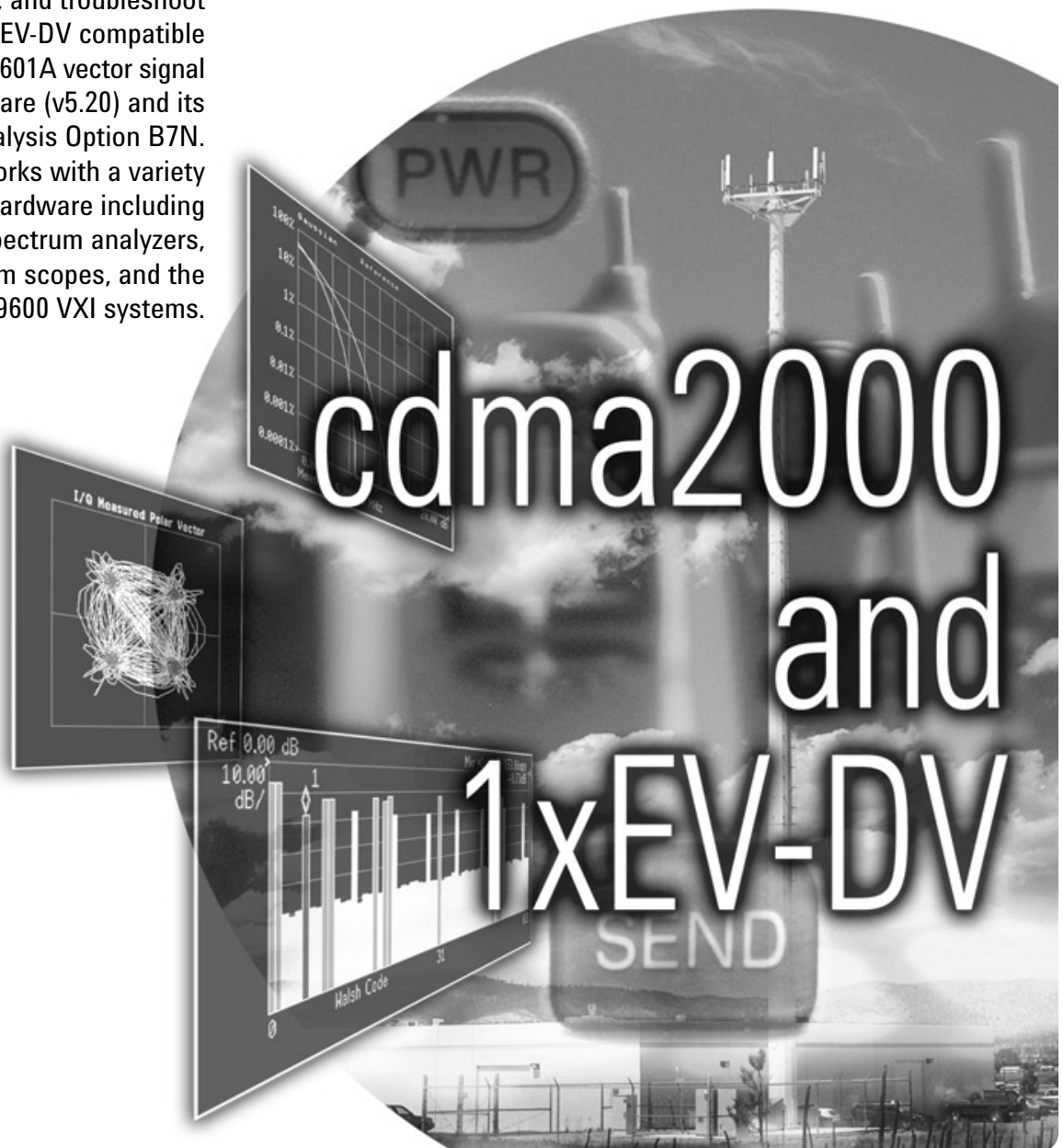


# Agilent 89601A Vector Signal Analysis Software for cdma2000 and 1xEV-DV Evaluation and Troubleshooting

Technical Overview with Self-Guided Demonstration

Measure, evaluate, and troubleshoot cdma2000 and 1xEV-DV compatible signals with the 89601A vector signal analysis software (v5.20) and its 3G modulation analysis Option B7N. This software works with a variety of measurement hardware including Agilent spectrum analyzers, Infiniium scopes, and the 89600 VXI systems.



Agilent Technologies

## Robust Analysis Tools and Unusual Flexibility

The 89601 Vector Signal Analysis (VSA) software is one of the most advanced signal analysis packages on the market today. It combines a robust set of analysis tools with unusual flexibility for applying and teaming these tools. Use this robustness and flexibility to

- test your signal to its standard
- troubleshoot problems when your signal fails to meet its standard

Use the 89601A software to

- analyze signals up to 6.0 GHz bandwidth (requires Infiniium scope)
- record signals and play them back to extend analysis capabilities
- demodulate standards-based signals ranging from NADC to cdma2000 to 802.11g WLAN
- demodulate signals based on less common or even proprietary standards
- troubleshoot digitally modulated signal problems, isolate symbol clock errors, identify filtering problems, and more
- use analog demodulation to
  - demodulate and analyze AM, FM, and PM modulated signals
  - analyze settling problems in oscillators and PLLs
  - locate unintentional modulation
- work in multiple domains and formats
- access a full set of markers to find peaks, measure frequency, phase, amplitude, offsets, simplify power measurements, perform gated measurements, and more
- work with a wide selection of measurement hardware
  - high dynamic range VXI bundles
  - spectrum analyzers offering high dynamic range and up to the 50 GHz frequency range
  - scopes with up to 6 GHz analysis bandwidth

- integrate analysis with the Agilent EEsof Advanced Design System (ADS)
  - analyze design simulations
  - analyze product/component performance
  - produce data for further analysis/reporting

### Advanced cdma2000/1xEV-DV analysis tools

Option B7N adds cdma2000 and 1xEV-DV demodulation capabilities to the 89601A VSA software. This option measures 3GPP2 Technical Specification Group cdma2000 specifications (C.S0002-C physical layer standard release C version 1.0, and C.S0003-C MAC standard release C) compliant signals and supports 3GPP2, release C, 1xEV-DV signal measurement capabilities.

These capabilities descramble, despread, and demodulate forward link and reverse link cdma2000, spread rate one (SR1) signals. The 1xEV-DV analysis is for forward link signals. The software automatically identifies all active channels, regardless of the symbol rate or Walsh code length.

Signal analysis capabilities include composite code domain power, composite time, and channel specific analysis. Measurement results may be shown in several trace display formats as well as numeric error data formats. Flexible display scaling and marker functionality enhance these measurement capabilities.

The software-based demodulator used in this analyzer incorporates advanced technology that does not require coherent carrier signals or symbol-clock timing signals. The software has a built-in IS-2000 filter. Signal locking requires only the carrier frequency, chip rate, reverse/forward link direction, and long code mask to be set. The demodulator uses the measured signal, called I/Q Meas Time, to generate an ideal signal, called IQ Ref Time. The software uses these signals to provide comparison data, modulation quality data results and error summary data.

Measurement result data includes: time and frequency domain trace data, code domain power data (composite or layer specific), code domain error data (composite or layer specific), channel data results, and overall error summary results.

If you have measurement hardware with two baseband channels, the 89601 VSA software provides IQ baseband measurement capability. You can also perform IQ baseband measurements on data from a file or the stream interface, i.e. ADS simulation.

