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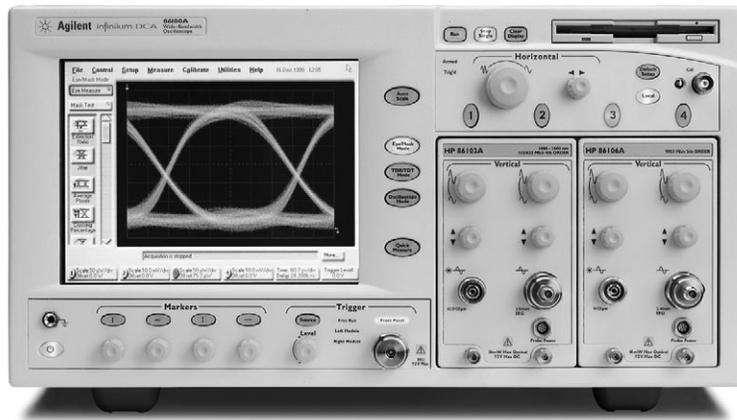
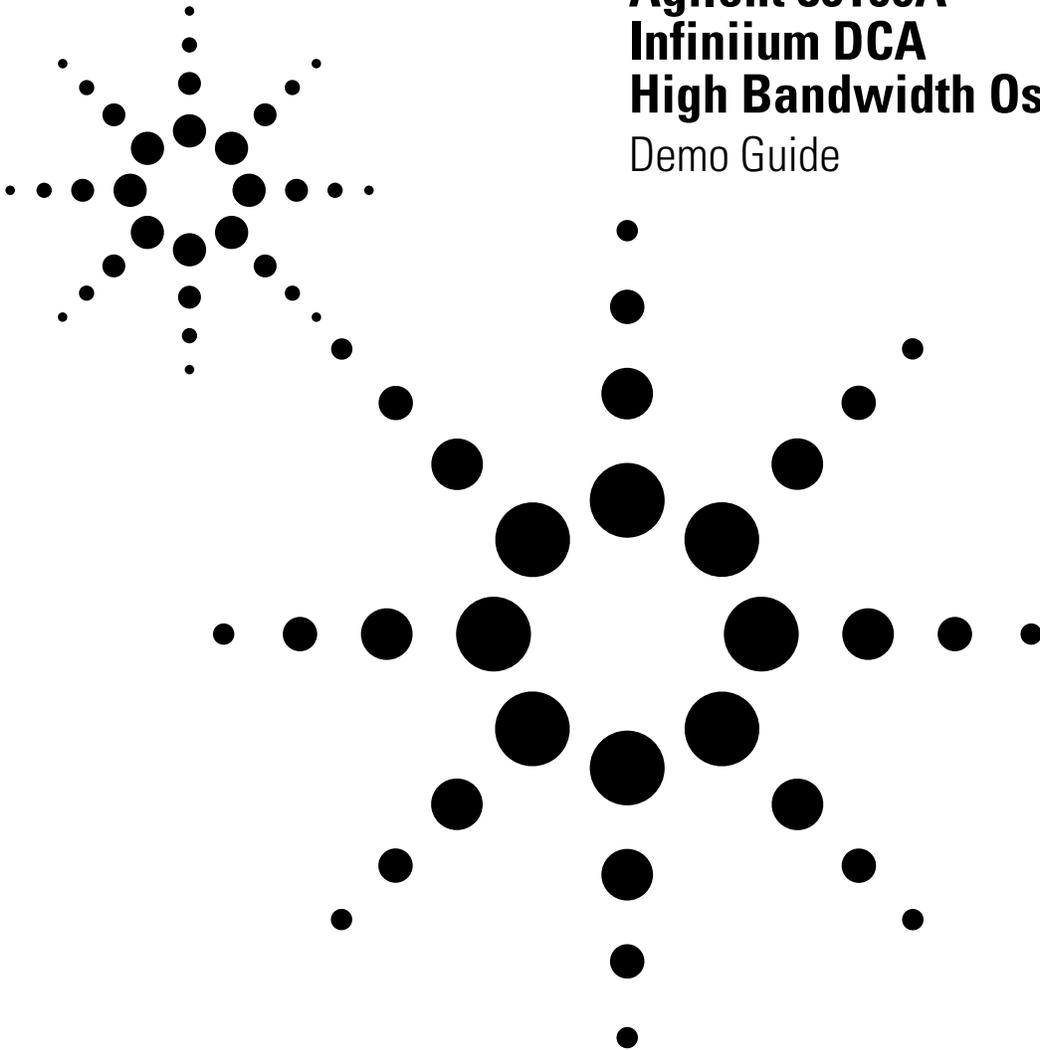
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# Agilent 86100A Infiniium DCA High Bandwidth Oscilloscope

Demo Guide



**Agilent Technologies**  
Innovating the HP Way

# Table of Contents

	<b>Page</b>
<b>Introduction</b> .....	3
<b>Things you should know about the data signal</b> .....	4
<b>Setup for testing optical signals</b> .....	5
<b>Setup for testing electrical signals</b> .....	6
<b>Powering up the 86100A</b> .....	7
<b>Triggering the 86100A</b> .....	8
<b>Viewing eye diagrams</b> .....	9
<b>Two button compliance test</b> .....	10
<b>Configuring Quick Measure</b> .....	11
<b>Automatic measurements</b> .....	12
<b>Performing a compliance test</b> .....	13
<b>Mask Margin Analysis</b> .....	14
<b>Markers</b> .....	15
<b>Histograms</b> .....	16
<b>Configuring Limit Tests</b> .....	17
<b>Calibrating the Infiniium DCA</b> .....	18
<b>Saving screen images</b> .....	19
<b>Printing screen images</b> .....	20
<b>On-line Information System</b> .....	21
<b>Table of plug-in modules</b> .....	23

## Introduction

This demo guide is a tool to gain familiarity with the basic functions and features of the Agilent 86100A Infiniium DCA. All exercises require a signal source and a trigger (clock) source. Key names surrounded by [ ] indicate hard keys located on the front panel, while key names surrounded by < > indicate the icons located on the touchscreen display.

