code domain power (measurement interval 1.25 ms)	
Display dynamic range	50 dB
Accuracy	±0.3 dB (Walsh channel power within 20 dB of total power)
Resolution	0.01 dB
Other reported power parameters	Average active traffic, maximum inactive traffic, average inactive traffic, pilot, paging, sync channels
Frequency error accuracy	±10 Hz (excludes frequency reference)
Pilot time offset (from even second signal to start of PN sequence)	
Range	–13.33 to +13.33 ms
Accuracy	±250 ns
Resolution	10 ns
Code domain timing (pilot to code-channel time tolerance)	
Range	±200 ns
Accuracy	±10 ns
Resolution	0.1 ns
Code domain phase (pilot to code-channel phase tolerance)	
Range	±200 mrad
Accuracy	±20 mrad
Resolution	0.1 mrad

Modulation accuracy (rho) measurement

Power range at RF input	+30 to –40 dBm
Measurement interval range	0.25 to 30 ms

Rho (waveform quality) (usable range 0.5 to 1.0)

Range	0.9 to 1.0
Accuracy	±0.005
Resolution	0.0001

Frequency error (frequency error excludes instrument time base error)

Input frequency error range	±900 Hz
Accuracy	±10 Hz + (transmitter frequency x frequency reference accuracy)
Resolution	0.1 Hz

Pilot time offset (from even second signal to start of PN sequence)

Range	–13.33 to +13.33 ms
Accuracy	±250 ns
Resolution	10 ns

EVM

Floor	2.5%	(1.8%, typical)
Accuracy	±0.5%	
Resolution	0.1%	

Carrier feedthrough

Accuracy	±2.0 dB
Resolution	0.1 dB

Magnitude error

Accuracy	±0.5%
Resolution	±0.01%

Phase error

Accuracy	±1.0 degrees
Resolution	0.1 degrees

Adjacent channel power ratio measurement

Power range at RF input +30 to –20 dBm

Dynamic range (referenced to average power of carrier in 1.23 MHz BW)

Offset frequency	**Integ BW**	**Dynamic range**
750 kHz	30 kHz	–82 dBc
885 kHz	30 kHz	–82 dBc
1.25625 MHz	12.5 kHz	–86 dBc
1.98 MHz	30 kHz	–85 dBc
2.75 MHz	1 MHz	–56 dBc

Relative accuracy	±0.9 dB
Resolution	0.01 dB

Spurious close measurement (at transmitter maximum power)

Carrier power range at RF input	+30 to –30 dBm
Minimum spurious emission power sensitivity at RF input	–70 dBm (30 kHz RBW)
Absolute accuracy for in-band signal	±1.0 dB
Relative accuracy	±1.0 dB
Resolution	0.01 dB

Demod sync

Even second input	Level and impedance same as external trigger
PN offset range	0 to 511 x 64 (chips)
In-band frequency range	
IS-95	824 to 849 MHz 869 to 894 MHz
J-STD-008	1850 to 1910 MHz 1930 to 1990 MHz

EDGE/GSM (Option E4406A-202) 3π/8 8PSK Modulation GSM (Option E4406A-BAH) GSMK Modulation

Power versus time measurement

Power versus time measures the average power during the "useful part" of the EDGE or GSM burst and verifies that the power ramp is within the EDGE or GSM mask. The specified EDGE or GSM masks for both base transceiver stations and mobile stations are provided. Power versus time also lets you view the rise, fall, and "useful part" of the burst. The timings are referenced to the transmitter from bit 13 to 14 of the training sequence (midamble).

Power vs. time and EDGE power vs. time

GMSK modulation (GSM)
3π/8 shifted 8PSK modulation (EDGE)

Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 510 kHz RBW

Minimum carrier power at RF input for GSM and EDGE	–30 dBm (nominal)
Absolute power accuracy for in-band signal (excluding mismatch error)	
18 to 30 °C;	–0.11 ± 0.60 dB (–0.11 ± 0.40 dB, typical)
0 to 55 °C;	–0.11 ± 0.90 dB
Power ramp relative accuracy	Referenced to mean transmitted power
RF input range = Auto +6 dB to noise	±0.26 dB
Mixer level ≤ -12 dBm +6 dB to noise	±0.26 dB
Measurement floor	–81 dBm + input attenuation (nominal)
Time resolution	200 ns
Burst to mask uncertainty	±0.2 bit (approx ±0.7 μs)

EDGE EVM measurement

The EDGE EVM measurement measures the modulation quality of the 3π/8 8PSK modulated signal providing you with IQ constellation diagram, error vector magnitude (EVM) in RMS and peak, 95 percentile, and I/Q origin offset.

