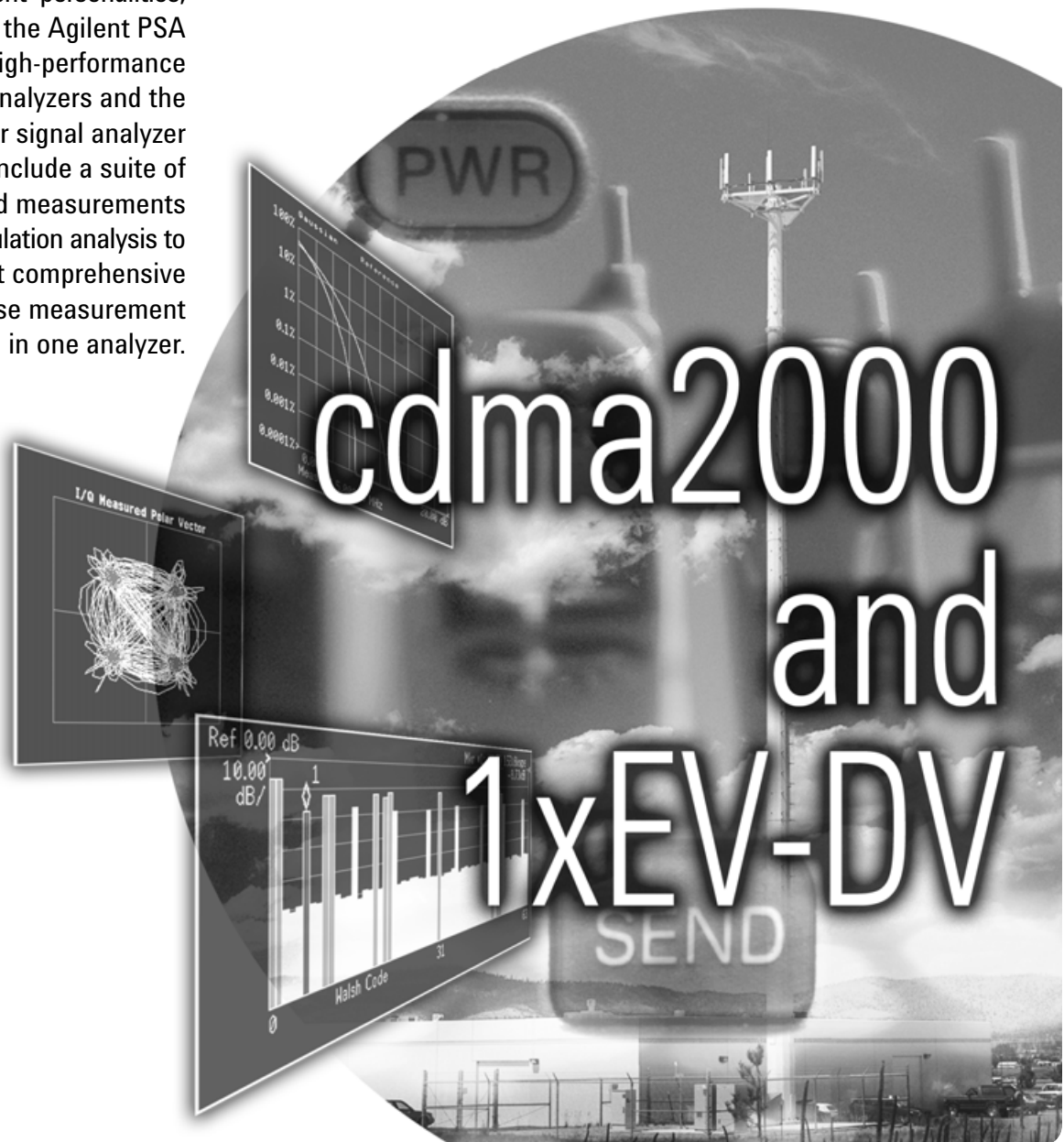# Agilent
PSA Series Spectrum Analyzers
E4406A Vector Signal Analyzer
cdma2000 and 1xEV-DV
Measurement Personalities

Technical Overview with Self-Guided Demonstration
Options B78 and 214

The cdma2000 and 1xEV-DV measurement personalities, available on the Agilent PSA Series high-performance spectrum analyzers and the E4406A vector signal analyzer (VSA) include a suite of standard-based measurements with digital modulation analysis to provide the most comprehensive and easy-to-use measurement solution in one analyzer.

Agilent Technologies

Make the Transition to Third-Generation (3G) Wireless Technology Faster and Easier

Migrating from cdmaOne to cdma2000 and 1xEV-DV will introduce new challenges in the design and test of base stations and mobile transmitters. Be at ease in this transition with a comprehensive, one-analyzer solution from Agilent.

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

The Agilent PSA Series offers high-performance spectrum analysis up to 50 GHz with powerful one-button measurements, a versatile feature set, and a leading-edge combination of flexibility, speed, accuracy, and dynamic range. Expand the PSA to include 3GPP2 digital signal analysis capability with the cdma2000 (Option B78) and 1xEV-DV (Option 214) measurement personalities.

For many manufacturing needs, the E4406A VSA, a vector signal analyzer, is an affordable platform that also offers the cdma2000 and 1xEV-DV personalities.

The cdma2000 measurement personality provides key transmitter measurements for analyzing systems based on the 3GPP2 Technical Specifications Group cdma2000 (TSG-C) specifications (C.S0010-A and C.S0011-A, March 2001).

Measurements may be performed on the forward and reverse link signals. The 3GPP2 Release C is supported by the 1xEV-DV measurement personality.

Technical overview includes
- measurement details
- demonstrations
- PSA Series key specifications for cdma2000 and 1xEV-DV measurements
- ordering information
- related literature

All demonstrations utilize the PSA Series and the E4438C ESG vector signal generator; however, they can also be performed with the E4406A VSA. Keystrokes surrounded by [ ] indicate hard keys located on the front panel, while key names surrounded by { } indicate soft keys located on the right edge of the display.

