Agilent
PSA Series Spectrum Analyzers
E4406A Vector Signal Analyzer
1xEV-DO Measurement Personality

Referring both 3GPP2 1xEV-DO Revision-0 and Revision-A

Technical Overview with Self-Guided Demonstration Option 204

The 1xEV-DO measurement personality, available on the Agilent PSA Series high-performance spectrum analyzers and the E4406A vector signal analyzer (VSA), solves your problems in 1x evolution data only (1xEV-DO) measurements with powerful signal analysis capabilities designed for standards-based measurements and easy-to-use functions in one analyzer. That means you can accelerate your development schedule to quickly obtain manufacturing efficiency.

Agilent Technologies

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

Migrating from cdma2000 to 1xEV-DO 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 for both 1xEV-DO revision 0 and revision A.
- 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 1xEV-DO digital signal analysis capability with the 1xEV-DO measurement personality (Option 204).

For many manufacturing needs, the E4406A VSA, a vector signal analyzer, is an affordable platform that also offers the 1xEV-DO personality.

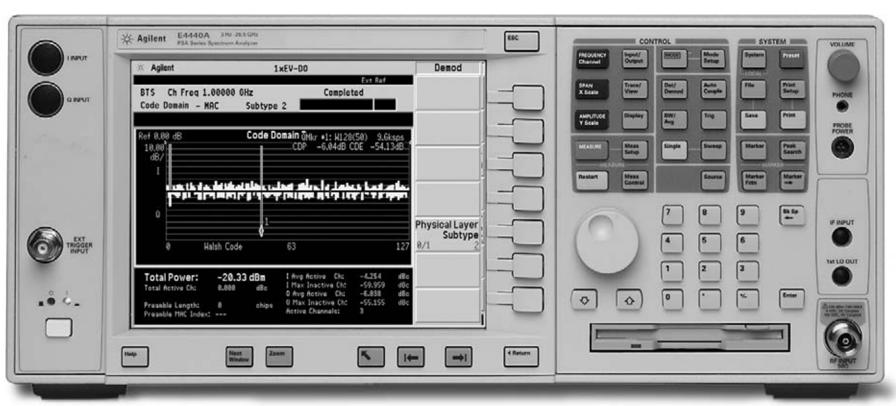
The 1xEV-DO measurement personality provides key transmitter measurements for analyzing systems based on 3GPP2 Technical Specifications Group cdma2000 (TSG-C) specifications (C.S0032-A and C.S0033-A, 2005-12). 3GPP2 C.S0024-A (2005-07) is also referred to support modulation analysis on both forward link and reverse link signals.

This technical overview includes

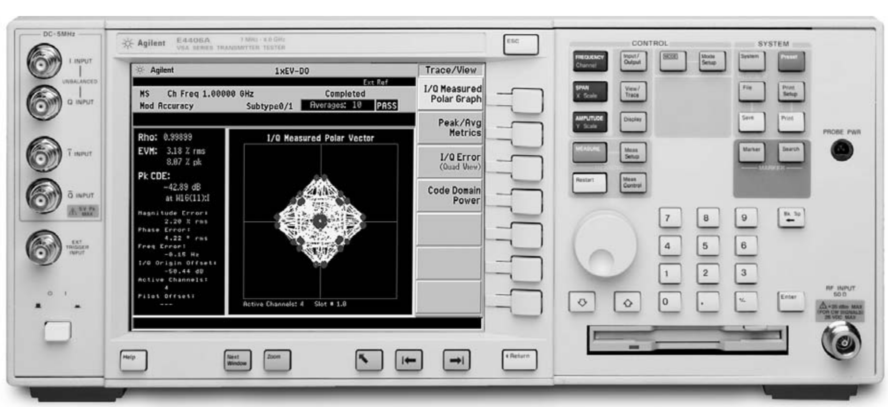
- demonstrations
- PSA Series key specifications for 1xEV-DO measurements
- ordering information
- related literature

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 4
Power vs. time page 5
Spurious emissions & ACP page 6
Occupied bandwidth page 7
Code domain analysis page 8
Modulation accuracy page 9
QPSK EVM page 11
1xEV-DO reverse link page 12



PSA Series spectrum analyzer



E4406A vector signal analyzer

Demonstration preparation

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

Note: Signal Studio 1xEV-DO (E4438C-404) provides the signal configuration for 1xEV-DO Revision-0. 1xEV-DO Revision-A, subtype 2 signal configuration, is already available with another software N7601A-SW1. For more details, please visit our web site at http://www.agilent.com/find/signal-studio/

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-DO forward link signal via LAN connection from the external PC.

Product type	Model number	Required options
ESG vector signal generator	E4438C	502, 503, 504, or 506 – frequency range up to at least 2 GHz 601 or 602 baseband generator 404 – Signal Studio 1xEV-DO software (rev 2.0 or later)
PSA Series spectrum analyzer	E4440A/E4443A/E4445A/ E4446A/E4447A/E4448A	B7J – Digital demodulation hardware 204 – 1xEV-DO measurement personality

(Use PSA with firmware revision A.09 or later.
For E4406A VSA, firmware revision A.10 or later is necessary.)

ESG

Instructions	Keystrokes
Preset the ESG.	[Preset]
Check the IP Address.	[Utility] {GPIB/RS-232/LAN} {LAN Setup} eg. {IP Addresss 192.168.100.1}

ESG Signal Studio-1xEV-DO

Instructions:	Keystrokes:
Run the Signal Studio 1xEV-DO.	Double-click the shortcut on your PC desktop or access the program via Windows start menu.
Verify the communication between ESG and Signal Studio via LAN.	Instruments menu has the list to connection. Input the Hostname or IP address of the ESG. Then press [Test Connection] button.
If "OK" comes out on Result and "EV-DO option is valid" on Note, it's ready to generate and download the signal data.	If you cannot see the "OK" on Result, please check the instrument hostname and IP address.
Select 1xEV-DO Forward link signal setup.	[Quick Setup] > [1xEV-DO Forward Link]
Name the signal as "FWD1".	Change the Project Name "Untitled" to "FWD1".
Set the carrier frequency and amplitude.	Frequency = 1 GHz, amplitude = –20 dBm
Change the configuration of the signals.	On Carrier 0, turn Traffic channel ON
Download the waveform to ESG.	Click [Generate] and [Download]

Connect the PC, ESG and PSA

Connect a PC or laptop (loaded with the Signal Studio-1xEV 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 1 for a diagram of this setup.