EDGE EVM (Error Vector Magnitude)	3π/8 shifted 8PSK modulation Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts
Carrier power range at RF input	–45 dBm (nominal)
EVM	
Range	0 to 25% (nominal)
Floor (RMS)	0.5%, (0.3%, typical)
Accuracy (RMS)	±0.5% (Power range at RF input from +27 to –12 dBm, EVM range 1% to 11%)
Frequency error	±1 Hz + (transmitter frequency x frequency reference accuracy)
I/Q origin offset range	–20 to –45 dBc
Trigger to T0 time offset	
Relative offset accuracy	±5.0 ns (nominal)

Output RF spectrum measurement

The output RF spectrum measurements determine the spectral energy emitted into the adjacent channels. The measurements are divided into two types: spectrum due to 3π/8 8PSK or GMSK modulation and noise, and spectrum due to switching transients (burst ramping). A single offset can be examined with a corresponding trace, or up to 15 offsets can be measured with a tabular data display.

Minimum carrier power at RF input	-15 dBm (nominal)
ORFS relative RF power uncertainty	
Due to modulation	
Offsets ≤ 1.2 MHz	±0.26 dB
Offsets ≥ 1.8 MHz	±0.36 dB
Due to switching	±0.27 dB (nominal)
ORFS absolute RF power accuracy 20 to 30 °C	±0.60 dB (±0.40 dB, typical)
Dynamic range	5-pole sync-tuned filters
Spectrum due to modulation	Methods: direct time and FFT

Offset frequency	GSM	EDGE
100 kHz	67.7 dB	67.7 dB
200 kHz	73.3 dB	73.3 dB
250 kHz	76.3 dB	76.3 dB
400 kHz	78.4 dB	77.9 dB
600 kHz	81.1 dB	80.2 dB
1.2 MHz	85.0 dB	83.3 dB
1.8 MHz	90.3 dB	82.4 dB
6.0 MHz	94.0 dB	85.3 dB

Spectrum due to switching

Offset frequency		
400 kHz	68.7 dB (100%)	71.2 dB (95%)
600 kHz	71.0 dB (100%)	73.1 dB (95%)
1.2 MHz	74.1 dB (100%)	77.0 dB (95%)
1.8 MHz	78.4 dB (100%)	80.4 dB (95%)

Transmit power measurement

The transmit power measurement determines the average power for an RF signal burst at or above a user specified threshold value. The threshold value may be absolute, or relative to the peak value of the signal.

Transmit power	GMSK modulation (GSM)
Carrier power range at	+30dBm(1W) to –60 dBm
Absolute power accuracy for in-band signal (excluding mismatch error)	+30 to –40dBm at RF input
+18 to 30 °C	±0.6 dB (±0.4 dB, typical)
0 to +55 °C	±0.9 dB
Relative power accuracy (same channel, different transmit power, input attenuator fixed), input level change 0 to –76 dB	±0.25dB (±0.1dB, typical)
Resolution	
Displayed	0.01dB
Remote query	0.001dB
Instrument repeatability	±0.05 dB (nominal)

Phase and frequency error measurement

Phase and frequency error measures the modulation quality of a GSM transmitter. Phase and frequency error can be displayed both numerically and or graphically. A binary representation of the demodulated data bits is also available.