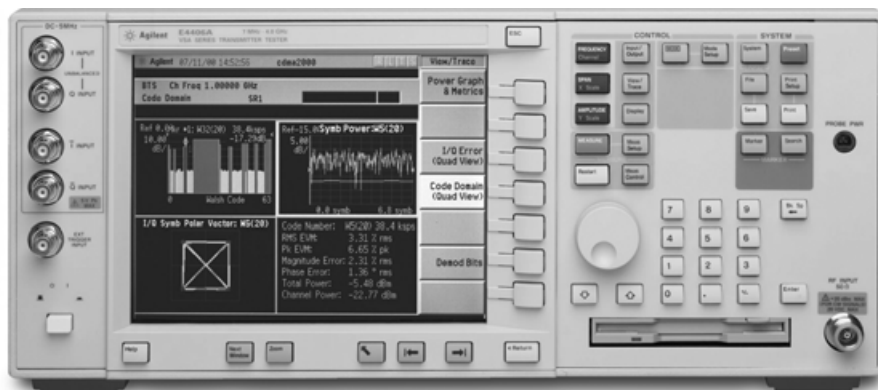Channel power page 3 · ACPR page 4 · Modulation accuracy page 10 · QPSK EVM page 12
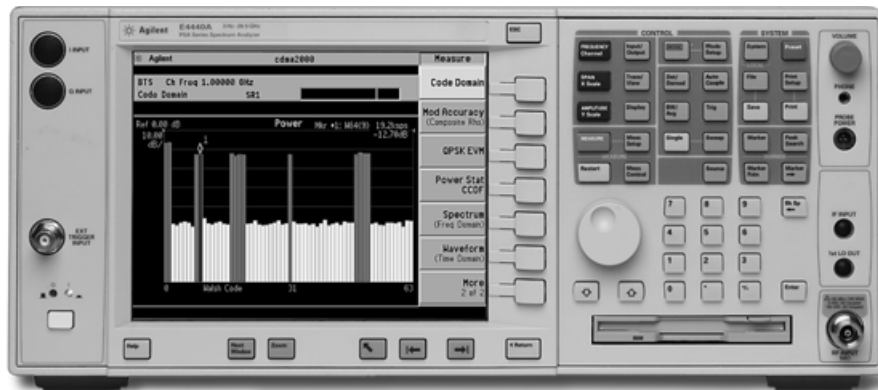
PSA series spectrum analyzer

Spectrum emission mask page 5 · Code domain analysis page 6 · Power statistics (CCDF) page 13 · Intermodulation distortion page 13

E4406A vector signal analyzer

Demonstration preparation

To perform the demonstrations, the ESG and the PSA Series require the following options.

Product type	Model number	Required options
ESG vector signal generator	E4438C	502, 503, 504, or 506 — frequency range up to at least 2 GHz 001 or 002 — baseband generator 401 — cdma2000 and IS95A personalities 414 — Signal Studio for 1xEV-DV (rev. A.1.0.18 or higher)
PSA Series spectrum analyzer	E4440A/E4443A/E4445A/ E4446A/E4448A	B7J — Digital demodulation hardware B78 — cdma2000 measurement personality 214 — 1xEV-DV measurement personality

To configure the instruments, connect the ESG's 50 Ω RF output to the PSA's 50 Ω RF input with a 50 Ω RF cable. Turn on the power in both instruments.

Now set up the ESG to provide a cdma2000 signal with nine channels.

Instructions	Keystrokes
On the ESG:	
Set the carrier frequency to 1 GHz.	[Preset] [Frequency] [1] {GHz}
Set amplitude to −10 dBm.	[Amplitude] [−10] {dBm}
Select cdma2000 mode.	[Mode] {CDMA} {Arb CDMA2000}
Generate a cdma2000 Spread Rate 1 signal.	{Spread Rate} {Spread Rate 1}
Select the channel structure.	{CDMA2000 Select} {9 Channel}
Change the data rate and Walsh code of a supplemental 1 traffic channel.	{More} {CDMA2000 Define} {Edit Channel Setup}, tab to Row 5 under "Walsh", {Edit Item} [5] {Enter}, tab to Row 5 under "Rate bps", {Edit Item} {More} {76800 Bps} [Return] {Apply Channel Setup} [Return] {More}
Activate the format.	{cdma2000 On} [RF On]

Channel power

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

Control the following channel power measurement parameters:

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

This exercise demonstrates the one-button channel power measurement on the PSA.

Instructions	Keystrokes
On the PSA:	
Perform factory preset. (skip this step for E4406A VSA)	[System] {Power On/Preset} {Preset Type} {Factory}
Enter the cdma2000 mode in the analyzer.	[Preset] [Mode] ({More} if necessary){cdma2000}
Choose transmitter device. The PSA can make measurements on both the forward and reverse links, but only the forward link will be demonstrated in this guide.	[Mode Setup] {Radio} {Device BTS}
Activate channel power measurement. Observe the white bars indicating the spectrum channel width and the quantitative values given beneath.	[MEASURE] {Channel Power}
Examine settings (Figure 1). Use this step to make setup changes in any measurement.	[Meas Setup]

Figure 1. Channel power
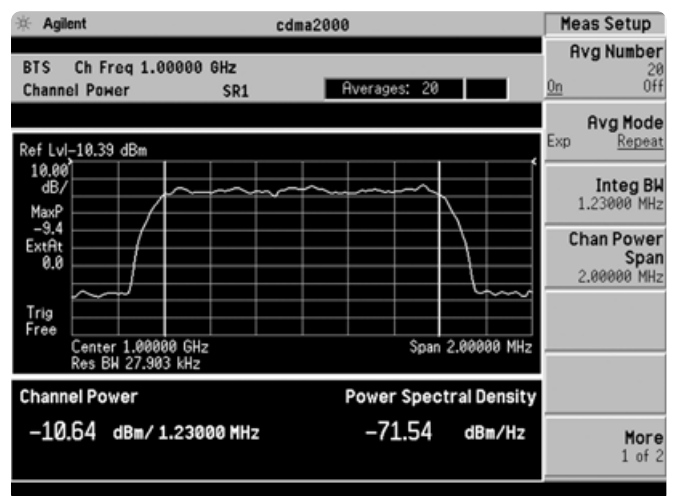
Adjacent channel power ratio (ACPR)

To avoid channel interference, it is important to measure and reduce any adjacent channel leakage power transmitted from a base station. Reducing transmitter channel leakage allows for more channels to be transmitted simultaneously, which in turn, increases base station efficiency. The characteristics of adjacent channel leakage power are mainly determined by the transmitter design. ACPR is a measure of the power in adjacent channels relative to the transmitted power.

