Agilent
PSA Series Spectrum Analyzers Self-Guided Demonstration for 1xEV-DO Measurements (Option 204)

Product Note

This demonstration guide is a tool to help you gain familiarity with the basic functions and important features of the Agilent PSA series spectrum analyzers. Because the PSA series offers expansive functionality, the demonstration guide is available in several pieces.

This portion introduces the advanced, one-button power measurements and digital demodulation capability of the 1xEV-DO measurement personality (Option 204). Other portions of the self-guided demonstration are listed in the "Product literature" section at the end of this guide and can be found at **http://www.agilent.com/find/psa**

All exercises in this demonstration utilize the E4438C ESG vector signal generator and Signal Studio software for 1xEV-DO forward link.

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.

Agilent Technologies

Table of contents

About the PSA series

The Agilent PSA series is a family of modern, high-performance spectrum analyzers with digital modulation analysis and one-button measurement personalities for 2G/3G applications. It offers an exceptional combination of dynamic range, accuracy and measurement speed.

The PSA delivers the highest level of measurement performance available in spectrum analyzers. An all-digital IF section includes fast Fourier transform (FFT) analysis and a digital implementation of a swept IF. The digital IF and innovative analog design provide much higher measurement accuracy and improved dynamic range compared to traditional spectrum analyzers. This performance is combined with measurement speed typically two to 50 times faster than spectrum analyzers using analog IF filters.

The PSA series complements Agilent's other spectrum analyzers such as the ESA series, a family of mid-performance analyzers that cover a variety of RF and microwave frequency ranges while offering a great combination of features, performance and value.

Part 1
Demostration preparation

The following options are required for the ESG series and the PSA series in order to perform this demonstration.

To configure these 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.

Product type	Model number	Required options
ESG	E4438C	E4438C-503 – 205 kHz to 3 GHz frequency range E4438C-001 – Internal baseband generator with 8 M sample memory E4438C-404 – Signal Studio 1xEV-DO software (rev A.02.00 or higher)
PSA series	E4440A/E4443A/E4445A E4446A/E4448A	B7J – Digital demodulation hardware 204 – 1xEV-DO measurement personality

Instructions	Keystrokes
On the ESG:	
Preset the ESG.	[Preset]
Check the IP Address.	[Utility] {GPIB/RS-232/LAN} {LAN Setup} eg. {IP Addresss 192.168.100.1}
On the Signal Studio-1xEV:	
Run the Signal Studio-1xEV forward link software.	Double-click on the Signal Studio-1xEV Fwd Link shortcut or access the program via the Windows Start menu.
Verify that the software is communicationg with the instrument via the LAN TCP/IP link.	From {Configuration} pull-down menu at the top of the configuration window, select {Sig Gen I/O}. In the {Connection} pull-down menu, select TCP/IP. Next, enter your ESG's IP Address in the Address area, then click {Check} button.
After this operation is performed, the software should return "Succeed".	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:	
Set the carrier frequency to 1GHz.	Enter [1] [GHz] into the Frequency field in the ESG configuration menu.
Set the amplitude to –20dBm.	Enter [-] [20] into the Amplitude field in the ESG Configuration menu.
Calculate the configured waveform. Note: At this point, you can optionally plot the spectrum, IQ signal, and CCDF curve via the [Plot] pull-down menu at the top of the configuration window. In the default setting, generated signal should have pilot channel only.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Step 1: 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.