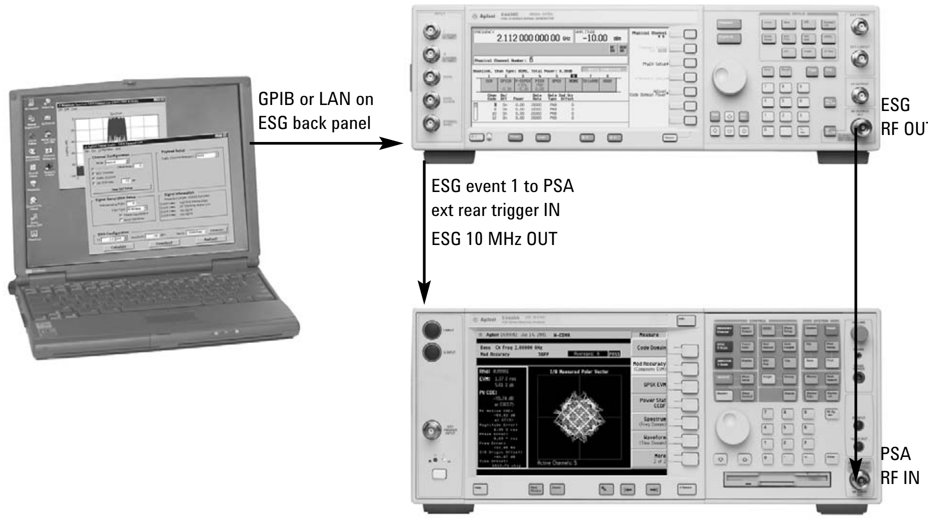


Figure 1. A computer running Signal Studio-1xEV-DO software (top) is connected to the ESG Vector Signal Generator (middle). The RF output of the ESG is connected to the RF input of the PSA Series with 1xEV-DO measurement personality (bottom).

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:

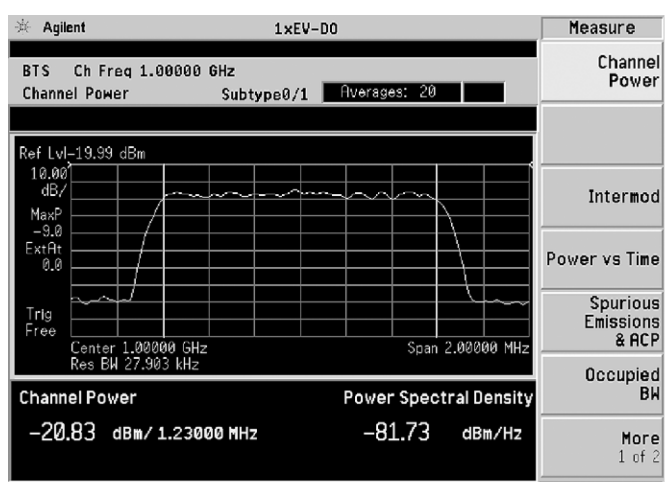
- integration bandwidth (defaults to 1.23 MHz)
- channel power span (defaults to 2 MHz)
- number of trace averages (defaults to 20)
- data points displayed (64 to 65536, defaults to 512)

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

PSA

Instructions	**Keystrokes**
Perform factory preset. (skip this step for E4406A VSA)	[System] {Power On/Preset} {Preset Type} {Factory} [Preset]
Enter the 1xEV-DO mode in the analyzer.	[Mode] ({More} if necessary) {1xEV-DO}
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. (Figure 2)	[MEASURE] {Channel Power}

Figure 2.
Channel power



Power versus time

Power versus time (PvT) is a key measurement for 1xEV-DO signals. 3GPP2 C.S0032 defines the "3.1.2.3.1 Total power" and "3.1.2.3.2 Pilot/MAC channel power". Measurement of the burst signal is necessary in the transmitter test for 1xEV-DO idle slot based on the "Pilot/MAC channel power" requirement. The burst mask test is very important for 1xEV-DO idle slot signal. As seen in the below window, the limit mask can be set for 5 regions.

Active slot also can be measured in PvT to support the "Total power" test item. In this measurement, only upper and lower limit lines can be seen because the signal is continuous, not bursted.

> In this exercise, the PvT measurement for idle slot burst signal can be seen. If the signal has different idle slot gain, the burst search threshold can be adjustable to the target signal configuration.

ESG Signal Studio-1xEV-DO

Instructions:	Keystrokes
Remove traffic channel to change the signal from Active slot to Idle slot (Pilot + MAC, burst signal).	Click the Traffic channel tab to turn OFF.
Download the waveform to ESG.	Click [Generate] and [Download]

PSA

Instructions	Keystrokes
Activate PvT measurement.	[MEASURE] {Power vs Time}
Set triggering for external rear port.	[Meas Setup] {Trig Source} {Ext Rear}
Select single measurement (not continuous).	[Meas Control] {Measure Single}
Restart the measurement. (Figure 3).	[Restart]

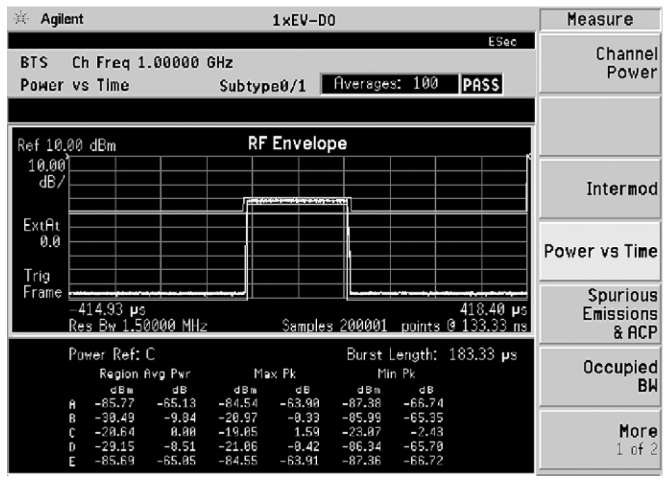


Figure 3. PvT measurement display with burst search threshold line (white)

Spurious emissions & ACP

Because the ACP measurement for 1xEV-DO is based on “Conducted Spurious Emissions” by 3GPP2, this measurement is merged into the personality as well. The measurement mode can be selected as either ACP or SEM (spectrum emission mask). When switching modes between ACP and SEM, the offset frequency, RBW, and limit lines are automatically adjusted according to the measurement definition in the 3GPP2 standard. Even though this is a burst signal, a RMS detector can be selected and the measurement offset and measurement interval can be set in units of chips and microseconds. The spurious emissions & ACP measurement has default offset and interval settings that can be accessed via the {Pre-Defined Ofs/Intvl} soft key menu under [Meas Setup].