- Adjust integration bandwidth (defaults to 1.23 MHz).
- Evaluate up to five adjacent channel pairs.
- Choose adjacent channel offset frequency, reference bandwidth, and limit values.
- Adjust and display both absolute and relative limits.
- Measure the total power in dBm or the PSD in dBm/Hz.
- View bar graph or spectrum.

In this exercise, the ACPR measurement will be made and the customizable offsets and limits explored.

Instructions	Keystrokes
On the PSA:	
Activate ACPR measurement.	[MEASURE] {ACPR}
Enable spectrum view.	[Trace/View] {Spectrum}
Expand spectrum display. Use this to expand any window in any measurement.	[Next Window] until spectrum display is highlighted in green, [Zoom] ([Zoom] again to return)
Add an offset and set its limit (Figure 2). Notice as the green PASS indicator in the upper right corner changes to a red FAIL when the signal does not meet limit requirements.	[Meas Setup] {Ofs & Limits} {Offset} {C} {Offset Freq On} [5] {MHz} {Rel Lim (Car)} [−90] {dBc}

Figure 2. ACPR
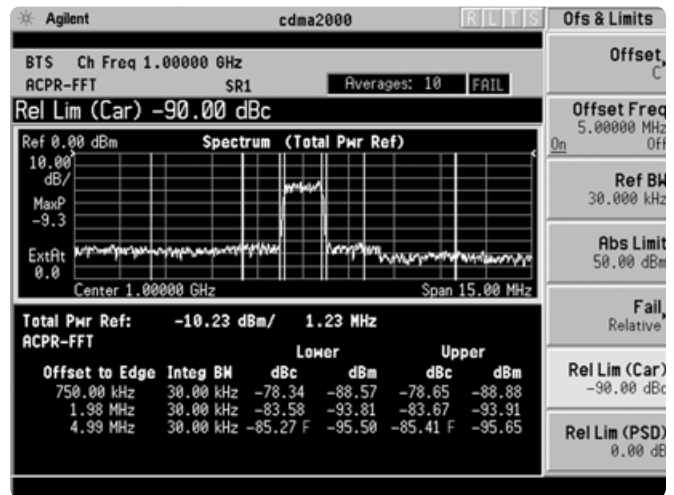
Spectrum emission mask

The performance standards recommended by the 3GPP2 for cdma2000 have specific limits for transmitted spurious emissions. This measurement has different limits for different frequency offsets measured in different resolution bandwidths. Completing this measurement with a traditional spectrum analyzer can be tedious and time consuming. The PSA makes this measurement with a single button press.

- View table and spectrum formats.
- Measure the total power in dBm or the PSD in dBm/Hz.
- Select the average or peak detector (defaults to average).
- Adjust measurement interval (defaults to 1 ms).
- Choose offset frequency, reference bandwidth, and limit values.
- Optimize speed and accuracy with variable measurement bandwidth.
- Customize reference channel span, step frequency, and resolution bandwidth.

This exercise illustrates the spectrum emission mask measurement and explores some of the customizable features. Notice in the PSA measurement that the mask limit is represented by a green trace on the screen.

Instructions	Keystrokes
On the PSA:	
Activate the spectrum emission mask measurement. Observe the mask and trace in the upper window and the table of measured values in the lower window.	[MEASURE] {Spectrum Emission Mask}
Choose the type of values to display. Observe the measurement values change in the lower window to reflect the selected value type.	[Display], choose {Abs Peak Pwr & Freq}, {Rel Peak Pwr & Freq} or {Integrated Power}
View customizable offsets and limits. Measurement parameters as well as limit values may be customized for any of the five offset pairs or for any individual offset.	[Meas Setup] {Offset/Limits} {More} {Limits}
Specify measurement interval (up to 10 ms) and select detector type (average or peak) (Figure 3).	[Meas Setup] {Meas Interval}, rotate KNOB, [⇑] or [⇓], {More}, toggle {Detector}

**Figure 3.
Spectrum emission mask**
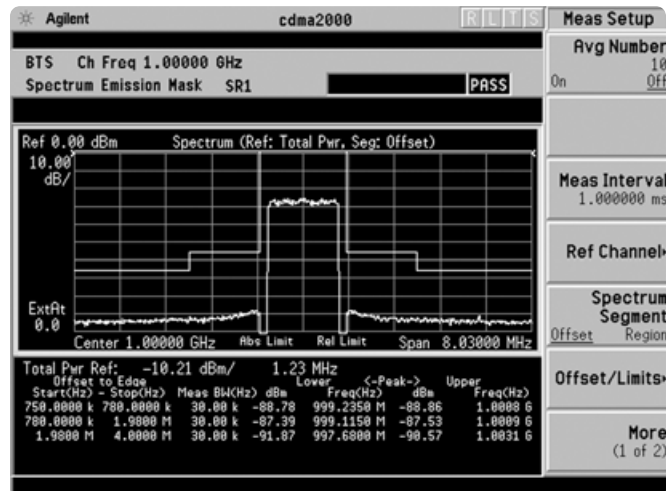
Code domain analysis

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

Unlike cdmaOne, cdma2000 uses Walsh codes of different lengths, and channels with shorter code lengths (higher data rates) occupy more code space. However, the code space used for channels with shorter code lengths is not contiguous.

There are two algorithms by which the PSA can display the code channel power. The Hadamard algorithm displays each Walsh code in sequence and uses the Consolidated Marker feature to display the composite representation of the traffic channel. The bit-reverse algorithm displays the channels as consolidated code space. The PSA shows a bar for each channel with the bar height proportionately representative of the channel power and the bar width proportional to the data rate.

> Now examine the cdma2000 signal using each of the algorithms.

