

# Agilent E4406A Vector Signal Analyzer



The image displays the Agilent E4406A Vector Signal Analyzer, a high-performance instrument used for testing and measuring complex signals. The device is shown in a studio setting, with a background featuring a mobile phone, a cellular tower, and a network diagram, all overlaid with a grid of white dots.

The main display screen shows the following information:

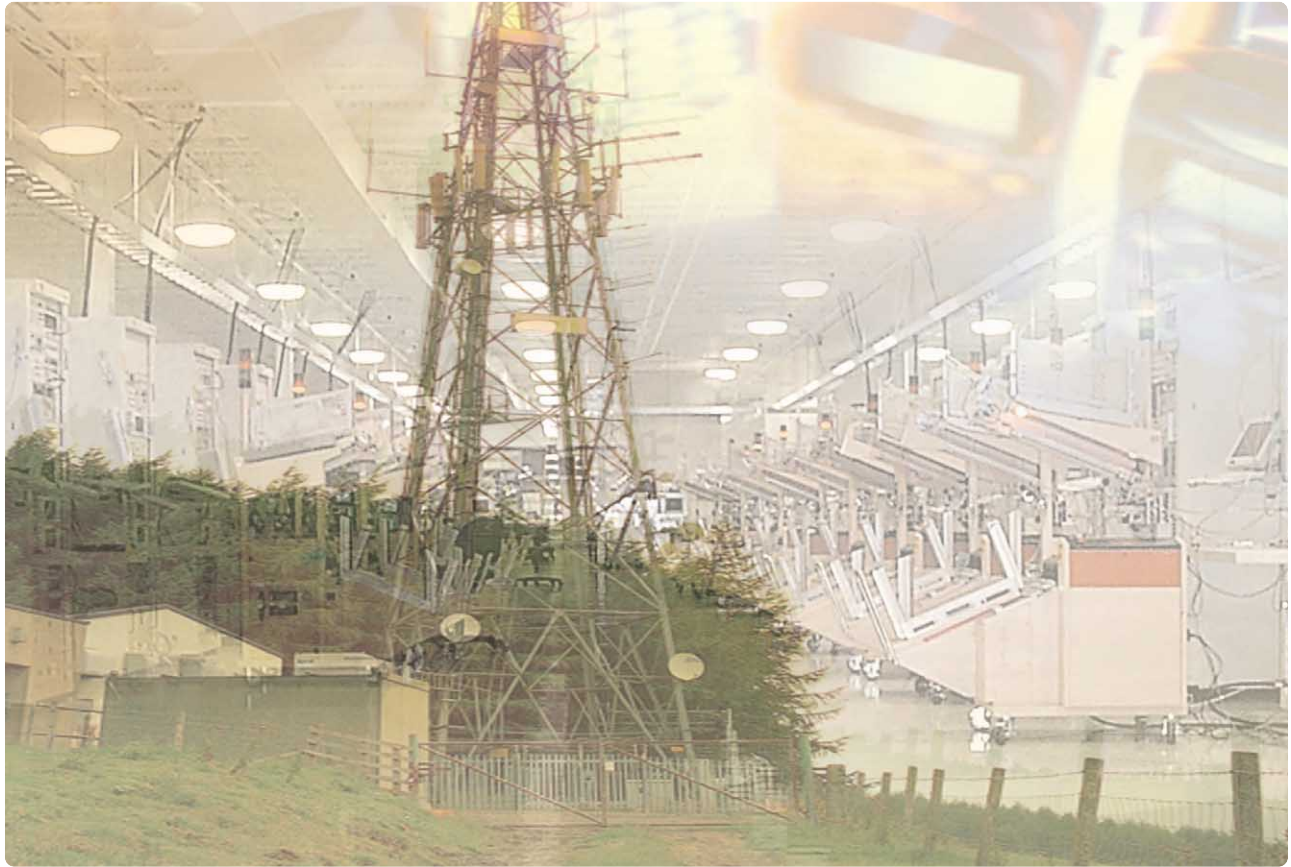
- Agilent** logo and **W-CDMA** mode.
- BTS Ch Freq 1.00000 GHz**
- Code Domain** with a **PASS** indicator.
- I/Q Measured Polar Vector** plot.
- Ref 0.00** and **10.00** dBm levels.
- Demod** section with binary data: I: 00, Q: 10, I: 00, Q: 01, I: 00, Q: 11, I: 011, Q: 101, I: 11011, Q: 10000, I: 0010010, Q: 10011011, I: 11001110, Q: 111100001, I: 101001011.