### What is the Infiniium DCA?

- A wide-bandwidth oscilloscope from Agilent Technologies
- A replacement for the Agilent 83480A
- A replacement for the Agilent 54750A

### 3 Instruments in One Box

- A digital communication analyzer  
—Eye/Mask Mode
- A wide bandwidth oscilloscope  
—Oscilloscope Mode
- A time domain reflectometer  
—TDR/TDT Mode

### Forward Compatible

Modules from the 83480A/54750A are fully compatible with the 86100A mainframe.

Remote programming commands from the 83480A/54750A are over 95% compatible with the 86100A mainframe.



## Things you should know before you begin using the 86100A Infiniium DCA?

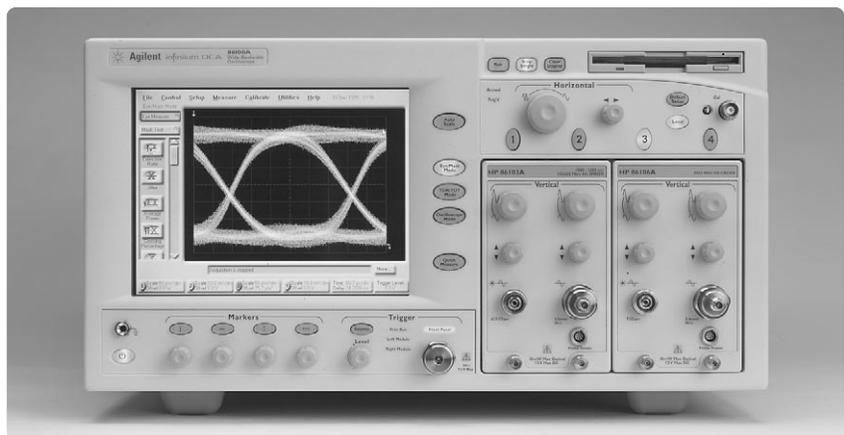
- Is your signal electrical or optical?
- What is the wavelength of your signal under test? 850 nm or 1310/1550 nm?
- Is the signal under test a multimode or single-mode signal?
- What is the bit rate of your signal?
- Do you have a trigger source for the 86100A?
- Will you be looking at eye diagrams or pulse trains?
- Will you be testing filtered or unfiltered signals?
- What is the average input power level of the signal under test?
- How much sensitivity do you need for the signal under test?
- Are you working with more than one bit rate?
- Do you have the right plug-in module for this demo exercise?

*Note: If you are using your own data signal as the signal under test, you will need to provide a clock that is synchronous to your data signal. You also need to select the appropriate mask and filter that corresponds to your data rate throughout this demo guide.*

## Setup for Testing Optical Signals (Eye Diagrams)



- Setting up 8133A pulse/data generator
- Set frequency to 2.4883 GHz or set it to match the data rate of the filter in your plug-in module
- Under Pulse/Data, select DATA, PRBS, NRZ
- Set amplitude to 1.0 V and offset to 0 V
- Set trigger to 1.0 V and offset to 0 V
- Enable outputs on pulse/data output and trigger channel output

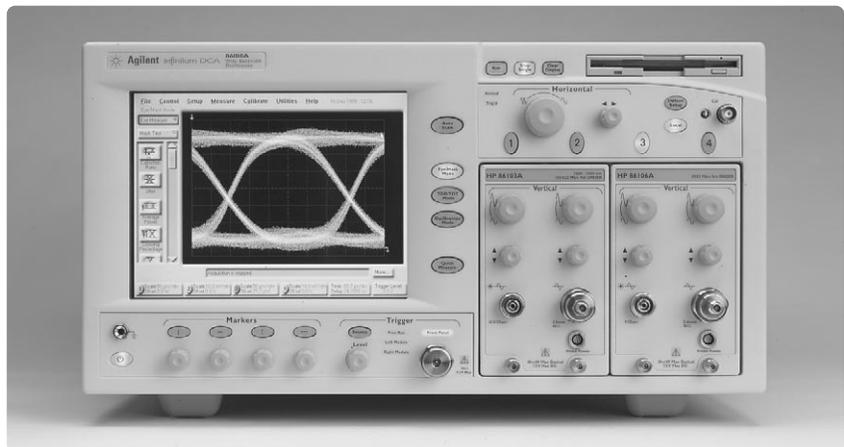


- Connect a 3.5mm (SMA) cable from the **8133A Pulse/Data Output** port to the **83430A DIGITAL IN** port.
- Connect another 3.5mm (SMA) cable from the **8133A Trigger Channel Output** port to the **86100A Trigger Input** port on the front panel.
- Connect an optical cable from the **83430A OPTICAL OUT** port to the **Optical Channel Input** port in the 86100A mainframe.

## Setup for Testing Electrical Signals (Eye Diagrams)



- Setting-up 8133A Pulse/Data Generator
- Set frequency to 2.4883 GHz or set it to match the data rate of the filter in your plug-in module
- Under Pulse/Data, select DATA, PRBS, NRZ
- Set amplitude to 1.0 V and offset to 0 V
- Set trigger to 1.0 V and offset to 0 V
- Enable outputs on pulse/data output and trigger channel output



- Connect a 3.5mm (SMA) cable from the **8133A Pulse/Data Output** port to the **Electrical Channel Input** port on the module in the 86100A mainframe.
- Connect another 3.5mm (SMA) cable from the **8133A Trigger Channel Output** port to the **86100A Trigger Input** port on the front panel.

## Powering-up the 86100A

- Press the [Power] button to turn the scope on.
- If a dialog box regarding “Microsoft Networking” comes up, press <Cancel>.
- If a dialog box asking for “Network or User password” comes up, press <Cancel>.
- If a dialog box regarding “Boot Logger” comes up, select the top choice, <“Booting under normal conditions.”>

## Powering-down the 86100A

Press the [Power] button to turn the scope off.

*Note:* Although the 86100A Infiniium DCA has a Windows® 98 based operating system, you do not need to go through the Windows shut-down process.

