

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

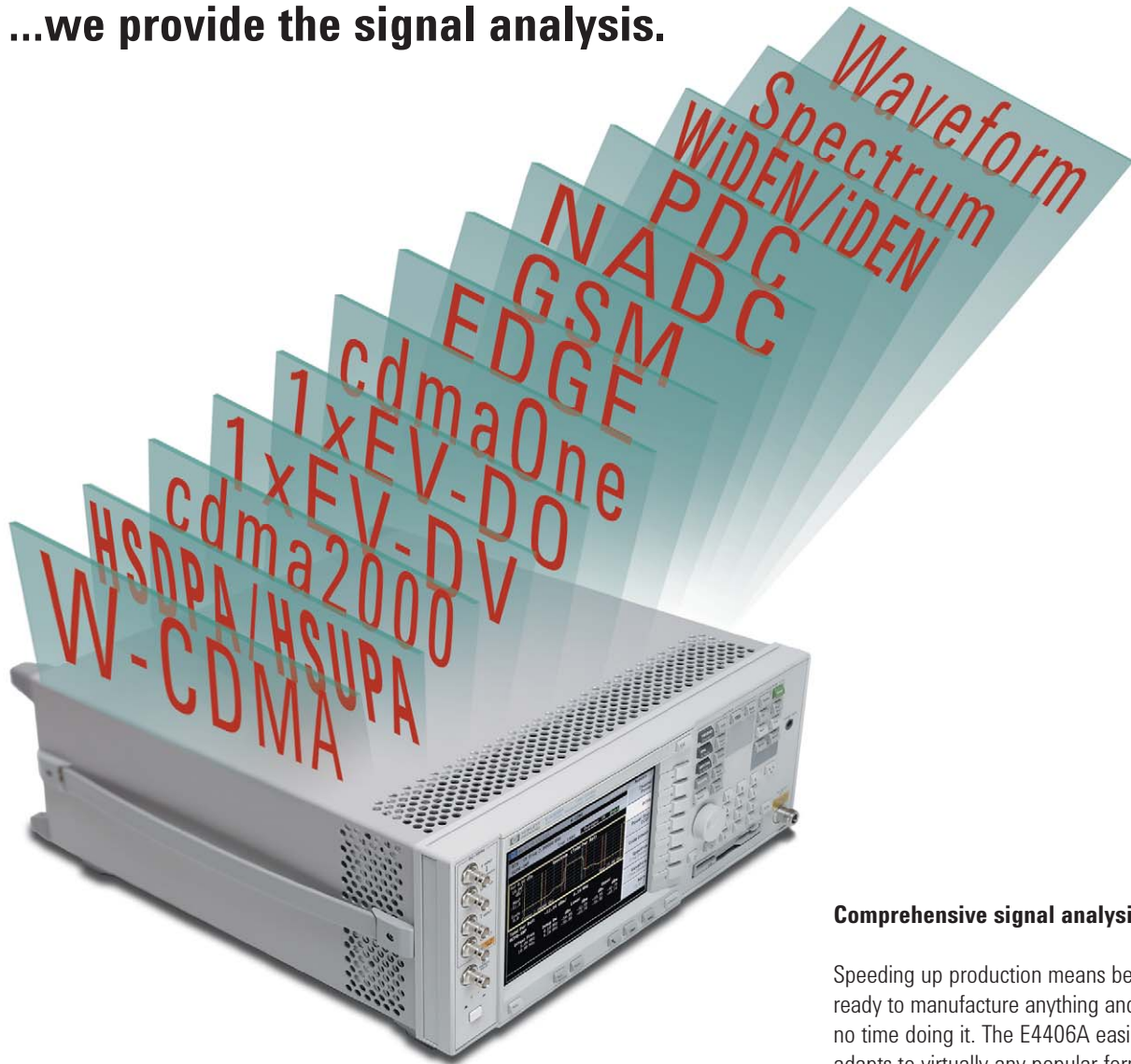
For engineers developing next-generation wireless components and systems, the E4406A provides W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, 1xEV-DO (Rev-0/A), and EDGE/GSM formats. Using one-button measurements, engineers can quickly verify conformance to these new formats. As the standards have evolved, we 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.