The right side of the interface shows a list of supported modes:

- W-CDMA (3GPP)
- EDGE w/GSM
- cdma2000
- cdmaOne
- NADC
- PDC
- More (1 of 2)

The physical device features a control panel with buttons for **FREQ**, **MODE**, **MEAS**, **VIEW**, **SEARCH**, **MARK**, **STOP**, **HELP**, **POWER**, **MODE**, **MEAS**, **VIEW**, **SEARCH**, **MARK**, **STOP**, **HELP**, and a **SYSTEM** section with **POWER**, **MODE**, **MEAS**, **VIEW**, **SEARCH**, **MARK**, **STOP**, **HELP**, and **SYSTEM** buttons. The front panel also includes a **DC-5MHz** input section, a **DC-5MHz** output section, and a **DC-5MHz** output section.

# 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.

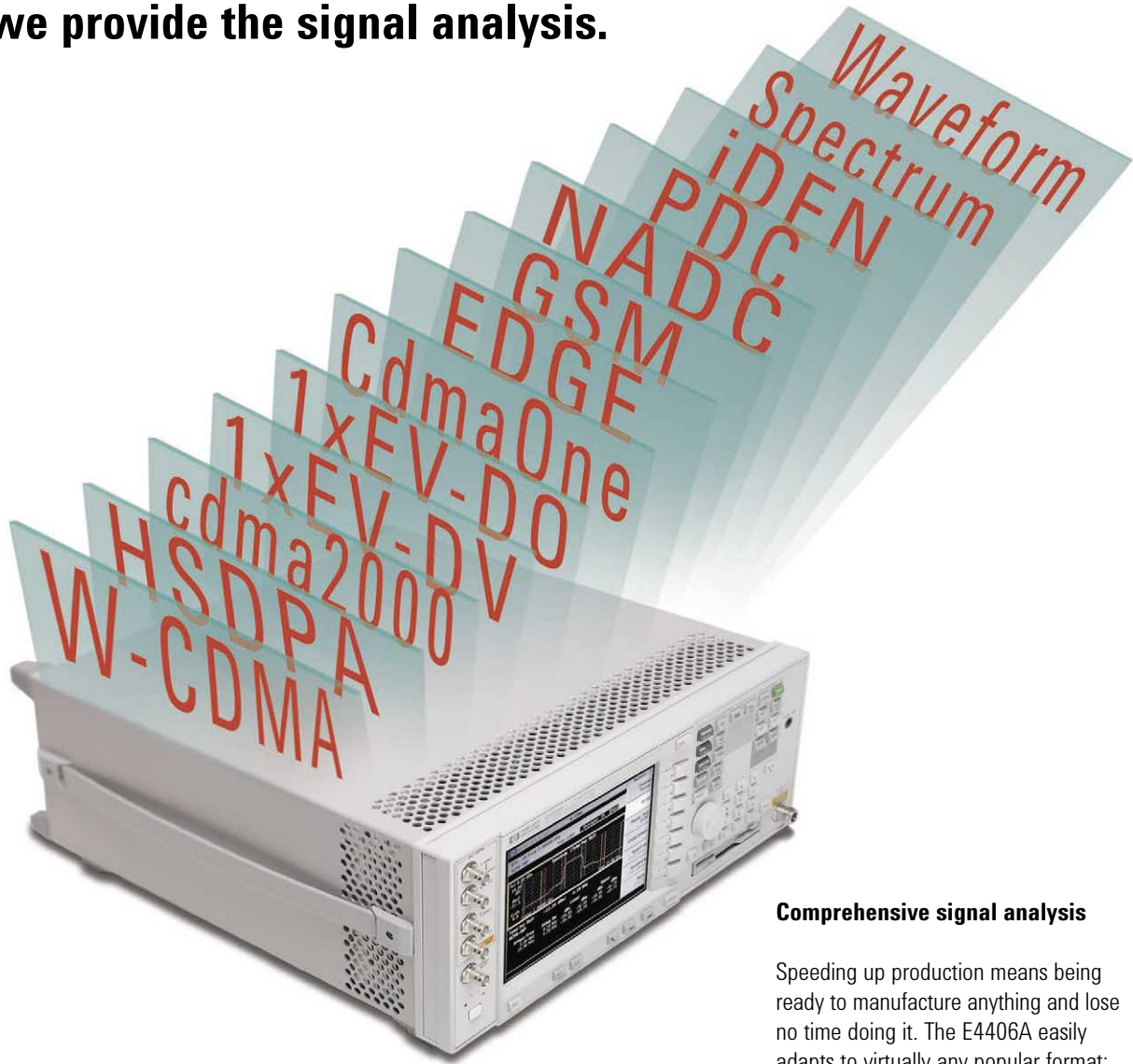
## 2.5G, 3G, and 3.5G formats

For engineers developing next-generation wireless components and systems, the E4406A provides W-CDMA, HSDPA, cdma2000, 1xEV-DV, 1xEV-DO 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:

