

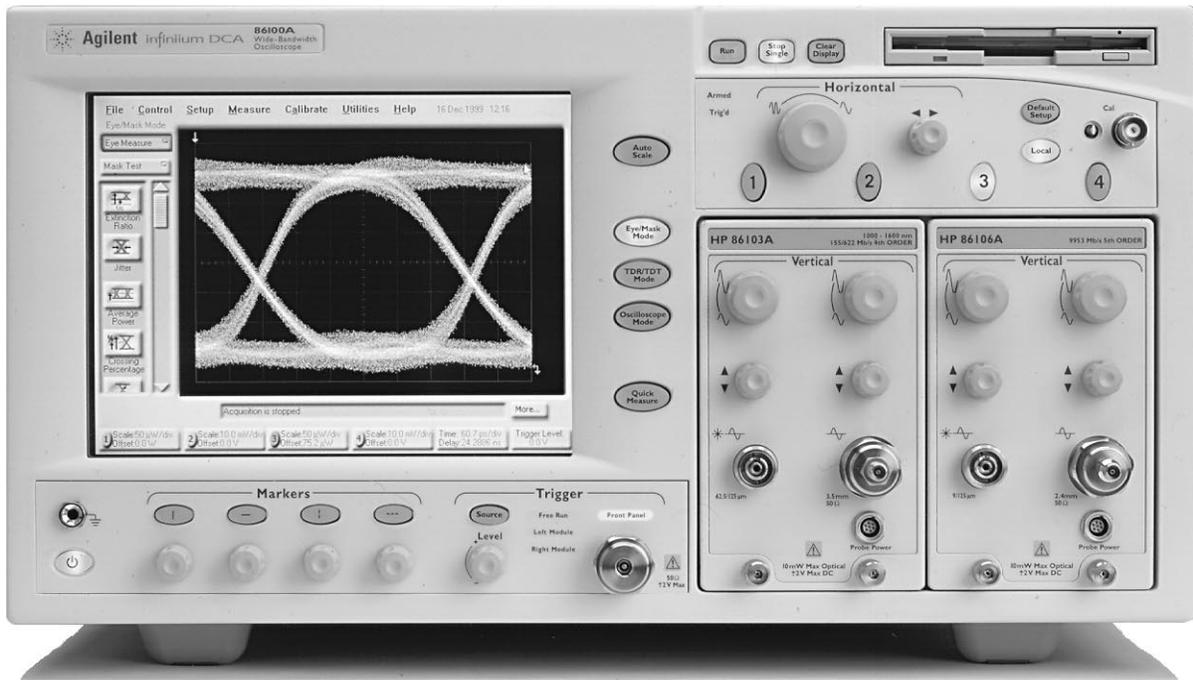
infiniium DCA

Agilent 86100A

Wide-Bandwidth

Oscilloscope

Technical Specifications



- **Modular platform with 100 Mbit/s to 10 Gbit/s compliance waveform testing**
- **Easier to use through a simplified user interface**
- **Faster measurement throughput**
- **Improved measurement accuracy and repeatability**
- **Compatible with Agilent 83480A-series modules**
- **Greater than 95% GPIB code compatible**



Agilent Technologies
Innovating the HP Way

Three Instruments in One

For basic oscilloscope operation there is easy front panel access with that familiar analog-look and feel. A windows®-based system let's you easily navigate through the user-interface. The Infiniium DCA can be viewed as three high-performance instruments in one. It's a general-purpose oscilloscope. It's a digital communications analyzer. It's a time domain-reflectometer. Just select the instrument mode and start making measurements.

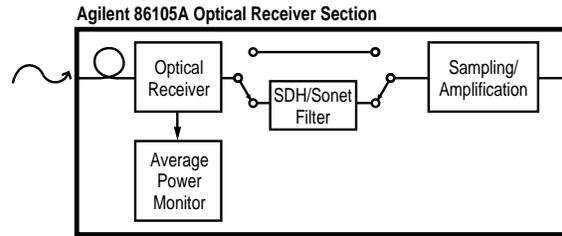
Digital Communications Analysis

Accurate eye-diagram analysis is essential for characterizing the quality of transmitters used from 100 Mbit/s to beyond 10 Gbit/s. The Agilent Infiniium DCA was designed specifically for the complex task of analyzing digital communications waveforms. Compliance mask and parametric testing no longer require a complicated sequence of setups and configurations. If you can press a button, you can perform a complete compliance test. The important measurements you need are right at your fingertips, including:

- industry standard mask testing with built-in margin analysis,
- extinction ratio measurements with improved accuracy and repeatability, and
- eye measurements: crossing %, eye height and width, '1' and '0' levels, jitter, rise or fall times and more.

The key to accurate measurements of lightwave communications waveforms is the optical receiver. The Infiniium DCA has a broad range of precision receivers integrated within the instrument.

- Built-in photodiodes, with flat frequency responses, yield the highest waveform fidelity. This provides high accuracy for extinction ratio measurements.
- Standards-based transmitter compliance measurements require filtered responses. Filters are automatically and repeatably switched in or out of the measurement channel remotely over GPIB or with a front panel button. The frequency response of the entire measurement path is calibrated, and will maintain its performance over long-term usage.
- The integrated optical receiver provides a calibrated optical channel. Optical signals are accurately displayed in optical power units.
- An accurate optical power meter is built within the module. Switches or couplers are not required for an average power measurement. Signal routing is simplified and signal strength is maintained.