Instructions	Keystrokes
On the PSA:	
Activate the code domain measurement.	[MEASURE] {More} {Code Domain}
Use the marker to examine Walsh code 5 using the Hadamard algorithm (Figure 4).[1] Notice the dark and light blue bars as part of the consolidated marker. The marker values indicate the power for a Walsh 8 channel.	[Marker] [5] [Enter]
Change the Walsh code algorithm to bit-reverse and examine the new result (Figure 5).	[Display] {Code Order Bit Reverse}, rotate KNOB to highlight widest Walsh channel

**Figure 4.
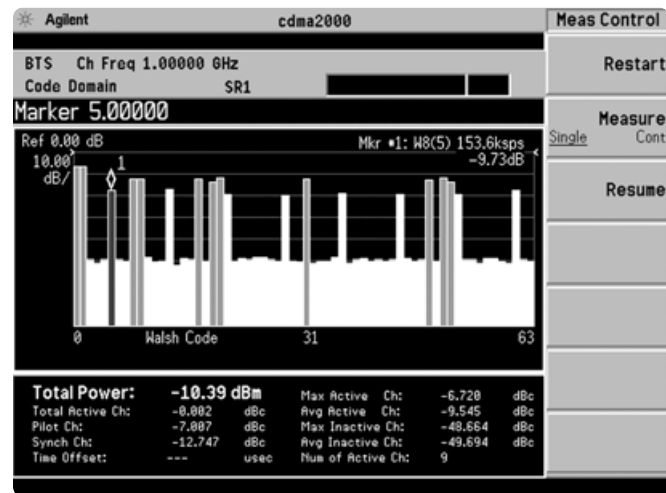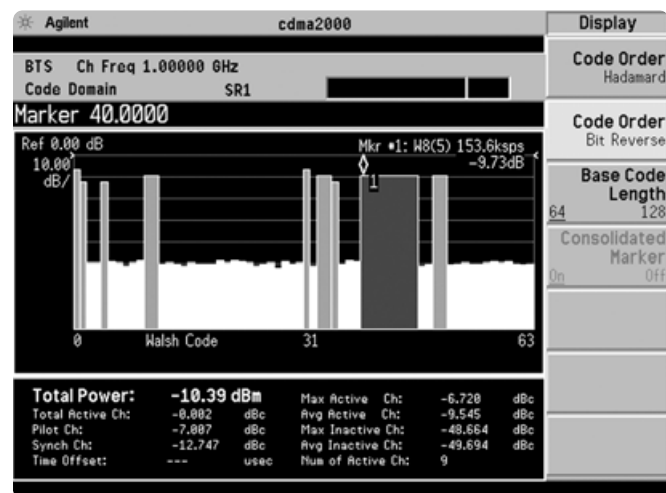Code domain power in Hadamard code order**

**Figure 5.
Code domain power in bit-reverse code order**

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1. The data rate programmed into the ESG will seem different than that measured with the PSA. In actuality, they are the same. The ESG gives the data rate in bits per second, while the PSA measures the data rate in symbols per second. The data rates are related through the radio configuration and the spreading rate.

Additionally, the PSA will de-spread any single code channel to provide magnitude and phase error data, EVM data, symbol power versus time plots, symbol polar vector plots, and demodulated (but not decoded) I and Q bits. You can also

- Use the active channel identification feature or manually set the code channel power threshold level.
- Select PN (pseudo noise sequence) offset.
- Measure quasi-orthogonal functions.
- Take advantage of multiple result views:
  – code power and symbol rates bar graph and table
  – I/Q symbol magnitude and phase errors and EVM plots
  – symbol power plot
  – I and Q bits
- Measure low-level signals more easily with optional preamplifier (Option 1DS).
- Filter the effects of adjacent carriers with multicarrier measurement support.

In this section, explore the many means by which to examine code domain data.

Instructions	Keystrokes
On the PSA:	
Change the Walsh code algorithm back to Hadamard and put the marker on Walsh code 17.	[Display] {Code Order Hadamard} {Marker} [17] [Enter]
Run single measurement.	[Single]
View magnitude error, phase error, and EVM plots for Walsh code 17 (Figure 6).	[Trace/View] {I/Q Error} {Marker} {More} {Mkr → Despread}
Look at more power characteristics.	[Trace/View] {Code Domain}
Show I and Q symbol bits. The display bits are those of Walsh code 17.	{Demod Bits}
Inspect more data (Figure 7). Up to 32 PGC's may be captured, and the bits of any serial combination of those may be viewed.	[Meas Setup] {More} {Capture Intvl} [10] [Return] [Restart] {Meas Interval} [3] [Enter] {Meas Offset} [5] [Enter]

**Figure 6.
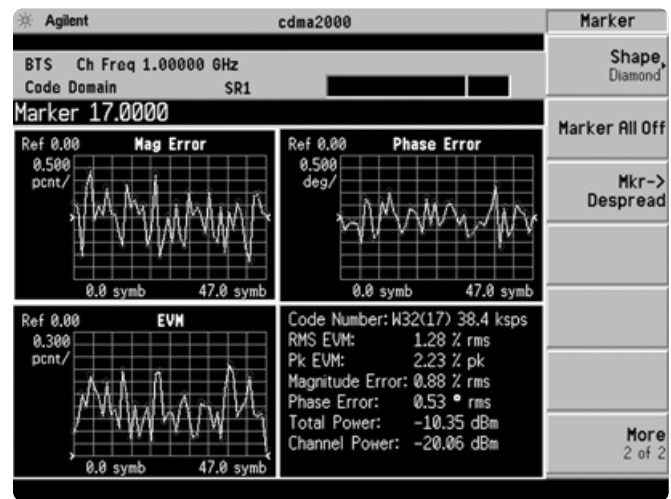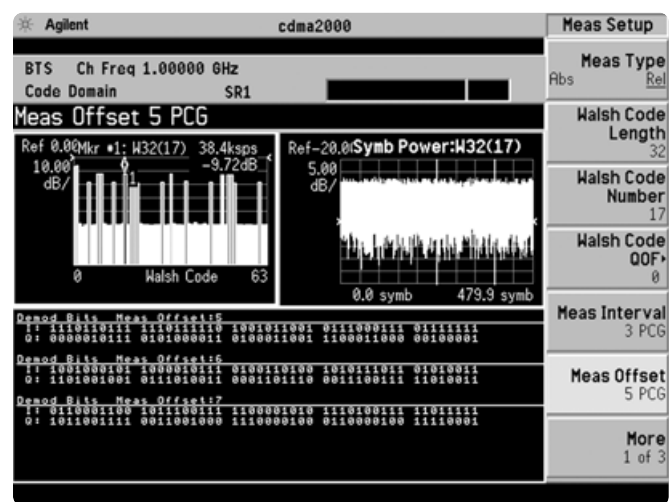Magnitude error, phase error, and EVM plots**

**Figure 7.
Symbol power and demodulated I/Q bits**

Connect the PC, ESG and PSA for 1xEV-DV signals

Connect a PC or laptop (loaded with the Signal Studio-1xEV-DV software and Agilent I/O Library) to the ESG over the GPIB or LAN interface. The setup procedure for this guide assumes the LAN interface is used. To use LAN interface from Signal Studio, you need to set up LAN Client with I/O Configuration of Agilent I/O Library. Follow the steps below, using 50 Ω RF cables:

• Connect the ESG RF Output port to the PSA RF Input port.
• Connect the ESG 10 MHz Out to the PSA Ext Ref In port.
• Connect the ESG event 1 port to the PSA Ext Trigger Input (rear panel).