## Table of Contents

## cdma2000/1xEV-DV Modulation Analysis Features

cdma2000/1xEV-DV	
Modulation Analysis Features . . .	3
Demonstration Preparation . . . . .	4
Setup Procedure . . . . .	5
Composite Measurements . . . . .	7
Composite vector diagram and	
error summary table . . . . .	7
Composite CDP and CDE . . . . .	9
Markers . . . . .	10
Channel Measurements . . . . .	12
Measuring a single channel . . . .	12
Code layer and code	
channel CDP and CDE . . . . .	14
F-PDCH in demod properties	
menu . . . . .	15
Making adaptive modulation	
and coding (AMC)	
measurements . . . . .	16
Additional Measurements . . . . .	18
Channel power . . . . .	18
Power statistics (CCDF) . . . . .	19
Key Menu Reference . . . . .	20
Demod Properties menu . . . . .	20
Trace data menus . . . . .	22
Ordering Information . . . . .	23

These features are applicable for both cdma2000 and 1xEV-DV modulation analysis

- standard presets for
  - cdma2000 reverse link
  - cdma2000 forward link
- variable, user-definable chip rate (1.2288 MHz standard pre-set)
- single layer or composite code-domain power and code-domain error traces (the composite display shows all code layers simultaneously); normalize code-domain power to display the CDP relative to the total signal power
- composite and single channel time-domain displays such as constellation, trellis and eye diagrams, IQ magnitude/phase error, and error vector traces
- mirrored (flipped) frequency spectrums used to remove the effects of high-side mixing or complex conjugation mismatches in simulated data
- measurement offset and interval (similar to time gating) used to select specific data slots for analysis

• averaging for code domain data and numeric error data in the Error Summary table, as follows

- RMS (video): computes an average of each RMS error update in the table
- RMS exponential: like RMS (video) except that averaging continues past the average count with an exponential weighting
- continuous peak hold: keeps track of the peak RMS error of each update in the table

These features are applicable to 1xEV-DV modulation analysis only

- automatic modulation scheme detection for F-PDCH channels
- manual control of all F-PDCH properties
- automatic active channel identification
- optional predefined F-PDCH active channel configuration for adaptive modulated signals
- optional gated active channel identification for adaptive modulated signals
- optional gated modulation detection for adaptive modulated signals

# Demonstration Preparation

This demonstration uses the 89601A VSA software and a PC meeting the requirements shown. No measurement hardware is required because the demonstration uses a pre-recorded signal recalled from a file.

**Table 1a. Demonstration PC and software requirements.**

PC requirement	Desktop	Laptop
CPU	180 MHz Pentium® or AMD-K6 (> 300 MHz recommended)	> 300 MHz Pentium or AMD-K6
Empty slots <i>(required only if using measurement hardware)</i>	1 PCI-bus slot (two recommended)	1 CardBus type II slot (two recommended)
RAM	192 MB (256 MB recommended)	192 MB (256 MB recommended)
Video RAM	4 MB (8 MB recommended)	4 MB (8 MB recommended)
Hard disk space	200 MB available	200 MB available
Operating system	Microsoft® Windows 2000® or XP Professional®	Microsoft Windows 2000 or XP Professional
Additional drive	CDROM or 3.5 inch floppy (if no network access available)	CDROM or 3.5 inch floppy (if no network access available)
Interface support <i>(required only if using measurement hardware)</i>	IEEE 1394-19951 (FireWire), LAN, or GPIB	IEEE 1394-19951 (FireWire), LAN, or GPIB

**Table 1b. Demonstration PC and software requirements.**

Software requirements	
Version	v5.20 or higher
Option	- 200: Basic vector signal analysis
	- 300: Hardware connectivity (required only if measurement hardware will be used)
	- B7N: 3G modulation analysis

## Setup Procedure

This procedure is intended to help users get started using the 89601A VSA software to evaluate cdma2000/1xEV-DV signals. Detailed information and explanations of the signal and the operation of the software are available in the 89601 on-line **Help** located on the toolbar.

### Recall the cdma2000/1xEV-DV example signal

The 89601A VSA software includes a pre-recorded cdma2000/1xEV-DV signal. Recall this recording as shown in Table 2.

### Setup the RF measurement parameters

Set the RF parameters as shown in Table 3 to measure the pre-recorded cdma2000/1xEV-DV signal.

### Connecting the signal to the analyzer

No hardware is required to analyze the recorded signal used in this procedure.

The 89601A software can analyze RF and baseband (I/Q) signals. Refer to the 89601A on-line **Help** 1xEV-DV or cdma2000 for information on hardware set-up. Refer to the *Ordering Information* at the end of this document for information on measurement hardware.

### Center frequency

In general, to assure a successful carrier lock, set the center frequency within approximately  $\pm 500$  Hz of the carrier frequency of the signal.

### Frequency span

When preparing to demodulate a signal, it is usually best to select a span that is slightly larger than the bandwidth of your signal. If you select a span that is too narrow, your measurement may have excessive errors or the software may lose carrier lock. For best results for cdma2000/1xEV-DV signals, the frequency span should be set according to the following formula

$$\text{Frequency span} \geq (1.204 \times \text{chip rate})$$

### Input range

The input range must be set correctly to obtain accurate measurements. Input ranges that are too low overload the hardware front-end. Input ranges that are too high increase noise, which increases errors reported in error data results, such as error vector magnitude (EVM.)

Setting the input range is not required on this pre-recorded signal. The example sets the input range only to illustrate how to use the input range control.

### Y Auto Scale

Clicking **Y Auto Scale** rescales and repositions the active trace to ensure that all points fall within the bounds of the trace display on the Y-axis. Unlike spectrum analyzers, the Y-axis scale is not tied directly to the input range. Changing the Y-axis scale does not change the input range attenuation of the measurement hardware.

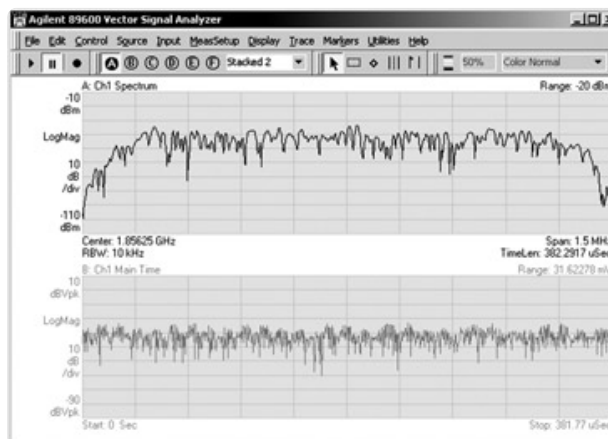
**Table 2. Signal recall instructions.**

Instructions	Toolbar menus
Go to the signals directory	File > Recall > Recall Recording
Select the recording	1xEVDV.sdf > Open
Start measurement	Click on <i>(toolbar, left side)</i>

**Table 3. RF measurement parameters setup instructions.**

Instructions	Toolbar menus
Set center frequency	MeasSetup > Frequency > Center Enter 1.85625 GHz
Set frequency span	MeasSetup > Frequency > Span Enter 1.5 MHz
Set input range	Input > Range > Range Enter -20 dBm
Auto scale trace A	Place cursor in trace A, right click the mouse > Y Auto Scale

**Figure 1.**



### Setup the demodulator

Select the cdma2000/1xEV-DV demodulator as shown in Table 4.

You should always view the signal spectrum first to be sure that the signal is present and that the center frequency, span, and input range are correct before selecting a demodulator.

After selecting the demodulator you need to set its configuration parameters. The software will automatically configure the demodulator if you select one of the available **Preset to Default** choices, or you can manually configure the demodulator from the **Demod Properties** menu.