The integrated optical channel can be used as a fully calibrated SONET/SDH/Gigabit Ethernet or Fibre Channel reference receiver or a wide-bandwidth receiver.

Eye Diagram Mask Testing

The Infiniium DCA provides efficient, high-throughput waveform compliance testing with a suite of standards based eye-diagram masks. The test process has been streamlined into a minimum number of keystrokes for testing at industry standard data rates.

Standard Masks

- 1X Gigabit Ethernet
- 2X Gigabit Ethernet
- 10X Gigabit Ethernet
- Fibre Channel 0133
- Fibre Channel 0266
- Fibre Channel 1063
- Fibre Channel 2125
- STM0/OC1
- STM1/OC3
- STM4/OC12
- STM16/OC48
- STM64/OC192
- STS1 EYE
- STS3 EYE

Other eye-diagram masks are easily created through scaling those listed above.

Perform these mask conformance tests with convenient user-definable measurement conditions, such as mask margins for guardband testing, number of waveforms tested, and stop/limit actions.

Measurement Speed

Measurement speed is achieved with both fast hardware and a usable instrument. In the lab, don't waste time trying to figure out how to make a measurement. With the uncomplicated Infiniium DCA you don't have to relearn a measurement each time you use it. In manufacturing, it is a battle to continually reduce cost per test. Solution: Fast PC-based processors, resulting in high measurement throughput and reduced test time.

Windows is a U.S. registered trademark of Microsoft Corporation.

Standard Measurements

The following measurements are available from the tool bar, as well as the pull down menus. Measurements are dependent on the DCA operating mode.

Oscilloscope Mode

Time

Rise Time, Fall Time, Jitter Period

Amplitude

Overshoot, Average Power, Amplitude Voltage, Peak to Peak Voltage, Root Mean Square Voltage

Eye/Mask Mode

Eye Measure

Extinction Ratio, Jitter, Average Power, Crossing Percentage, Rise Time, Fall Time, One Level, Zero Level, Eye Height, Eye Width, Signal to Noise, Duty Cycle Distortion

Mask Test

Select Mask, Start Mask Test, Exit Mask Test, Select Filter, Mask Test Margins, Mask Test Scaling

Standard Functions

Standard functions are available through pull down menus and soft keys, and some functions are also accessible through the front panel knobs

Markers

Vertical and Horizontal, 2 sets, User Selectable

Limit Tests

Acquisition Limits

Limit Test Run Until Condition - Off, Waveforms, Samples Report Action on Failures - Save waveform to memory or disk, Save screen image to disk

Measurement Limit Test

Specify Number of Failures to Stop Limit Test
When to Fail Selected Measurement - Inside Limits, Outside Limits, Always Fail, Never Fail
Report Action on Failure - Save waveform to memory or disk, save screen image to disk, save summary to disk

Mask Limit Test

Specify Number of Failed Samples
Report Action on Failure - Save waveform to memory or disk, save screen image to disk, save summary to disk

Configure Measurements

Thresholds

10%, 50%, 90% or 20%, 50%, 80% or Custom

Eye Boundaries

1 and 2

Format Units for

Duty Cycle Distortion - Time or Percentage
Extinction Ratio - Ratio, Decibel or Percentage
Eye Width - Time or Ratio
Jitter - Root Mean Square or Peak to Peak
Average Power - Watts or Decibels

Time Base Definition

Standard or Custom

Quick Measure Configuration

4 User Selectable Measurements for Each Mode

Eye/Mask Mode Default Settings

Extinction Ratio, Jitter Root Mean Square, Average Power, Crossing Percentage

Oscilloscope Mode Default Settings

Rise Time, Fall Time, Period, Voltage Amplitude

Histograms

State

On or Off

Axis

Horizontal or Vertical
Adjustable Window via Marker Knobs

Scaling

1 to 8 divisions

Math Measurements

4 User Definable Functions

Operator - Magnify, Invert or Subtract
Source - Channel, Memory or Constant

Set up and Info

Histograms
Track Measurement
Algorithm
Configuration

Calibrations

Vertical (Amplitude)
Horizontal (Time Base)
Extinction Ratio
Probe
Optical Channel

Front Panel Calibration Output Level

User Selectable -2V to 2V

Horizontal Skew Adjustment

Per Channel, User Selectable

Set Time and Date

Show Time and Date

Remote Interface

Set GPIB Interface

Touch Screen Configuration

Calibrate to Video Display
Configure Display Area

Upgrade Software

Upgrade Mainframe
Upgrade Module

About 86100A

System Serial Number and Configuration
Module Serial Number and Configuration

Configurable to Meet Your Needs

The Infiniium DCA supports a wide range of plug-ins for testing both optical and electrical signals. Select plug-ins to get the specific bandwidth, filtering, and sensitivity you need.



Built-in Information System

The Infiniium DCA has a context-sensitive on-line manual providing immediate answers to your questions about using the instrument. Links on the measurement screen take you directly to the information you need. There is no need for a large paper manual consuming your shelf space.

File Sharing and Storage

Use the internal 2 GB hard drive or 3.5 inch, 120 MB SuperDisk™ floppy disk drive to store instrument setups, waveforms, or screen images. Images can be stored in formats easily imported into various programs for documentation and further analysis. LAN is supported for network access and file sharing.