> This exercise illustrates SEM and ACP measurements for idle slots. Notice in the PSA measurement that the mask limit is represented by a green trace on the screen.

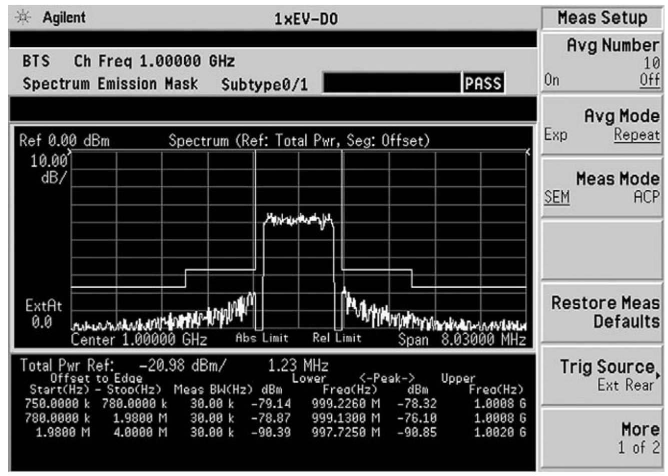
Note:

Because the PSA series performs fast Fourier transforms (FFT) for this measurement, the local oscillator (LO) steps in discrete frequency increments. (The step size is assigned under [Meas Setup] {Offset/Limits} {Step Freq}.) A measurement is made at each frequency point; offset segments group the points. For each segment, the resolution bandwidth can be individually specified. {Step Freq} and {Res BW} default to coupled mode. When these parameters are set manually, it is essential that the resolution bandwidth be larger than the step size. If not, some signal components will be missed when they fall between successive peaks of the resolution bandwidth filter. In fact, it is good practice to make the {Res BW} twice as wide as the step size given that the filter is Gaussian. This ensures that successive filter bandwidth steps will overlap.

PSA

Instructions	Keystrokes
Activate the spurious emissions & ACP measurement.	[MEASURE] {Spurious emissions & ACP}
Set triggering for external rear port.	[Meas Setup] {Trig Source} {Ext Rear}
Restart the measurement (Figure 4).	[Restart]

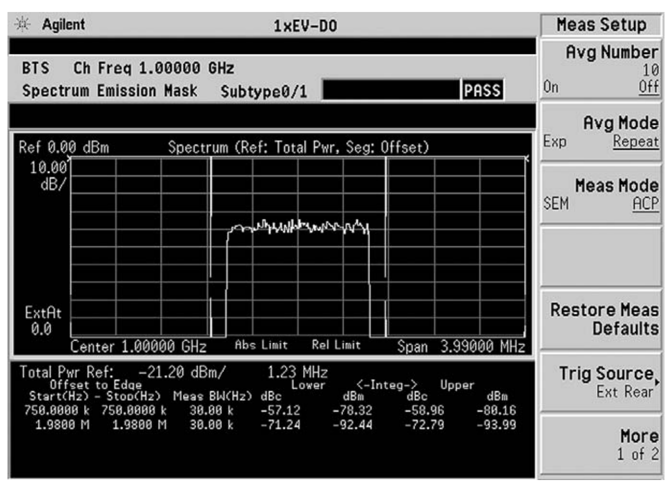
Figure 4. SEM (spectrum emission mask) measurement for idle slot



PSA

Instructions	Keystrokes
Change measurement mode from SEM to ACP.	[Meas Setup] {Meas Mode ACP}
Restart the measurement (Figure 5).	[Restart]

Figure 5. ACP measurement for idle slot



Occupied bandwidth

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

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

In this measurement, the total power of the displayed span is measured. Then the power is measured inward from the right and left extremes until 0.5 percent of the power is accounted for in each of the upper and lower parts of the span. The calculated difference is the occupied bandwidth. For simple setup, the PSA defaults to a 1.48-MHz PASS/FAIL limit value.

ESG Signal Studio-1xEV-DO

Instructions:	Keystrokes
Add traffic channel for Active slot with QPSK modulation.	Click the Traffic channel tab to turn ON.
Download the waveform to the ESG.	Click [Generate] and [Download]

PSA

Instructions	Keystrokes
Change the occupied bandwidth (Figure 6)	[MEASURE] {Occupied BW}

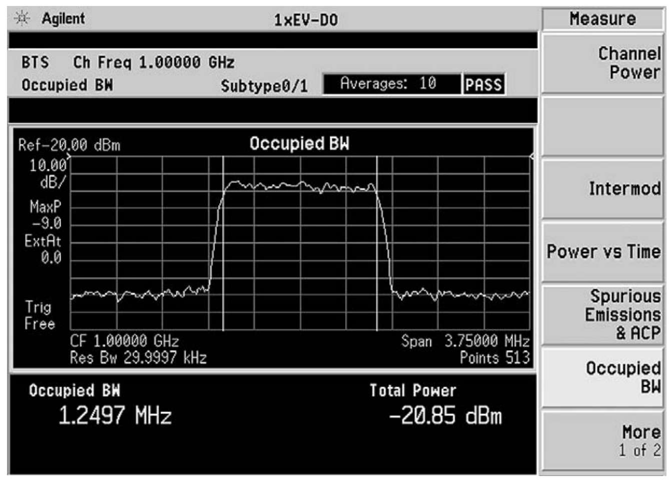


Figure 6. Occupied bandwidth

Code domain analysis

The code domain analysis measurement provides a variety of 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 helps to identify problems throughout the transmitter design from coding to the RF section. System imperfections, such as amplifier non-linearity, will present themselves as an undesired distribution of power in the code domain.