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

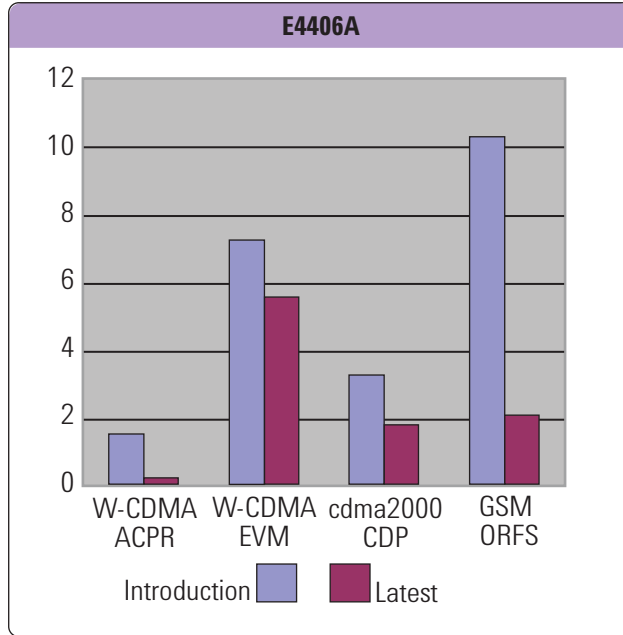
An investment for your future

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.

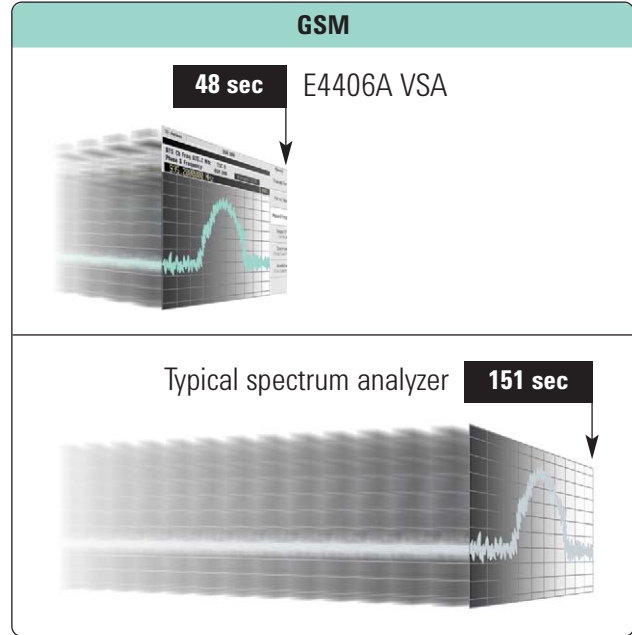
Easy to use

Multi-format

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.

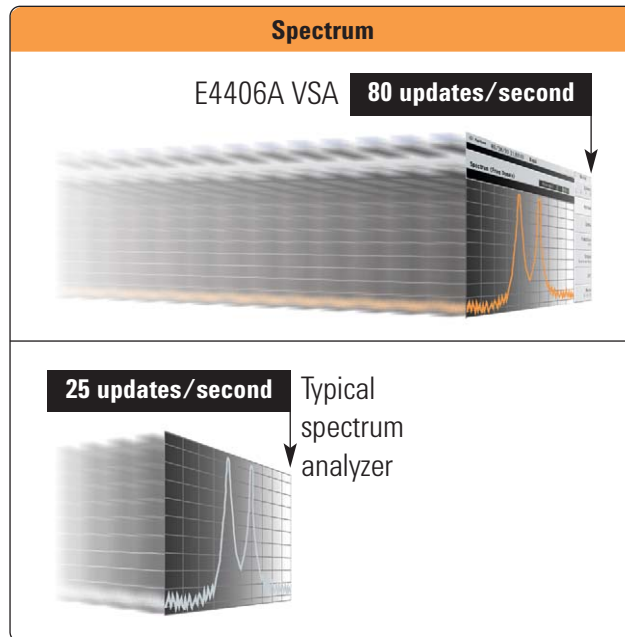
The E4406A delivers a logical user interface and a wealth of quick “one button” measurements, enabling designers to quickly try multiple tests without getting bogged down in cryptic menus. The E4406A interface provides the edge needed to expediently evaluate new designs and successfully meet the demands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