#### **An investment for your future**

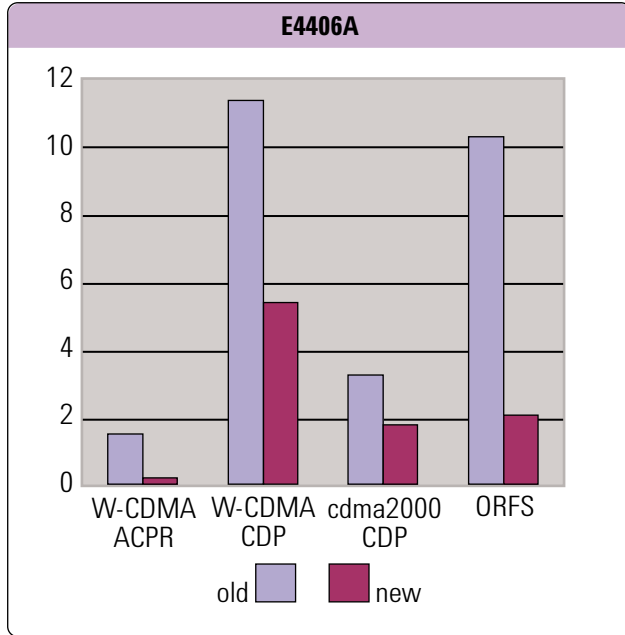
The number of wireless technologies deployed around the world is growing and the demand for any particular format can change quickly. The E4406A offers format and frequency flexibility.

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

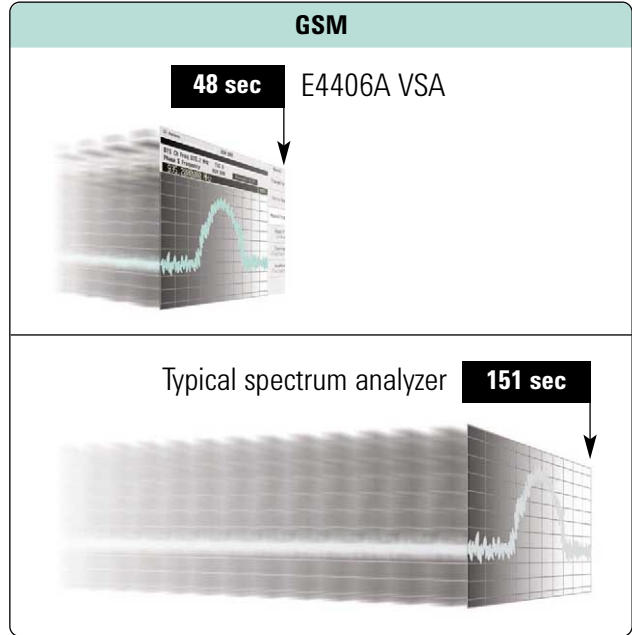
**Easy to use**

**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 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. Output radio frequency spectrum (ORFS) is two times faster, W-CDMA code domain power (CDP) is five times faster, and 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.

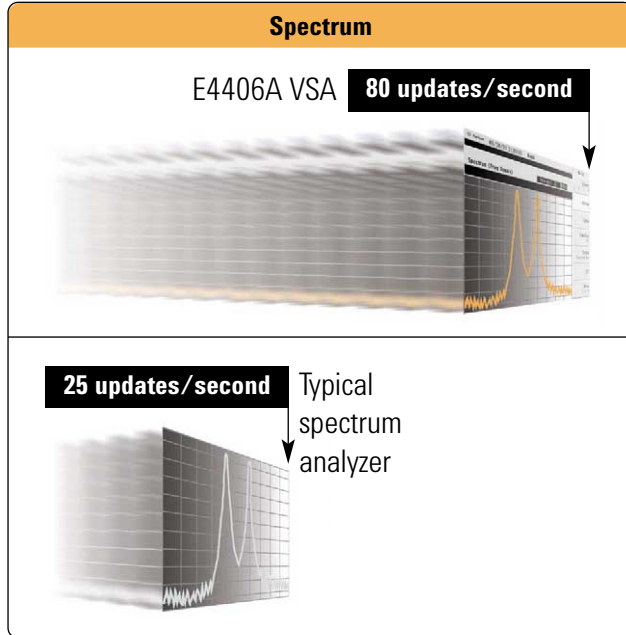
The E4406A delivers a logical user interface and a wealth of quick “one button” measurements, enabling designers to quickly try multiple test without getting bogged down in cryptic menus. The E4406A interface provides the edge needed to expediently evaluate new designs and successfully meet the demands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