## Calibrating the Touchscreen Display

You can calibrate the touch screen to insure its accuracy. The calibration aligns the touch screen with the video display. Therefore, when you touch an element on the display screen, the instrument can detect the task you want to perform.

To calibrate the touch screen, click/touch the <Utilities> button on the Windows instrument toolbar. The Utilities dialog box opens. Click/touch the <Touch Screen Config...> button from the pop-up menu. Click/touch the <Calibration... > menu. A calibration window opens and instructs you to touch the targets on the display screen. When calibration is complete, the calibration window closes.

## Triggering the 86100A

Before we begin using the 86100A, we should discuss a very important topic about the 86100A. Understanding the 86100A trigger is critical to getting a true representation of your data signal.

The 86100A Infiniium DCA like the 83480A and 54750A is a repetitive sampling scope. Unlike a real-time scope, a repetitive sampling scope does not have the ability to trigger directly on the data signal.

- A real-time scope captures an entire waveform on each trigger. The sample rate of the scope's A/D determines the sample spacing and the acquisition memory determines the number of points captured on the display.
- A repetitive scope measures only the instantaneous amplitude of the waveform at the sampling instant. The input signal is sampled only once per trigger event. Upon the next trigger event, the scope adds a small delay and samples another point. After many triggers, the input waveform is reconstructed on the display screen.

The 86100A therefore requires a trigger source separate from the data signal. To see a pulse train, you must have a trigger source that is synchronous to the data input and the data must be a repetitive signal. To see an eye diagram, you must have a trigger source that is synchronous to the data input but does not have to be a repetitive signal.

If you do not have access to a trigger source, clock recovery modules that can recover the clock from your data signal are available.

The free-run triggering mode can only be used to view the waveform for amplitude information without any timing information. For your signal under test, it can be used to see if you have a signal. This triggering mode can also be useful for viewing and determining the amplitude range of your trigger signal.

The sensitivity of the external trigger input is:

- 40 mV p-p at 100 MHz
- 200 mV p-p at 2.5 GHz (sinusoidal input or 200ps min. pulse width)
- 200 mV p-p at 2 to 12 GHz (sinusoidal input)

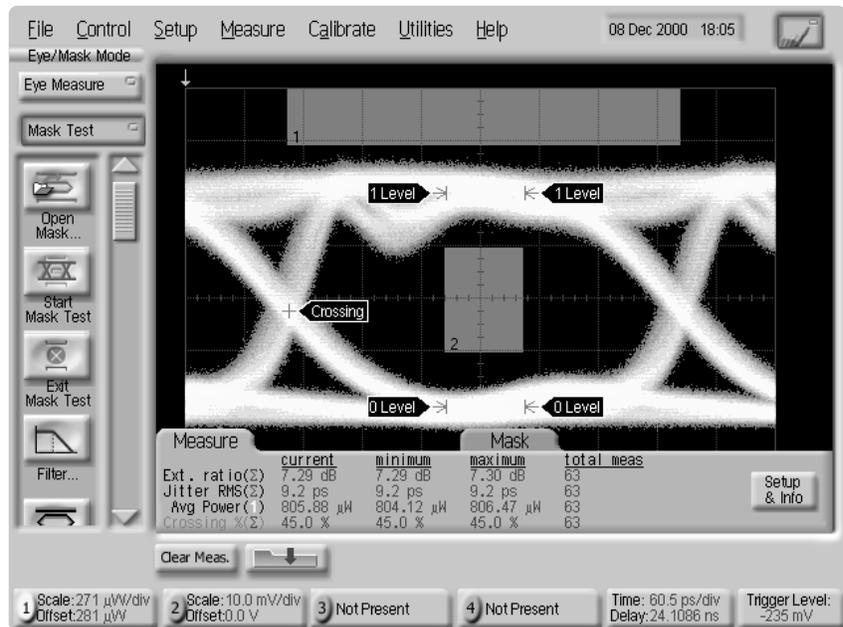
For further information on triggering the 86100A Infiniium DCA, please contact your Agilent sales representative or call Agilent Technical Support 1-800-452-4844.

## Viewing eye diagrams

In this section, you will setup the 86100A to view the eye diagram of an OC-48/STM-16 signal. You will also bring up the SONET/SDH compliant mask to test your signal for compliance. Finally, Quick Measure will be used to measure four automatic eye parameters.

- Press the [Default Setup] button on the front panel
- Press [Eye/Mask Mode] button on the front panel
- Press the [Autoscale] button
- Press <Mask Test> icon from the measurement tool bar on the display
- Press <Open Mask> icon from measurement tool bar
- Scroll down and select mask file <STM016\_OC48.msk>
- Press <Open>
- Press <Start Mask Test> from the display to start the mask test.  
*Notice that the mask has aligned itself to the waveform and mask test information is on the display.*
- Press the [Quick Measure] button from the front panel
- Notice the four default automatic eye parameters are now being measured and the results are shown in the measurement display area.

Your screen should look similar to this.



## Two Button Push Demo for Compliance Test

In this section, you will configure the Quick Measure button to do a compliance test<sup>1</sup> on your signal with two button presses.

- First, press the [Default Setup] button<sup>2</sup> from the front panel to start from a known operating condition and reset the instrument to its factory default settings.
- Press the [Eye/Mask Mode] on the front panel
- Press the [Autoscale] button
- Next, we will configure the Quick Measure button to do a compliance test
- Press <Measure> from the Windows instrument toolbar
- Select <Quick Measure Config... > from the drop-down menu
- Select <Eye/Mask Mode> from the opened configuration menu
- Select four automatic measurements or use the default selections
- Press <Select Mask> and use the scroll bars to find and select the mask file that corresponds to your bit rate
- Press <Select> and then press <Start Mask Testing> box to insert a checkmark in the box
- Close the Quick Measure configuration box
- Now you are ready to perform a compliance test with two button presses!

1. Press <Autoscale> button
2. Press <Quick Measure> button

Congratulations! You're Done!

---

1. If you do not have the OC-48 compliance filter turned on; you will need to turn it on for a true compliance test.  
2. The [Default Setup] button resets the instrument to its factory default settings including all of the Quick Measure setups.