**Now
even
faster**

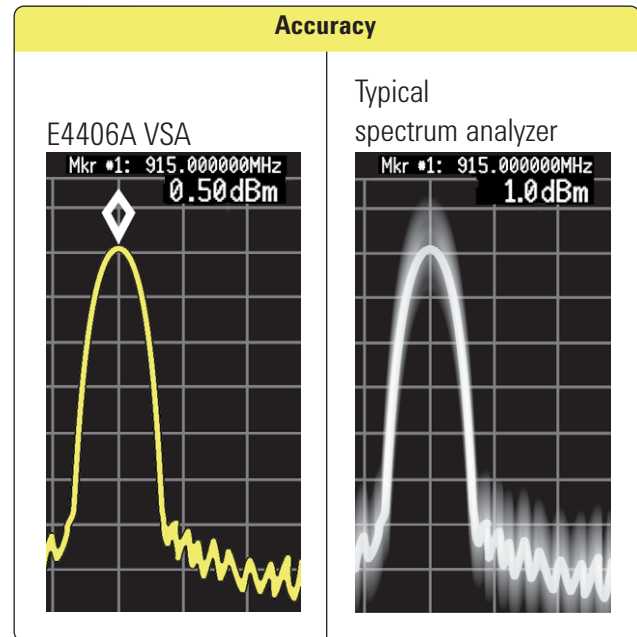
**“We have
decreased the
(transmitter power calibration)
test time by 25%.”**

**–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 inter-modulation distortion and other amplitude measurements up to three times faster using the E4406A.