See Figure 8 for a diagram of this setup.

To configure the instruments, simply connect the ESG's 50 Ω RF output to the PSA's 50 Ω RF input with a 50 Ω RF cable. Turn on the power in both instruments.

Now set up the ESG and Signal Studio to provide a 1xEV-DV signal via LAN connection from the external PC.

GPIB or LAN on
ESG back panel
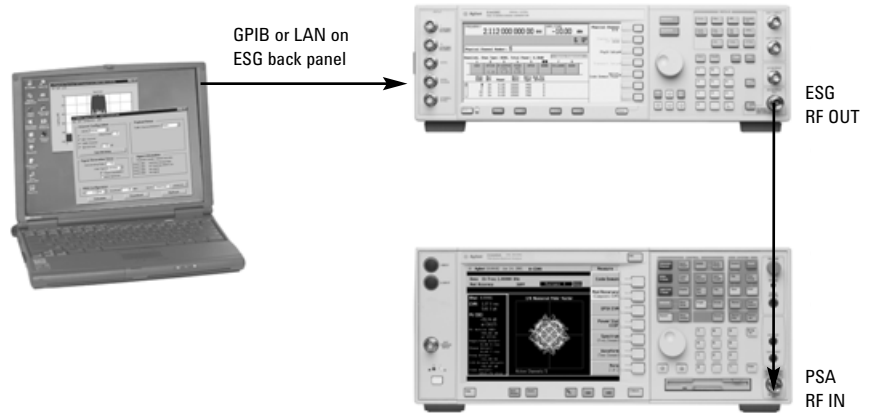
ESG
RF OUT

PSA
RF IN

Figure 8. A computer running Signal Studio-1xEV-DV software (top) is connected to the ESG Vector Signal Generator (middle). The RF output of the ESG is connected to the RF input of the PSA Series with cdma2000 and 1xEV-DV measurement personalities (bottom).

Instructions	Keystrokes
On the ESG:	
Preset the ESG.	[Preset]
Check the IP Address.	[Utility] {GPIB/RS-232/LAN} {LAN Setup} eg. {IP Address 192.168.100.1}
On the Signal Studio-1xEV-DV:	
Run the Signal Studio-1xEV-DV and cdma2000 software.	Double-click on the Signal Studio-1xEV-DV shortcut or access the program via the Windows Start menu.
Verify that the software is communicating with the instrument via the LAN TCP/IP link.	From Connect pull-down menu at the top of the configuration window, select Sig Gen. In Instrument Connection, select TCP/IP. Next, enter your ESG's IP Address in the Address area, then click [Test Connection] button.
After this operation is performed, the software should return "Established".	If this is the case, select [OK]. If this is not the case, re-verify the instrument is connected and re-check the IP Address and TCP/IP link.
On the Signal Studio-1xEV-DV:	
Set the carrier frequency to 1GHz.	Enter [1] [GHz] into the Frequency field in the ESG configuration menu.
Set the amplitude to –10dBm.	Enter [-] [10] into the Amplitude field in the ESG Configuration menu.
Under [Link Control] tab, configure 1xEV-DV signal as Table 1.	Put state check boxes and enter power as defined. To change F-PDCH 1 channel numbers, press [Setup] button.
Activate 1xEV-DV signal.	Switch [State] of 1xEV-DV setup [Off] to [On].
Download the signal data to the ESG.	Click [Apply].

**Table 1. Test-model definition for 1xEV-DV**

	Walsh	Code Number	Number	Power (linear)	Power (dB)
Pilot	64	0	1	0.2	-7.0
Paging	64	1	1	0.338	-4.7
Sync	64	32	1	0.084	-10.7
F-FCH	64	8	1	0.169	-7.7
F-PDCCH	64	9	1	0.039	-14.0
F-PDCH	32	31	15	0.039	-14.0

In code domain, 1xEV-DV Option 214 adds the following capabilities 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/hexa-decimal format

Instructions	Keystrokes
On the PSA:	
Activate the code domain.	[Measure] [More] [Code Domain]
Change the Walsh code algorithm back to Bit Reverse and put the marker on Walsh code 18.	[Display] {Code Order Bit Reverse} {Marker} [18] [Enter] {Mkr → Despread}
Look at more power characteristics (Figure 9).	[Trace/View] {Code Domain}
Show I and Q symbol bits. The display bits are those of Walsh code 18.	{Demod Bits}
Switch the demod bits format from binary to hex (Figure 10).	[Next Window] until bit stream window is highlighted in green. [Display] {Demod Bits Format Binary	Hex}

Figure 9.
Code Domain power in Bit Reverse code order
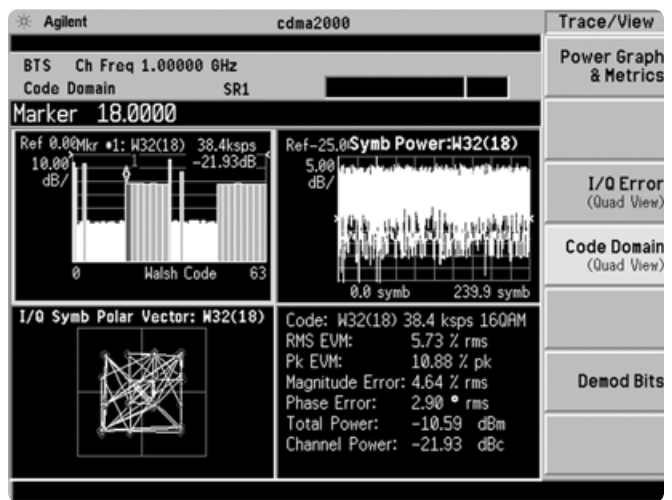
In this section, explore the many means by which to examine code domain data of the 1xEV-DV signal.