**Now even faster**

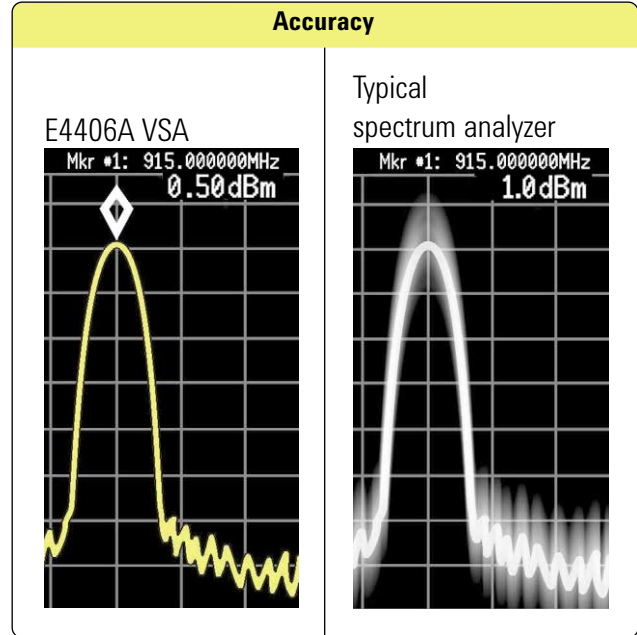
**“We have decreased the (transmitter power calibration) test time by 25%.”**

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

## Accuracy

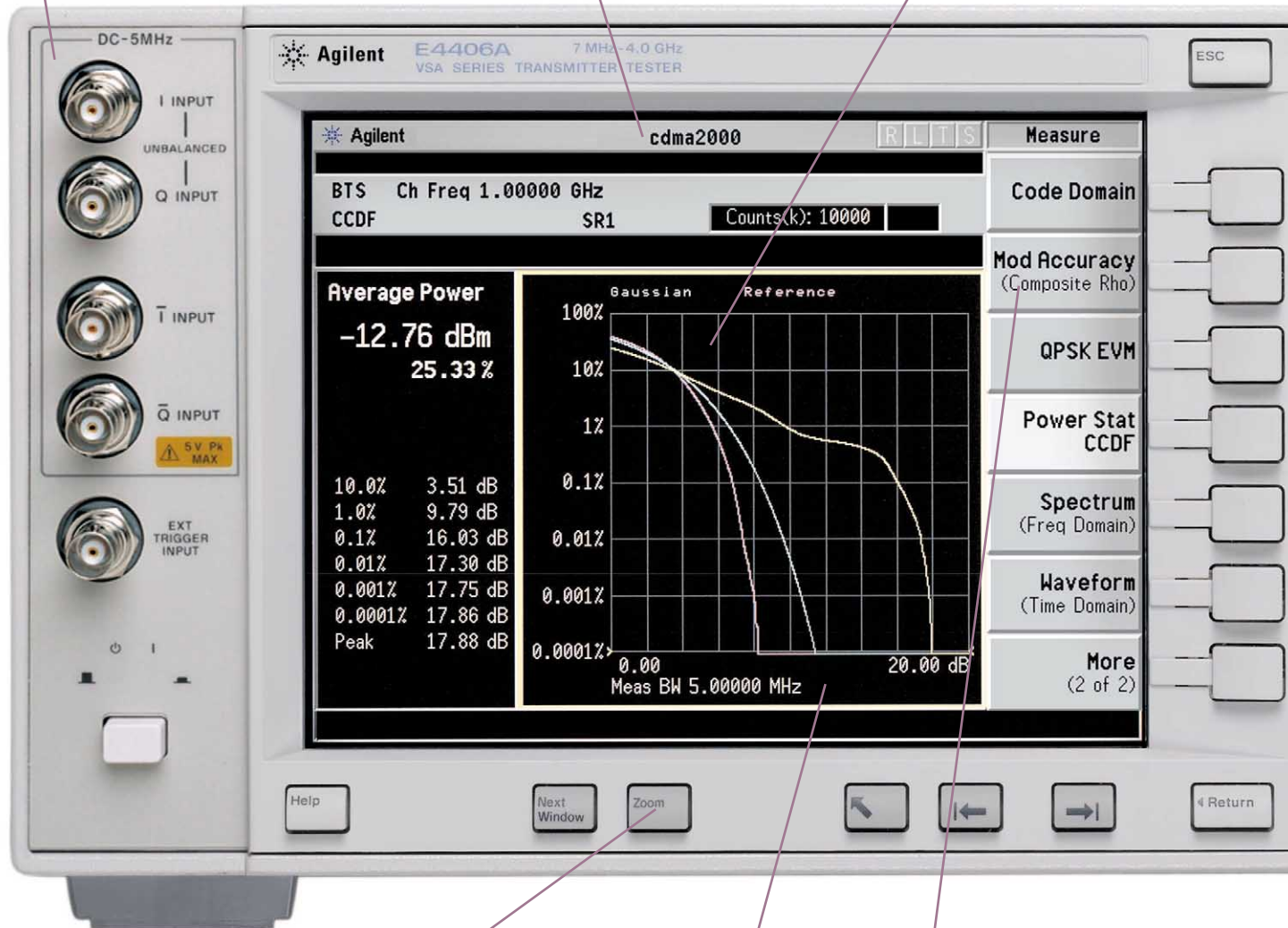
You don't need to reduce measurement speed to get accurate results. Superior absolute level accuracy of  $\pm 0.6$  dB ( $\pm 0.4$  dB typical) provides unmatched performance and minimizes test uncertainty. Combined with a linearity of  $\pm 0.25$  dB over a 76 dB range, the E4406A is a state-of-the-art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