## Configuring Quick Measure

In this exercise, we will configure the Quick Measure button to automatically perform your favorite four measurements when the instrument is in the Eye/Mask Mode.

- Press the [Eye/Mask Mode] button from the front panel
- Press <Measure> from Windows instrument menu at the top of the display
- Select <Quick Measure Config... > from the drop-down menu
- Select the <Eye/Mask Mode> icon from the touchscreen
- Select the four automatic measurements that you would like to configure
- Press <Close> to close the quick measure configuration box
- Press [Quick Measure] button to update and display the four quick measurements that you just selected.

To configure the Quick Measure button to automatically perform your favorite four measurements in the Oscilloscope Mode.

- Press the [Oscilloscope Mode] button from the front panel
- Press <Measure> from Windows instrument menu at the top of the display
- Select <Quick Measure Config... > from the drop-down menu
- Select the <Oscilloscope Mode> icon from the touchscreen
- Select the four automatic measurements that you would like to configure
- Press <Close> to close the quick measure configuration box
- Press [Quick Measure] button to update and display the four quick measurements that you just selected.

*Note: Some of the automatic scope measurements (risetime, falltime, period) will not work properly if you are looking at an eye diagram. You will notice that these measurements will have a question mark (?) next to the measurement in the measurement display area.*

## More Automatic Measurements

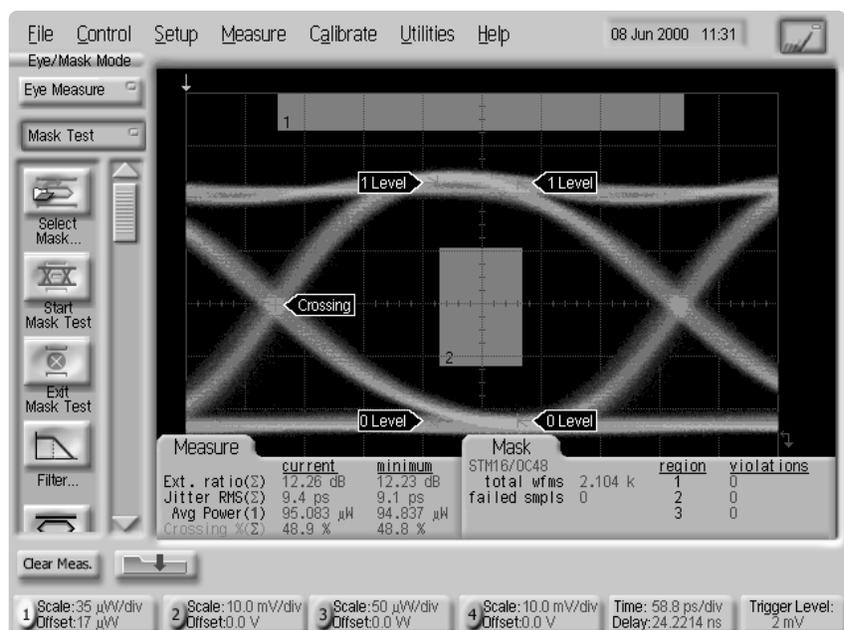
- Press the [Eye/Mask Mode] button on the front panel
  - Select <Eye Measure> icon from the measurement toolbar on the display
  - Notice all of the automatic measurements available by scrolling through the selections
  - Click on some of the eye measurement icons
  - Notice that when you press a measurement icon, the instrument displays the measurement results and shows you how the measurement is constructed. If you need more information, you can easily jump into the On-line help manual by pressing the <Setup & Info> button on the measurement display area.
- 
- Press the [Oscilloscope Mode] button on the front panel
  - Notice that the set of automatic measurement icons on the display have changed to reflect the oscilloscope measurements
  - Click on some of the scope measurement icons.  
*Note: Some of the automatic scope measurements (risetime, falltime, period) will not work properly if you are looking at an eye diagram. You will notice that these measurements will have a question mark (?) next to the measurement in the measurement display area.*
  - Notice that there are two sets of automatic measurements in the oscilloscope mode, <Time> and <Amplitude>

## Performing SONET/SDH Compliance Test

In this section, you will turn the OC-48/STM-16 compliance filter ON to test your signal for SONET/SDH compliance. All three standards (SDH/SONET, Gigabit Ethernet, and Fibre Channel) require that eye mask tests be performed with an optical receiver that has a 4th-order Bessel Thompson filter response.

- Press the [Default Setup] button from the front panel to start from a known operating condition and reset the instrument to its factory default settings.
- Press the [Eye/Mask Mode] on the front panel
- Press the [Autoscale] button
- Select the <Mask Test> icon from the measurement toolbar on the left side of the display
- Press <Select Mask> icon from the measurement toolbar
- Scroll down and select mask file <STM016\_OC48.msk> and press <Open>
- Press <Filter> icon from the measurement toolbar on the display. You may have to scroll down on the toolbar using the slider to see the filter icon.  
*Note: This <Filter> icon is only available when the 86100A is in the Eye/Mask mode. You can also access this filter menu by pressing <Setup> and <Channel> on the Windows toolbar or the <Channel> key at the bottom of the screen.*
- Turn the OC-48/STM-16 filter ON from dialog box by pressing <ON> from the pop-up menu. If there are more than one filter installed in your plug-in module, you will have to choose the appropriate filter next.
- <Close> the dialog box and press the [Quick Measure] button to begin automatic eye/mask measurements
- Press <Start Mask Test> from the display to start the mask test and align the mask to the waveform