Figure 10.
**Symbol power and demodulated I/Q bits**
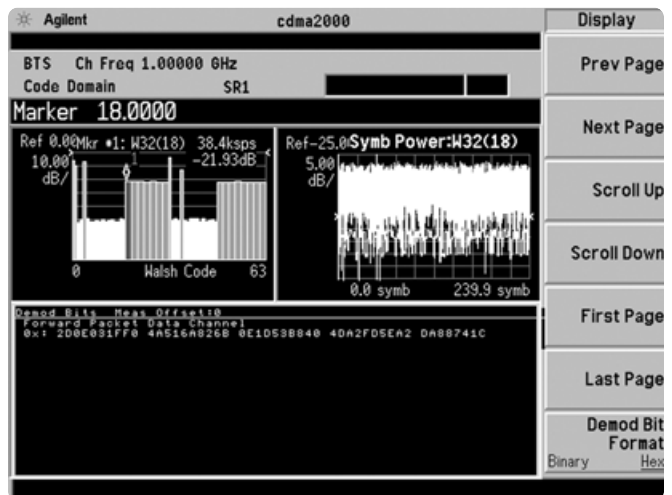
Modulation accuracy (composite rho)

An important measure of modulation accuracy for cdma2000 and 1xEV-DV signals is rho. Rho is the ratio of the correlated power to the total power. The correlated power is computed by removing frequency, phase, and time offsets and performing a cross correlation between the corrected signal and an ideal reference. However, a rho measurement can also be performed on signals with multiple code channels. This measurement is known as composite rho. It allows you to verify the overall modulation accuracy for a transmitter, regardless of the channel configuration, as long as a pilot channel is present. A composite rho measurement accounts for all spreading and scrambling problems in the active channels, and for all baseband, IF, and RF impairments in the transmitter chain.

Another effective way to quantify modulation accuracy is to compare the received signal to an ideal signal. Figure 9 defines the error vector, a measure of the amplitude and phase differences between the ideal modulated signal and the actual modulated signal. The root-mean-square (rms) of the error vector is computed and expressed as a percentage of the square root of the mean power of the ideal signal. This is the error vector magnitude (EVM). EVM is a common modulation quality metric widely used in digital communications.

Figure 11.
The error vector

10
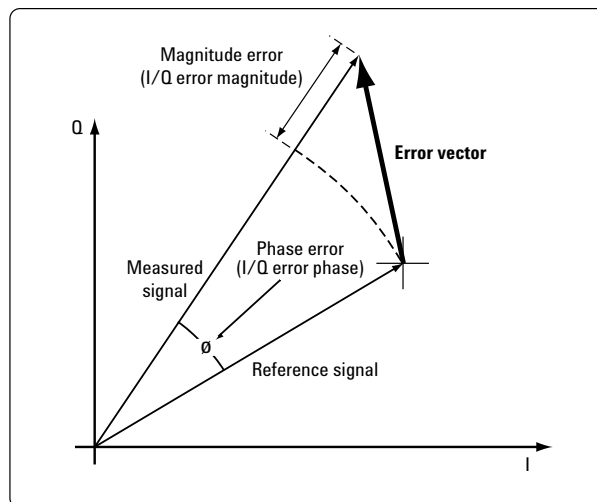
Composite EVM measures the EVM of the multicode channel signal. It is valuable for evaluating the quality of the transmitter for a multichannel signal, detecting spreading or scrambling errors, identifying certain problems between baseband and RF sections, and analyzing errors that cause high interference in the signal.

- Measure EVM, rho, and peak code domain error (CDE).
- Customize limits for rms EVM, peak EVM, rho, peak CDE, timing error, and phase error.
- Specify chip and PN offsets.
- View I/Q polar constellation and magnitude error, phase error, and EVM plots.
- Read power, timing, phase and EVM data for each active channel.
- Choose to include or exclude the I/Q origin offset in the EVM calculation.
- Use the optional preamplifier to measure low-level signals.
- Enable adjacent carrier filtering.

The 1xEV-DV signal can be correctly demodulated when 1xEV-DV is enabled on PSA.

The 1xEV-DV Option 214 should be installed with cdma2000 Option B78.

This exercise explores the different ways in which the modulation accuracy measurement can be used.

| Instructions	Keystrokes
On the PSA:	
Activate modulation accuracy measurement (Figure 12). Observe the I/Q measured polar vector display on the right and the quantitative data provided on the left.	[MEASURE] {More} {Mod Accuracy}
Examine limit values menu. This menu allows the limits to be easily customized for use with the pass/fail indicator.	[Meas Setup] {Limits}
View magnitude and phase error and EVM plots (Figure 13).	[Trace/View] {I/Q Error}
View power, timing, and phase data using the multichannel estimator.	[Meas Setup] {More} {Advanced} (Multi Channel Estimator <u>On</u>} [Trace/View] {Power Timing & Phase}

Figure 12.
I/Q polar vector plot
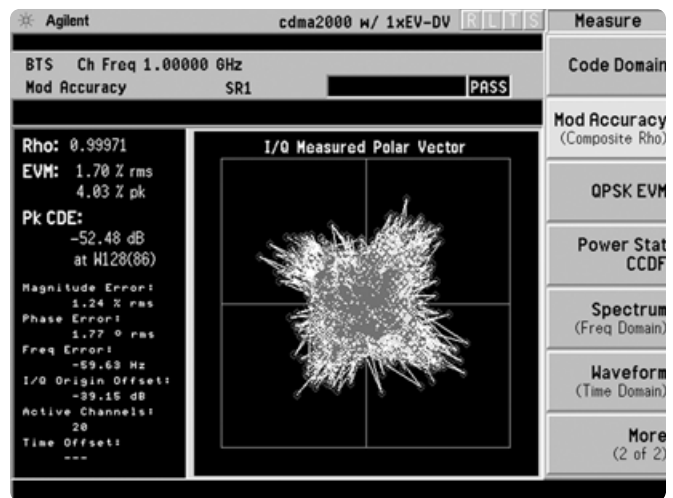
Figure 13.
I/Q error plots
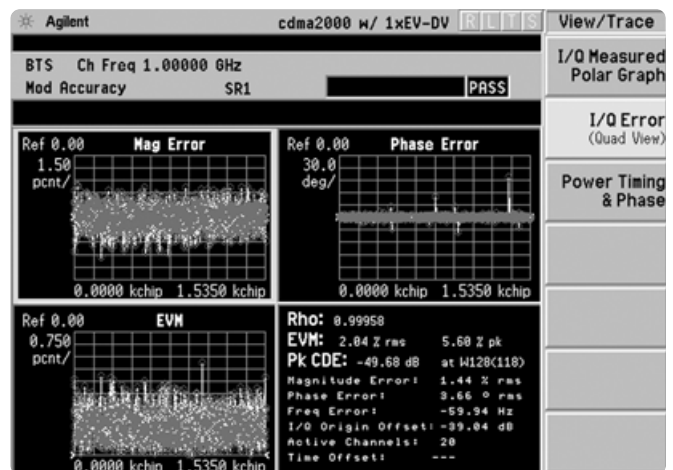
QPSK EVM

The QPSK EVM measurement is used to get some indication of the modulation quality at the chip level for a single-channel signal. It can detect baseband filtering, modulation, and RF impairments, but does not detect spreading or scrambling errors.

