

# Keysight DSO90008 Series

## Low-Profile High-Performance Oscilloscopes/Digitizers

Engineered for research at the cutting edge of modern physics

Data Sheet



## Low-profile oscilloscopes/digitizers

- DSO90808A: 8-bit, 8 ch, 8 GHz, 40 GS/s
- DSO91208A: 8-bit, 8 ch, 12 GHz, 40 GS/s
- DSO91308A: 8-bit, 8 ch, 13 GHz, 40 GS/s

## Why choose Keysight low profile oscilloscope/digitizers for your high performance measurement needs?

When you're working in high energy physics, radar or doing spectrum monitoring you're pushing scientific research to the limits, and your measurement technology has to keep pace. Keysight Technologies, Inc. offers industry-leading digitizing performance in an industry-unique low profile package to ensure that you make the most accurate measurements every time.

The Keysight Technologies, Inc. Infiniium 90008 Series low profile oscilloscope/digitizers house eight 40GSa/s ADCs and two CPUs in a 7U high package for the industry's densest channel count at these speeds.



## Infiniium 90008A Series oscilloscopes/digitizers

Model	Bandwidth	Channel count	Resolution	Sample rate	Memory depth
DSO91308A	13 GHz	8	8 bits	40 GSa/s on all channels (25 ps sample spacing)	10 Mpts std. up to 1 Gpt per channel
DSO91208A	12 GHz				
DSO90808A	8 GHz				

## Key features

- Optional high-speed PCIe® bus transfers data to external PC at sustained rates up to 150 MB/s
- Certified with Citrix Corporation for full operation without hard drive
- Selected filter system to provide response with less than 0.3% pre-shoot
- Device drivers for VxWorks, LabVIEW RT, and Linux, with application code examples for MATLAB, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI
- Options from extensive software applications library including InfiniiScan three stage event triggering, EZJIT jitter analysis, Vector Signal Analysis (VSA) software, and de-embedding and equalization software.

## How much time can I capture?

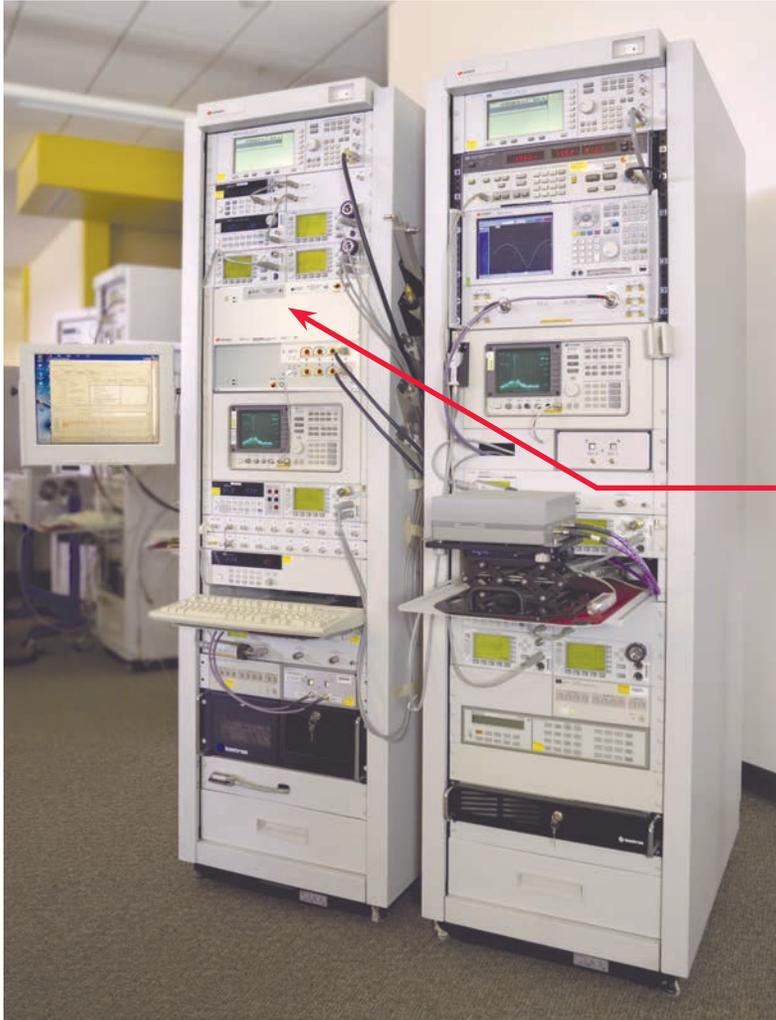
Sampling rate	10 Mpts of memory	20 Mpts of memory	50 Mpts of memory	100 Mpts of memory	200 Mpts of memory	500 Mpts of memory	1 Gpts of memory
40 GSa/s	250 μs	500 μs	1.25 ms	2.5 ms	5.0 ms	12.5 ms	25.0 ms
20 GSa/s	500 μs	1 ms	2.5 ms	5.0 ms	10.0 ms	25.0 ms	50.0 ms