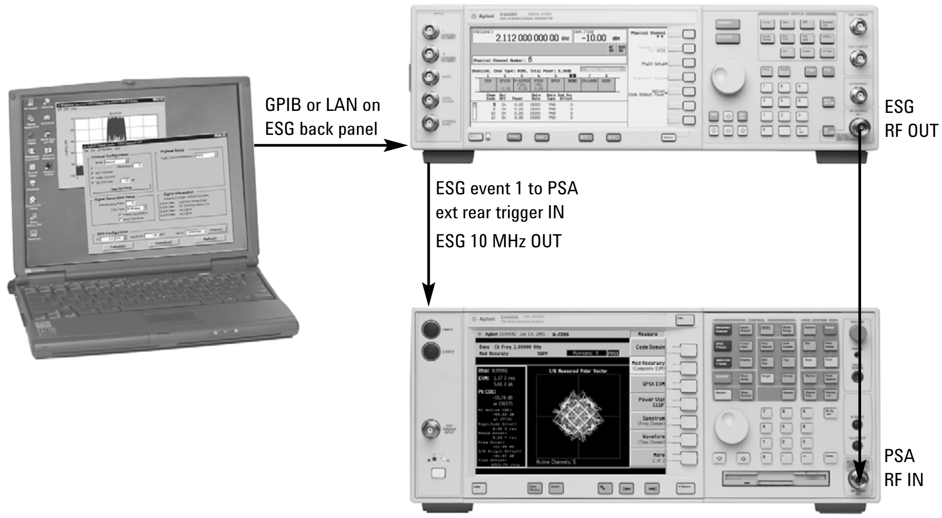


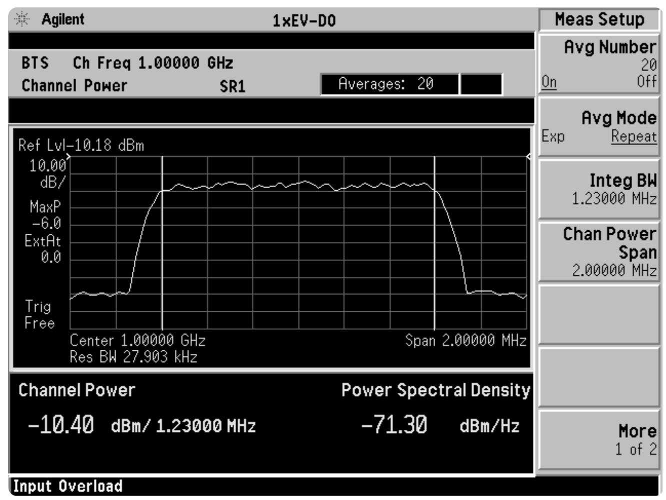
Figure 1. A computer running Signal Studio-1xEV software (top) is connected to the ESG Vector Signal Generator (middle). The RF output of the ESG is connected to the RF input of the PSA Series with 1xEV-DO measurement personality (bottom).

Part 2
Channel power

The channel power measurement identifies the channel power within a specified bandwidth (default of 1.23MHz) and the power spectral density (PSD) in dBm/Hz. This exercise demonstrates the one-button channel power measurement on the PSA.

Instructions	Keystrokes
On the PSA:	
Perform factory preset.	[System] {Power On/Preset} {Preset Type} {Factory} Then press [Preset].
Enter the 1xEV-DO mode in the analyzer. If {1xEV-DO} does not appear in the Mode menu, try {More}.	[Mode] {1xEV-DO}
Set the center frequency to 1GHz.	[Frequency] [1] {GHz}
Activate channel power measurement to observe the white bars indicating the spectrum channel width and the quantitative values given beneath.	[MEASURE] {Channel Power}
Examine the measurement settings (figure 2). Use this step to make setup changes in any measurement.	[Meas Setup]

Figure 2. Channel power with measurement setup menu



Part 3
Power versus time

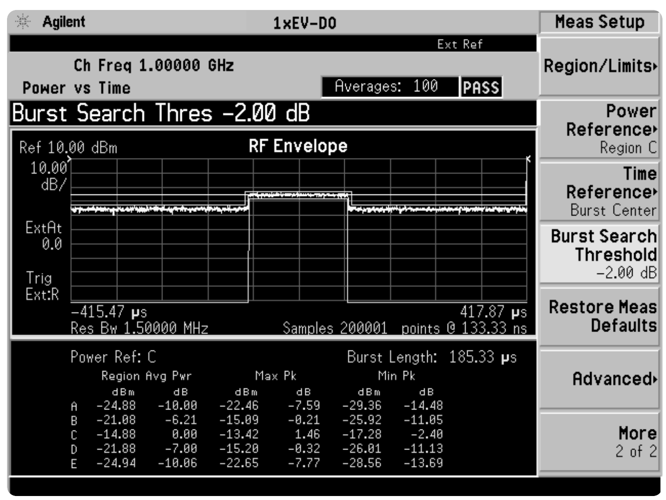
Power versus time (PvT) is a key measurement for 1xEV-DO signals. 3GPP2 C.S0032 defines the “3.1.2.3.1 Total power” and “3.1.2.3.2 Pilot/ MAC channel power”. Measurement of the burst signal is necessary in the transmitter test for 1xEV-DO idle slot based on the “Pilot/MAC channel power” requirement. 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.

Instructions	Keystrokes
On the Signal Studio-1xEV:	
Activate the MAC channel.	Check the box next to {MAC Channel} in the Channel Configuration menu.
Calculate the configured waveform. Note: Adding the MAC channel to the Pilot means generating idle slot signal of 1xEV-DO. This signal doesn’t have any data channels and should be a burst signal.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Instructions	Keystrokes
On the PSA:	
Activate PvT measurement.	[MEASURE] {Power vs Time}
Set triggering for external rear port.	[Meas Setup] {Trig Source} {Ext Rear}
Change burst search threshold from –10 dB to –2 dB (figure 3).	{More} {Burst Search Threshold} [-2] [Enter]
Select single measurement (not continuous).	[Meas Control] {Measure Single}
Restart the measurement.	[Restart]

Figure 3.
Power versus time with a burst search threshold of –2 dB



Part 4
Spurious emissions & ACP

Because the ACP measurement for 1xEV-DO is defined as "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].

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.