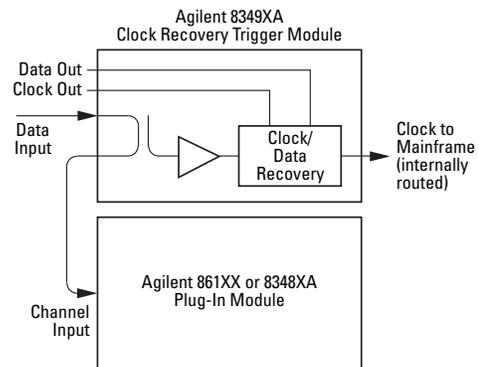
Powerful Display Modes

Use gray scale and color graded trace displays to gain insight into device behavior. Waveform densities are mapped to color or easy-to-interpret gray shades. These are infinite persistence modes where shading differentiates the number of times data in any individual screen pixel has been acquired.

SuperDisk is a trademark of Imation Corporation.

Internal Triggering Through Clock Recovery

Very high-speed oscilloscopes are not capable of triggering directly on the signal under test. Typically an external timing reference is used to synchronize the oscilloscope to the test signal. In cases where a trigger signal is not available, clock recovery modules are available to derive a timing reference directly from the waveform to be measured. The Agilent 8349X series of clock recovery modules cover the three most popular transmission media used today—electrical lines, multimode, and single-mode fiber. A built-in coupler reduces external hardware requirements. All three modules have excellent jitter performance to ensure accurate measurements. Each clock recovery module is designed to synchronize to a variety of common transmission rates.



Improved Autoscaling

Autoscaling has been significantly improved to provide quick horizontal and vertical scaling of both pulse and eye-diagram waveforms.

Time Domain Reflectometer (TDR)

TDR measurements are focused on high-speed applications where it is necessary to optimize electrical system components, such as microstrip lines, PC board traces, SMA edge launchers and coaxial cables where imperfections cause signal distortion and reflections. Signal integrity is a critical requirement in high-speed digital signal transmission. (Available mid-2000. Easily upgraded for instruments purchased prior to the release of TDR.)

Gated Triggering

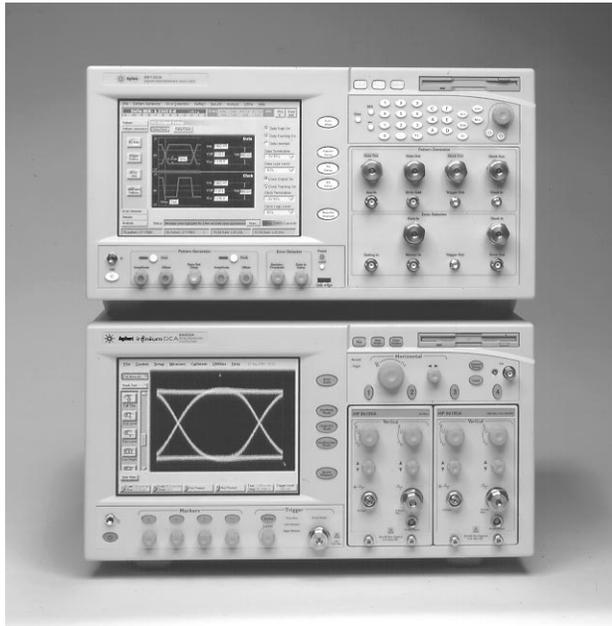
Trigger gating port allows easy external control of data acquisition for circulating loop or burst-data experiments. Use TTL-compatible signals to control when the instrument does and does not acquire data.

Easier Calibrations

Calibration of your instrument has been simplified by placing all the performance level indicators and calibration procedures in a single high-level location. This provides greater confidence in the measurements made and saves time in maintaining equipment.

Stimulus Response Testing Using the Agilent 86130A BitAnalyzer

Error performance analysis represents an essential part of digital transmission test. The Infiniium DCA and Agilent 86130A BitAnalyzer error performance analyzer come together to create a powerful test solution where two instruments together can perform measurements that would otherwise be impossible. Contact your local Agilent sales office for the most up-to-date features available.



Transitioning from the Agilent 83480A to the Infiniium DCA

The Infiniium DCA has been designed to be a virtual drop-in replacement for the Agilent 83480A digital communications analyzer and Agilent 54750A wide-bandwidth oscilloscope. All modules used in the Agilent 83480A and 54750A can also be used in the Infiniium DCA. (TDR modules—Summer 2000). The remote programming command set for the Infiniium DCA has been designed for direct compatibility with software written to control the 83480A and 54750A. (Due to improvements and updates in performance, a small set of remote commands may need minor modifications to control the Infiniium DCA.) Due to a significantly faster processor, tests run on the Infiniium DCA should require less time than those performed with the Agilent 83480A or 54750A.

Modules for the Agilent Infiniium DCA

The Infiniium DCA has a large family of plug-in modules designed for a broad range of data rates for optical and electrical waveforms. The Infiniium DCA can hold up to 2 modules for a total of 4 measurement channels.