The parameters set by the **Preset to Default** selections, and the values they are set to, are shown below. See the 89601A on-line **Help** for more information on these controls

#### Forward/Reverse link direction

Forward

Chip rate 1.2288 MHz  
 Symbol rate 64  
 Spread-code-length (Symbol Rate) 64  
 (19.2 ksym/s)

Result length 16 PCG

Mirrored spectrum No

Base code

(forward link only) 64

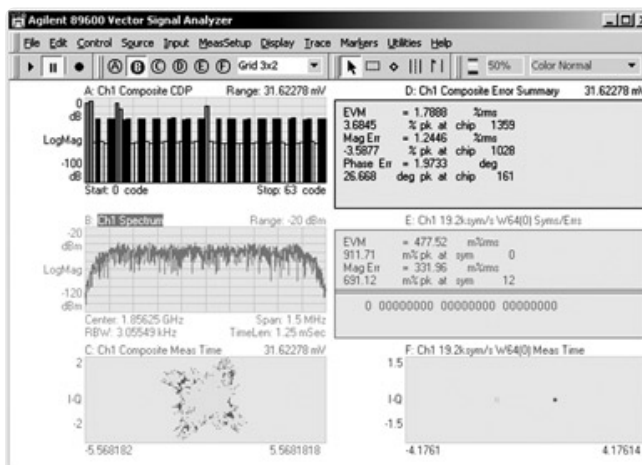
Long code mask (reverse link only)

Defined channel (not required)

**Table 4. Instructions to setup the demodulator.**

Instructions	Toolbar menus
Select the demodulator	MeasSetup > Demodulator > 3G Cellular > cdma2000/1xEV-DV
Preset all demodulator parameters to forward link	MeasSetup > Demod Properties > Format (tab) > Preset to Default...> Forward
Enable 1xEV-DV analysis	MeasSetup > Demod Properties > Format (tab) > Enable 1xEV-DV analysis
Add four traces to the display	Display > Layout > Grid 3x2
Start the measurement	Click on ►

**Figure 2.**



# Composite Measurements

A composite measurement is a measurement made on all code channels at once. These measurements include: composite code domain power (CDP), composite code domain error (CDE), as well as time domain measurements such as rho, EVM, EVM spectrum, and EVM time. These measurements are useful for evaluating the overall in-band performance of the cdma2000/1xEV-DV signal.

## Composite vector diagram and error summary table

The steps shown in Table 5 set up the composite constellation and composite error summary table. *(These steps are provided to show how to set a constellation trace and an error table. The same information is already available in traces C and D of the previous step.)*

### Trace A: Composite measurement time (constellation display)

This constellation is quite noisy but is characteristic of the composite cdma2000/1xEV-DV signal. Seeing this shape provides a first order indication that the demodulator is properly setup.

### Trace B: Composite error summary

The composite error summary display shows you the following measurement results for the composite signal:

*Composite EVM* (EVM) is the error vector magnitude for the composite signal, including all Walsh code lengths and Walsh code numbers. The table shows RMS percentage EVM, the peak (largest) percentage EVM, and the chip number with the peak percentage EVM. This parameter is computed at the chip rate.

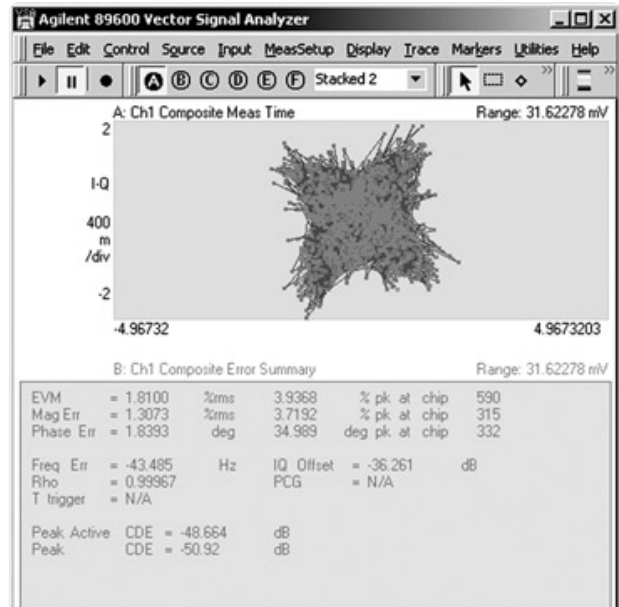
*Composite magnitude error* (Mag Err) is the difference in amplitude between the I/Q measured signal and the I/Q reference signal for the composite signal.

The display shows these magnitude error values: the RMS percentage magnitude error, the peak percentage magnitude error, and the chip number with the peak percentage magnitude error.

**Table 5. Instructions for composite constellation and composite error summary table setup.**

Instructions	Toolbar menus
Set the display to a stack of two traces	Display > Layout > Stacked 2
Change trace A to show composite IQ time (constellation)	Double click on trace A's title <i>(upper left corner of trace)</i> > Channel 1 <sup>1</sup> Comp > IQ Meas Time
Auto-scale trace A	Right click on trace A > Y Auto Scale
Change trace B to show the composite error summary table	Double click on trace B's title <i>(upper left corner of trace)</i> > Channel1 <sup>1</sup> Comp > Error Summary

**Figure 3.**



1. Channel 1 refers to the measurement channel, not to any channel contained in the signal

*Composite phase error* (Phase Err) is the difference, in phase, between the I/Q reference signal and the I/Q measured signal for composite signal, including all Walsh code lengths and Walsh code numbers.

The display shows these phase error values (in degrees): the RMS phase error, the peak phase error, and the chip number with the peak phase error.

*Composite IQ offset* (also called I/Q origin offset) indicates the magnitude of the carrier feed-through signal. When there is no carrier feed-through, IQ offset is zero (infinity dB). Refer to EVM spectrum in this section for a second measure of carrier leakage.

*Composite frequency error* (Freq Err) shows the composite signal carrier frequency error relative to the analyzer's center frequency. This parameter is displayed in Hertz and is the amount of frequency shift, from the analyzer's center frequency, that the analyzer must perform to achieve carrier lock.

*Composite rho* is the normalized correlation coefficient between the measured and ideal reference signals, and is designated as the waveform quality factor. The maximum value of rho is 1.0, which means the measured signal and reference signal are identical.

*Composite PCG* identifies the PCG used for the composite measurement (except composite CDP). The composite PCG ignores the measurement offset, which is different from the channel PCG (see following section), which uses the measurement offset. The composite PCG number is available only when the measurement is triggered.

For an accurate PCG number, the trigger should be a signal like an "even second" signal that is synchronized to the start of the cdma2000 frame.

*Composite T trigger* shows the amount of time, in chips, from the trigger to the start of the sync symbol. For example, the sync symbol marks the beginning of a frame of 16 PCGs. If you select a trigger that starts the measurement at the beginning of a PCG, the T trigger value would be 0 chips. The T trigger value is displayed only for triggered measurements.

*Composite peak active CDE* is the largest active code channel code domain error (in dB). This is the largest measured CDE for all active code channels in the composite signal.

*Composite peak CDE* is the largest measured code channel code domain error. This is the largest measured CDE for all code channels (active and inactive) in the base code layer (the code layer with the smallest symbol rate) in the composite signal.

If averaging is on, averaging is applied to most of the numeric error data in the error summary data except for peak EVM, peak magnitude, and peak phase error. These values are averaged only for the continuous peak hold averaging type.



**Composite CDP and CDE**

Composite code domain power (CDP) and composite code domain error (CDE) measure the power and error of the signal by code channel. They provide more detail on signal behavior and modulation quality than the composite EVM or rho.

The steps shown in Table 6 will take you through setting up these measures.

**Trace A: Composite CDP**

The CDP trace shows the measured power in each code channel in the composite signal. This trace is an analysis of the distribution of signal power across the set of code channels normalized to the total signal power.

The data is shown in a multi-color form that assigns a unique color to each code layer and related active code channels. In this example the active channels are orange (standard cdma2000) and blue (1xEV-DV packet data channels). The inactive channels have no fill color.