Instructions	Keystrokes
On the PSA:	
Activate the spurious emissions & ACP measurement.	[MEASURE] {Power vs Time}
Set triggering for external rear port.	[Meas Setup] {Trig Source} {Ext Rear}
Restart the measurement (figure 4).	[Restart]

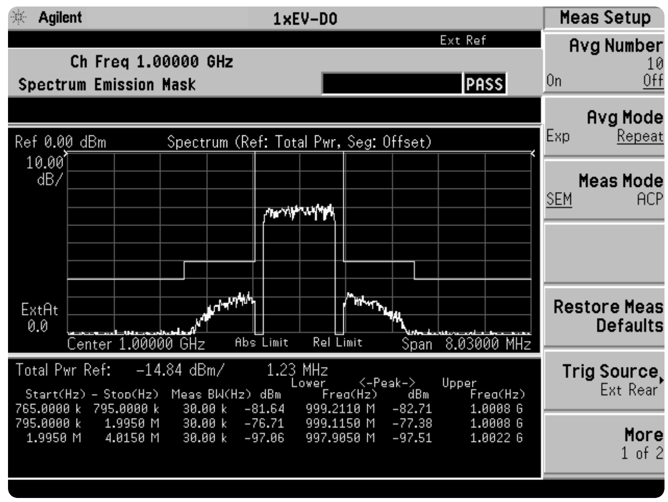


Figure 4.
SEM (spectrum emission mask) measurement for idle slot

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

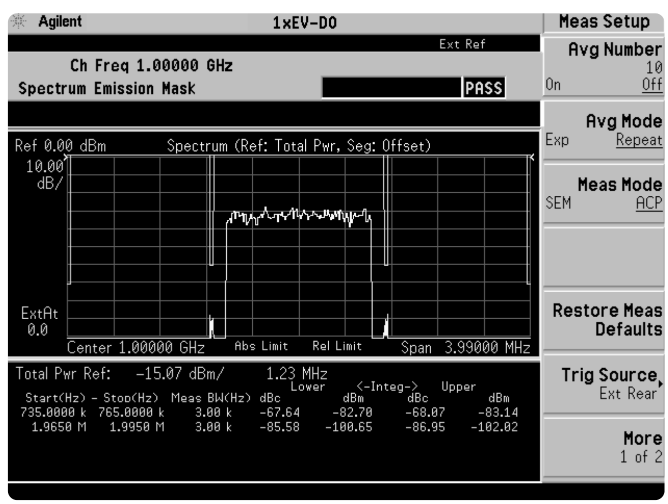


Figure 5.
ACP measurement for idle slot

Part 5
Occupied bandwidth

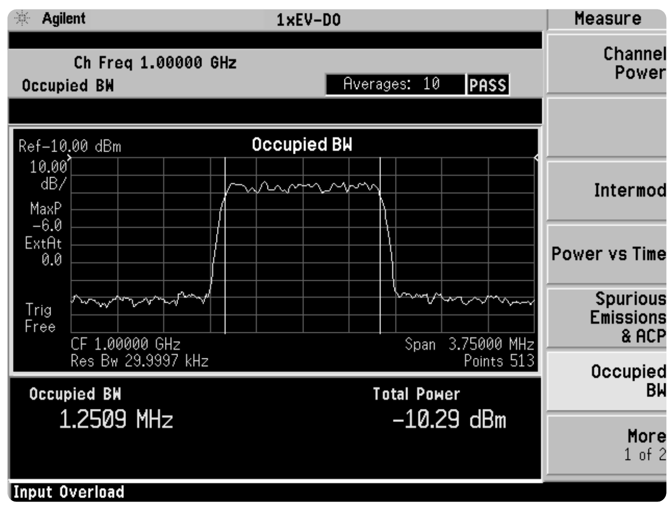
Occupied bandwidth is a measure of the frequency range that has 0.5 percent of the total radiated power each above and below it. In other words, it determines the frequency bandwidth that contains 99 percent of the total radiated power.

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.

Instructions	Keystrokes
On the Signal Studio-1xEV	
Activate all the pilot, MAC, and data channels.	Check the box next to {Traffic Channel} in the Channel Configuration menu.
Calculate the configured waveform Note: Adding the traffic channel to the idle slot means generating an active slot signal of 1xEV-DO. This signal has all channels and should be continuous.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Instructions	Keystrokes
On the PSA:	
Change the occupied bandwidth (figure 6).	[MEASURE] {Occupied BW}

Figure 6. Occupied bandwidth



Part 6
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.

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*

Instructions	Keystrokes
On the PSA:	
Activate the code domain measurement (figure 7).	[MEASURE] {More} {Code Domain}
Change the channel type from pilot to MAC (figure 8).	[Meas Setup] {More} {Channel Type} {MAC}