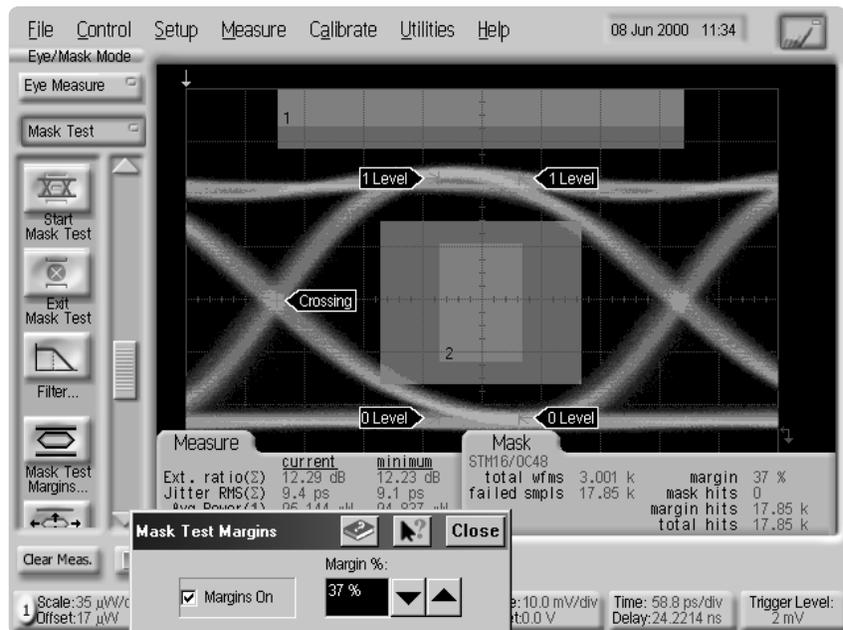
- Notice that the eye shape has changed. The rise and fall times have decreased and any overshoot and ringing may have decreased as well. The eye should look much cleaner now and look similar to this image.
- The reason for this is due to the reduction in the module's bandwidth as a result of turning the OC-48 filter on.



## Mask Margin Analysis

Mask margins are useful when your input waveform passes a mask test without any mask violations and you want to determine how much larger you can increase the size of the mask before mask violations occur. Mask hits/failures are easily viewed with red pixels.

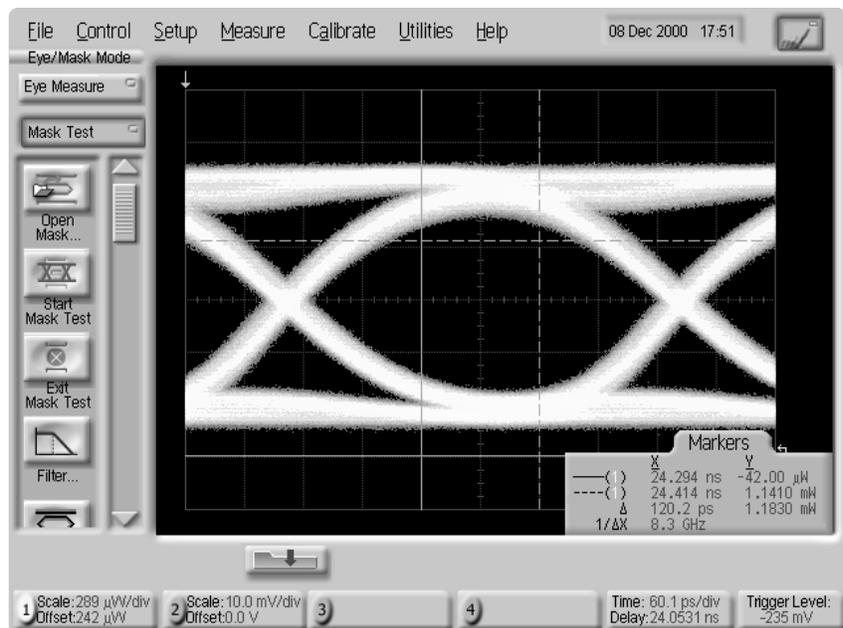
- Press the [Eye/Mask Mode] button on the front panel
- Press the <Mask Test> icon from the measurement toolbar on the touchscreen  
*Note: To use mask test margins, you must have a mask loaded on the display. If you do not have a mask on display, load your mask at this time following instructions from prior exercises.*
- Scroll down and select <Mask Test Margins... > from the mask test toolbar
- Click in the <Margins ON> box to insert a checkmark in the box
- Press the <up arrow> to increase the margin % number
- Notice that the mask on display now has a box with a darker shade of gray. This box is the mask margin that you just created.
- Keep increasing the mask margin to force a mask margin violation. You will notice the violations will be displayed in RED and the margin hits # shown in the mask measurement display area will increase.



## Using Markers

Controlling markers in the 86100A Infiniium DCA have been greatly simplified. Two X-Y marker pairs with individual knob control are available from the front panel. These knobs are also used for easy configuration of histograms.

- Turn on all 4 markers by pressing the marker buttons on the front panel
- Notice the delta X and Y information on the screen and ease of controlling these markers.
- Try moving the markers off screen. Notice the markers do not disappear off the screen.
- However, if you change the delay, the marker will maintain its position on the waveform and as soon as you adjust the marker, it will immediately snap onto the display.



In the Oscilloscope mode, the two horizontal position markers (1st and 3rd marker control knob on the mainframe) are known as waveform markers. These two markers track the waveform and ride on the waveform as you move the marker.

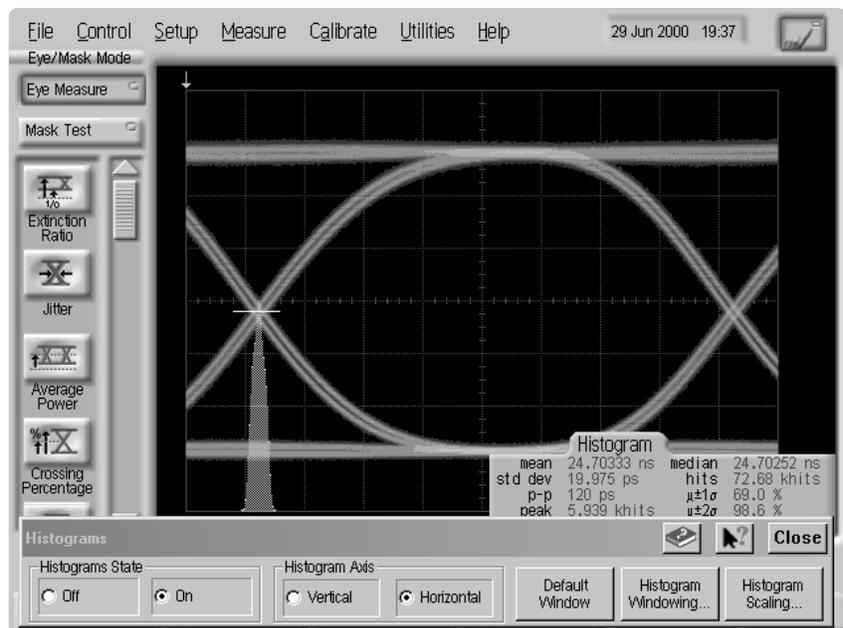
# Histograms

In this exercise, you will learn how to use Histograms to perform statistical analysis on your signal. You will setup the instrument to measure jitter by using histograms and markers.