For the time division multiplexed (TDM) feature of 1xEV-DO signals, we need to verify that the access network (base station) is transmitting the correct power in each of the channels. Errors in the code domain usually arise from the channel elements that construct the individual channels or from incorrect network software settings. Since the pilot channel is the active channel, its power level relative to the carrier is displayed below the code domain plot. This can also be verified using the markers. Not only the pilot channel but also MAC and traffic channels can be seen in code domain. Once you capture a signal in the code domain measurement, you can change the channel types from pilot to MAC and traffic.

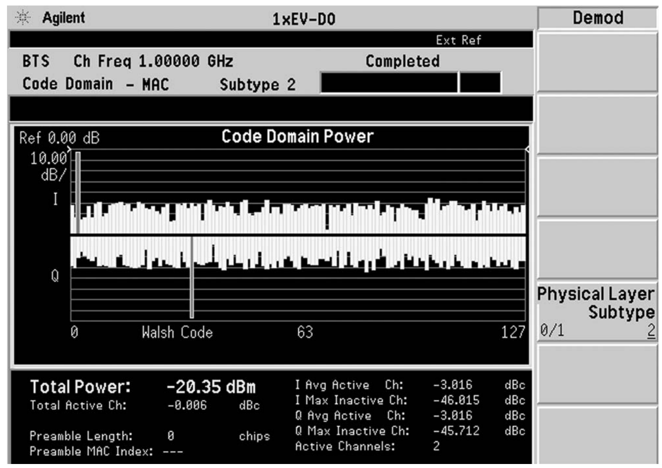
A traffic channel of 1xEV-DO could have three modulation types; QPSK, 8PSK, and 16QAM. For the traffic channel code domain analysis, the PSA will de-spread any single code channel in chip power versus time trace, symbol IQ polar vector, slot power versus time, and demodulated bits. Multiplexed demodulated bits information is also available by switching [Trace/View] menu.

Now examine the 1xEV-DO signal using each of the algorithms.

PSA

Instructions	Keystrokes
Activate the code domain measurement.	[MEASURE] {More} {Code Domain}
Swith the physical layer type.	[Mode Setup] {Demod} {Physical Layer Subtype 0/1 2}
Change the channel type from pilot to MAC (Figure 7).	[Meas Setup] {More} {Channel Type} {MAC}
Restart the measurement	[Restart]

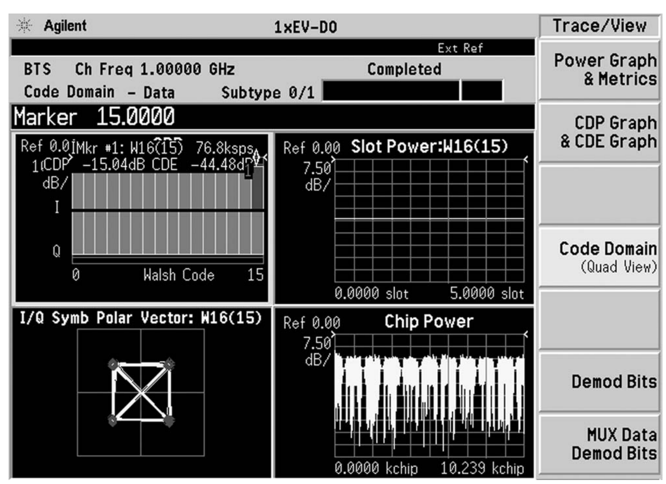
**Figure 7.
1xEV-DO code domain for the MAC channel with subtype 2 (1xEV-DO rev. A)**



PSA

Instructions	Keystrokes
Switch the physical layer type.	[Mode Setup] {Demod} {Physical Layer Subtype 0/1 2}
Change the channel type to data.	[Meas Setup] {More} {Channel Type} {Data}
View the constellation of the traffic channels.	[Trace/View] {Code Domain (Quad View)}
Place the marker on channel 15 and despread the channel to view the data (Figure 8).	[Marker] [15] {Enter} {More} {Mkr - > Despread}

**Figure 8.
1xEV-DO code domain for the DATA channel with subtype 1 (1xEV-DO rev. 0)**



Note:
Notice that there are two active MAC channels. Each MAC channel is identified by a MAC Index(I) value that is between 0 and 63 that defines an 64 ary Walsh cover. The Reverse Activity (RA) channel is assigned MAC index 4 and Reverse Power Control (RPC) channels are assigned MAC index 5 to 63. The Walsh code assigned to the MAC index values are determined using the following equation:

$W^{64}_{i/2}$ *for MAC Index i = 0,2,4,...,62*

$W^{64}_{(i-1)/2 + 32}$ *for MAC Index i = 1,3,5,...,63*

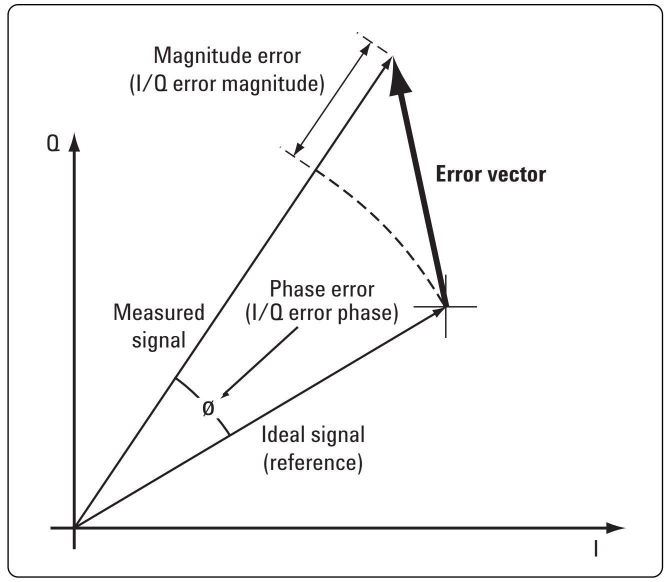
Modulation accuracy (waveform quality)*

An important measure of modulation accuracy for 1xEV-DO 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 offset and performing a cross correlation between the correlated signal and an ideal reference. Rho is important because uncorrelated power appears as interference to a receiver. 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 impairment in the transmitter chain.