Figure 7.
1xEV-DO code domain power measurement for the pilot channel

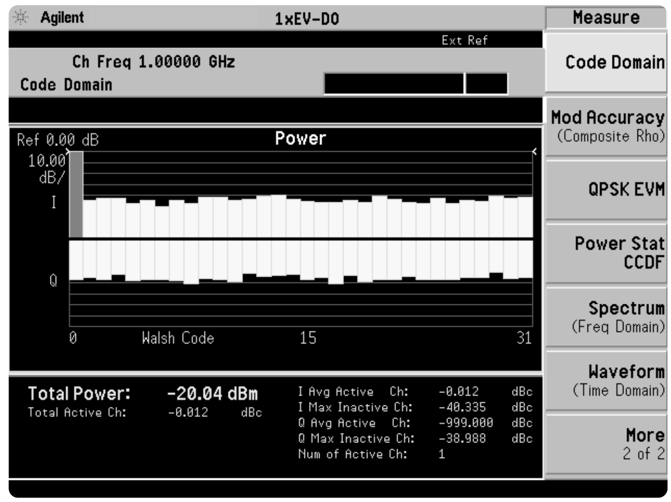
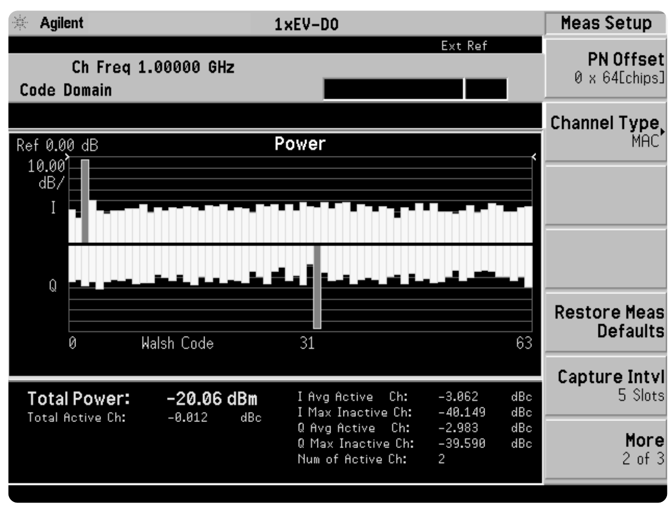


Figure 8.
1xEV-DO code domain power measurement for the MAC channel

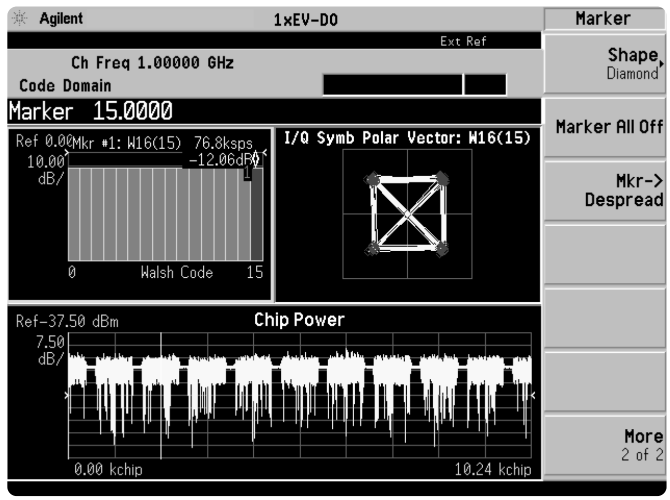


A traffic channel of 1xEV-DO could have three modulation types; QPSK, 8PSK, and 16QAM. For the traffic channel code domain measurement, the PSA will de-spread any single code channel to provide chip power versus time plots and symbol polar vector plots.

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

Instructions	Keystrokes
On the PSA:	
Change the channel type to data.	[Meas Setup] {More} {Channel Type} {Data}
View the constellation of the traffic channels.	[Trace/View] {I/Q Polar & Power Graph}
Place the marker on channel 15 and despread the channel to view the data (figure 9).	[Marker] [15] {Enter} {More} {Mkr - > Despread}

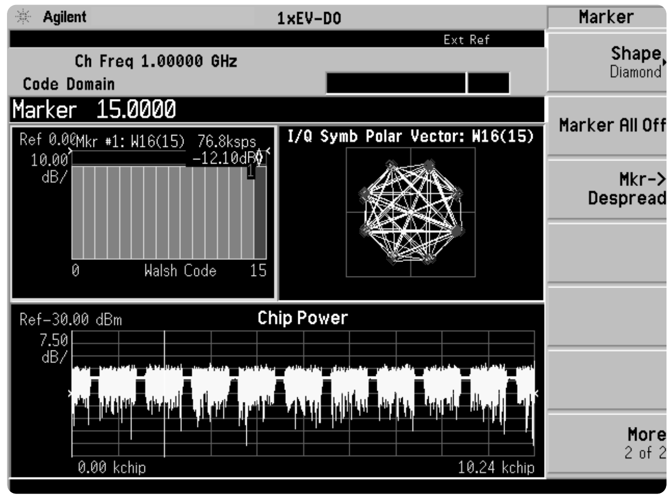
Figure 9.
1xEV-DO code domain power measurement for the traffic channels



Instructions	Keystrokes
On the Signal Studio-1xEV	
Change the traffic channel modulation to 8PSK.	Click {Time Slot Setup} in the Channel Configuration menu. In the yellow Fast Edit pill-down menu at the bottom of the "Modulation" column, select {8PSK}. Click {OK}.
Calculate the configured waveform.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Instructions	Keystrokes
On the PSA:	
Restart the code domain measurement (figure 10).	[Restart]