# The E4406A VSA...

**Baseband measurements** with balanced/unbalanced multiple impedance inputs

**Focused** applications including EDGE, GSM, W-CDMA, HSDPA, cdma2000, 1xEV-DV, 1xEV-DO, cdmaOne, and NADC 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

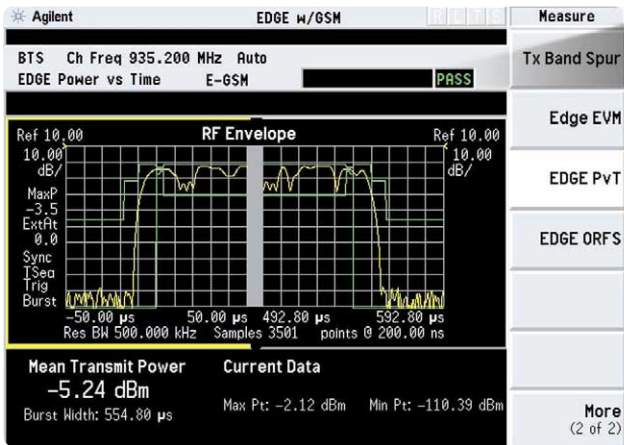


**Built-in** floppy disk drive provides PC compatibility and data archiving

**High-speed** 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.

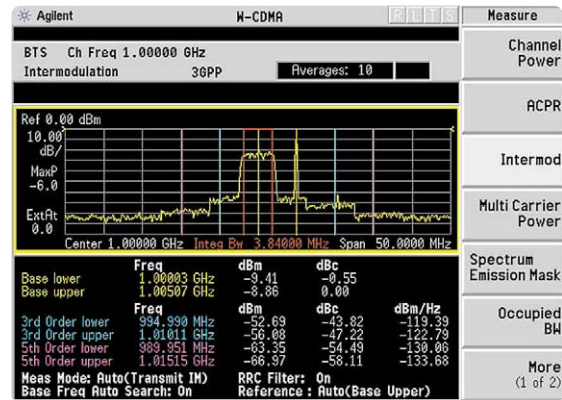
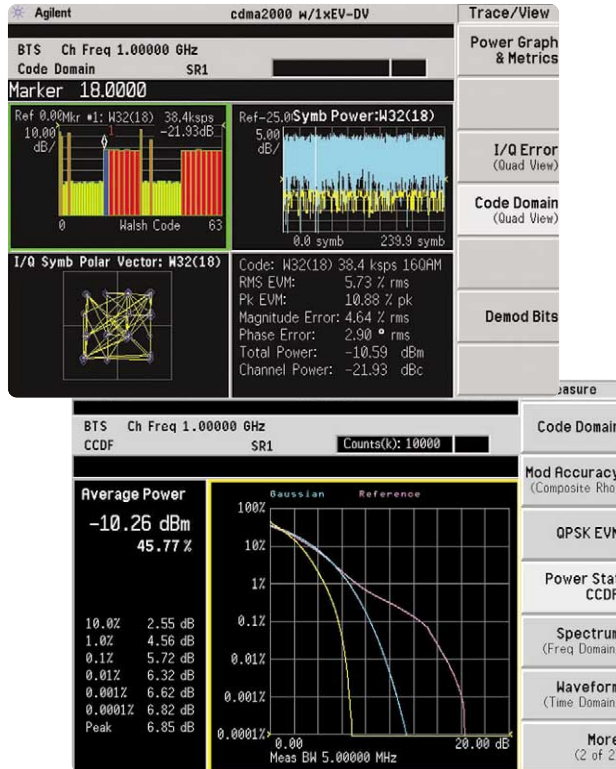
## Speed and throughput