Another effective way to quantify modulation accuracy is to compare the signal being measured 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.

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

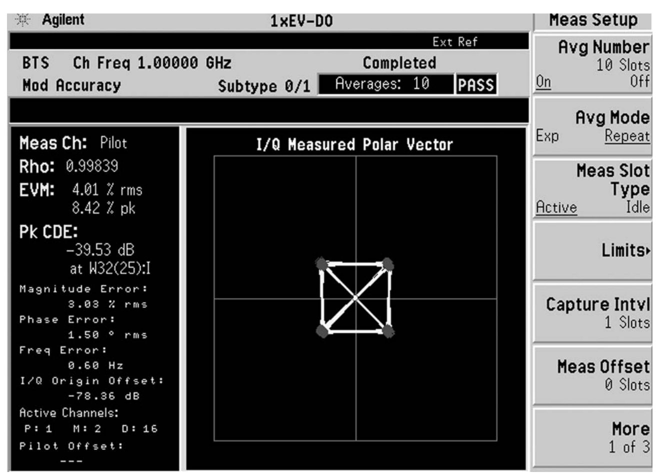
Figure 9. Error vector magnitude



PSA

Instructions	Keystrokes
Activate modulation accuracy measurement (Figure 10).	[MEASURE] {More} {Mod Accuracy}
Turn on averaging for 10 slot length.	[Meas Setup] {Avg Number 10 slots On | Off
Select single measurement (not continuous).	[Meas Control] {Measure Single}.
Restart the modulation accuracy measurement.	[Restart]

Figure 10. Pilot channel modulation accuracy



In PSA revision 8 or earlier and E4406A revision 9 or earlier, measurement name was "Modulation accuracy (composite rho)". To use the same measurement name defined in 3GPP2 conformance test, we've changed the name in the latest firmware (PSA A.09 and E4406A A.10).

The PSA measures rho and EVM, as well as magnitude, phase, and code domain errors. In this exercise, the above measurements will be explored.

The measurement results are shown in the left window and the I/Q constellation is in the right window. If you prefer to view the numeric results only, please change displays in [Trace/View] key.

- Measure EVM, rho, frequency error, I/Q origin offset, and pilot offset with the active channel numbers for the selected channel type.
- Customize limits for rms EVM, peak EVM, rho, frequency error and I/Q origin offset.
- Select channel type from some selections: pilot, MAC, data, preamble, and overall in forward link. pilot, DRC, ACK, and data in reverse link.
- Comply the waveform quality measurements in 3GPP2 defined in C.S0032 (forward link) and C.S0033 (reverse link).
- View I/Q polar vector constellation, magnitude error, phase error, and EVM plots.
- Specify PN offset (forward link).
- Read power, timing, phase and EVM data for each active channel in Power Timing and Phase view (forward link).
- Set flexible long code mask for I and Q separately between 00000000000 and 3FFFFFFFFFF (reverse link).
- Choose to include or exclude the I/Q origin offset in the EVM calculation.
- Use the optional preamplifier to measure low-level signals.
- Statistic analysis can be provided by [View/Trace] when averaging

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

PSA

Instructions	Keystrokes
Change channel type from pilot to data.	[Meas Setup] {More} {Display channel Type} {Data}
Restart the measurement (Figure 11).	[Restart]
Change the view for numeric results only (Figure 12).	[Trace/View] {Result Metrics (One Slot)}

Figure 11. Modulation accuracy for data channel

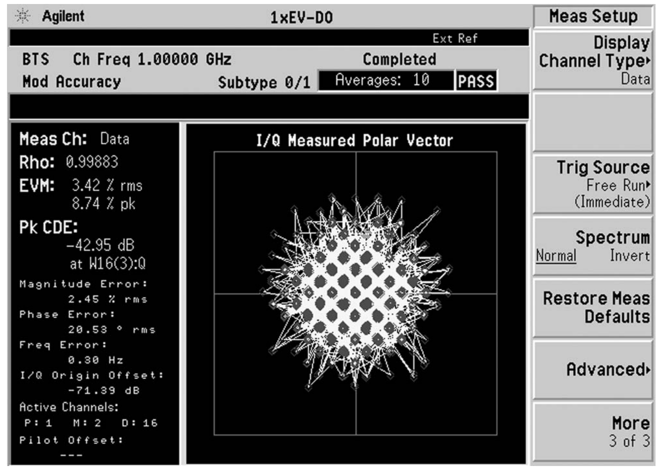
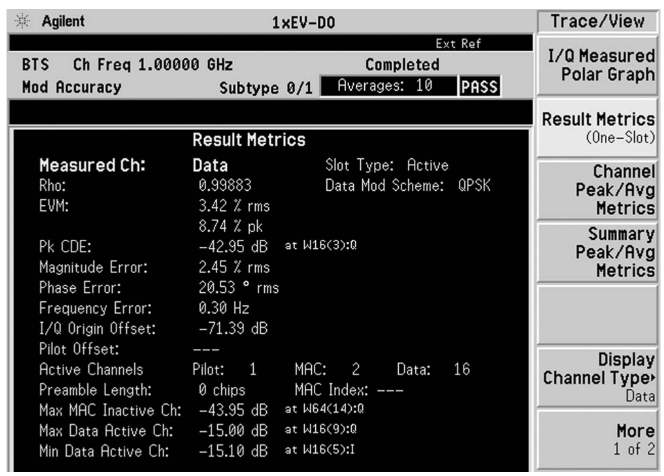


Figure 12. Numeric result summary of measured channel for one-slot



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.

In the default setting, the Meas Offset and Interval are set as: 464 chips and 96 chips, respectively. QPSK modulation can be found not only in the pilot channel, but also in the MAC and traffic (data) channels if selected. Using the modulation accuracy (composite rho) measurement, you can check the EVM results for each channel with QPSK modulation. To set the target segment in the 1xEV-DO signal, you can select the measurement offset and interval. The variable measurement offset and intervals are very useful selecting the desired slot to be analyzed with the QPSK EVM measurement. For example, Pilot #1, MAC #3, and Idle slot #2 can be selected in {Preset Meas Ofs/Intvl} under [Meas Setup] soft key menu.