The Agilent 86101A module and 86103A incorporate two measurement channels, one optical and one electrical. The electrical channel has two selectable bandwidth settings. In the 12.4 GHz bandwidth mode, oscilloscope noise performance is excellent. The 20 GHz mode allows greater fidelity for high speed signals. The calibrated, integrated optical channel has over 2.85 GHz bandwidth for easy, precise single mode and multimode optical measurements. The 86101A and 86103A utilize switchable reference filters for transceiver compliance testing at OC-3, OC-12, Fibre Channel 1063 Mb/s, and Gigabit Ethernet 1250 Mb/s data rates. The Agilent 86101A operates over the 780 nm to 850 nm wavelength range, and the 86103A operates over the 1000 nm to 1600 nm wavelength range.

The Agilent 86105A module incorporates two measurement channels, one optical and one electrical. The electrical channel has two selectable bandwidth settings. In the 12.4 GHz bandwidth mode, oscilloscope noise performance is excellent. The 20 GHz mode allows greater fidelity for high speed signals. The calibrated, integrated optical channel has 20 GHz bandwidth for single mode optical measurements. The 86105A utilizes switchable reference filters for transceiver compliance testing at OC-3, OC-12, OC-48 or OC-192 data rates.

The Agilent 86106A module incorporates a 10 Gb/s optical reference receiver and a 40 GHz electrical channel. The electrical channel also has a reduced bandwidth setting of 18 GHz for improved noise performance. The 86106A module includes a reference receiver path for 10 Gb/s transmitter test that has been designed to meet OC-192 future standards.

The Agilent 86109A module incorporates a 30 GHz optical measurement channel and a 40 GHz electrical channel. The electrical channel also has a reduced bandwidth setting of 18 GHz for improved noise performance. The optical channel frequency response is designed to minimize distortion of the displayed optical pulse and does not include any provision for switching a SDH/SONET filter into the channel.

The Agilent 86112A electrical module provides two measurement channels with user selectable bandwidths. The 12.4 GHz bandwidth mode provides excellent oscilloscope noise performance for accurate measurement of small signals. The 20 GHz bandwidth mode provides high fidelity display and measurement of very high speed waveforms.

The Agilent 83484A electrical module provides two measurement channels with user selectable bandwidths. The 26.5 GHz bandwidth mode provides excellent oscilloscope noise performance for accurate measurement of small signals. The 50 GHz bandwidth mode provides high fidelity display and measurement of very high speed waveforms.

The Agilent 8349XA series of clock recovery modules provide a recovered clock trigger and recovered data output, and the ability to trigger on data for slower nonstandard rates. The 83491A accepts electrical inputs, the 83492A accepts multimode fiber inputs, and the 83493A accepts single mode fiber inputs. All three clock recovery modules support standard telecom and enterprise data rates.

Specifications

Specifications describe warranted performance over the temperature range of +10°C to +40°C (unless otherwise noted). The specifications are applicable for the temperature after the instrument is turned on for one (1) hour. This period of continuous operation must occur while self-calibration is valid. Many performance parameters are enhanced through frequent, simple user calibrations. **Characteristics** provide useful, non-warranted information about the functions and performance of the instrument. *Characteristics are printed in italic typeface.*

Factory Calibration Cycle -For optimum performance, the instrument should have a complete verification of specifications once every twelve (12) months.

General Specifications

This instrument meets Agilent Technologies' environmental specifications (section 750) for class B-1 products with exception as described for temperature and condensation. Contact your local field engineer for complete details.

Temperature Operating Non-operating Humidity Operating Non-operating Altitude Operating Non-operating Vibration Operating Non-operating Power Requirements Voltage Power (including modules) Weight Without modules Each Module Dimensions (excluding handle) Without front connectors and rear feet With front connectors and rear feet	10°C to +40°C (50°F to +104°F) -40°C to +70°C (-40°F to +158°F) Up to 90% humidity (non-condensing) at +40°C (+104°F) Up to 95% relative humidity at +65°C (+149°F) Up to 4,600 meters (15,000 ft) Up to 15,300 meters (50,000 ft) Random vibration 5–500 Hz, 10 minutes per axis, 2.41 g (rms) Random vibration 5–500 Hz, 10 minutes per axis, 0.3 g (rms); Resonant search, 5–500 Hz swept sine, 1 octave/min sweep rate, 0.75 g, 5 minute resonant dwell at 4 resonances/axis 90–132 or 198–264 Vac, 48–66 Hz 545 VA; 375 W 12.7 kg (28 lb) 1.2 kg (2.6 lb) 215.1 mm H x 425.5 mm W x 521 mm D (8.47 in x 16.75 in x 20.5 in) 215.1 mm H x 425.5 mm W x 584 mm D (8.47 in x 16.75 in x 23.0 in)
---	---

Mainframe Specifications

HORIZONTAL SYSTEM (Time Base) Scale Factor Minimum Maximum Delay Minimum Maximum Time Interval Accuracy Time Interval Resolution Time Display Resolution Display Units	Full scale is ten divisions. 10 ps/div 1 s/div Time offset relative to the front panel trigger input on the instrument mainframe. ≥ 24 ns (Standard), 28 ns (Option 001) <i>1000 screen diameters or 10 s, whichever is smaller</i> ≤ 8 ps + 0.1% of reading (dual marker measurement performed at a temperature within $\pm 5^\circ\text{C}$ of horizontal calibration temperature) 8 ps + 0.1% + 0.5 ps/ $^\circ\text{C}$ to (5 < absolute temperature value < 15°C) \leq (screen diameter)/(record length) or 62.5 fs, whichever is larger 451 points horizontally Bits or time
VERTICAL SYSTEM (Channels) Number of Channels Full Resolution Channel Scales Adjustments	4 (simultaneous acquisition) Adjusts in a 1-2-5-10 sequence for coarse adjustment or fine adjustment resolution from the front panel knob Scale, offset, activate filter