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

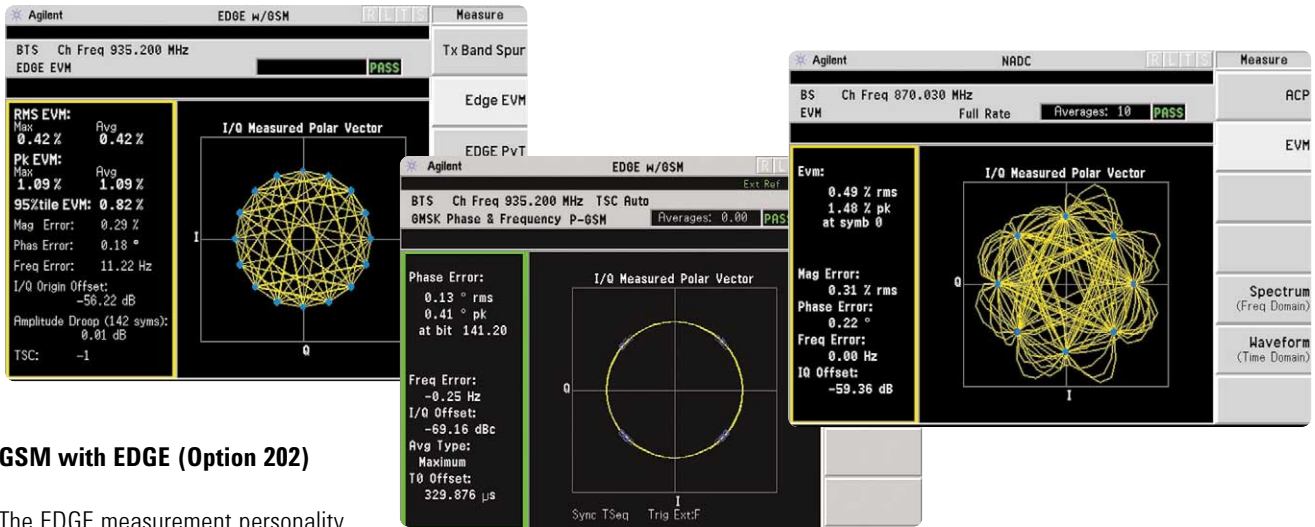
Digital modulation presents new challenges to amplifier manufacturers. Designers need effective methods to quickly characterize digital signals. The E4406A's complementary cumulative-distribution function (CCDF) is useful for determining a signal's power statistics, revealing the power peaks relative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

- Error vector magnitude (EVM)
- Multi-slot power versus time (PvT)
- 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:

- 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)

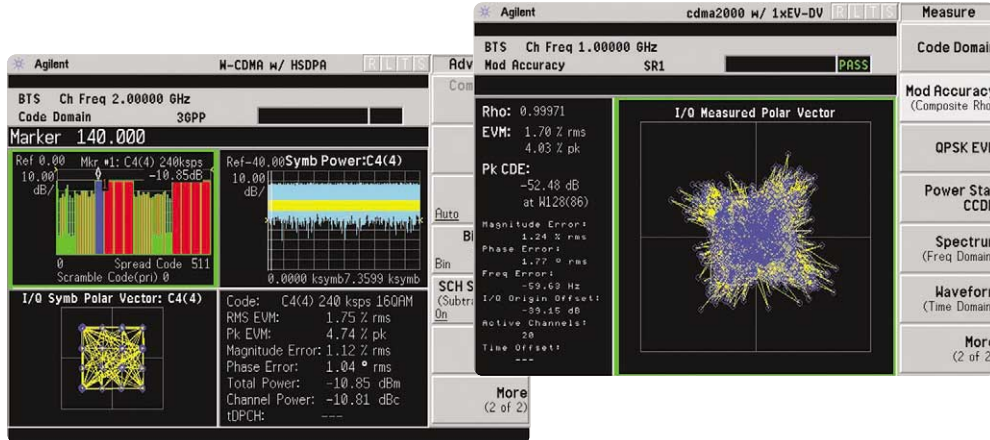
The personalities feature base station and mobile radio mode set-ups, as well as sync word search capability.

## iDEN (Option HN1)

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

- Occupied bandwidth (OBW)
- ACPR
- Transmitter bit error rate (BER)

# ... 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 (Option 210)

HSDPA Option 210 adds the following capabilities to BAF

- Code domain analysis
  - Pre-defined test model 5
  - 16QAM/QPAK detection
  - Demodulation bits in binary/hexadecimal format
  - Adaptive modulation support
  - HS-DPCCH power  $\beta$
- Modulation accuracy
  - HSDPA support

## 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

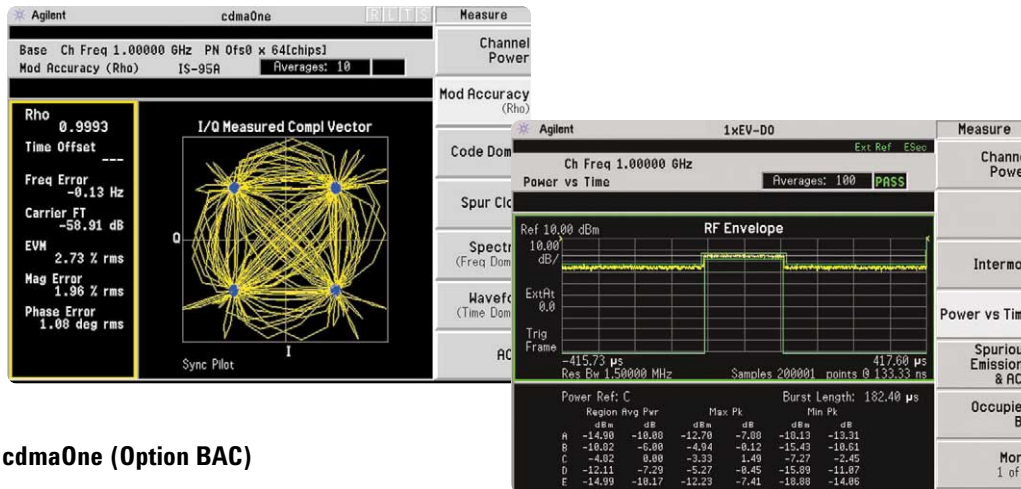
Advanced code domain analysis algorithms display Walsh codes for either Hadamard or OVFS coding schemes in a multi-rate view. Other capability includes code domain error, symbol EVM, symbol power versus time, active channel identification, variable PN offset, quasi-orthogonal functions and demodulated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

Along with the world's fastest ACPR measurements, this personality features PN (pseudo-noise sequence) search, time offset, and carrier feed-through analysis.