- Determine rms and peak EVM (maximum and average).
- View I/Q polar vector diagram or magnitude error, phase error, and EVM plots.
- Specify measurement interval (128 to 1536, defaults to 256 chips).
- Enable adjacent carrier filtering.

This exercise involves changing the cdma2000 signal to a single-channel signal and measuring the error characteristics.

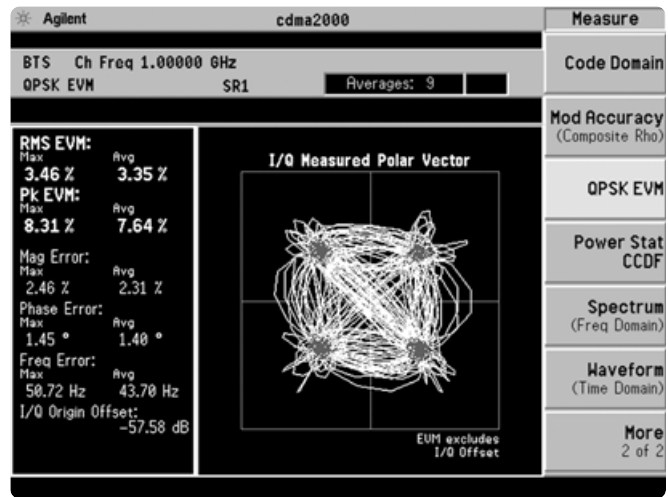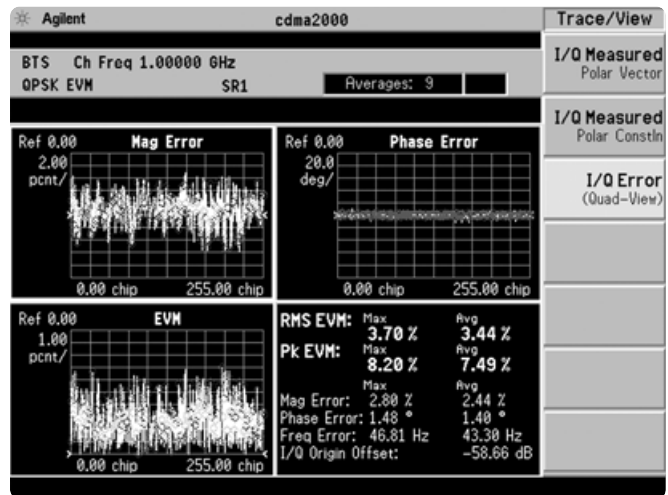| Instructions	Keystrokes
On the ESG:	
Change the signal to have one channel (pilot).	{CDMA2000 Select} {Pilot}
On the PSA:	
Switch on the QPSK EVM measurement (Figure 14).	[MEASURE] {More} {QPSK EVM}
View magnitude and phase error and EVM plots (Figure 15).	[Trace/View] {I/Q Error}

Figure 14.
QPSK constellation

Figure 15.
Magnitude and phase error and EVM plots

Power statistics (CCDF)

The complementary cumulative distribution function (CCDF) is a plot of peak-to-average power ratio (PAR) versus probability and it characterizes the power statistics of a signal. CCDF is a key tool for power amplifier design for cdma2000 base stations, which is particularly challenging because the amplifier must be capable of handling the high PAR the signal exhibits while maintaining good adjacent channel leakage performance. Designing multicarrier power amplifiers pushes complexity yet another step further.

- Customize measurement band width (defaults to 5 MHz).
- Specify measurement interval.
- Set a reference trace or compare to Gaussian noise trace.
- Take advantage of the 0.01 dB histogram resolution.

This exercise illustrates the simplicity of measuring CCDF for cdma2000 transmitted signals.

Instructions	Keystrokes
On the PSA:	
Measure the CCDF (Figure 16). The yellow line is the input signal. The blue reference line is the CCDF of Gaussian noise.	[MEASURE] {More} {Power Stat CCDF}

Figure 16. CCDF

Intermodulation distortion

The harmonic distortion of a system is an indication of the linearity of its components. This measurement quantifies the third- and fifth-order intermodulation distortion components of two continuous wave (CW) signals or of a cdma2000 modulated signal and a CW signal.

- Select number of averages (defaults to 10).
- Measure two-tone or transmitted intermodulation (IM) distortion.
- Choose to specify base frequency or have it automatically detected.
- Apply RRC filtering if desired.

This exercise requires two ESG vector signal generators, if available. The current ESG will be called ESG1 and should retain the current settings. The output of a second ESG, now called ESG2, should be added to that of ESG1 via a combiner.