Note: Time span capture = Memory depth x 1/Sampling rate

## Enabling Research at the Cutting Edge of Physics

Keysight has engineered the Infiniium 90008 Series oscilloscope/digitizers to meet your most demanding requirements by delivering the features you need to ensure fast and reliable measurements every time:

1. Unmatched real-time measurement accuracy
2. Fast offload speeds and compatibility with industry standard computation packages
3. Powerful internal capabilities with dual on-board PCs and off-the-shelf software



Get 8 channels of 40 GSa/s digitizer rate in 7U high 19" rack mount package

## Unmatched Real-Time Measurement Accuracy

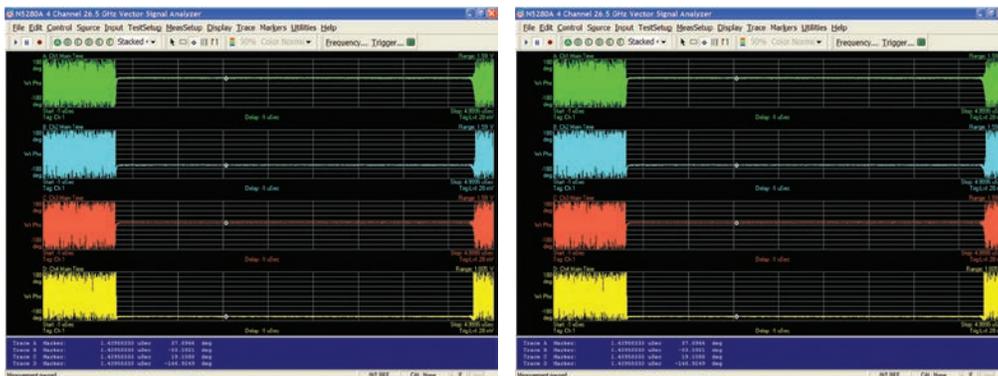
Industry's lowest noise floor: To enable our DSO90008 Series digitizers to operate at high frequencies with minimal electromagnetic interference (EMI) we relied on our expertise in radio frequency (RF) technology. Keysight invested in key technology blocks like our proprietary Faraday caged front end to deliver the lowest noise floor in the industry for the most accurate measurements available.

### Precision time base

Each bank of four digitizers has a precision crystal-controlled time base. Sample rates can be selected, in a 1, 2, 2.5, 4, 5 sequence, from 10 S/s to 40 GS/s. An internal trigger time interpolator (TTI) with high timing resolution is used to assist with trigger time measurements and positioning with respect to the internal clock (sampling time). The digitizers can also be locked to an external 10 MHz reference. The digitizers feature a sequence acquisition mode that allows the capture and storage of consecutive “single” waveforms. In segmented memory mode the acquisition memory is divided into segments. Waveforms are stored in successive memory segments as they arrive based on a trigger event. The memory can be divided into any number of segments between 2 and 130,000, with segment lengths from 16 points up to 0.5 G points (depending on installed memory). Sequence acquisition mode is extremely useful in almost all impulse-response type applications such as radar, sonar, lidar, time-of-flight, ultrasonics, medical and biomedical research.