## 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 the 3GPP2 and TIA/EIA/IS-856 standards.

Forward link

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

Reverse link

- Code domain
- Modulation accuracy (composite rho)

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 (composite rho), and QPSK EVM can also measure for each channel's Pilot, MAC, and Data in QPSK/8PSK/16QAM. 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.

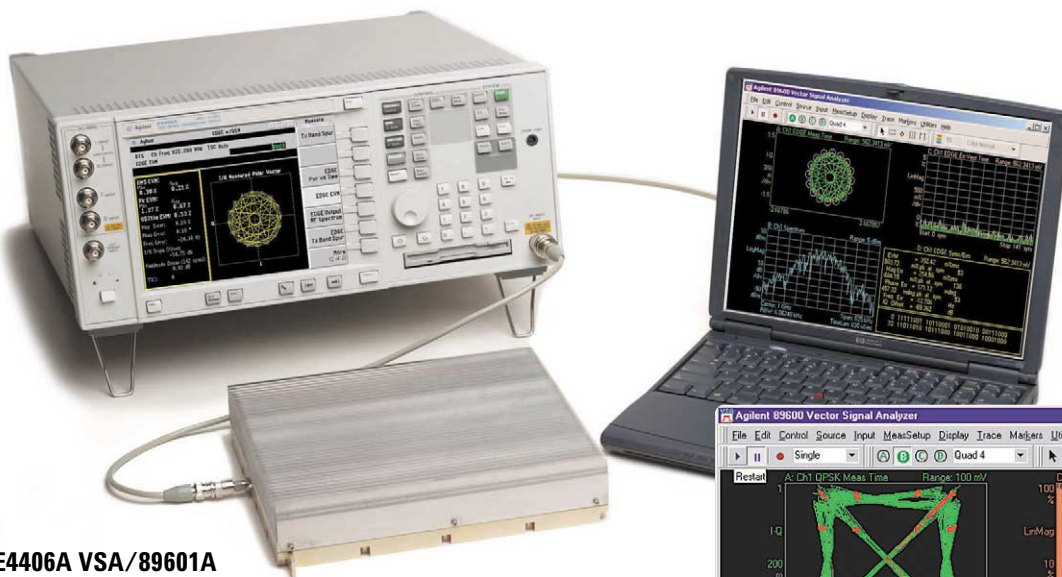
Ideally suited for R&D engineers and manufacturing environments, this option allows measurement of baseband I and Q signals in either balanced or unbalanced systems. Input configurations include 50-ohm unbalanced, 600-ohm balanced, and 1-Mohm balanced or unbalanced – enabling a variety of systems to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

Applicable in-band 3GPP W-CDMA, HSDPA, 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).