- Determine rms and peak EVM (maximum and average).
- View I/Q polar vector diagram or magnitude error, phase error, and EVM plots.
- Enable adjacent carrier filtering.

> This exercise involves changing the 1xEV-DO signal to a single-channel signal.

PSA

Instructions	**Keystrokes**
Perform the QPSK EVM measurement.	[MEASURE] {More} {QPSK EVM}
Turn averaging off.	[Meas Setup] {Avg Number Off}
Set triggering for external rear.	{Trig Source} {Ext Rear}
Select single measurement (not continuous).	[Meas Control] {Measure Single}
Restart the QPSK EVM measurement (Figure 14)	[Restart]

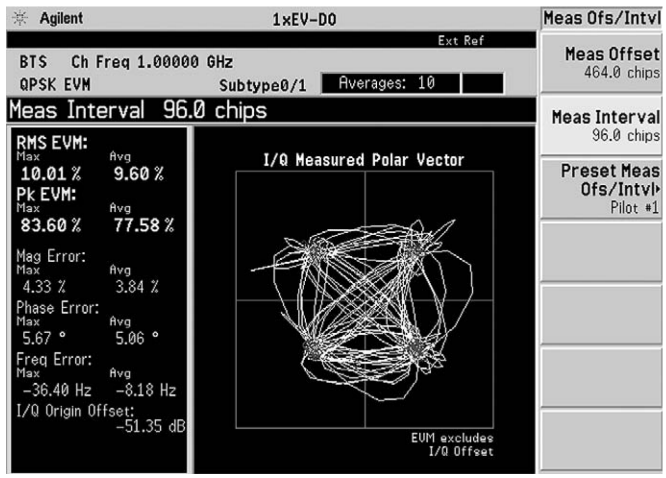


Figure 13. QPSK EVM for pilot

Reverse link modulation analysis for 1xEV-DO

For the reverse link of 1xEV-DO, Option 204 provides the following measurements in Code Domain and Modulation Accuracy (Waveform Quality).

ESG Signal Studio-1xEV-DO

Instructions:	Keystrokes
Select 1xEV-DO Reverse link signal setup for 1xEV-DO revision 0 configuration.	[Quick Setup] > [1xEV-DO Reverse Link]
Name the signal as “REV1”.	Change the Project Name “Untitled” to “REV1”
Set the carrier frequency and amplitude.	Frequency = 1 GHz, Amplitude = -20 dBm
Change the configuration of the signals.	On Carrier 0, Pilot = ON, DRC = ON with DRC relative gain 3.00 dB, ACK = ON with ACK relative gain 3.00 dB, DATA = ON with DATA relative gain 3.75 dB. I and Q Mask should be 0 (zero)
Download the waveform to ESG.	Click [Generate] and [Download]

PSA

Instructions	Keystrokes
Change the radio setup from BTS (Fwd) to MS (Rev).	[Mode Setup] {Radio} {Device MS}
Go to code domain measurement.	[MEASURE] {Code Domain}
After capturing the signal, change the code order from Hadamard to Bit Reverse.	[Display] {Code Order} {Bit Reverse}
Switch view to Code Domain quad view.	[Trace/View] {Code Domain (quad view)}
Put a marker on ACK channel to see the power control of symbol power trace.	[Marker] [3] [Enter] {More} {Mkr -> Despread}
Modify the measurement setup to see longer data.	[Meas Setup] {Meas Offset} = 0 slot, {Meas Interval} = 3 slot
Switch view to Demodulated bits (Figure 14).	[Trace/View] {Demod Bits}
Move to modulation accuracy measurement.	[MEASURE] {Mod Accuracy}
Select IQ polar vector graph and switch to other views (Figure 15).	[Trace/View] {I/Q Measured Polar Graph}

Figure 14.
Demodulated bits view presents power-off half slots with X

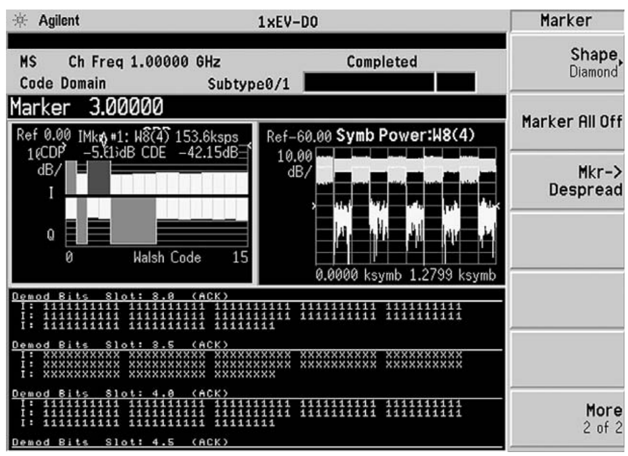
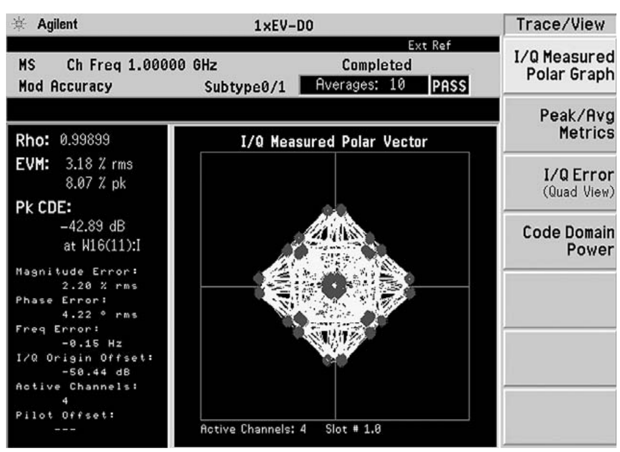


Figure 15.
Modulation accuracy in I/Q polar graph view



Reverse link modulation analysis for 1xEV-DO (continued)

Signal Studio 1xEV-DO (E4438C-404) provides the signal configuration for 1xEV-DO Revision-0. 1xEV-DO Revision-A, subtype 2 signal configuration, is already available with another software N7601A-SW1. For more details, please visit our web site at http://www.agilent.com/find/signal-studio/

Screen shots on this page were captured with a sample signal generated by Agilent Signal Studio for 1xEV-DO Rev.A N7601A-SW1.