Accuracy

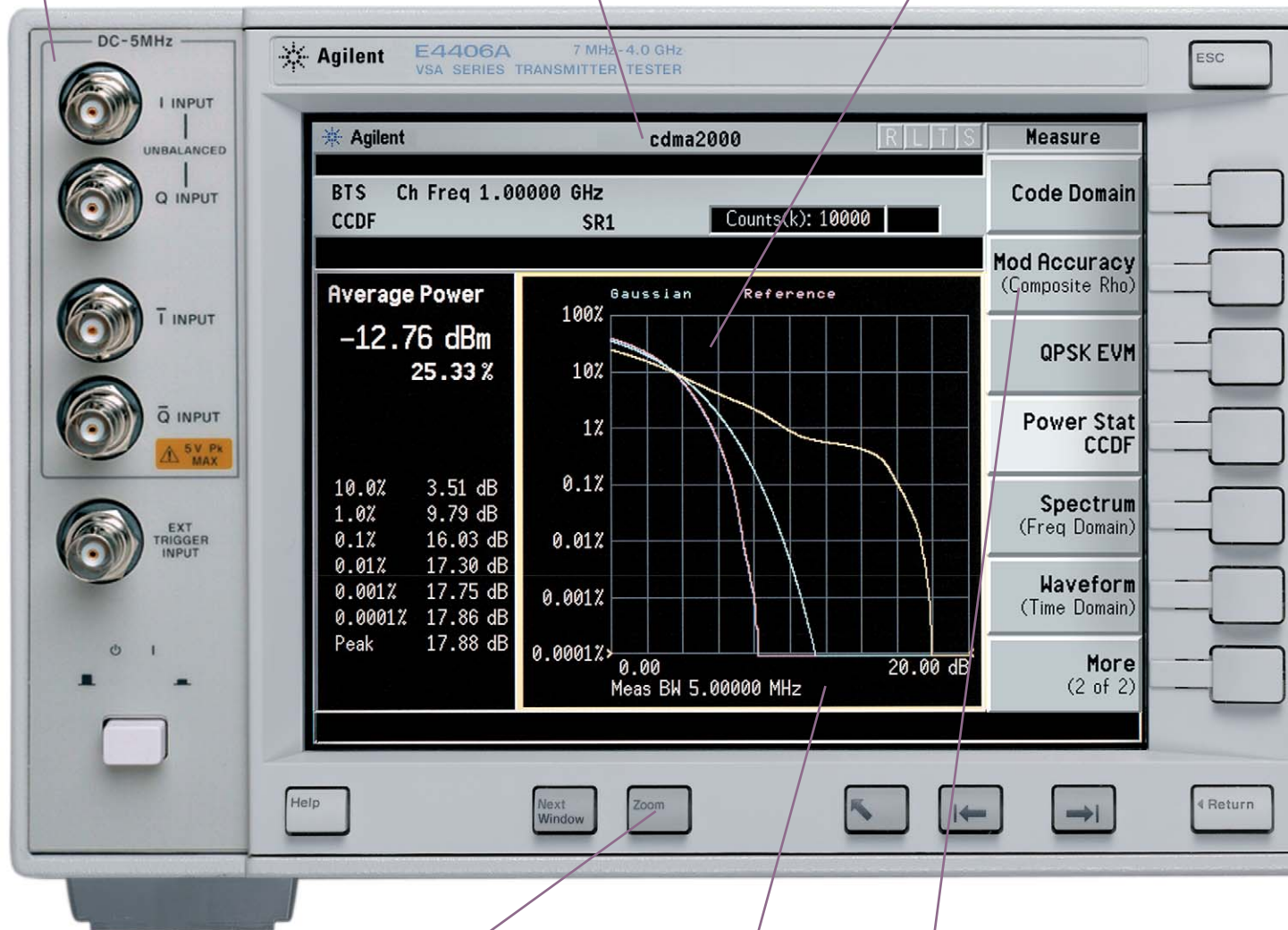
You don't need to reduce measurement speed to get accurate results. Superior absolute level accuracy of ± 0.6 dB (± 0.4 dB typical) provides unmatched performance and minimizes test uncertainty. Combined with a linearity of ± 0.25 dB over a 76 dB range, the E4406A is a state-of-the-art measurement tool.

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.



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

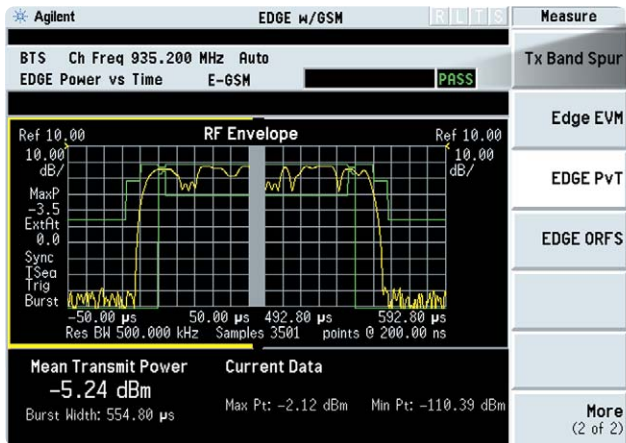
Intuitive key strokes



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



Designed for manufacturing...