# Coupling speed and power...

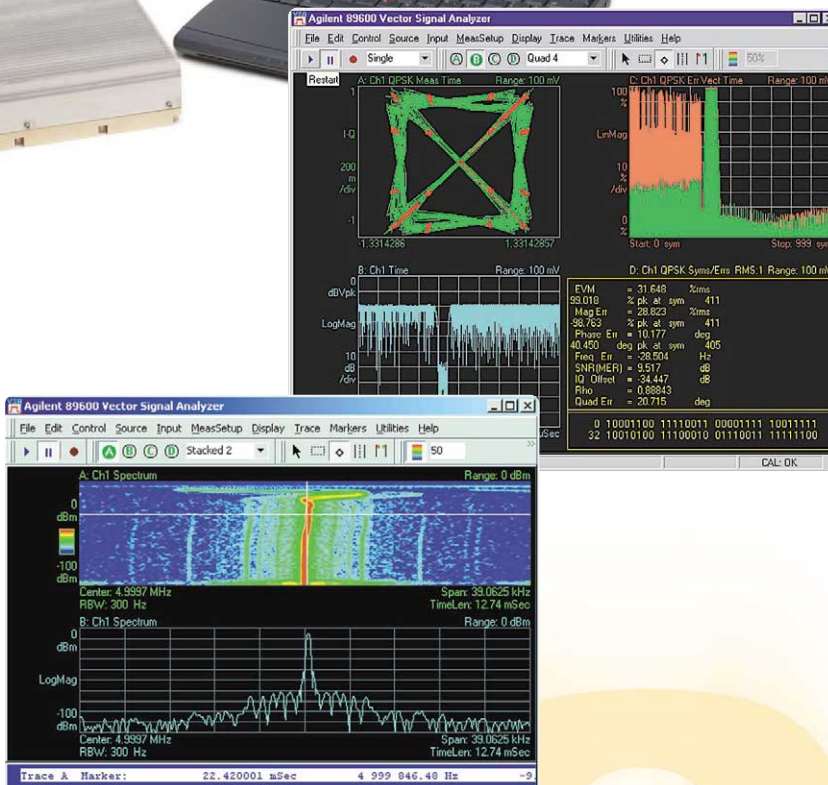


## E4406A VSA/89601A software combination

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 is the heart of the Agilent 89600 series of vector signal analyzers. This software provides flexible tools for demodulating and analyzing even the most advanced digital modulations, whether or not they are contained in an established standard.

Features include variable block size signal acquisition with user-selectable pulse search and synch words, and a user-controllable adaptive equalizer. Filter types include cosine (raised and square-root raised), Gaussian, and low-pass – all with configurable alpha/BT. Supported modulation formats for both continuous and burst carriers include FSK (2, 4, 8, and 16 level), BPSK, QPSK, OQPSK, DQPSK, p/4DQPSK, 8PSK, QAM (16 to 256 level), VSB (8 and 16 level), EDGE, and MSK.



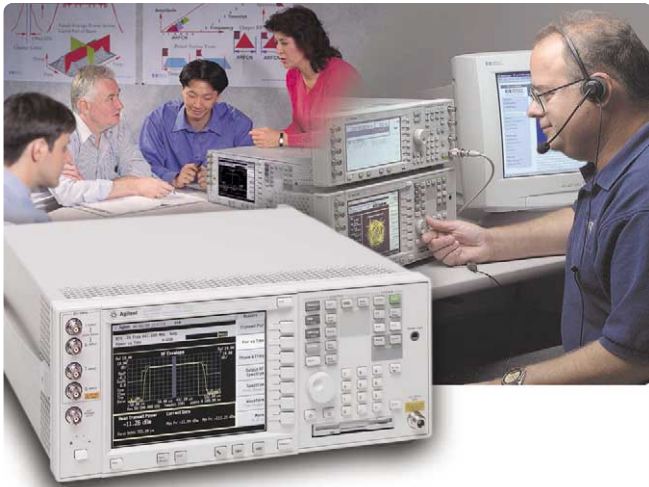
The software also provides signal capture and analysis features, such as the capability to download signal capture files for playback through signal generators, and display high-speed spectrograms.

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](http://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
- VXI Plug and Play drivers

### Peripheral and product interfaces

- parallel printer port
- printer support
- VGA monitor output
- Agilent E4438C ESG vector signal generator
- 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
- manuals on CD-ROM and on the Web

### Software

- programming examples on CD-ROM
- SCPI (Standard Commands for Programmable Instruments)
- PC-based performance verification and adjustment software

# Ordering information

## E4406A vector signal analyzer

Model	Description
E4406A	7 MHz to 4 GHz
Option	Description
<i>Digital Demodulation Measurements</i>	
E4406A-202	EDGE with GSM measurement personality
E4406A-204	1xEV-DO measurement personality
E4406A-B78	cdma2000 measurement personality
E4406A-214	1xEV-DV measurement personality <sup>1</sup>
E4406A-BAC	cdmaOne measurement personality
E4406A-BAE	NADC, PDC measurement personality
E4406A-BAF	W-CDMA measurement personality
E4406A-210	HSDPA measurement personality <sup>2</sup>
E4406A-BAH	GSM measurement personality
E4406A-HN1	IDEN measurement personality

### Inputs and outputs

E4406A-300	321.4 MHz IF output
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### Baseband IQ inputs

E4406A-B7C	I/Q inputs
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### 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 <sup>3</sup>	Taiwan - Chinese localization
E4406A-AB1 <sup>3</sup>	Korea - Korean localization
E4406A-AB2 <sup>3</sup>	China - Chinese localization
E4406A-ABD <sup>3</sup>	German localization
E4406A-ABF <sup>3</sup>	France - French localization
E4406A-ABJ <sup>3</sup>	Japan - Japanese localization
E4406A-OB0 <sup>3</sup>	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 36 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
E4444A	Benchlink spectrum analyzer software
89601A	Vector signal analysis software



## Agilent Email Updates

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### Agilent T&M Software and Connectivity

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## 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 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.

By internet, phone, or fax, get assistance with all your test and measurement needs.

Phone or Fax  
**United States:**  
 (tel) 800 452 4844

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

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

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

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

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

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

**Other Asia Pacific Countries:**  
 (tel) (65) 6375 8100  
 (fax) (65) 6836 0252  
 Email: [tm\\_asia@agilent.com](mailto:tm_asia@agilent.com)

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

### Online Assistance:

[www.agilent.com/find/assist](http://www.agilent.com/find/assist)

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