### Full bandwidth probing and accurate de-embedding and equalization software

The performance of Keysight's oscilloscopes is matched by the superiority of our probing, de-embedding and equalization offerings. Maintain full bandwidth performance to the probe tip with our InfiniiMax probing solutions, including SMA cables and high temperature probes. Equalize waveforms with our hardware accelerated N5465A InfiniiSim Waveform Transformation Toolset. Configurable system modeling allows you to remove the deleterious effects of unwanted channel elements, simulate waveforms with channel models inserted, view waveforms in physically unprobeable locations, and compensate for loading of probes and fixtures. The N5461A Serial Data Equalization software allows you to model equalization techniques in real time.



Multi channel phase coherent Vector Signal Analysis.

## Unmatched Real-Time Measurement Accuracy (Continued)

### Multi-module synchronization

Each module contains 2 independently synchronized 4-channel digitizers. If more than four synchronous data acquisition channels are required, multiple digitizers can be combined in one of two ways. The first is to utilize the auxiliary trigger in and trigger out, which provides time correlation and synchronization up to 30 ns. Multiple channel synchronization to sub-pico second accuracy for five and more channels may be achieved by providing a distributed trigger signal to the aux trigger of each bank of four channels. Multiple modules can be connected in either fashion enabling hundreds of 40 GSa/s time-correlated channels.

### Fast offload speeds and compatibility with industry standard computation packages

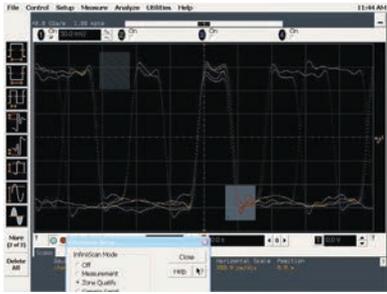
The memory and acquisition controller component of our acquisition system is a digital CMOS integrated circuit. A high-speed data demultiplexer with on-board memory, it is designed to capture and memorize 8-bit digital data, at speeds of up to 40 GSa/s. The DSO90008A series digitizers have provisions for up to 1 Gpt per channel of acquisition memory. Remote and offload access through 10/100/1000 BaseT LAN interface with Web-enabled connectivity using ultra-responsive Ultra VNC. GPIB over LAN provides remote measurement. LXI class C compliant. A USB 2.0 device port lets you control the scope and transfer data via USB 2.0.

Offload data for custom analysis on your PC using an optional high-speed PCIe bus card available through [www.dolphinics.com](http://www.dolphinics.com) to transfer data at sustained rates up to 150 MB/s. Device drivers for VxWorks, LabVIEW RT, and Linux, with application code examples for MATLAB, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI come standard.

### Powerful on board capabilities with dual PCs and off-the-shelf software

Each 8 channel module boasts two PCs that run application software and provide standard I/O functionality. In addition, custom IDA (Infiniium Data Accelerator) hardware on the acquisition boards speeds measurements requiring filtering and math algorithms. Packed with numerous general-purpose measurements and analysis features, Infiniium 90008 Series oscilloscope/digitizers can also be outfitted with a number of unique software options. Supported application packages can speed scientist's insight into research questions. Key software options are listed on the following pages. For a complete list of supported software visit [www.keysight.com/find/scope-apps](http://www.keysight.com/find/scope-apps)

## Software Options to Aid Testing



Identify signal integrity issues with InfiniiScan Zone – Qualify triggering.

### InfiniiScan event identification (N5415A)

Rapidly trigger on complex events and identify signal integrity issues. This innovative software quickly scans through thousands of acquired waveform cycles and isolates anomalous signal behavior.

This application is supported on all models.