**Trace B: Composite CDE**

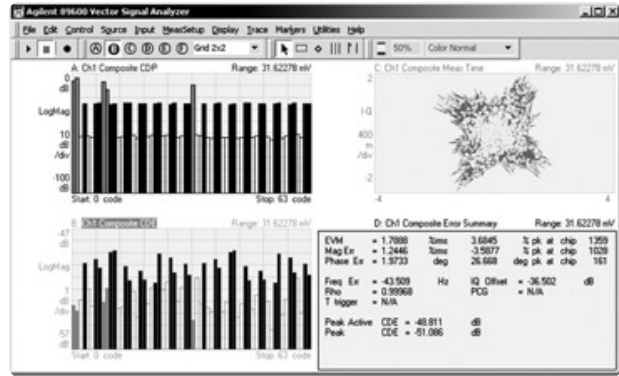
The composite CDE trace shows the CDE values for each active code channel (Walsh code number) for all code layers (Walsh code lengths). It also shows the CDE value for each inactive code channel at the lowest code layer. The CDE of a particular code channel is a measure of the error power in a code channel relative to the total signal power.

The data is shown in a multi-color form that assigns a unique color to each code layer and related active code channels. In this example the active channels are orange (standard cdma2000), and blue (1xEV-DV data packet channels). The inactive channels have no fill color.

**Table 6. Composite CDP and CDE setup instructions.**

Instructions	Toolbar menus
Add two more grids to the display so CDP and CDE can be shown	Display > Layout > Grid 2x2
Change trace A to show composite CDP	Double click on Trace A's title > Channel 1 <sup>1</sup> CDP > CDP composite
Auto-scale trace A	Right click on trace A > Y Auto Scale
Change trace B to show composite CDE	Double click on Trace B's title > Channel 1 <sup>1</sup> CDP > CDE composite
Auto-scale trace B	Right click on trace B > Y Auto Scale

**Figure 4.**



1. Channel 1 refers to the measurement channel, not to any channel contained in the signal

## Markers

The 89601 VSA software includes several markers and marker functions accessible from the **Markers** menu. Each trace has its own set of markers. You can quickly set marker locations, manually re-position them, locate peak values, and couple the markers between traces to show common values. Marker calculation features allow you to easily calculate band power, RMS band power, and channel-to-noise power.

Markers can also help users understand the information presented in a trace. For cdma2000/1xEV-DV modulation, the CDP and CDE displays related code channels (Walsh code number) are dispersed along the X-axis as defined by the Hadamard code order. This makes visually identifying related code channels difficult. The Trace A marker solves this problem by pointing to the related parts, in this case a 1xEV-DV packet data channel.

### Trace A: Composite CDP, Hadamard order, with markers

The marker shows the following values (bottom of screen):

Symbol rate	38.4 Ksym/s
Walsh code length	32
Walsh code number	14
Power level	-25.143 dB
Asterisk *	The asterisk indicates the marker is positioned on an active channel

### Trace B: Composite CDE, bit reverse order

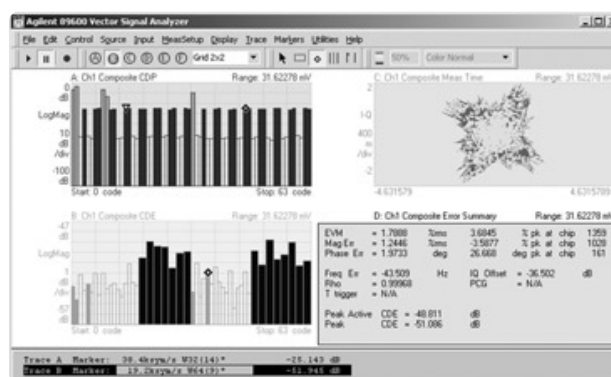
Another way to look at the composite code domain channels is to reorder them so related code channels are displayed adjacent to each other. The bit-reversed generation of Walsh channels provides us with this code ordering.

In trace B the channels are shown in bit reverse order.

**Table 7. Marker setup.**

Instructions	Toolbar menus
Enable the trace A marker	Click on trace A > Markers > Tool > Marker <i>OR</i> Right click on trace A > Show Marker
Enable the trace B marker	Right click on trace B > Show Marker
Change the code order in trace B to bit reverse	Click on trace B > Trace > Digital Demod > Code Order ( <i>drop down menu</i> ) > Bit Reverse > Close

**Figure 5.**



### EVM time and EVM spectrum

Two useful displays for evaluating the behavior of the composite signal are error vector time and error vector spectrum.

The steps shown in Table 8 will take you through setting up these measures.

#### Trace A: EVM time

EVM time shows EVM behavior over time, where chips represent time. You can view error vector time data as EVM, error vector phase, the I component, or the Q component only. This feature is used to find impulsive errors such as a transient overload event or a clock circuit giving off spikes. It is also useful for finding low frequency errors caused by close-in phase noise. Trace A is typical of a signal without any of these problems. It is relatively flat and consistent across all 1.527 kchips.

#### Trace B: EVM spectrum

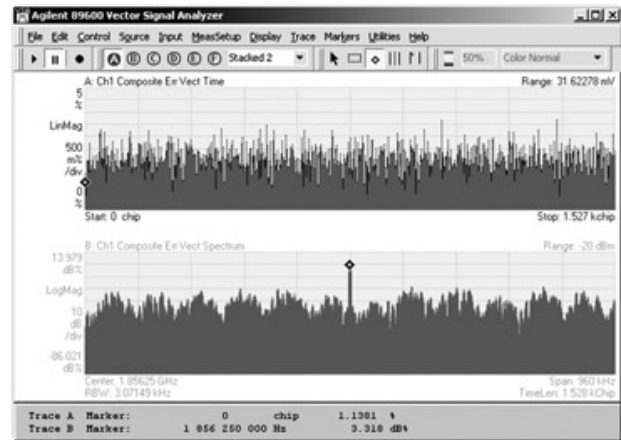
EVM spectrum is the FFT of the EVM time trace and shows the frequency content of the EVM. Trace B shows a high error signal at 1.856 GHz (see Trace B marker value at bottom of display.) This is the carrier frequency of the pre-recorded signal and represents carrier feed through. Any spurious signal will show up as a discrete peak in the composite error vector spectrum trace.

The analyzer's demodulator removes carrier-frequency error. Therefore, in the composite error vector spectrum display, you must add the carrier-frequency error to marker readouts to obtain exact frequency information. The carrier-frequency error (Freq Err) is shown in the Composite Error Summary Table.

Table 8. EVM time and EVM spectrum setup.

Instructions	Toolbar menus
Setup a display with only two vertically stacked traces	Display > Layout > Stacked 2
Set the top trace to display error vector time	Double click on trace A's title > Channel 1 Comp > Error Vector Time
Set the bottom trace to display error vector spectrum	Double click on trace B's title > Channel 1 Comp > Error Vector Spectrum
Enable a marker in the bottom trace	Click on trace B > Markers > Tool > Marker <i>OR</i> Right click on trace B > Show Marker
Put the marker on the peak near the center of the trace	Right click on trace B > Peak
Start the measurement	Click on ►

Figure 6.



# Channel Measurements

## Measuring a single channel

The instructions in Table 9 show how to use markers and the **Copy Marker to Despread Chan** function to quickly view a single channel in your cdma2000/1xEV-DV signal. You can also go directly to the desired channel by entering its parameters in the **Demod Properties** menu.

**Copy marker to Despread Chan** sets the Walsh code length and Walsh code number parameters in the **Demod Properties > Channel/Layer** menu.

Walsh code length and Walsh code number specify the channel used for channel trace displays. These traces include Chan Syms/Errs (which displays the symbol table for the selected channel), Chan Mag Error, Chan Phase Error, Chan Error Vector, and Chan IQ Meas Time.