- Press the [Default Setup] button from the front panel to start from a known operating condition and reset the instrument to its factory default settings.
- Press the [Eye/Mask Mode] button from the front panel
- Press the [Autoscale] button
- Press the <Mask Test> icon from the measurement toolbar on the display
- Press <Filter> icon from the measurement toolbar on the display
- Turn the appropriate filter ON and close the dialog box
- Press <Measure> from the Windows instrument toolbar
- Select <Histograms... > from the drop-down menu
- Turn the Histogram State ON by pressing the <ON> box
- Select the <Horizontal> Axis
- Click on the <Histogram Windowing... > box to open the Histogram window  
*Note: A box should have appeared on the display and the four marker control buttons should be active and ON.*
- By using the marker control knobs, adjust the red histogram windowing box to a thin line and place it on the crossing point of the eye diagram. See example diagram below.
- Close the Histogram Window box

Your screen should look similar to this.

*Note: Unfortunately, the histogram window box can only be displayed when the histogram window is open.*



## Configuring Limit Tests

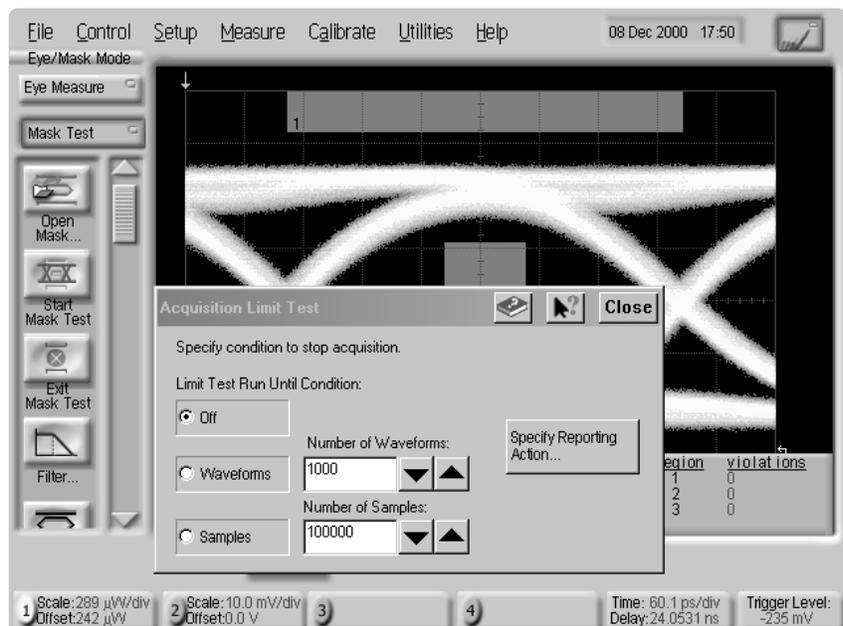
Next we will use the Limit Tests feature to stop the scope after acquiring 100 waveforms.

- Press <Measure> from Windows instrument menu at the top of the display
- Select <Limit Tests> from the drop-down menu

There are three types of limit tests that can be performed on the Infiniium DCA. These limit tests will stop the instrument from acquiring data once the instrument meets the specified limit conditions.

- Acquisition Limit Test - used to set the instrument to stop acquiring data after the instrument acquires a specified number of waveforms or samples.
  - Measurement Limit Test - used to define the number of failures you want to occur on all active measurements (up to four active measurements) before the limit test stops. You can select each of the active measurements and configure the limit test fail conditions for each measurement.
  - Mask Test Limit Test - used to set the instrument to stop acquiring data after the instrument acquires a specified number of mask failed samples.
- Select <Acquisition Limits... > from the next pop-up menu

- Click on <Waveforms>
- Change the number of waveforms to 100 by using the arrows or by clicking on the displayed number and entering 100 on the pop-up keyboard



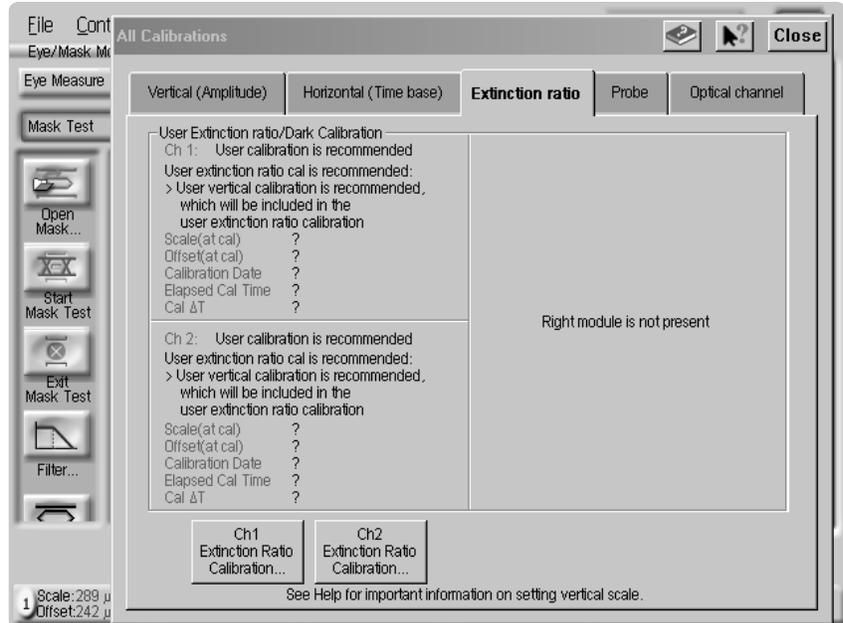
The <Specify Reporting Action... > can be used to specify what the instrument does with the limit test data after each test fails or is completed.