Mainframe Specifications (continued)

	Standard (Direct Trigger)	Option 001 (Divided Trigger)
Trigger Modes: Internal Trigger ¹ External Direct Trigger ² Limited Bandwidth ³ Full Bandwidth	Freerun <i>DC to 100 MHz</i> DC to 2.5 GHz	
External Divided Trigger		2 to 12 GHz (<i>1 to 15 GHz</i>)
Jitter	2.5 ps + 5*10E-5 of delay setting ⁴	<i>1.7 ps RMS for time delays less than 100 ns</i>
Sensitivity	200 m Vpp (sinusoidal input or 200 ps minimum pulse width)	200 m Vpp sinusoidal input from 2 to 12 GHz
Trigger Configuration: Trigger Level Adjustment	-1 V to +1 V	AC coupled
Edge Select	Positive or negative	
Hysteresis ⁵	Normal or high sensitivity	
Trigger Gating: Gating Input Levels (TTL compatible)	<i>Disable: 0 to 0.6 V</i> <i>Enable: 3.5 to 5 V</i> <i>Pulse width >500 ns, period >1 μs</i>	
Gating Delay	<i>Disable: 627 ns + trigger period +</i> <i>Max time displayed</i> <i>Enable: 100 ns</i>	
Trigger Impedance: Nominal Impedance	50Ω	
Reflection	10% for 100 ps rise time	
Connector Type	3.5 mm (male)	
Maximum Trigger Signal	±2 V + 2 Vac peak (+16 dBm)	

¹ The freerun trigger mode internally generates an asynchronous trigger that allows viewing the sampled signal amplitude without an external trigger signal but provides no timing information. Freerun is useful in troubleshooting external trigger problems.

² The sampled input signal timing is recreated by using an externally supplied trigger signal that is synchronous with the sampled signal input.

³ The DC to 100 MHz mode is used to minimize the effect of high frequency signals or noise on a low frequency trigger signal.

⁴ Measured at 2.5 GHz with the triggering level adjusted for optimum trigger.

⁵ High Sensitivity Hysteresis Mode improves the high frequency trigger sensitivity but is not recommended when using noisy, low frequency signals that may result in false triggers without normal hysteresis enabled.

COMPUTER SYSTEM AND STORAGE	
CPU	300 MHz Microprocessor
Disk Drive	2 GByte internal hard drive and 3.5" MS-DOS® compatible 120 MB SuperDisk floppy disk drive. Store and recall setups, waveforms, and screen images to both the hard drive and the floppy drive. Storage capacity is limited only by disk space.
File Types/Management	Setup files .SET Waveform files .WFM (internal) Color grade gray scale files .CGS
Waveforms	Internal, verbose, Y values
Images	bmp, eps, gif, pcx, ps
Operating System	Microsoft Windows 98
Waveform Store	4 nonvolatile waveform memories Waveform memory setup (for each channel) (vertical scale, offset, horizontal scale, position)
Printer	Configure Printer Options Waveform only Include instrument setup info Monochrome Invert waveform background color Add printer

Mainframe Specifications (continued)

DISPLAY Display Area Active Display Area Waveform Viewing Area Display Resolution Waveform Colors Persistence Modes Waveform Overlap Connect-the-dots Persistence Graticule Grid Intensity Backlight Saver Dialog Boxes	170.9 mm x 128.2 mm (8.4 inch diagonal color active matrix LCD module incorporating amorphous silicon TFTs) 171mm x 128 mm (21,888 square mm) 6.73 in x 5.04 in (33.92 square inches) <i>103 mm x 159 mm (4.06 in x 6.25 in)</i> 640 pixels horizontally x 480 pixels vertically Select from 100 hues, 0–100% saturation and 0–100% luminosity Gray scale, color grade, variable, infinite When two waveforms overlap, a third color distinguishes the overlap area On/Off selectable Minimum, Variable (100 ms to 40 s), Infinite On/Off 0 to 100% 2 to 8 hrs, enable option Opaque or transparent
FRONT AND REAR PANEL INPUTS AND OUTPUTS Cal Trigger GPIB RS-232 Centronics +15 V Bias Mouse Gated Trigger Input Keyboard LAN Video Output	BNC (female) and test clip, banana plug APC 3.5 mm, 50Ω, ±2 V maximum Fully programmable, complies with IEEE 488.2 Serial Printer, 9 pin D-sub (male) Parallel Printer port, 25 pin D-sub (female) 100 ma, 15 V, SMB PS/2 TTL compatible IBM 5 pin (female) (for optional keyboard) A keyboard must be used to setup LAN connectivity (available mid-2000) VGA, full color, 15 pin D-sub (female)