**Trace A: Channel 1 composite CDE**  
See the previous section.

## Trace B: Channel 1 chan error vector time

This trace shows how the error vector changes with time (where symbols represent time) for the specified code channel (Walsh code number) and code layer (Walsh code length). The ideal error vector time trace is a flat horizontal line at zero percent.

The error vector time trace is made up of complex, time-domain data. Each point in the trace has two components: I and Q. To make sense of the data you must select an appropriate trace data format (**Trace > Format > Format:** drop-down list).

<i>Linear mag</i>	Shows the EVM
<i>Real (I)</i>	Shows the I component of the error vector
<i>Imag (Q)</i>	Shows the Q component of the error vector
<i>Wrap phase</i>	Shows error vector phase

## Trace C: IQ measured time

This trace is the demodulated data sampled at the chip times for the specified code channel (Walsh code number) and code layer (Walsh code length). This data can also be displayed in Q-eye, I-eye, and trellis-eye formats (double click on the Y-axis label).

If normalization is off, the analyzer shows the instantaneous magnitude. If normalization is on, the analyzer scales the IQ measured and IQ reference traces to map them onto the unit circle, which yields a unitless y-axis.

## Trace D: Ch1 Syms/Errs

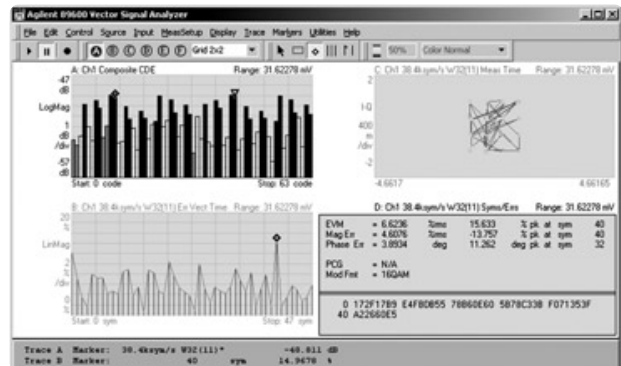
This display shows the error summary data for the specified Walsh code number and Walsh code length. Unlike the Composite Symbols/Errors table this table shows the demodulated bits.

If averaging is on, averaging is applied to most numeric error data in the error summary data with the following exceptions. The peak data values, such as peak EVM, peak magnitude, and peak phase error are averaged only for the continuous peak hold averaging type.

**Table 9. Instructions for making channel measurements**

Instructions	Toolbar menus
Setup a 2x2 display grid	Display > Layout > Grid 2x2
Set trace A to display composite code domain error	Double click on the trace A's title > Channel 1 CDP > CDE composite
Auto-scale trace A's vertical scale to get better resolution	Right click on trace A > Y Auto Scale
Send the marker to the channel with the highest CDE	Right click on trace A > Peak
Select the marked channel for more detailed analysis	Right-click on trace A > Copy Marker to Despread Chan
Change Trace C to display the vector diagram for the selected channel	Double click trace C's title > Channel 1 Chan > IQ Meas Time
Change Trace D to display the symbol table for the selected channel	Double click on trace D's title > Channel 1 Chan > Syms/Errs
Change Trace B to display the error vector time trace for the selected channel	Double click on trace B's title > Channel 1 Chan > Error Vector Time
Auto-scale trace B	Right click on trace B > Y Auto Scale
Send the B marker to the channel with the highest EVM	Right click on trace B > Peak

**Figure 7.**



## Code layer and code channel CDP and CDE

The instructions in Table 10 show how to measure code domain power and code domain error for a specific spread code length or layer.

### Trace A: 38.4 ksym/s CDP

This trace shows the measured channel power for all code channels (Walsh code number) within the specified code layer (Walsh code length.) If the measurement interval is greater than one, all slots within the measurement interval are averaged together to produce the CDP Layer results.

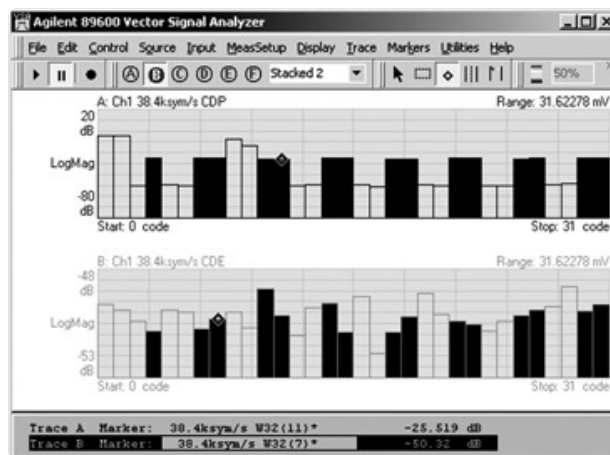
### Trace B: 38.4 ksym/s CDE

This trace shows the channel power error values for each code channel (Walsh code number) within the specified code layer (Walsh code length.) The CDE of a particular code channel is a measure of the error power in a code channel relative to the total signal power. CDE Layer trace data results are computed only from the first measured slot. This is different than CDP Layer trace data results, which can include more than the first slot in the measurement results.

**Table 10. Channel code domain power and error measurement configuration instructions.**

Instructions	Toolbar menus
Select trace A and setup a display with only two vertically stacked traces	Click on trace A Display > Layout > Stacked 2
Set the demodulator to measure the CDP for Walsh code length 32	MeasSetup > Demod Properties... > Channel/Layer (tab) > Walsh code length > 32 (38.4 ksym/s) (drop down menu) > Close
Set trace A to display the CDP for the layer	Double click on the trace A's label > Channel 1 CDP > CDP layer > OK
Auto-scale trace A	Right click trace A > Y Auto Scale
Set trace B to display the CDE for the layer	Double click on the trace B's label > Channel 1 CDP > CDE layer > OK
Auto scale trace B	Right click trace B > Y Auto Scale

**Figure 8.**



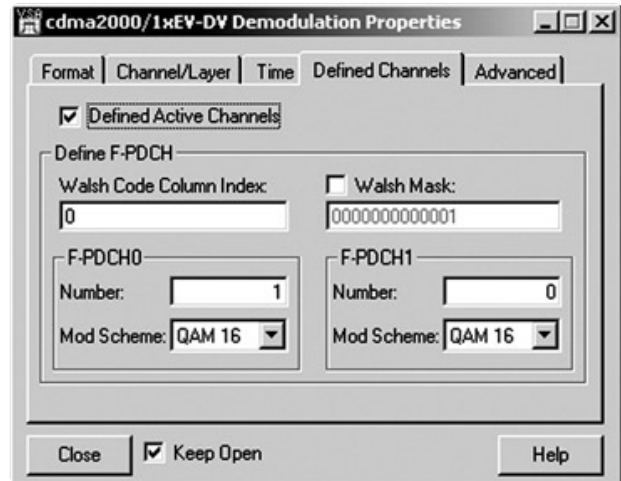
### F-PDCH in demod properties menu

Use the **Defined Active Channel** feature in the **Demod Properties** menu when the 89601 VSA's auto-detection algorithm is not properly identifying the F-PDCH active channels or modulation formats. **Defined Active Channels** forces the analyzer to override the auto-detection algorithm and to recognize all F-PDCH channels specified by the **Define F-PDCH** parameters.

This feature is particularly useful in early design when errors may be too great to allow the auto-detection algorithm to successfully identify all active channels.

To define the measurement channels, you must specify the Walsh-code assignments and modulation formats for both the F-PDCH0 and F-PDCH1 channels. The defined F-PDCH channels are always presumed active regardless of the actual input signal. The total number of identified active channels includes those specified by the **Defined Channels** and any additional active channels detected by the active channel algorithm.

Figure 9.