1xEV-DO revision A (subtype 2)
All channels ON, E2E4
Relative Gain:
(RRI/AuxPilot: 0dB) DRC: 1dB
ACK/DSC: 3dB Data: 5dB
Long Code Mask
I: 0x0, Q: 0x0
RRI bit: NA
Data:
Data Rate: 1843.2kbps,
Bit Pattern: PN9

PSA

Instructions	Keystrokes
Switch the subtype from 0/1 to 2.	[Mode Setup] {Demod} {Physical Layer Subtype 2}
Go to Code Domain measurement and run a measurement.	[MEASURE] {Code Domain} [Start]
Change the view to Code Domain quad view.	[Trace/View] {Code Domain (quad view)}
Put a marker on data channel on Q phase and despread to see more symbol retails.	[Marker] [20.5] [Enter] {Mkr -> Despread}
Change the branch to IQ combined analysis (Figure 16).	[Meas Setup] {I/Q Branch IQC}
Move to Mod Accuracy measurement.	[MEASURE] {Mod Accuracy}
Switch the view to see the detailed statistic results (Figure 17).	[Trace/View] {Peal/Avg Metrics}

Figure 16.
Code domain quad view with data in 8PSK constellation on IQ combined branch

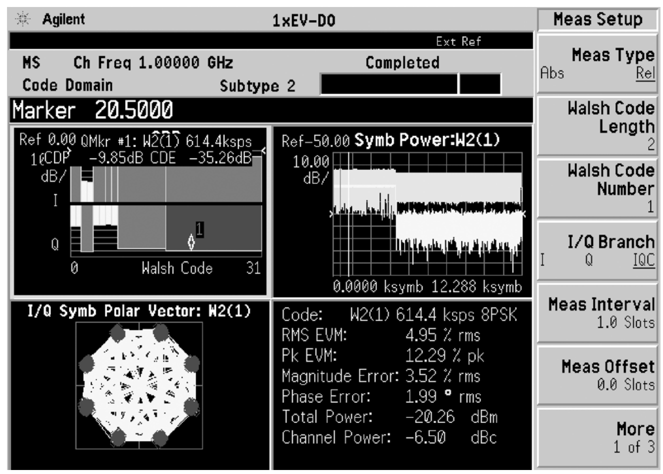
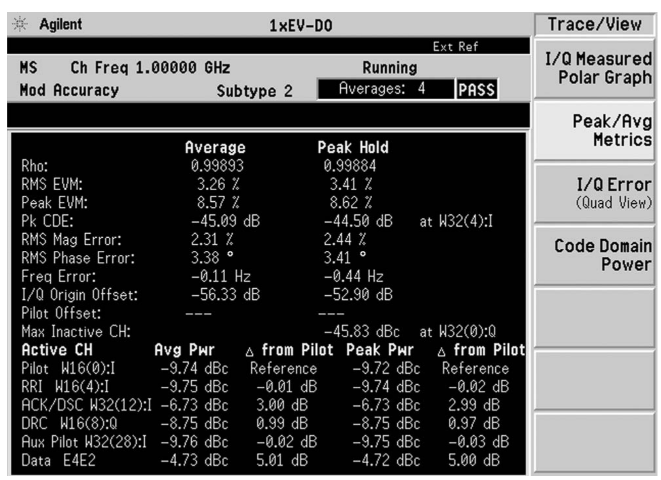


Figure 17.
Mod Accuracy in Peak and Average result metrics view



PSA Series Key Specifications[1]

1xEV-DO measurement personality (10 MHz to 3 GHz)

The following specifications apply to models E4443A/45A/40A/ only.
Models E4446 and E4448A 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)
Attenuation > 2 dB	
Relative power accuracy:	±0.08 dB (±0.03 dB typical)

Power vs. time (PvT)

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

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 (nominal)

Occupied bandwidth

Minimum carrier power at RF input	–40 dBm
Frequency accuracy	0.3 percent (nominal)

Spurious emissions & ACP

Minimum carrier power at RF input	–20 dBm
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

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

QPSK EVM

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

Modulation accuracy (composite rho)

Minimum carrier power at RF input	–50 dBm (nominal)
Accuracy	
Composite EVM	±1.0 dB (nominal)
Rho	±0.0010 (at rho = 0.99751, EVM 5 percent)
	±0.0044 (at rho = 0.94118, EVM 25 percent)
Frequency error	±10 Hz + (transmitter frequency x frequency reference error) (nominal)

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

PSA Series Ordering Information

For further information, refer to PSA Configuration Guide, 5989-2773EN

PSA Series spectrum analyzer

E4443A 3 Hz to 6.7 GHz
E4445A 3 Hz to 13.2 GHz
E4440A 3 Hz to 26.5 GHz
E4447A 3 Hz to 42.98 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, 7 or 8)
Example options E4440A-B7J, E4448A-1DS

Warranty & Service

Standard warranty is one year.