Module Specifications

Module	Optical Channel Bandwidth	Electrical Channel Bandwidth	Filters	Data Rates
86101A	3 GHz, high sensitivity	12.4/20 GHz	Select 2 switchable filters	OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, Fibre Channel, Gigabit Ethernet
86103A	3 GHz, high sensitivity	12.4/20 GHz	Select 1 or 2 switchable filters	OC-3/STM-1, OC-12/STM-4, Fibre Channel, Gigabit Ethernet
86105A	20 GHz, unfiltered	12.4/20 GHz	Select 1 or 2 switchable filters	OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64
86106A	30 GHz	18/40 GHz	Select 1 filter	OC-192/STM-64
86109A	30 GHz, unfiltered	18/40 GHz		
83484A	N/A	26.5 GHz and 50 GHz		
86112A	N/A	Two 20 GHz		

Multi Mode and Single Mode Optical/Electrical Modules	86101A	86103A	86105A
---	--------	--------	--------

OPTICAL CHANNEL SPECIFICATIONS

Optical Channel Unfiltered Bandwidth	2.85 GHz (3 GHz typical)		20 GHz
Wavelength Range	750–870 nm	1000–1600 nm	
Calibrated Wavelengths	850 nm	1310 nm/1550 nm	1310 nm/1550 nm
Filtered Data Rates (MB/s)	155, 622, 1066, 1250	155, 622, 1066, 1250	155, 622, 2488, 9953
Sensitivity (smallest avg. power for mask test)	–17 dBm	–20 dBm	–10 dBm
Transition Time (10% to 90% calculated from TR = 0.48/BW optical)			
Filtered	<190 ps/OC-48, <750 ps/OC-12, <3 ns/OC-3		
Unfiltered	160 ps or less	25 ps or less	
RMS Noise			
Characteristic	1.5 μ W	1 μ W, opt 201, 301 1.5 μ W, opt 202, 302	8 μ W, 12.4 GHz 15 μ W, 20 GHz
Maximum	2.5 μ W	1.5 μ W, opt 201, 301 2.5 μ W, opt 202, 302	12 μ W, 12.4 GHz 25 μ W, 20 GHz
Scale Factor (per division)			
Minimum	5 μ W		20 μ W
Maximum	100 μ W		500 μ W
dc Accuracy (single marker, referenced to average power monitor, <50 μ W/division)	\pm 6 μ W \pm 0.4% of full scale \pm 3% of (reading-channel offset)		\pm 25 μ W \pm 2% of (reading-channel offset), 12.4 GHz \pm 25 μ W \pm 4% of (reading-channel offset), 20 GHz
dc Difference (two markers, referenced to average power monitor, 50 μ W/division)	\pm 0.8% of full scale \pm 3% of (reading-channel offset)		\pm 2% of (reading-channel offset), 12.4 GHz \pm 4% of (reading-channel offset), 20 GHz
dc Offset (referenced two divisions from screen bottom)	+0.2 mW to –0.6 mW		1 mW to –3 mW
Average Power Monitor (specified operating range)			
	–30 dBm to –2.2 dBm	–30 dBm to 0 dBm	–30 dBm to +3 dBm
Factory Calibrated Accuracy	\pm 5% \pm 100 nW \pm connector uncertainty, 20°C to 30°C		
User Calibrated Accuracy	\pm 2% \pm 100 nW \pm power meter uncertainty, <5°C change		
Maximum Input Power			
Specified	0.4 mW (–4 dBm) peak		2 mW
Maximum Peak	10 mW		
Fiber Input	62.5/125 μ m, user selectable connector		9/125 μ m single-mode
Input Return Loss (HMS-10 connector fully filled fiber)	20 dB		33 dB

Multimode and Single Mode Optical/Electrical Modules (continued)	86101A	86103A	86105A
ELECTRICAL CHANNEL SPECIFICATIONS			
Electrical Channel Bandwidth	12.4 and 20 GHz		
Transition Time (10% to 90%, calculated from TR = 0.35/BW)	28.2 ps, 12.4 GHz 17.5 ps, 20 GHz		
RMS Noise Characteristic	<i>0.25 mV, 12.4 GHz</i> <i>0.5 mV, 20 GHz</i>		
Maximum	0.5 mV, 12.4 GHz 1 mV, 20 GHz		
Scale Factor			
Minimum	1 mV/division		
Maximum	100 mV/division		
dc Accuracy (single marker, referenced to average power monitor)	±0.4% of full scale ±2 mV ±1.5% of (reading-channel offset), 12.4 GHz ±0.4% of full scale ±2 mV ±3% of (reading-channel offset), 20 GHz		
dc Difference (two markers, referenced to average power monitor, 50 μW/division)	±0.8% of full scale ±1.5% of delta, 12.4 GHz ±0.8% of full scale ±3% of delta, 20 GHz		
dc Offset (referenced two divisions from screen bottom)	±500 mV		
Input Dynamic Range (relative to channel offset)	±400 mV		
Maximum Input Power	16 dBm ±2 Vdc		
Nominal Impedance	50 ohm		
Reflections (for 30ps rise time)	5%		
Electrical Input	3.5 mm		

Module Specifications (continued)