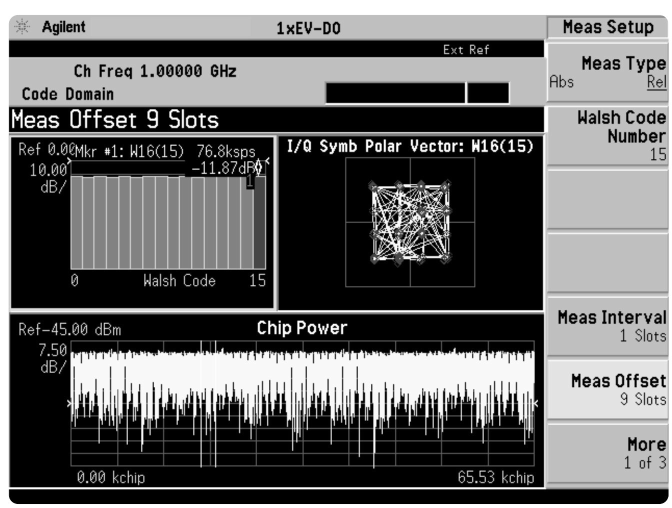
Figure 10.
1xEV-DO code domain measurement for traffic channels with 8PSK modulation



Instructions	Keystrokes
On the Signal Studio-1xEV:	
Change the traffic channel modulation to mixed.	Click {Time Slot Setup} in the Channel Configuration menu. In the yellow Fast Edit pill-down menu at the bottom of the “Modulation” column, select {Mixed}. Click {OK}.
Calculate the configured waveform.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Instructions	Keystrokes
On the PSA:	
Increase the capture interval up to 32 slots.	[Meas Setup] {More} {Capture Intvl} [32] [Enter]
Restart the code domain measurement.	[Restart]
Change the measured offset and interval to find the modulation type differences in each slot (figure 11).	[Meas Setup] {Meas Offset}, then rotate the KNOB. {Meas Interval} rotate the KNOB.

Figure 11.
Changing the capture interval to find the various modulation types



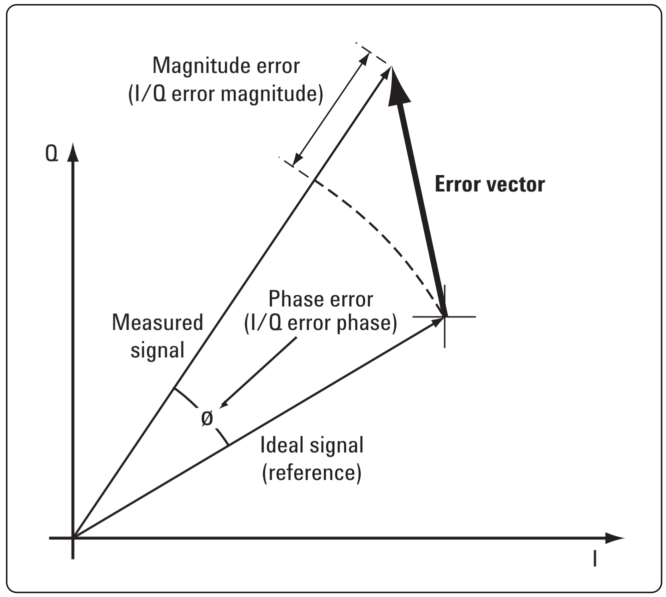
Part 7
Modulation accuracy (composite rho)

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 12 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 12. Error vector magnitude



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

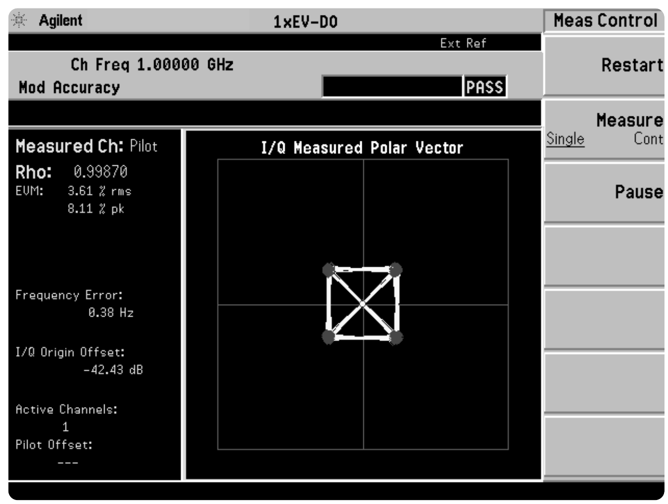
Modulation accuracy shows the pilot channel's rho, EVM, magnitude error, phase error, frequency error, and IQ origin offset. Like the code domain measurement, to view the other active channels, the channel type must be selected. There are four selections: pilot, MAC, data, and overall. Overall rho measurement is required by 3GPP2 standard, C.S00 32 3.1.2.2.2 Waveform Quality.

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.

Instructions	Keystrokes
On the Signal Studio-1xEV:	
Change the traffic channel modulation to QPSK.	Click {Time Slot Setup} in the Channel Configuration menu. In the yellow Fast Edit pill-down menu at the bottom of the "Modulation" column, select {QPSK}. Click {OK}.
Calculate the configured waveform.	Click [Calculate].
Download the waveform to the ESG.	Click [Download].