- Close the Acquisition Limit test box
- Press [Clear Display] button from the front panel
- Press [Run] button to start the limit test
- To re-run the test, press the [Clear Display] button then the [Run] button again from the front panel

## Calibrating the Infiniium DCA

Calibrating the 86100A has been simplified by placing all the performance level indicators and calibration procedures in a single location.

- Press <Calibrate> from the Windows instrument menu
- Select <All Calibrations... > from the pop-up menu
- Dark Cal from the 83480A has been renamed to Extinction Ratio Cal in the 86100A.



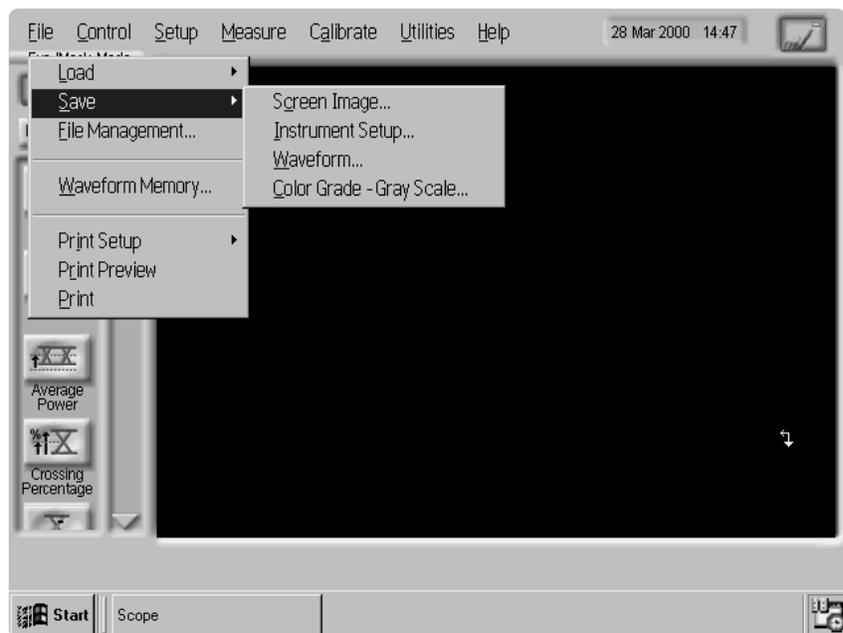
- **Vertical (Amplitude) calibration** is used to calibrate the plug-in module for accurate amplitude measurements by establishing the vertical calibration factors for the plug-in module. This calibration is recommended every 10 hours and/or when the temperature of the mainframe has changed by more than 1° C.
- **Horizontal (Timebase) calibration** is used to calibrate the input trigger hysteresis and timebase of the mainframe. Horizontal calibration must be performed by a qualified Agilent service personnel on an annual basis.
- **Extinction Ratio calibration** allows the instrument to identify internally generated offset (dark level) signals and removes them during extinction ratio measurement calculations. The instrument identifies the offset by measuring displayed signals when no light is present at the instrument input. In the 83480A, this calibration was known as “dark cal”.
- **Probe Calibrations** allows the instrument to identify the gain (or loss) and offset of specific probes that are connected to an electrical channel of the instrument.
- **Optical Channel Cal** (also known as O/E cal) is performed to compensate for the photodetector responsivity, which provides an accurate display of the received optical waveform. It is used to calibrate the plug-in module to a specific user defined wavelength that is different from the factory-calibrated wavelengths.

## Saving Screen Images to Disk

The 86100A Infiniium DCA has a 3.1 Gbyte hard disk drive and a 120 Mbyte SuperDisk floppy drive. You can save screen images as well as instrument setups, waveforms, and color-grade scale database. The LAN interface allows you to save to a networked disk drive.

- Press <File> from the Windows instrument toolbar on the touchscreen
- Press <Save> from the drop-down menu
- Press <Screen Image...> from the next drop-down menu
- On the box labeled “Look in:”, press the down arrow and notice that you can save to both the hard drive and the floppy drive.
- On the box labeled “Files of Type:”, press the down arrow to display the many formats that you can save screen images (bmp, pcx, eps, ps, gif).
- Also notice the saving options, Waveform Only, Monochrome, and Invert Waveform Background Color.

*Note: We recommend saving the screen images in .pcx rather than .bmp format if you want a smaller file. A .bmp file is about 900 KB compared to a .pcx file that is about 80 KB.*



## Printing

This section will show you how to connect and configure your printer to work with the Infinium DCA. You can also print to a network printer by using the LAN interface.

- Connect the printer to the Infinium DCAs rear-panel parallel port. Use the parallel cable that was shipped with the printer.
- Press <File> from the Windows instrument menu bar on the touchscreen
- Press <Print Setup> from the drop-down menu
- Press <Add Printer...> from the next pop-up menu  
An on-line Help window opens with instructions for connecting your printer. Follow the instructions. You must use the Add Printer Wizard to select the printer driver for your printer.
- Close the help manual

### Using Print Preview to show what a printout would look like

- Press <File> from the Windows instrument menu bar on the touchscreen
- Press <Print Preview> from the drop-down menu
- Touch the waveform on the display to zoom in on the waveform
- Scroll down to show all of the information along with the waveform that will be printed (i.e., timestamp, vertical and horizontal setup information and trigger)
- To change the printer properties, close the print preview screen
- Press <File> from the Windows instrument menu bar on the touchscreen again
- Press <Print Setup> from the drop-down menu
- Select <Configure Printer> from the next pop-up menu
- Notice that you have many print options, such as printing in monochrome, waveforms only and printing setup information.