High Bandwidth, Single Mode Optical / Electrical Modules	86106A	86109A
OPTICAL CHANNEL SPECIFICATIONS		
Optical Channel Unfiltered Bandwidth	Filtered only	30 GHz
Wavelength Range	1000–1600 nm	
Calibrated Wavelengths	1310 nm and 1550 nm	
Filtered Data Rates (MB/s)	9953	
Sensitivity (smallest average power for mask test)	–8 dBm	
Transition Time (10% to 90%, calculated from TR = 0.48/BW optical)	<25 ps, filtered mode	13 ps
RMS Noise		
Characteristic	15 μ W	
Maximum	30 μ W	
Scale Factor		
Minimum	20 μ W/division	
Maximum	500 μ W/division	
dc Accuracy (single marker, referenced to average power monitor)	$\pm 50 \mu$ W $\pm 4\%$ of (reading-channel offset)	
dc Difference (two markers, referenced to average power monitor, 50 μ W/division)	$\pm 4\%$ of delta	
dc Offset (referenced two divisions from screen bottom)	+1 mW to –3 mW	
Average Power Monitor (specified operating range)	–27 dBm to +3 dBm (2 μ W to 2 mW)	
Factory Calibrated Accuracy	$\pm 5\% \pm 100$ nW \pm connector uncertainty, 20°C to 30°C	
User Calibrated Accuracy	$\pm 2\% \pm 100$ nW \pm power meter uncertainty, <5°C change	
Maximum Input Power		
Specified	2 mW	
Maximum Peak	10 mW	
Fiber Input	9/125 μ m, user selectable	
Input Return Loss (HMS-10 connector fully filled fiber)	30 dB	

ELECTRICAL CHANNEL SPECIFICATIONS

Electrical Channel Bandwidth	18 and 40 GHz
Transition Time (10% to 90%, calculated from TR = 0.35/BW)	19.5 ps or less, 18 GHz; 9 ps or less, 40 GHz
RMS Noise	
Typical	0.25 mV, 18 GHz; 0.5 mV, 40 GHz
Maximum	0.5m V, 18 GHz; 1.0 mV, 40 GHz
Scale Factor	
Minimum	1 mV/division
Maximum	100 mV/division
dc Accuracy (single marker, referenced to average power monitor)	$\pm 0.4\%$ of full scale ± 2 mV $\pm 1.5\%$ of (reading-channel offset), 18 GHz $\pm 0.4\%$ of full scale ± 2 mV $\pm 3\%$ of (reading-channel offset), 40 GHz
dc Difference (two markers, referenced to average power monitor, 50 μ W/division)	$\pm 0.8\%$ of full scale $\pm 1.5\%$ of delta, 18 GHz $\pm 0.8\%$ of full scale $\pm 3\%$ of delta, 40 GHz
dc Offset (referenced two divisions from screen bottom)	± 500 mV
Input Dynamic Range (relative to channel offset)	± 400 mV
Maximum Input Power	16 dBm ± 2 Vdc
Nominal Impedance	50 ohm
Reflections (for 20 ps rise time)	5%
Electrical Input	2.4 mm

Module Specifications (continued)

Dual Electrical Channel Modules	86112A	83484A	
Electrical Channel Bandwidth	12.4 and 20 GHz	26.5 and 50 GHz	
Transition Time (10% to 90%, calculated from TR = 0.35/BW)	28.2 ps, 12.4 GHz; 17.5 ps, 20 GHz	13.2 ps, 26.5 GHz; 7 ps, 50 GHz	
RMS Noise			
Characteristic	0.25 mV, 12.4 GHz; 0.5 mV, 20 GHz	0.46 mV, 26.5 GHz; 0.92 mV, 50 GHz	
Maximum	0.5 mV, 12.4 GHz; 1 mV, 20 GHz	0.75 mV, 26.5 GHz	
Scale Factor			
Minimum	1 mV/division		
Maximum	100 mV/division		
dc Accuracy (single marker, referenced to average power monitor)	±0.4% of full scale ±2mV ±1.5% of (reading-channel offset), 12.4 GHz ±0.4% of full scale ±2 mV ±3% of (reading-channel offset), 20 GHz	±0.4% of full scale ±2 mV ±1.2% of (reading-channel offset), 26.5 GHz ±0.4% of full scale ±2 mV ±2% of (reading-channel offset), 50 GHz	
dc Difference (two markers, referenced to average power monitor, 50 µW/division)	±0.8% of full scale ±1.5% of delta, 12.4 GHz ±0.8% of full scale ±3% of delta, 20 GHz	±0.8% of full scale ±1.2% of delta, 26.5 GHz ±0.8% of full scale ±2% of delta, 50 GHz	
dc Offset (referenced two divisions from screen bottom)	±500 mV		
Input Dynamic Range (relative to channel offset)	±400 mV		
Maximum Input Power	16 dBm ±2 Vdc		
Nominal Impedance	50 ohm		
Reflections (for 30 ps rise time)	5%		
Electrical Input	3.5 mm	2.4 mm	
Clock Recovery Single Mode, Multimode and Electrical Modules			
	83491A	83492A	83493A
Channel Type	Electrical	Multimode Optical	Single Mode Optical
Clock Recovery Phase Locked Loop Bandwidth			
Internal Path Triggering	50 to 70 kHz		
External Output	4 to 5 MHz		
Data Rates (MB/s)	155, 622, 1060, 1250, 2120, 2488, 2500	155, 622, 1060, 1250, 2120, 2488, 2500	155, 622, 1250, 2488, 2500
Tracking/Acquisition Range	±0.1%		
Internal Splitter	50/50	50/50	10/90
Output Jitter	<0.0125 UI RMS		
Input Power for Clock Recovery	-10 dBm to +3 dBm	750 to 860 nm, -10 to +3 dBm 1000 to 1600 nm, -13 to +3 dBm	-20 dbm to +3 dBm
Input/Output Connectors	APC 3.5 mm, 50 ohm	HMS-10 universal connector 62.5/125 µm	HMS-10 universal connector 9/125 µm
Auxiliary Recovered Clock and Regenerated Data Outputs	Type N with SMA adapters		
Input Return Loss	dc-1250 MHz, 20 dB 1250-2500 MHz, 15 dB	20 dB	28 dB
Input Insertion Loss	dc-1250 MHz, 7 dB 1250-2500 MHz, 15 dB	5 dB Maximum	1.5 dB Maximum