Phase and Frequency Error	GMSK modulation (GSM) Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts.
Carrier power range at RF Input	+27 to –45 dBm (nominal)
Phase error	
Floor (RMS)	<0.5°
Accuracy (RMS)	±0.5° (phase error range 1° to 15°)
Peak phase error	
Floor	<1.5°
Accuracy	±2.0° (phase error range 3° to 25°)
Frequency error	
Accuracy	±5 Hz + (transmitter frequency x frequency reference accuracy)
I/Q offset	
Range	–15 to –50 dBc (nominal)
Burst sync time uncertainty	±0.1 bit (approx. ±0.4 μs)
Trigger to T0 time offset	
Relative offset accuracy	±5.0 ns (nominal)

Burst sync

Source	Training sequence, RF amplitude, external rear, none. Actual available choices dependent on measurement.
Training sequence code	GSM defined 0 to 7 auto (search) or manual
Burst type	Normal (TCH and CCH), Sync (SCH), Access (RACH)

In-band frequency range

Down band GSM	400 to 500 MHz
GSM 900, P-GSM	890 to 915 MHz 935 to 960 MHz
GSM 900, E-GSM	880 to 915 MHz 925 to 960 MHz
DCS 1800	1710 to 1785 MHz 1805 to 1880 MHz
PCS1900	1850 to 1910 MHz 1930 to 1990 MHz
GSM 450	450.4 to 457.6 MHz 460.4 to 467.6 MHz
GSM480	478.8 to 486 MHz 488.8 to 496 MHz
GSM850	824 to 849 MHz 869 to 894 MHz

NADC/PDC (Option E4406A-BAE)

ACPR measurement

Carrier power range at RF input	+27 to –20 dBm
Dynamic range	
NADC mode	
Offset frequency (Integ BW)	
30 kHz (32.8 kHz)	–35 dB (nominal)
60 kHz (32.8 kHz)	–65 dB
90 kHz (32.8 kHz)	–70 dB
PDC mode	
Offset frequency (Integ BW)	
50 kHz (21.0 kHz)	–55 dB
100 kHz (21.0 kHz)	–70 dB
Relative accuracy	
Resolution	±1.0 dB
Display resolution	0.01 dB

EVM measurement

EVM measurement measures the modulation quality of pi/4QPSK modulated signal providing you with IQ constellation diagram, error vector magnitude (EVM) in RMS and peak as well as each chip of magnitude error, phase error and EVM.

Range at RF input (Common in NADC and PDC)	+27 to –20 dBm
EVM	
Range	0 to 25%
Floor	1.0%
Accuracy	±0.6%
I/Q origin offset	
Range	–10 to –50 dBc
Resolution	0.01 dB display resolution
Carrier frequency error	
Frequency resolution	0.01 Hz display resolution

OBW measurement (PDC only)

Range at RF input	+27 to –20 dBm
Frequency	
Resolution	0.1 kHz
Accuracy	+400 Hz, –100 Hz

In-band frequency range (NADC)

800 MHz band	
Mobile transmit	824 to 849 MHz
Base station transmit	869 to 894 MHz
PCS band	
Mobile transmit	1850 to 1910 MHz
Base station transmit	1930 to 1990 MHz

In-band frequency range (PDC)

800 MHz band #1	810 to 828 MHz 940 to 958 MHz
800 MHz band #2	870 to 885 MHz 925 to 940 MHz
800 MHz band #3	838 to 840 MHz 893 to 895 MHz
1500 MHz band	1477 to 1501 MHz 1429 to 1453 MHz

General characteristics

Temperature range

Operating	0 to +55 °C
Non-operating	–40 to +71 °C

EMI compatibility

Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

Radiated immunity (RF input)

When tested at 3 V/m according to IEC 801-3/1984, the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz, except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth, the displayed average noise level may be up to –90 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to ±90 dBm displayed on the screen.

Electrostatic

In accordance with IEC 801-2/1991, an discharge air discharge of up to 8 kV, or a contact discharge of up to 4 kV, will not cause any change of instrument state or measurement data. However, discharges to center pins of front or rear panel connectors might cause damage to the associated circuitry.