For more information: [www.keysight.com/find/infiniiScan](http://www.keysight.com/find/infiniiScan)



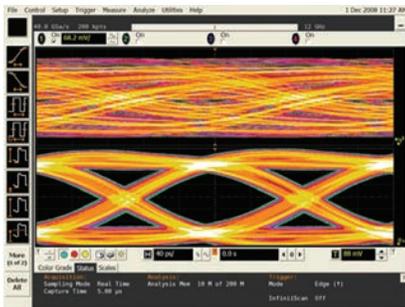
Control your applications remotely.

### Infiniiium application remote interface (N5452A)

Operate your Infiniiium compliance and validation applications remotely using .NET languages.

This application is supported on all models.

For more information: [www.keysight.com/find/RPI](http://www.keysight.com/find/RPI)



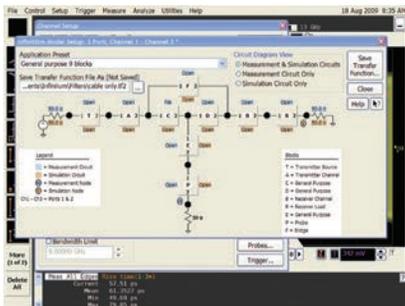
Reduce receiver errors by opening tightly shut eyes.

### Serial Data Equalization (N5461A)

Measure at the pin and use equalization to see a virtual eye on the other side of an equalizer. Model equalization techniques such as DFE, FFE, and CTLE.

This application is supported on all models.

For more information: [www.keysight.com/find/SDE](http://www.keysight.com/find/SDE)



Model channel effects including reflection.

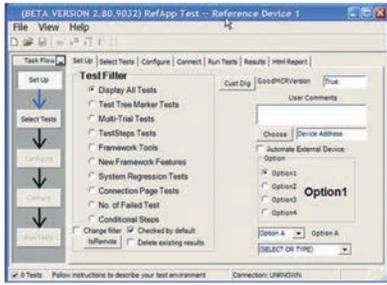
### InfiniiSim Waveform Transformation Toolset (N5465A)

Use the InfiniiSim toolset to combine measurements and models to view simulated scope measurement results at any location in your design. Import design models (s-parameters or transfer functions), acquire real-time scope data, and transform to measurement locations you need.

This application is supported on all models.

For more information: [www.keysight.com/find/InfiniiSim](http://www.keysight.com/find/InfiniiSim)

## Software Options to Aid Testing (Continued)

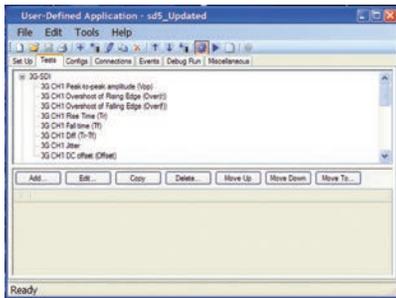


Control your applications remotely.

### MATLAB data analysis software (Option 061 or 062 on new scope purchases)

MATLAB is a data analysis software environment and scripting language used by over 1,000,000 users in aerospace/defense, automotive, communications, electronics, and other applications. MATLAB is now available directly from Keysight as in instrument option with the purchase of your Keysight 90000 Series oscilloscope. Install MATLAB on your oscilloscope or remote PC to make customized measurements, design and apply your own filters to oscilloscope signals, graphically visualize signals in 2-D or 3-D plots, automate measurements, or build test applications. Purchase MATLAB with your Keysight 90000 Series oscilloscope to ensure version compatibility and so that your MATLAB software license is always available when you need it.

For more information: [www.keysight.com/find/matlab\\_oscilloscopes](http://www.keysight.com/find/matlab_oscilloscopes)

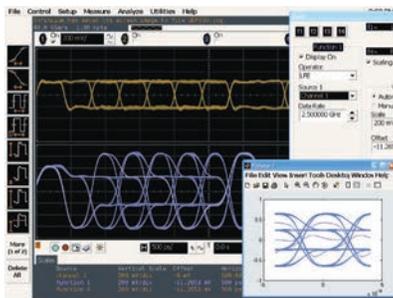


Quickly automate oscilloscope measurements.