Instructions	Keystrokes
On the PSA:	
Activate modulation accuracy measurement (figure 13).	[MEASURE] {More} {Mod Accuracy}
Turn averaging off.	[Meas Setup] {Avg Number Off}
Select single measurement (not continuous).	[Meas Control] {Measure Single}.
Restart the modulation accuracy measurement.	[Restart]

Figure 13. Pilot channel modulation accuracy



Instructions	Keystrokes
On the PSA:	
Change channel type from pilot to MAC.	[Meas Setup] {More} {Rho/EVM Channel Type} {MAC}
Restart the measurement (figure 14).	[Restart]
Change channel type from MAC to data.	[Meas Setup] {More} {Rho/EVM Channel Type} {Data}
Select modulation type of data part.	{Rho/EVM Data Type} {QPSK}
Restart the measurement (figure 15).	[Restart]
Change channel type from data to overall.	[Meas Setup] {More} {Rho/EVM Channel Type} {Overall}
Restart the measurement (figure 16).	[Restart]
Change the view for numeric results only (figure 17).	[Trace/View] {Result Metrics}

Figure 14. MAC channel modulation accuracy

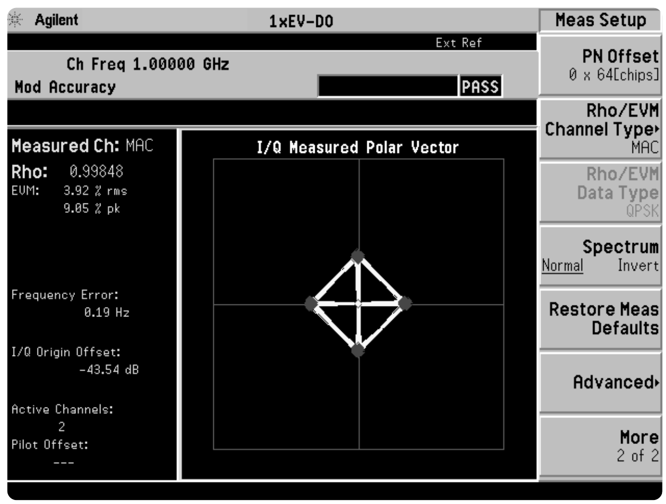


Figure 15. Data channel modulation accuracy

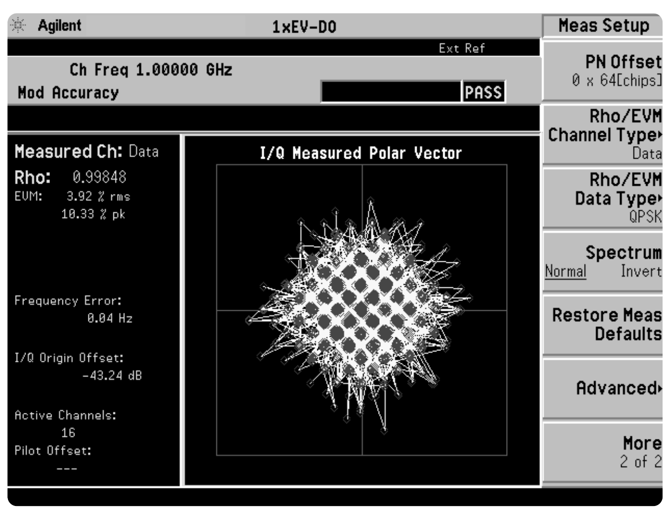


Figure 16.
Modulation accuracy for overall rho

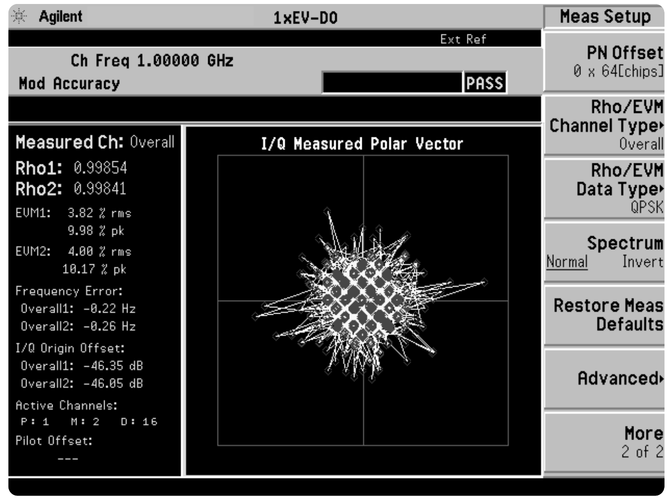
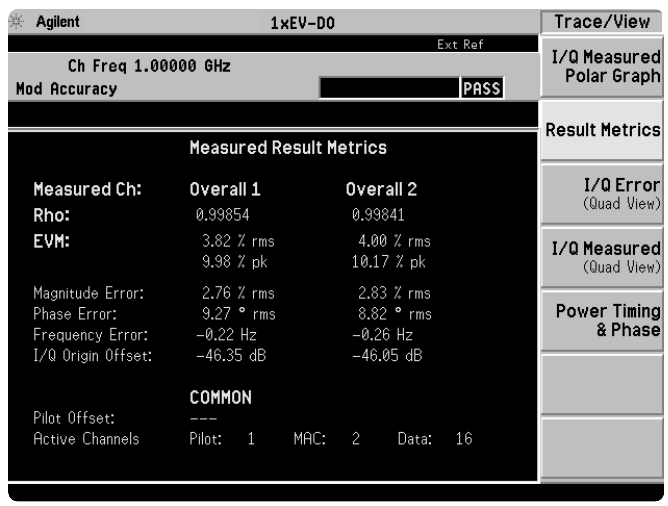


Figure 17.
Numeric result table for rho of overall-1 and overall-2



Part 8
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. This exercise involves changing the 1xEV-DO signal to single-channel signal and measuring the error characteristics.