## Making adaptive modulation and coding (AMC) measurements

1xEV-DV supports adaptive modulation and coding (AMC) in the F-PDCH channel.

In the AMC system, the modulation scheme of each packet data channel may be dynamically changed between QPSK, 8PSK, or 16QAM every sub-packet length. The F-PDCH sub-packet length can be transmitted using one, two, or four slot durations.

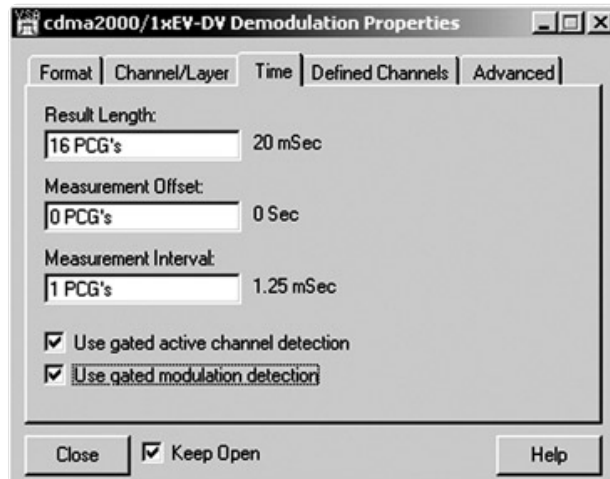
The analyzer does not directly support AMC signal measurements; however, AMC measurements can be accomplished on a slot-by-slot basis. If a code channel changes modulation format or active status, you can obtain correct measurement results by limiting the measurement to intervals that have a constant modulation scheme.

To properly measure a 1xEV-DV signal with AMC on the F-PDCH channel (Walsh code length 32), follow these setup instructions.

a. Select the **Use gated modulation detection** and **Use gated active channel detection** modes from the **Time** properties tab [**MeasSetup** > **Demod Properties** > **Time** tab]. This makes sure that only those slots within the specified measurement interval are included in the measurement data.

b. Carefully specify the appropriate measurement interval using the **Measurement Interval** and **Measurement Offset** parameters. It is important that you select measurement intervals that contain only one modulation type and have a total number of slots equivalent to an integral number of F-PDCH sub-packet lengths.

Figure 10.





c. Carefully specify the appropriate measurement interval using the **Measurement Interval** and **Measurement Offset** parameters.

It is important that you select measurement intervals that contain only one modulation type and have a total number of slots equivalent to an integral number of F-PDCH sub-packet lengths.

d. If a despread channel measurement of an F-PDCH channel does not automatically detect the correct modulation scheme, you can override it by selecting the **Manual Modulation Scheme** mode and specifying the desired modulation format [**MeasSetup** > **Demod Properties** > **Channel/Layer** tab].

e. If the analyzer is not correctly auto-detecting the active channels, possibly due to extreme power changes (burst on/off), override the threshold level by using the **Active Channel Threshold** parameter on the **Advanced** tab [**MeasSetup** > **Demod Properties** > **Advanced** tab].

Figure 11.

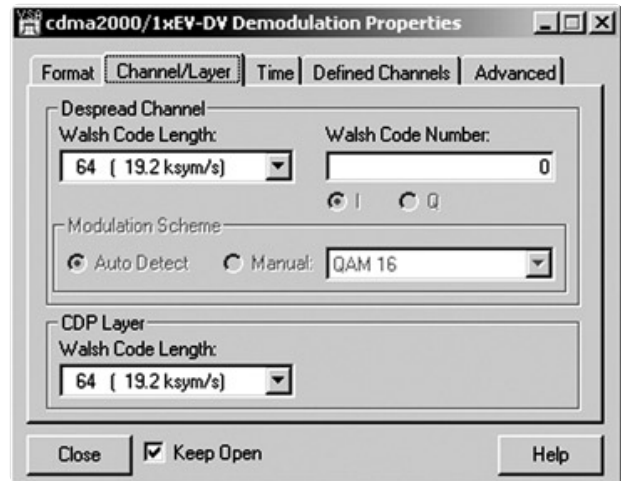
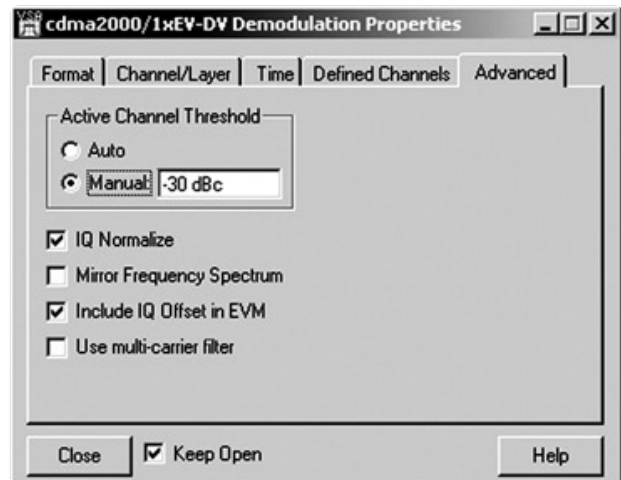


Figure 12.



# Additional Measurements

## Channel power

The 89601 VSA band power measurement determines the total power in a user-specified bandwidth. This measurement is used to make standards-based channel power measurements by setting the bandwidth and center frequency of the band power marker to the values called out in the standard.

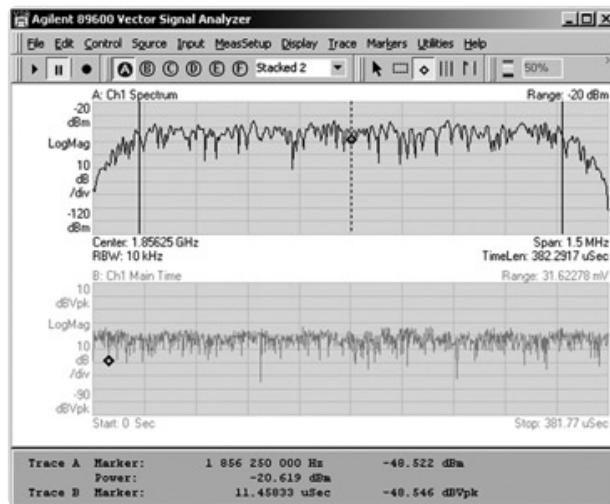
The following band power measurement parameters are user-controlled

- center frequency
- bandwidth
- number of averages (in **MeasSetup** > **Average** menu)
- power calculation
  - band power (dB)
  - RMS square root power ( $V_{rms}$ )
  - C/N - carrier to noise power (dB)
  - C/No - carrier to noise density (dB/Hz)

**Table 11. Setup for measuring channel power.**

Instructions	Toolbar menus
Pre-set the set up for the 89601 software	File > Preset > Preset Setup
Recall the 1xEV-DV signal	File > Recall > Recall Recording > 1xEV-DV.sdf > Open
Start the measurement	Click on ( <i>toolbar, left side</i> )
Auto-scale trace A	Double click on trace A > Y Auto Scale
Activate the band power marker in the spectrum trace	Right click trace A > Show Band Power
Set the center frequency and span for the band power marker	Markers > Calculation > Center, Width Center: 1.85625 GHz Width: 1.2288 MHz
Select the power calculation	Markers > Calculation > Calculate > Band Power
Activate a marker and put it at the center frequency (Optional, shows frequency and power at center of span)	Right click on trace > Show Marker Markers > Position > X Position Enter: 1.85625 GHz

**Figure 13.**



### Power statistics (CCDF)

The complementary cumulative distribution function (CCDF) characterizes the power statistics of a signal by plotting the peak-to-average power ratio (PAR) versus probability of occurrence. This is a key measurement for power amplifiers designed for cdma2000/1xEV-DV base stations as these devices must be capable of handling the PAR of the digitally modulated signals while maintaining good adjacent channel leakage performance.