FAIL
PASS



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

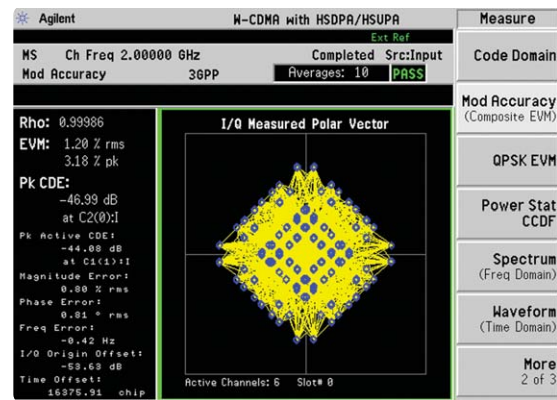
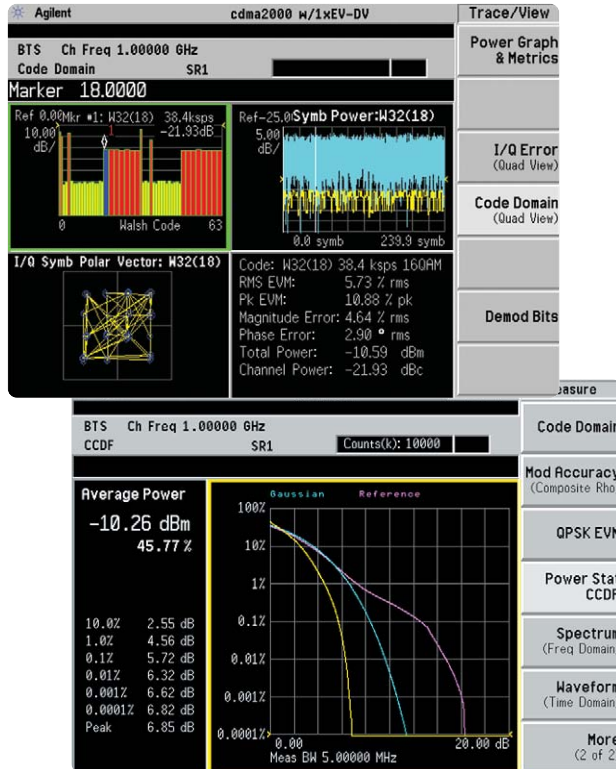
In manufacturing, you need straightforward pass/fail verification of critical specifications. With built-in test limits you don't have to keep track of every standard. The E4406A performs tests to the requirements of current industry standards with free, easy-to-install, firmware updates.

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

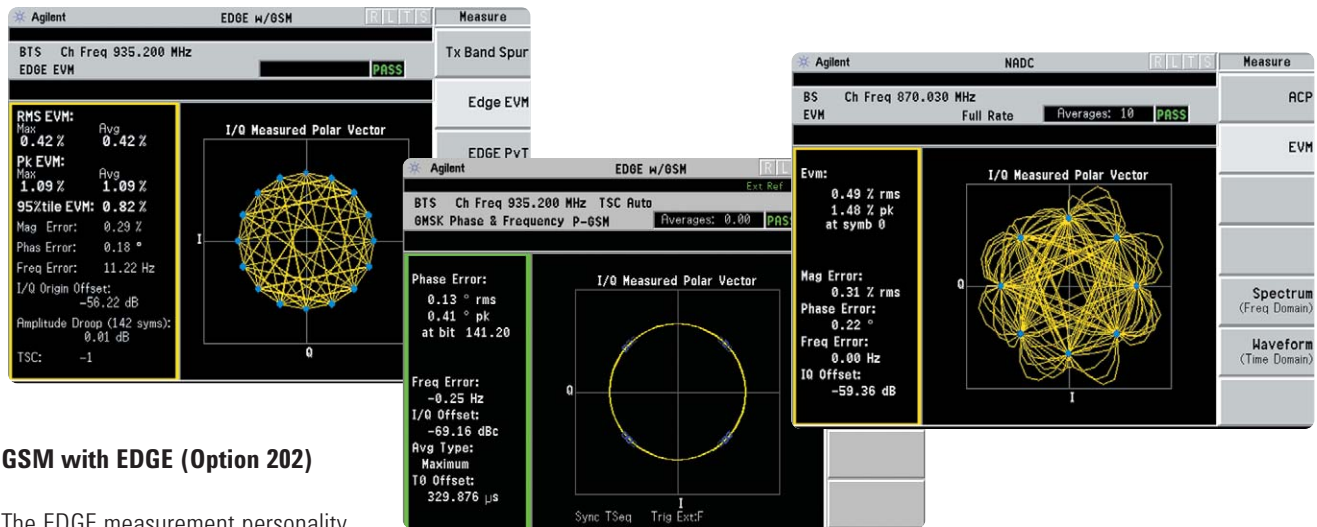
Digital modulation presents new challenges to amplifier manufacturers. Designers need effective methods to quickly characterize digital signals. The E4406A's complementary cumulative-distribution function (CCDF) is useful for determining a signal's power statistics, revealing the power peaks relative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