Power requirements

Voltage, frequency	90 to 132 V rms, 47 to 440 Hz 195 to 250 V rms, 47 to 66 Hz
Power consumption, ON	< 350 W
Power consumption, standby	< 20 W

Weight

Net	19 kg (42 lb) (nominal) 20 kg (44 lb) with baseband IQ inputs
Shipping	39 kg (86 lb) (nominal)

Dimensions

177 mm H x 426 mm W x 432 mm D
(7.0 in H x 16.8 in W x 17 in D)

Front panel

RF input		
Connector	Type N female	
Impedance	50 Ω (nominal)	
VSWR		
20 to 2205 MHz	≤ 1.4:1	(≤ 1.24:1, typical)
2205 MHz to 4 GHz	≤ 1.6:1	(≤ 1.4:1, typical)
50 MHz	≤ 1.4:1	(≤ 1.08:1, typical)
Baseband I/Q inputs	Supports: Basic, W-CDMA/ HSDPA, cdma2000/1xEV-DV, and EDGE/GSM modes	
Connectors	(4 each I, Q, $\overline{I}$, $\overline{Q}$) BNC female	
Balanced input impedance (4 connectors: I, Q, $\overline{I}$, and $\overline{Q}$)	600 Ω, 1 MΩ (nominal) (switchable)	
Unbalanced input impedance (2 connectors: I and Q)	50 Ω, 1 MΩ (nominal) (switchable)	
VSWR 50 Ω impedance only	≤ 1.4:1 (≤ 1.08:1, typical)	

Note: Instrument noise sidebands and spurious responses might be affected by the quality of the external reference used.

Probe pwr

Voltage/current	+15 Vdc, ±7% at 150 mA maximum –12.6 Vdc, ±10% at 150 mA maximum

Rear panel

10 MHz OUT	
Connector	BNC female
Impedance	50 Ω (nominal)
Output amplitude	≥ 0 dBm (nominal)

EXT REF IN

Connector	BNC female
Impedance	50 Ω (nominal)
Input amplitude range	–5 to +10 dBm (nominal)
Maximum DC level	±28 Vdc
Frequency	1 MHz to 30 MHz, selectable
Frequency lock range	±5 x 10–6 of the specified external reference input frequency

TRIGGER IN

Connector	BNC female
Impedance	–10 kΩ (nominal)
Trigger level	–5 to +5 V

TRIGGER 1 OUT and TRIGGER 2 OUT

Connector	BNC female
Impedance	50 kΩ (nominal)
Trigger level	0 to +5 V (no load)

MONITOR output

Connector	VGA compatible, 15-pin mini D-SUB
Format	VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, noninterlaced)
Resolution	640 x 480

PARALLEL interface

Allows printing to compatible printers

GPIB interface

Allows communication with compatible devices

LAN interface

Allows communication with 10baseT LAN

Agilent E4406A vector signal analyzer product and application information

Agilent E4406A Vector Signal Analyzer, Brochure
Literature number 5968-7618E

PSA Series Spectrum Analyzers E4406A Vector Signal Analyzer Technical Overviews

- *W-CDMA and HSDPA/HSUPA Measurement Personality*
  Literature number 5988-2388EN
- *cdma2000 and 1xEV-DV Measurement Personality* Literature number 5988-3694EN
- *1xEV-DO Measurement Personality*
  Literature number 5988-4828EN
- *GSM with EDGE Measurement Personality*
  Literature number 5988-2389EN

Select the Right Agilent Signal Analyzer for Your Needs, Selection Guide
Literature number 5968-3413E

Application notes

AN 1298 Digital Modulation in Communications Systems – An Introduction
Literature number 5965-7160E

AN 1311 Understanding CDMA Measurements for Base Stations and Their Components
Literature number 5968-0953E

AN 1312 Understanding GSM/EDGE Transmitter and Receiver Measurements for Base Transceiver Stations and their Components
Literature number 5968-2320E

AN 1313 Testing and Troubleshooting Digital RF Communications Transmitter Designs
Literature number 5968-3578E

AN 1314 Testing and Troubleshooting Digital RF Communications Receiver Designs
Literature number 5968-3579E

AN 1324 Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations, Literature number 5968-5537E

AN 1335 HPSK Spreading for 3G,
Literature number 5968-8438E

AN 1355 Designing and Testing 3GPP W-CDMA Base Stations Literature number 5980-1239E

AN 1356 Designing and Testing 3GPP W-CDMA User Equipment Literature number 5980-1238E

AN 1357 Designing and Testing cdma2000 Base Stations Literature number 5980-1303E

AN 1358 Designing and Testing cdma2000, Mobile Stations Literature number 5980-1237E

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Printed in USA, April 30, 2006
5968-3030E

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