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.

Instructions	Keystrokes
On the PSA:	
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 18)	[Restart]
Change the measurement segment from Pilot #1 to MAC #3.	[Meas Setup] {Meas Offset & Interval} {Preset Meas Ofs/Intvl} {MAC} {MAC #3}
Restart the measurement (figure 19).	[Restart]

Figure 18. QPSK EVM for pilot

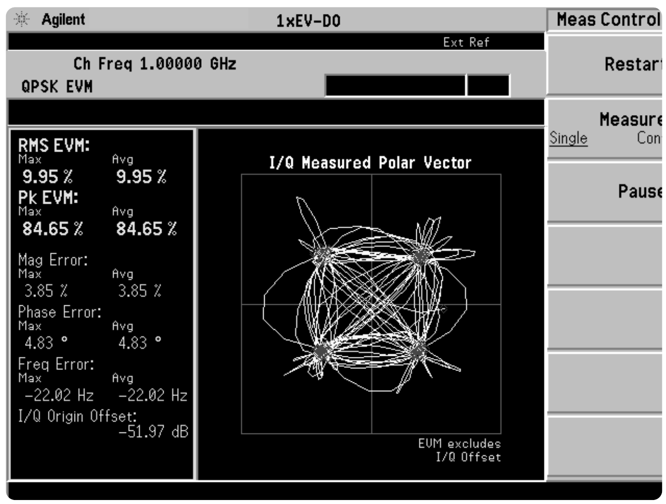
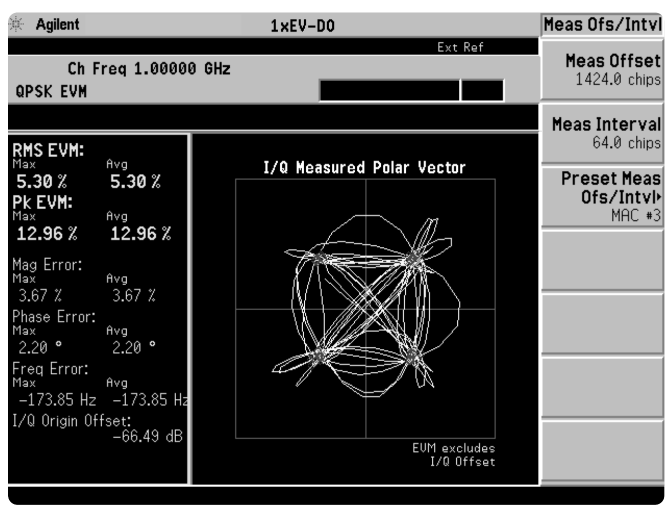


Figure 19. QPSK EVM for MAC #3



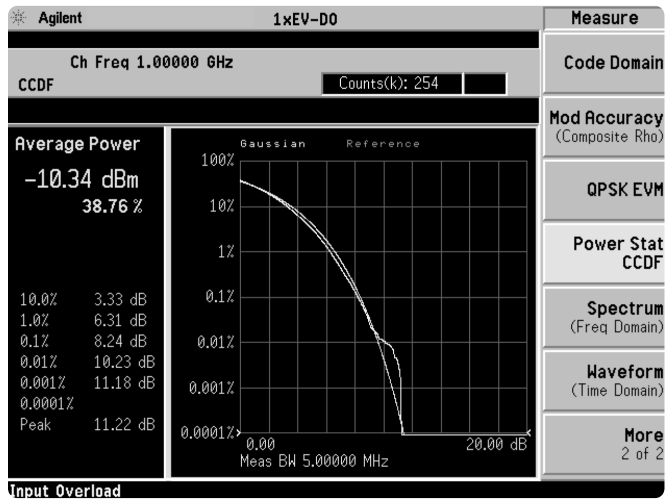
Part 9
Power statistics (CCDF)

The complementary cumulative distribution function (CCDF) is plot of peak-to-average power ratio (PAR) versus probability and fully characterizes the power statistics of a signal. It is a key tool for power amplifier design for 1xEV-DO 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 multi-carrier power amplifiers pushes complexity yet another step further.

This exercise illustrates the simplicity of measuring CCDF for 1xEV-DO transmitter signals.