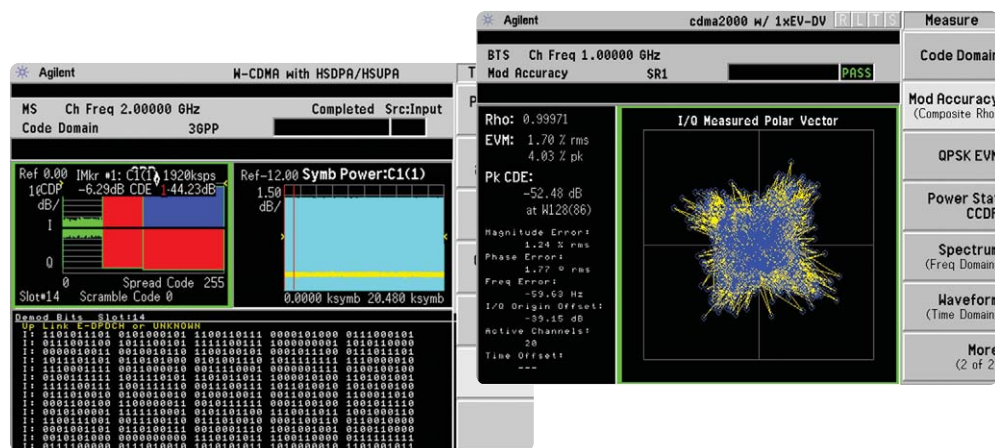
WiDEN/iDEN (Option HN1)

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
- P_{VT}
- 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.

HSUPA/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.

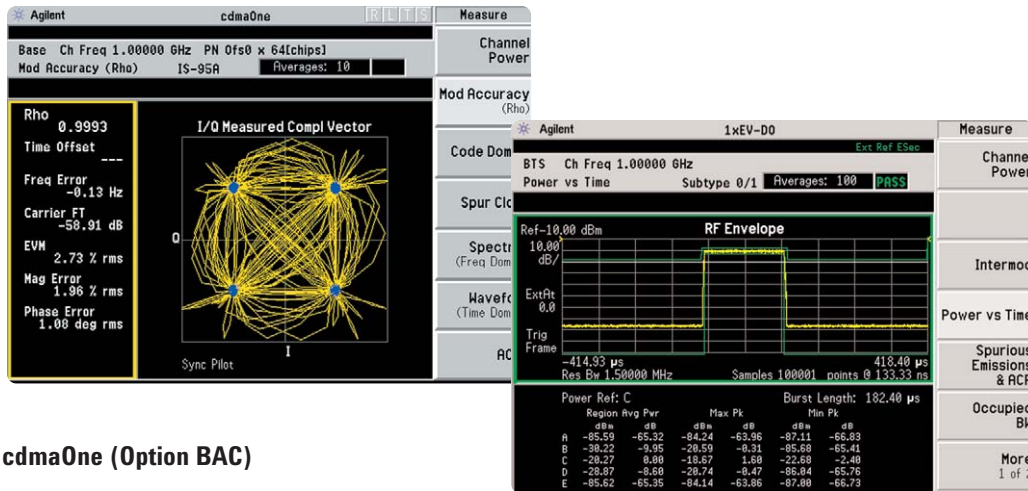
1xEV-DV (Option 214)

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



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

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.



...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 transferred to 89601A PC software for in-depth analysis.



Coupling speed and power...