### Supported Printers

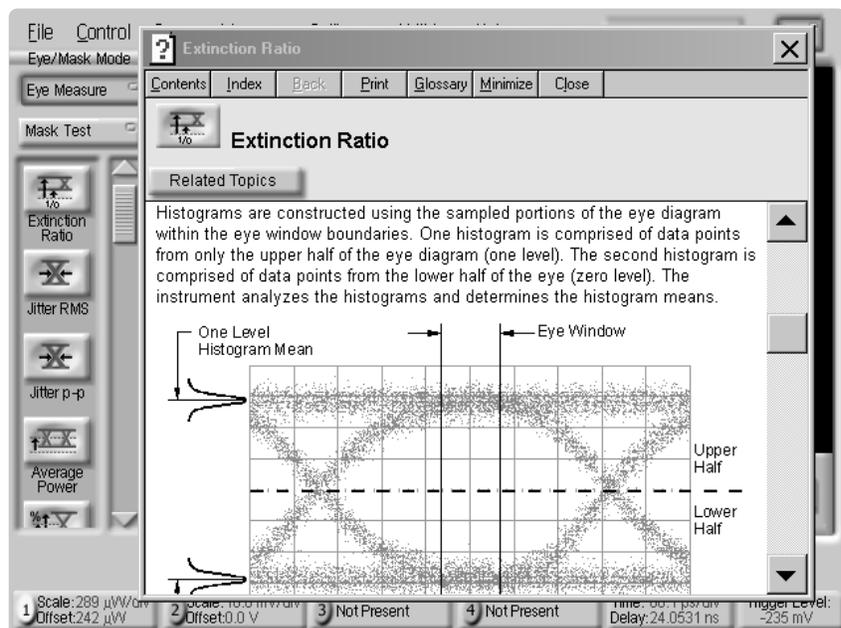
HP DeskJet 850	HP DeskJet 1200C	HP LaserJet 4P
HP DeskJet 890C	HP DeskJet 1600C	HP LaserJet 4000N
HP DeskJet 970		

If your printer is not one of the supported printers listed, you will need the printer driver disk that was shipped with your printer and click Have Disk on the Add Printer Wizard dialog box.

## Using the On-line Help

In this section, you will learn how to use the on-line manual. The Infiniium DCA has a context sensitive on-line manual providing links to the information you need directly from the measurement screen. You will see an example of this by using the Setup & Info guide on extinction ratio measurement.

- Press the [Default Setup] button on the front panel
- Press [Eye/Mask Mode] button on the front panel
- Press the [Autoscale] button
- Press the [Quick Measure] button from the front panel
- Press the <Setup & Info> box from the measurement display area
- Select <Ext. Ratio ( $\Sigma$ )> from the pop-up menu
- Select <Algorithm> from pop-up menu
- Scroll down to view the on-line user manual, which should look like the figure below.



- Press <Contents> tab from the help menu.

The following figure shows the contents of the on-line help.



As you can see, the on-line help which is stored in the hard drive is very easy to use and full of helpful information.

- **Setup guide** - gives you step-by-step procedures for many configuration and measurement tasks.
- **Plug-in modules** - provides a list of all of the 86100A family of modules as well as detailed technical specifications.
- **Specifications** - provides technical specifications on the 86100A mainframe including vertical, horizontal, trigger, display, computer system and storage.
- **Connector care** - provides helpful information on common types of fiber-optic connectors and important information on connector care.

You can also print the entire contents of a help topic or a pop-up window.

## 83480A/86100A Plug-in Module Comparison Table

Agilent 86100A Module Model No.	Detailed Description	Equivalent 83480A Module Model No.
<b>86101A</b>	Optical Channel: Amplified, 750-860 nm Multimode (MM), 2.85 GHz BW Sensitivity: -17 dBm • Option 201 - 155 and 622 Mb/s filters • Option 202 - 1063 and 1250 Mb/s filters.....(83487A Option 041)  Electrical Channel: 12.4 GHz and 20 GHz BW, 3.5 mm connector	<b>83487A</b>
<b>86103A</b>	Optical Channel: Amplified, 1000-1600 nm Multimode (MM), 2.85 GHz BW Sensitivity: -20 dBm • Option 201 - 155 and 622 Mb/s filters.....(83486A Option 040) • Option 202 - 1063 and 1250 Mb/s filters.....(83486A Option 041)  Electrical Channel: 12.4 GHz and 20 GHz BW, 3.5 mm connectors	<b>83481A</b> <b>83486A</b>
<b>86105A</b>	Optical Channel: Unamplified 1000-1600 nm Single Mode (SM), 12.4 GHz and 20 GHz BW Sensitivity: -8 dBm • Option 101 - 155 Mb/s filter..... (83485A Option 030) • Option 102 - 622 Mb/s filter.....(83485A Option 032) • Option 103 - 2488 Mb/s filters.....(83485A Option 034) • Option 201 - 622 and 2488 Mb/s filters • Option 202 - 2488 and 9953 Mb/s filters  Electrical Channel: 12.4 GHz and 20 GHz BW, 3.5 mm connectors	<b>83485A</b>
<b>86106A</b>	Optical Channel: Unamplified 1000-1600 nm Single Mode (SM) Sensitivity: -8 dBm • Option 101 - 9953 Mb/s Fourth Order filter..... (83485B Option 040) • Option 102 - 9953 Mb/s Fifth Order filter..... (83485B Option 050)  Electrical Channel: 18 GHz and 40 GHz BW, 2.4 mm connectors	<b>83485B</b>
<b>86109A</b>	Optical Channel: Unamplified 1000-1600 nm Single Mode (SM), 30 GHz BW Sensitivity: -8 dBm • No switchable filter  Electrical Channel: 18 GHz and 40 GHz BW, 2.4 mm connector	<b>83482A</b>
<b>86112A</b>	Dual Electrical Channels: 12.4 GHz and 20 GHz BW, 3.5 mm connectors	<b>83483A</b>
<b>83484A</b>	Dual Electrical Channels: 26.5 GHz and 50 GHz BW, 2.4 mm connectors	<b>83484A</b>

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