Instructions	Keystrokes
On the PSA:	
Measure the CCDF (Figure 20). Note: The yellow line is the input signal. The blue reference line is the CCDF of Gaussian noise.	[MEASURE] {More} {Power Stat CCDF}

Figure 20.
CCDF



Part 10
Intermodulation distortion

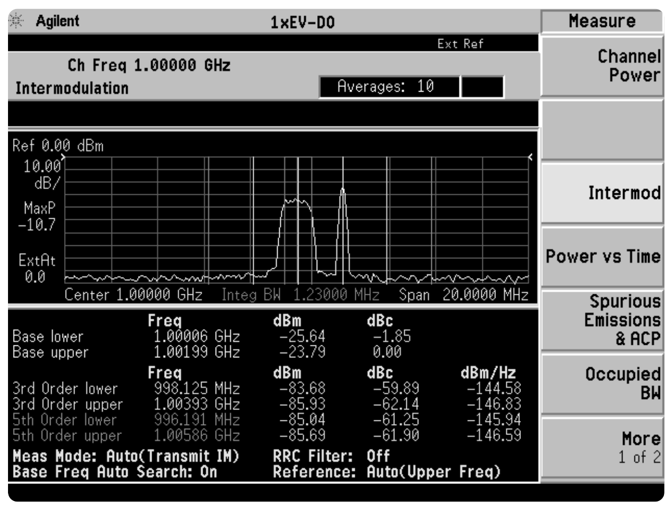
This exercise requires two ESG series signal generators, if available.

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.

This measurement identifies the third and fifth harmonic distortion components of two continuous wave (CW) signals or of a 1xEV-DO modulated signal and a CW signal. The PSA makes this measurement quick and easy.

Instructions	Keystrokes
On the ESG1:	
Keep generating a 1xEV-DO modulated signal	
On the ESG2:	
Set up a CW signal, offset by 2 MHz from the modulated signal of ESG1.	[Preset] [Frequency] [1.002] {GHz} [Amplitude] [-20] {dBm} [RF On]
On the PSA:	
Activate the intermodulation distortion measurement (figure 21)	[MEASURE] {Intermod}

Figure 21. Intermodulation distortion



Product literature

PSA Series - The Next Generation, brochure, literature number 5980-1283E
PSA Series, data sheet, literature number 5980-1284E
Phase Noise Measurement Personality, product overview, literature number 5988-3698EN
W-CDMA Measurement Personality, product overview, literature number 5988-2388EN
GSM with EDGE Measurement Personality, product overview, literature number 5988-2389EN
cdma2000 Measurement Personality, product overview, literature number 5988-3694EN
1xEV-DO Measurement Personality, product overview, literature number 5988-4828EN
cdmaOne Measurement Personality, product overview, literature number 5988-3695EN
NADC/PDC Measurement Personality, product overview, literature number 5988-3697EN
PSA Series Spectrum Analyzers, Option H70, 70 MHz IF Output, product overview, literature number 5988-5261EN
Self-Guided Demonstration for Spectrum Analysis, product note, literature number 5988-0735EN
Self-Guided Demonstration for Phase Noise Measurements, product note, literature number 5988-3704EN
Self-Guided Demonstration for W-CDMA Measurements, product note, literature number 5988-3699EN
Self-Guided Demonstration for GSM and EDGE Measurements, product note, literature number 5988-3700EN
Self-Guided Demonstration for cdma2000 Measurements, product note, literature number 5988-3701EN
Self-Guided Demonstration for 1xEV-DO Measurements, product note, literature number 5988–6208EN
Self-Guided Demonstration for cdmaOne Measurements, product note, literature number 5988-3702EN
Self-Guided Demonstration for NADC and PDC Measurements, product note, literature number 5988-3703EN
PSA Series Demonstration CD, literature number 5988-2390EN
Optimizing Dynamic Range for Distortion Measurements, product note, literature number 5980-3079EN
PSA Series Amplitude Accuracy, product note, literature number 5980-3080EN
PSA Series Swept and FFT Analysis, product note, literature number 5980-3081EN
PSA Series Measurement Innovations and Benefits, product note, literature number 5980-3082EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software, product note, literature number 5988-5015EN
Selecting the Right Signal Analyzer for Your Needs, selection guide, literature number 5968-3413E
8 Hints for Millimeter Wave Spectrum Measurements, application note, literature number 5988–5680EN
PSA Series Spectrum Analyzer Performance Guide Using 89601A Vector Signal Analysis Software, product note, literature number 5988-5015EN
89600 series + PSA, 802.11A and HiperLAN2 ODFM Measurements, product note, literature number 5988-4094EN
N4256A Amplifier Distortion Test Set, product overview, 5988-2925EN
BenchLink Web Remote Control Softeware, product overview, literature number 5988-2610EN
HP 8566B/68B Programming Code Compatibility for PSA and ESA-E Series Spectrum Analyzers, product overview, literature number 5988-5808EN
IntuiLink Software, Data Sheet, Literature Number 5980-3115EN

For more information on the PSA series, please visit:

www.agilent.com/find/psa

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.

Agilent Email Updates

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

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

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

Phone or Fax

United States:
(tel) 800 452 4844

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

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

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

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

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

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

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

Other Asia Pacific Countries:
(tel) (65) 6375 8100
(fax) (65) 6836 0252
Email: tm_asia@agilent.com

Online Assistance:
ww.agilent.com/find/assist

Product specifications and descriptions in this document subject to change without notice.

Printed in U.S.A., *July 25, 2002*
5988-6208EN

Agilent Technologies