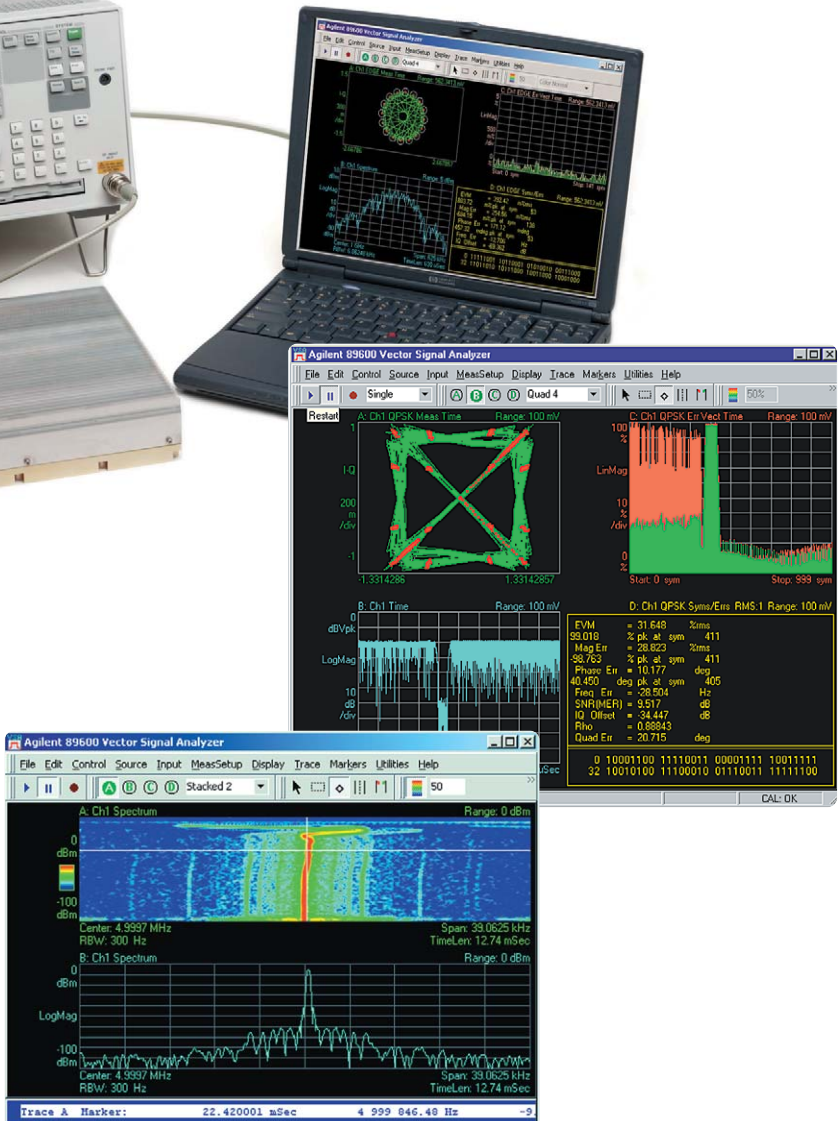


E4406A VSA/89601A software combination

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 DVBOAM, 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.

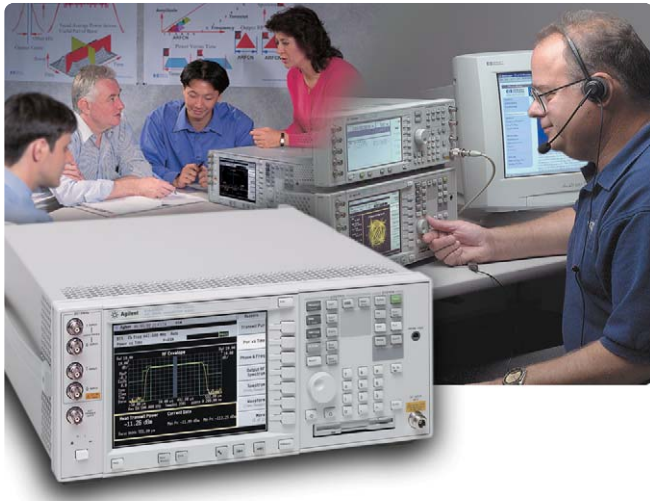
The 89601A software runs on a PC connected to the E4406A, via LAN or GPIB, and provides hardware control and results displays along with modulation analysis.



...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](http://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
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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-OB0 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.)
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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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