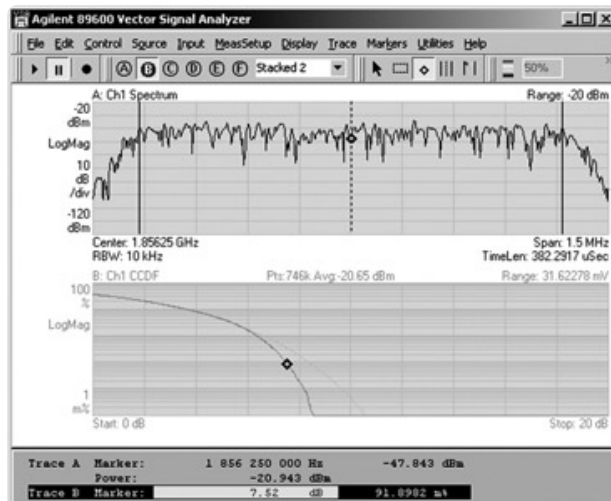
In the example shown the average power of the signal is  $-20.65$  dBm (top center of grid B) and only 0.091 percent of all signal peaks measured were more than 7.52 dB above the signal's average power.

**Table 12. Set up for measuring CCDF.**

Instructions	Toolbar menus
This measurement is made on the time trace of the signal. Refer to <i>Setup the RF measurement parameters</i> in the <i>Setup Procedures</i> section. The digital demodulators must be off for this measurement to work. <b>(MeasSetup &gt; Demodulator &gt; Demod Off)</b>	
Change the "Main time" trace to CCDF	Double click on the trace title (upper left corner of grid) > Channel 1 > CCDF
Start the measurement	Click on ►
Activate a marker on the CCDF trace	Right click on the trace > Show Marker
Find the PAR needed to assure the signal will be clipped < 0.1% of the time	Drag the marker along the CCDF plot until the marker readout at the bottom of the display shows <100 m% < 0.1% of the time

If the bottom of the CCDF graph is jagged (looks like stair steps) keep running the measurement. CCDF is a statistical measurement and gives best results with large sample sizes. The sample size is shown as "Pts" parameter at the top of the CCDF trace. The "Avg" parameter shows average measured signal power.

**Figure 14.**



# Key Menu Reference

## Demod properties menu

Access these menus via the toolbar by clicking **MeasSetup** > **Demod Properties** (the cdma2000/1xEV-DV demodulator must be selected). For more information on the functions controlled by the menu click the **Help** button in the lower right corner of the menu.

Figure 15. Demod Properties menu > Format tab

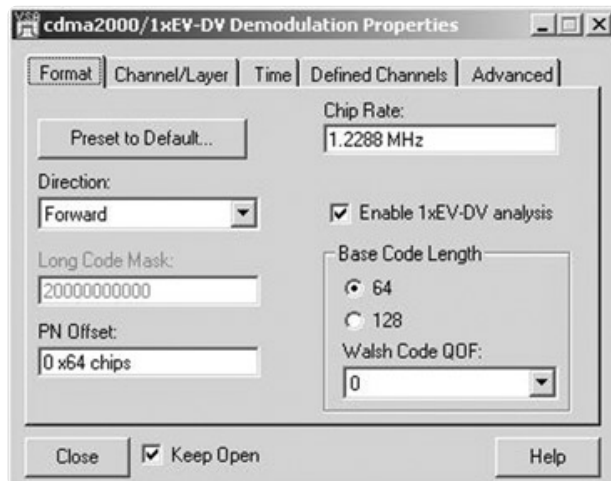


Figure 16. Demod Properties menu > Channel/Layer tab

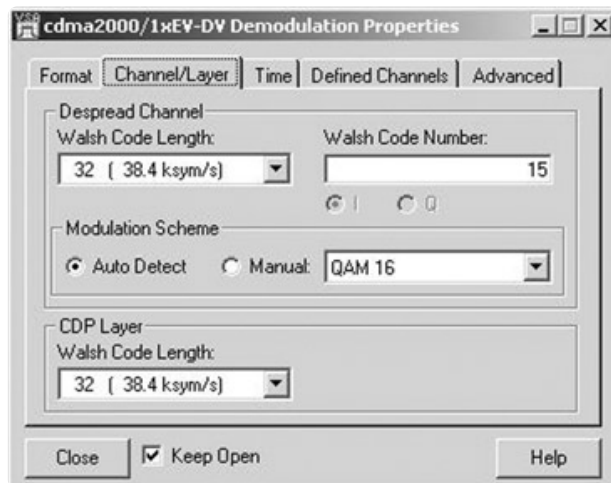
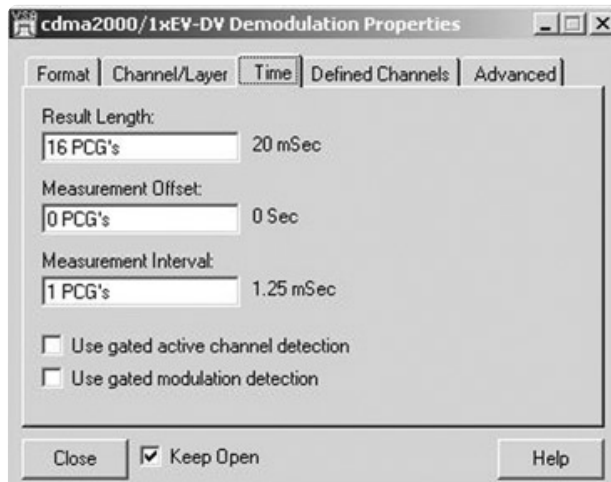
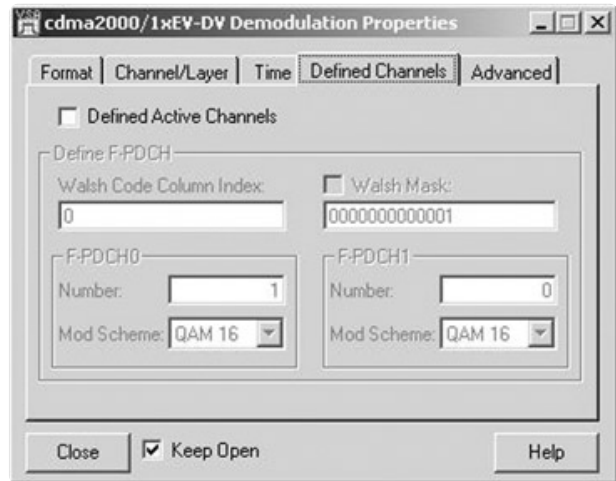


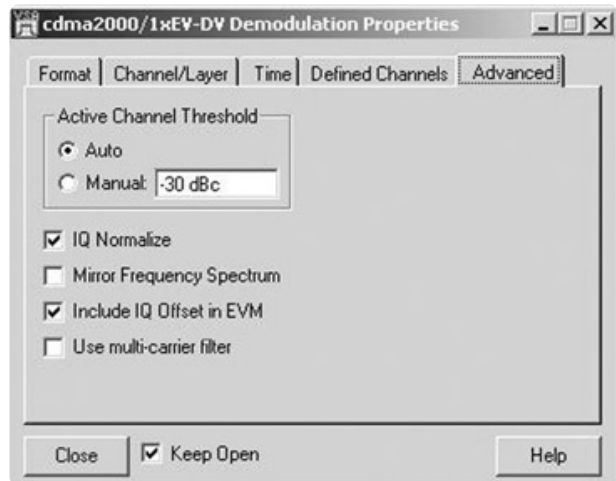
Figure 17. Demod Properties menu > Time tab