Ordering Information

86100A	Infiniium DCA Mainframe, Wide Bandwidth Digital Oscilloscope
Option 001	12 GHz Trigger Bandwidth
Option AX4	Rack Mount flange Kit
Option AXE	Rack Mount Flange Kit with Handles
Option UK6	Commercial Cal Certificate with Test Data
86101A	High Sensitivity, Multimode, Optical/Electrical Module
Option 201	OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s)
Option 202	FC (1.06 Gb/s), GBEN (1.25 Gb/s)
86103A	High Sensitivity, Multimode, Optical/Electrical Module
Option 201	OC-3/STM-1 (155 Mb/s), OC-12/STM-4 (622 Mb/s)
Option 202	FC (1.06 Gb/s), GBEN (1.25 Gb/s)
86105A	Single Mode, Optical/Electrical Module
Option 101	OC-3/STM-1 (155 Mb/s)
Option 102	OC-12/STM-4 (622 Mb/s)
Option 103	OC-48/STM-16 (2.488 Gb/s)
Option 201	OC-12/STM-4 (622 Mb/s), OC-48/STM-16 (2.488 Gb/s)
Option 202	OC-48/STM-16 (2.488 Gb/s), OC-192/STM-64 (9.952 Gb/s)
86106A	High Bandwidth, Single Mode, Optical/Electrical Module
Option 101	OC-192/STM-64 (9.952 Gb/s) Fourth Order
Option 102	OC-192/STM-64 (9.952 Gb/s) Fifth Order
86109A	High Bandwidth, Single Mode, Optical/Electrical Module
86112A	Dual Channel 20 GHz Electrical Module
83484A	Dual Channel 50 GHz Electrical Module
83491A	Electrical Clock Recovery Module
83492A	Multimode Clock Recovery Module
83493A	Single Mode Clock Recovery Module

Warranty Options (for all products)

Option W30	3 years of customer return repair service
Option W32	3 years of customer return calibration service
Option W50	5 years of customer return repair service
Option W52	5 years of customer return calibration service

Optional Accessories

83446A	Lightwave Clock and Data Receiver
11 982A	High-Speed Lightwave Receiver
83440B/C/D	High-Speed Lightwave Receiver
54118A	500 MHz to 18 GHz Trigger
N1020A	TDR Probe Kit
54006A	6 GHz Hand-Held Probe
54701	2.5 GHz Active Probe
83480A-KI6	Switch Matrix
83480A-KI7	RIMM Fixture
10086A	ECL Terminator
83430A	Lightwave Digital Source
11898A	Plug-in Module Remote/Extender
54008B	24 ns Delay Line

Connector Options for all Optical Modules

Option 011	Diamond HMS-10 Connector Interface
Option 012	FC/PC Connector Adapter
Option 013	DIN Connector Adapter
Option 014	ST Connector Adapter
Option 017	SC Connector Adapter

Additional Connection Devices for Electrical Modules

SMA (f-f) Adapter, Agilent part number 1250-1158
 APC 3.5 (f-f) Adapter, Agilent part number 1250-1749

For more information about Agilent Technologies test and measurement products, applications, services, and for a current sales office listing, visit our web site,

www.agilent.com/comms/lightwave

You can also contact one of the following centers and ask for a test and measurement sales representative.

United States:

Agilent Technologies
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
(tel) 1 800 452 4844

Canada:

Agilent Technologies Canada Inc.
5150 Spectrum Way
Mississauga, Ontario
L4W 5G1
(tel) 1 877 894 4414

Europe:

Agilent Technologies
Test & Measurement
European Marketing Organisation
P.O. Box 999
1180 AZ Amstelveen
The Netherlands
(tel) (31 20) 547 9999

Japan:

Agilent Technologies Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi,
Tokyo 192-8510, Japan
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Latin America:

Agilent Technologies
Latin American Region Headquarters
5200 Blue Lagoon Drive, Suite #950
Miami, Florida 33126, U.S.A.
(tel) (305) 267 4245
(fax) (305) 267 4286

Australia/New Zealand:

Agilent Technologies Australia Pty Ltd
347 Burwood Highway
Forest Hill, Victoria 3131, Australia
(tel) 1-800 629 485 (Australia)
(fax) (61 3) 9272 0749
(tel) 0 800 738 378 (New Zealand)
(fax) (64 4) 802 6881

Asia Pacific:

Agilent Technologies
24/F, Cityplaza One, 1111 King's Road,
Taikoo Shing, Hong Kong
(tel) (852) 3197 7777
(fax) (852) 2506 9284

Technical data subject to change
Copyright © 2000
Agilent Technologies
Printed in U.S.A. 2/00
5968-8546E



Agilent Technologies
Innovating the HP Way