R-51B-001-3C	1-year return-to-Agilent warranty extended to 3 years

Calibration[1]

R-50C-011-3	Inclusive calibration plan, 3 year coverage
R-50C-013-3	Inclusive calibration plan and cal data, 3 year coverage
E444xA-0BW	Service manual
E444xA-UK6	Commercial calibration certificate with test data
R-52A	Calibration software and licensing (ordered with PSA)
N7810A	PSA Series calibration application software (stand-alone order)

Measurement Personalities

E444xA-226	Phase noise	
E444xA-219	Noise figure	Requires 1DS
E444xA-241	Flexible digital modulation analysis	
E444xA-BAF	W-CDMA	Requires B7J
E444xA-210	HSDPA/HSUPA	Requires B7J and BAF
E444xA-202	GSM w/ EDGE	Requires B7J
E444xA-B78	cdma2000	Requires B7J
E444xA-214	1xEV-DV	Requires B7J and B78
E444xA-204	1xEV-DO	Requires B7J
E444xA-BAC	cdmaOne	Requires B7J
E444xA-BAE	NADC, PCD	Requires B7J
E444xA-217	WLAN	Requires 122 or 140
E444xA-211	TD-SCDMA	
E444xA-215	External source control	
E444xA-266	Programming code compatibility suite	
E444xA-233	Built-in measuring receiver personality	

Hardware

E444xA-1DS	RF-internal preamplifier 100 kHz to 3 GHz	Excludes 110
E444xA-110	RF/µW internal preamplifier (10 MHz to upper frequency limit of the PSA)	Exclude 1DS
E444xA-B7J	Digital demodulation hardware	
E444xA-122	80 MHz bandwidth digitizer	E4440A/43A/45A only, excludes 140, 107, H70
E444xA-140	40 MHz bandwidth digitizer	E4440A/43A/45A only, excludes 122, 107, H70
E444xA-123	Switchable MW preselector bypass	Excludes AYZ
E444xA-124	Y-axis video output	
E444xA-AYZ	External mixing	E4440A/47A/46A/48A only, excludes 123
E444xA-107	Audio input 100 Ω	Requires 233 to operate; Excludes 122, 140
E444xA-111	USB device side I/O interface	
E444xA-115	512 MB user memory	Excludes 117. Shipped standard in all PSA instruments with serial number prefix ≥MY4615 unless 117 is installed
E444xA-117	Secure memory erase	Excludes 115
E4440A-BAB	Replaces type-N input connector with APC 3.5 connector	E4440A only; required by E4440A-233
E444xA-H70	70 MHz IF output	Excludes 122, 140. Not available for E4447A

PC Software

E444xA-230	BenchLink Web Remote Control Software	
EE444xA-235	Wide BW digitizer external calibration wizard	Requires 122 E4443A/45A/40A only

Accessories

E444xA-1CM	Rack mount kit
E444xA-1CN	Front handle kit
E444xA-1CP	Rack mount with handles
E444xA-1CR	Rack slide kit
E444xA-015	6 GHz return loss measurement accessory kit
E444xA-045	Millimeter wave accessory kit
E444xA-0B1	Extra manual set including CD ROM

1. Options not available in all countries.

Related Literature

Publication Title Number	Publication Type	Publication
PSA in general		
Selecting the Right Signal Analyzer for Your Needs	Selection Guide	5968-3413E
PSA Series	Brochure	5980-1284E
PSA Series	Configuration Guide	5989-2773EN
Self-Guided Demonstration for Spectrum Analysis	Product Note	5988-0735EN
Wide bandwidth and vector signal analysis		
40/80 MHz Bandwidth Digitizer	Technical Overview	5989-1115EN
Using Extended Calibration Software for Wide Bandwidth Measurements, PSA Option 122 & 89600 VSA	Application Note 1443	5988-7814EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software	Product Note	5988-5015EN
89650S Wideband VSA System with High Performance Spectrum Analysis	Technical Overview	5989-0871EN
Measurement personalities and applications		
Phase Noise Measurement Personality	Technical Overview	5988-3698EN
Noise Figure Measurement Personality	Technical Overview	5988-7884EN
External Source Measurement Personality	Technical Overview	5989-2240EN
Flexible Modulation Analysis Measurement Personality	Technical Overview	5989-1119EN
W-CDMA and HSDPA/HSUPA Measurement Personalities	Technical Overview	5988-2388EN
GSM with EDGE Measurement Personality	Technical Overview	5988-2389EN
cdma2000 and 1xEV-DV Measurement Personalities	Technical Overview	5988-3694EN
cdmaOne Measurement Personality	Technical Overview	5988-3695EN
WLAN Measurement Personality	Technical Overview	5989-2781EN
NADC/PDC Measurement Personality	Technical Overview	5988-3697EN
TD-SCDMA Measurement Personality	Technical Overview	5989-0056EN
Built-in Measuring Receiver Personality / Agilent N5531S Measuring Receiver	Technical Overview	5989-4795EN
BenchLink Web Remote Control Software	Product Overview	5988-2610EN
IntuiLink Software	Data Sheet	5980-3115EN
Programming Code Compatibility Suite	Technical Overview	5989-1111EN
Hardware options		
PSA Series Spectrum Analyzers Video Output (Option 124)	Technical Overview	5989-1118EN
PSA Series Spectrum Analyzers, Option H70,70 MHz IF Output	Product Overview	5988-5261EN
Spectrum analyzer fundamentals		
Optimizing Dynamic Range for Distortion Measurements	Product Note	5980-3079EN
PSA Series Amplitude Accuracy	Product Note	5980-3080EN
PSA Series Swept and FFT Analysis	Product Note	5980-3081EN
PSA Series Measurement Innovations and Benefits	Product Note	5980-3082EN
Spectrum Analysis Basics	Application Note 150	5952-0292
Vector Signal Analysis Basics	Application Note 150-15	5989-1121EN
8 Hints for Millimeter Wave Spectrum Measurements	Application Note	5988-5680EN
Spectrum Analyzer Measurements to 325 GHz with the Use of External Mixers	Application Note 1453	5988-9414EN
EMI	Application Note 150-10	5968-3661E

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 on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

Agilent Open

www.agilent.com/find/open
Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.

Agilent Email Updates

www.agilent.com/find/emailupdates
Get the latest information on the products and applications you select.

Agilent Direct

www.agilent.com/find/agilentdirect
Quickly choose and use your test equipment solutions with confidence.

www.agilent.com/find/psa

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

www.agilent.com/find/contactus

Phone or Fax
United States:
(tel) 800 829 4444
(fax) 800 829 4433

Canada:
(tel) 877 894 4414
(fax) 800 746 4866

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

Europe:
(tel) 31 20 547 2111

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

Korea:
(tel) (080) 769 0800
(fax) (080) 769 0900

Latin America:
(tel) (305) 269 7500

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

Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6755 0042
Email: tm_ap@agilent.com
Contacts revised: 05/27/05

Printed in USA, April 30, 2006
5988-4828EN

Agilent Technologies