### User-definable application (N5467A)

Rapidly develop your own automated measurements and tests. This application provides the framework you need to quickly program and automate any single or set of measurements the oscilloscope can make. The application also provides full control of other Keysight instruments and HTML reporting capabilities.

For more information: [www.keysight.com/find/UDA](http://www.keysight.com/find/UDA)

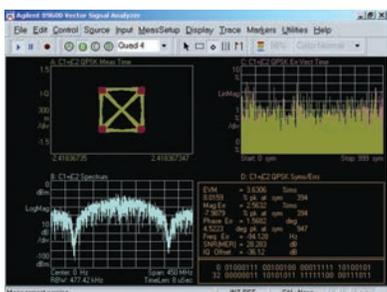


Signal equalization using user-defined function.

### User-defined function (N5430A)

If we haven't provided exactly what you need, use the N5430A User Defined Function software to create it yourself. Develop your own math functions or filters using MATLAB. Your custom functionality is seamlessly integrated into the Infiniium 90000 menus and results are displayed on the scope screen. This requires MATLAB (available as Option 062) to be installed directly on the oscilloscope. Keysight is the only T&M manufacturer today that sells and supports MATLAB as its own product. This application is supported on all models and requires MATLAB software (not included with UDF).

For more information: [www.keysight.com/find/UDF](http://www.keysight.com/find/UDF)



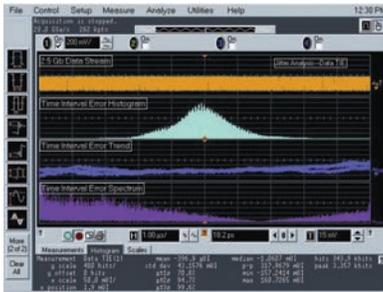
Use vector signal analysis software to see FFT-based spectrum analysis.

### Vector signal analysis software (89601A)

Expand the measurement capability of your scope with the 89601A vector signal analysis software. This advanced DSP-based software takes the digitized signal data from the scope and displays FFT-based spectrum analysis and wide-bandwidth digital modulation analysis for wireless communication signals such as WCDMA and cdma2000 and wireless networking signals such as 802.11 WiFi and 802.16 WiMax. Take advantage of the super-wide bandwidth of your scope to capture and evaluate radar signals.

For more information: [www.keysight.com/find/VSA](http://www.keysight.com/find/VSA)

## Software Options to Aid Testing (Continued)



### EZJIT analysis software (E2681A)

Quickly characterize and evaluate most commonly needed jitter measurements, including cycle-cycle, N-cycle, period, time-interval, error, setup and hold time, histograms, measurement trending and jitter spectrum.

For more information: [www.keysight.com/find/EZJIT](http://www.keysight.com/find/EZJIT)

Conduct jitter analysis.



### Noise reduction and bandwidth control (N5403A)

Eliminate excess noise caused by high oscilloscope bandwidth that you don't need. Noise Reduction allows you to choose the right bandwidth for your measurement, ensuring you make the most accurate measurement.

For more information: [www.keysight.com/find/N5403A](http://www.keysight.com/find/N5403A)

Eliminate excess noise.