**Figure 18.**  
Demod Properties  
menu > Defined  
Channels tab



**Figure 19.**  
Demod Properties  
menu > Advanced tab

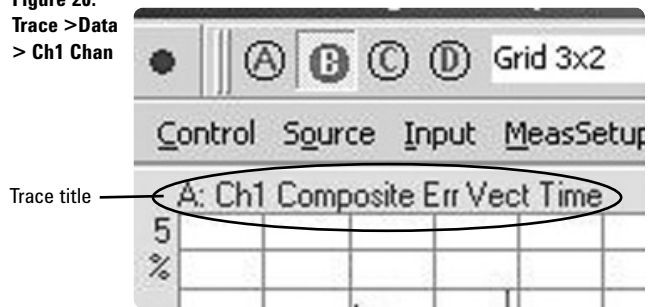


### Trace data menus

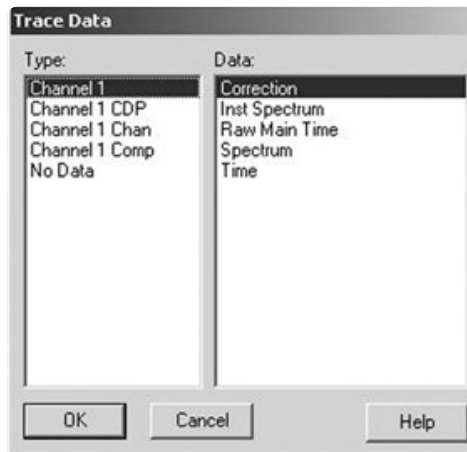
Access this menu by clicking **Trace > Data > Ch1 Chan** in the toolbar or by double clicking on the trace title annotation at the upper left corner of the trace you wish to change.

For more information on the functions controlled by the menu, click the **Help** button in the lower right corner of the menu.

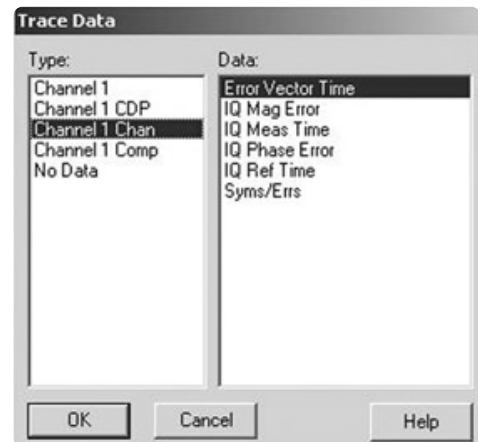
**Figure 20.**  
Trace >Data  
> Ch1 Chan



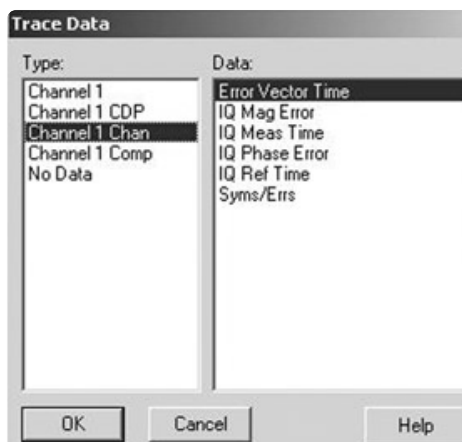
**Figure 21.**  
Trace data menu >  
Type: Channel 1 >  
Data (display)  
menu selections



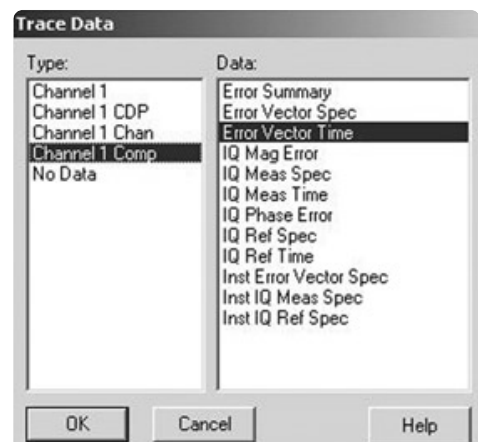
**Figure 22.**  
Trace data > Type:  
Channel 1 CDP >  
Data (display)  
menu selections



**Figure 23.**  
Trace data > Type:  
Channel 1 Chan >  
Data (display)  
menu selections



**Figure 24.**  
Trace data > Type:  
Channel 1 Comp >  
Data (display)  
menu selections



## Ordering Information

The 89601A VSA software works with a variety of measurement hardware, sourcing hardware, and other software.

In general an external PC with a LAN, FireWire, or GPIB interface is required to run the software and control the hardware.

### 89601A Vector Signal Analysis software

89601A	VSA software, node-locked license
89601AN	VSA software, floating license
Opt 200	Basic analysis software
Opt 300	Hardware connectivity
Opt AYA	Flexible vector modulation analysis
Opt B7N	3GPP modulation analysis
Opt B7R	WLAN modulation analysis
Opt 105	Advanced design system streaming interface

### Measurement hardware Vector signal analyzer bundled systems<sup>1</sup>

*(Two baseband channels and/or two RF channels available)*

Models	Frequency range	Max. analysis bandwidth
89610S	DC to 40 MHz	40 MHz
89611S	52 to 88 MHz	36 MHz
89640S	DC to 2.7 GHz	36 MHz
89641S	DC to 6.0 GHz	36 MHz

### PSA Series spectrum analyzers

Models	Frequency range	Max. analysis bandwidth
E4440A	3 Hz to 26.5 GHz	8 MHz
E4443A	3 Hz to 6.7 GHz	8 MHz
E4445A	3 Hz to 13.2 GHz	8 MHz
E4446A	3 Hz to 44 GHz	8 MHz
E4448A	3 Hz to 50 GHz	8 MHz

### ESA-E Series spectrum analyzers

Models	Frequency range	Max. analysis bandwidth
E4401B	9 kHz to 1.5 GHz	10 MHz
E4402B	9 kHz to 3.0 GHz	10 MHz
E4404B	9 kHz to 6.7 GHz	10 MHz
E4405B	9 kHz to 13.7 GHz	10 MHz
E4407B	9 kHz to 26.5 GHz	10 MHz

### Infiniium oscilloscopes

Models	Frequency range	Max analysis bandwidth
54830B/D	DC to 780 MHz	780 MHz
54831B/D	DC to 780 MHz	780 MHz
54832B/D	DC to 1.0 GHz	1 GHz
54853B <sup>2</sup>	DC to 2.5 GHz	2.5 GHz
54854B <sup>2</sup>	DC to 4.0 GHz	4 GHz
54855B <sup>2</sup>	DC to 6.0 GHz	6 GHz

### Sources

#### ESG Series digital RF signal generators

E4431B	250 kHz to 2 GHz
E4432B	250 kHz to 3 GHz
E4433B	250 kHz to 4 GHz
E4434B	250 kHz to 1 GHz
E4435B	250 kHz to 2 GHz
E4436B	250 kHz to 3 GHz
E4437B	250 kHz to 4 GHz
E4438C	250 kHz to 1/2/3/4/6 GHz

#### PSG Series microwave signal generators

E8267	250 kHz to 20 GHz
-------	-------------------

### Software

#### Advanced Design System (ADS) software

Advanced RF/ $\mu$ W design and simulation software.

1. 89601A/AN software included

2. Software can be run on Infiniium internal PC

### **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 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 Email Updates**

[www.agilent.com/find/emailupdates](http://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](http://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](mailto:tm_asia@agilent.com)

##### **Online Assistance:**

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

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

**© Agilent Technologies, Inc. 2004  
Printed in U.S.A., February 23, 2004  
5989-0681EN**

---

Pentium is a U.S. registered trademark of Intel Corporation. Microsoft, Windows 2000, NT, and XP Professional are U.S. registered trademarks of Microsoft Corporation.



**Agilent Technologies**