Instructions	Keystrokes
On the ESG2:	
Set up a CW signal, offset by 5 MHz from the cdma2000 signal of ESG1.	[Preset] [Frequency] [1.002] {GHz} [Amplitude] [–5] {dBm} [RF On]
On the PSA:	
Activate the intermodulation distortion measurement (Figure 17).	[MEASURE] {Intermod}

Figure 17. Intermodulation distortion

PSA Series
Key Specifications[1]

cdma2000 and 1xEV-DV measurement personalities
The following specifications apply to models E4440A/43A/45A only.
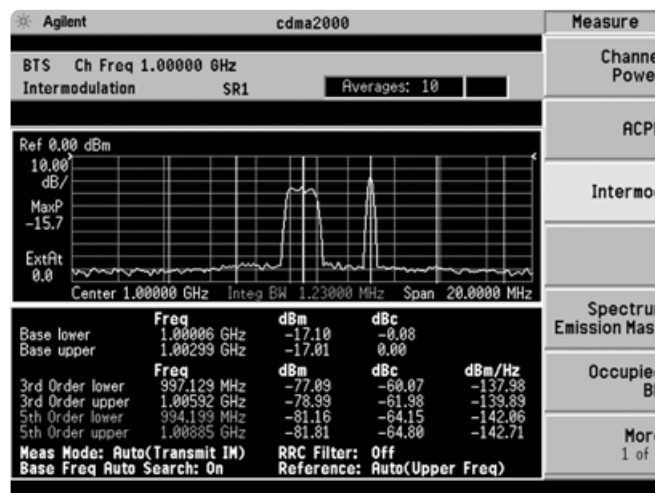*Models E4446A and 4448A have similar but not warranted performance.*

Channel power
Minimum power at RF input	−74 dBm (nominal)
Absolute power accuracy	±0.67 dB (±0.18 dB typical)
Relative power accuracy	±0.08 dB (±0.03 dB typical)

ACPR
Minimum power at RF input   −38 dBm (nominal)

Dynamic range (reference to average
power of carrier in 1.25 MHz bandwidth)

Offset frequency / integrated bandwidth	
750 kHz / 30 kHz	−84.9 dBc
885 kHz / 30 kHz	−85.2 dBc
1256.25 kHz / 12.5 kHz	−89.6 dBc
1980 kHz / 30 kHz	−86.8 dBc
2750 kHz / 1000 kHz	−71.7 dBc
ACPR relative accuracy	±0.09 dB

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

Intermodulation distortion
Minimum carrier power at RF input	−30 dBm

Occupied bandwidth
Minimum carrier power at RF input	−40 dBm (nominal)
Frequency accuracy	0.3% (nominal)

Spectrum emission mask
Minimum carrier power at RF input   −20 dBm (nominal)
Dynamic range, relative:
750 kHz offset (30 kHz RBW)   −84.7 dB (−86.4 dB typical)
Sensitivity, absolute:
750 kHz offset (30 kHz RBW)   −97.9 dBm (−99.9 dBm typical)
Accuracy, relative:
750 kHz offset   0.14 dB

Code domain
Code domain power:
Minimum power at RF input   −60 dBm (nominal)
Relative accuracy
(0 to 10 dBc, QPSK)   ±0.015 dB
(0 to −10 dBc, 8PSK/16QAM)   ±0.015 dB (nominal)
Symbol power versus time:
Minimum power at RF input   −40 dBm (nominal)
Accuracy
(QPSK)   ±0.1 dB
(8PSK/16QAM)   ±0.1 dB (nominal)

QPSK EVM
Minimum power at RF input   −20 dBm (nominal)
EVM accuracy   ±1.0% (nominal)
Frequency error accuracy   ±10 Hz (nominal) + (transmitter frequency x
frequency reference error)

Modulation accuracy (composite Rho)
Minimum carrier power at RF input   −60 dBm (nominal)
Accuracy (QPSK)
Global EVM	±0.75%
Rho	±0.0010
Pilot time offset	±300 ns
Code domain timing	±1.25 ns
Code domain phase	±10 mrad
Frequency error	±10 Hz + (transmitter frequency x frequency reference error)

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1. For specifications on the E4406A VSA, please refer to the E4406A VSA data sheet, literature number 5968-3030E.

Ordering Information

PSA Series spectrum analyzers

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

Options
To add options to a product, use the following ordering scheme:
Model   E444xA (x = 0, 3, 5, 6 or 8)
Example options E4440A-B7J
                E4448A-1DS

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

Digital demodulation measurements
E444xA-BAF	W-CDMA measurement personality
E444xA-210	HSDPA measurement personality[1]
E444xA-202	GSM w/ EDGE measurement personality
E444xA-B78	cdma2000 measurement personality
E444xA-214	1xEV-DV measurement personality[2]
E444xA-204	1xEV-DO measurement personality
E444xA-BAC	cdmaOne measurement personality
E444xA-BAE	NADC, PCD measurement personality

General purpose measurements
E444xA-226	Phase noise measurement personality
E444xA-219	Noise figure measurement personality
E444xA-211	TD-SCDMA measurement personality
E4440A-AYZ	External mixing
E4446A-AYZ	External mixing
E4448A-AYZ	External mixing

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

Inputs and outputs
E4440A-BAB   Replaces type-N input connector with APC 3.5 connector

Connectivity software
E444xA-230   BenchLink Web Remote Control Software

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

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

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

R-50C-001	Standard calibration
R-50C-002	Standards compliant calibration

E4406A vector signal analyzer
E4406A 7 MHz to 4 GHz

Options
To add options to a product, use the following ordering scheme:
Model   E4406A
Example options E4406A-BAH

Digital demodulation measurements
E4406A-BAF	W-CDMA measurement personality
E4406A-210	HSDPA measurement personality[1]
E4406A-B78	cdma2000 measurement personality
E4406A-214	1xEV-DV measurement personality[2]
E4406A-202	EDGE with GSM measurement personality
E4406A-204	1xEV-DO measurement personality
E4406A-BAH	GSM measurement personality
E4406A-BAC	cdmaOne measurement personality
E4406A-BAE	NADC, PDC measurement personality
E4406A-HN1	IDEN measurement personality

Inputs and outputs
E4406A-B7C   I/Q inputs

Connectivity software
E444xA-230   BenchLink Web Remote Control Software

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

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

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

R-50C-001	Standard calibration
R-50C-002	Standards compliant calibration

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1. Requires Option BAF.
2. Requires Option B78.
3. Options not available in all countries.

Product Literature

Selecting the Right Signal Analyzer for Your Needs, selection guide, literature number 5968-3413E

PSA Series literature

PSA Series, brochure, literature number 5980-1283E

PSA Series, data sheet, literature number 5980-1284E

E4406A VSA literature

E4406A VSA, brochure, literature number 5968–7618E

E4406A VSA, data sheet, literature number 5968–3030E

Application literature

Designing and Testing cdma2000 Base Stations, application note, literature number 5980–1303E

Designing and Testing cdma2000 Mobile Stations, application note, literature number 5980–1237E

HPSK Spreading for 3G, application note, literature number 5968–8438E

For more information on the E4406A VSA or the PSA Series, please visit:

www.agilent.com/find/vsa

www.agilent.com/find/psa

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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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