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics

<b>Vertical</b>			
Input channels	Eight		
Analog bandwidth (-3 dB) <sup>*,10</sup>	<b>90808A</b>	<b>91208A</b>	<b>91308A</b>
	8 GHz	12 GHz	12 GHz
DSP enhanced bandwidth <sup>3</sup>	91304A: 13-GHz real-time, user-selectable DSP enhanced bandwidth		
Rise time/fall time <sup>11</sup>	<b>90808A</b>	<b>91208A</b>	<b>91308A</b>
10 to 90%	54 ps	35 ps	32 ps
20 to 80%	38 ps	25 ps	23 ps
Input impedance	50 Ω, ± 3%		
Sensitivity <sup>1</sup>	1 mV/div to 1 V/div		
Input coupling	DC		
Vertical resolution <sup>2</sup>	8 bits, ≥ 12 bits with averaging		
Channel to channel isolation (any two channels with equal V/div settings)	DC to 3 GHz: 90808A/91208A/91308A: 60 dB (≥ 1000:1) 3 to 8 GHz: 40 dB (≥ 100:1) 8 GHz to BW: 35 dB (≥ 56:1)		
DC gain accuracy <sup>*,1</sup>	± 2% of full scale at full resolution channel scale (± 2.5% for 5 mV/div)		
Maximum input voltage <sup>*</sup>	± 5 V		
Offset range <sup>*,1</sup>	<b>Vertical sensitivity</b>	<b>Available offset</b>	
	0 mV/div to ≥ 40 mV/div	± 0.4 V	
	> 40 mV/div to ≥ 75 mV/div	± 0.9 V	
	> 75 mV/div to ≥ 130 mV/div	± 1.6 V	
	> 130 mV/div to ≥ 240 mV/div	± 3.0 V	
	> 240 mV/div	± 4.0 V	
Offset accuracy <sup>*,1</sup>	≤ 3.5 V: ± (2% of channel offset + 1% of full scale) + 1 mV > 3.5 V: ± (2% of channel offset + 1% of full scale)		
Dynamic range	± 4 div from center screen		
DC voltage measurement accuracy <sup>*,1</sup>	Dual cursor: ± [(DC gain accuracy) + (resolution)] Single cursor: ± [(DC gain accuracy) + (offset accuracy) + (resolution/2)]		
RMS noise floor (scope only)	<b>90808A</b>	<b>91208A</b>	<b>91308A</b>
<b>Volts/div</b>			
5 mV	1322 μV	435 μV	467 μV
10 mV	358 μV	483 μV	536 μV
20 mV	498 μV	650 μV	758 μV
50 mV	1.15 mV	1.45 mV	1.73 mV
100 mV	2.22 mV	2.80 mV	3.37 mV
200 mV	4.28 mV	5.41 mV	6.58 mV
500 mV	11.5 mV	14.7 mV	17.4 mV
1 V	22.3 mV	28.5 mV	34.1 mV

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics (Continued)

<b>Vertical (Continued)</b>			
RMS noise floor (scope with probe)	<b>90808A</b>	<b>91208A</b>	<b>91308A</b>
Volts/div	with 1168A	with 1169A	with 1169A
20 mV	2.2 mV	2.5 mV	2.7 mV
50 mV	2.3 mV	2.8 mV	3.1 mV
100 mV	2.9 mV	3.5 mV	4.2 mV
200 mV	4.7 mV	5.9 mV	7.5 mV
500 mV	12 mV	15 mV	19 mV
1 V	23 mV	28 mV	37 mV
<b>Horizontal</b>			
Main timebase range	5 ps/div to 20 s/div real-time, 5 ps/div to 500 ns/div equivalent-time		
Main timebase delay range	-200 s to 200 s real-time, -25 μs to 200 s equivalent-time		
Zoom timebase range	1 ps/div to current main time scale setting		
Channel deskew	± 25 μs range, 100 fs resolution		
Time scale accuracy *	± (0.4 + 0.5 * YrsSinceCal) ppm pk		
Delta-time measurement accuracy	6a, 6b, 7		
Absolute, averaging disabled	$\sqrt{\left(\frac{5.0 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 20 \times 10^{-24} + \frac{\text{TimeScaleAccy} \cdot \text{Reading}}{2}} \text{ sec pk}$		
Absolute, > -256 averages	$\sqrt{\left(\frac{0.35 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.1 \times 10^{-24} + \frac{\text{TimeScaleAccy} \cdot \text{Reading}}{2}} \text{ sec pk}$		
Standard deviation, averaging disabled	$\sqrt{\left(\frac{1.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.6 \times 10^{-24}} \text{ sec}_{\text{rms}}$		
Standard deviation, > -256 averages	$\sqrt{\left(\frac{0.1 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.01 \times 10^{-24}} \text{ sec}_{\text{rms}}$		
Jitter measurement floor <sup>6a, 6b</sup>			
Time interval error <sup>6c</sup>	$\sqrt{\left(\frac{1.0 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.3 \times 10^{-24}} \text{ sec}_{\text{rms}}$		
Period jitter	$\sqrt{\left(\frac{1.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.6 \times 10^{-24}} \text{ sec}_{\text{rms}}$		
N-cycle, cycle-cycle jitter	$\sqrt{\left(\frac{2.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 1.7 \times 10^{-24}} \text{ sec}_{\text{rms}}$		

# Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

## Performance characteristics (Continued)

Acquisition								
Maximum real-time sample rate	91308A/91208A/90808A: 40 GSa/s							
Memory depth per channel								
Standard	10 Mpts on 8 channels							
Option 20M	20 Mpts on 8 channels							
Option 50M	50 Mpts on 8 channels							
Option 100	100 Mpts on 8 channels							
Option 200	200 Mpts on 8 channels							
Option 500	500 Mpts on 8 channels							
Option 01G	1 Gpts on 8 channels							
Maximum acquired time at highest real-time resolution								
	<b>91308A/91208A/90808A</b>							
Resolution	25 ps (40 GSa/s)							
Standard	0.25 ms							
Option 20M	0.5 ms							
Option 50M	1.25 ms							
Option 100	2.5 ms							
Option 200	5.0 ms							
Option 500	12.5 ms							
Option 01G	25.0 ms							
Data transfer speed								
Gigabit Ethernet	Samples	1 k	64 k	1 M	16 M	32 M	128 M	
	MSa/s (Word)	0.1	1.88	9.25	12.00	12.80	12.80	
	MSa/s (Byte)	0.11	1.88	12.60	19.70	20.30	22.00	
USB 2.0 hi-speed (device)	Samples	1 k	64 k	1 M	16 M	32 M	128 M	
	MSa/s (Word)	0.11	1.88	8.34	8.55	9.07	11.38	
	MSa/s (Byte)	0.11	1.88	11.60	14.40	14.90	18.10	
Sampling modes								
Real-time	Successive single-shot acquisitions							
Real-time with averaging	Selectable from 2 to 65534							
Real-time with peak detect	91308A/91208A/90808A: 40 GSa/s							
Real-time with hi resolution	Real-time boxcar averaging reduces random noise and increases resolution							
Equivalent-time	Resolution: 100 fs							
Segmented memory	Full bandwidth on all 4 channels, 262,144 sample points maximum memory							
	Captures bursting signals at maximum sample rate without consuming memory during periods of inactivity							
	Number of segments: Up to 131,072 segments (depending on installed memory depth and model number)							
	Minimum intersegment time: 91308A/91208A/90808A: 2.7 $\mu$ s (the time between the end of the previous acquisition and the beginning of the next acquisition)							
	Maximum number of segments:							
	<b>Sample rate</b>	<b>10 M</b>	<b>20 M</b>	<b>50 M</b>	<b>100 M</b>	<b>200 M</b>	<b>500 M</b>	<b>1 G</b>
	DSO91308A, 91208A, 90808A	1024	2048	4096	8192	16384	32768	65536
Filters								
Sin(x)/x Interpolation	On/off selectable FIR digital filter. Digital signal processing adds points between acquired data points to enhance measurement accuracy and waveform display quality.							

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics (Continued)

Hardware trigger	
Sensitivity <sup>1</sup>	91308A/91208A/90808A: <ul style="list-style-type: none"> <li>– Internal low<sup>1</sup>: 2.0 div p-p 0 to 5 GHz</li> <li>– Internal high<sup>1</sup>: 0.3 div p-p 0 to 4 GHz, 1.0 div p-p 4 to 7.5 GHz</li> </ul>
Level range	
Internal	± 4 div from center screen or ± 4 Volts, whichever is smallest
Auxiliary	± 5 V, also limit input signal to ± 5 V
Sweep modes	Auto, triggered, single
Display jitter (displayed trigger jitter) <sup>6a, 8</sup>	90808A, 91208A, 91308A: $\sqrt{\left(\frac{0.9 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.3 \times 10^{-24} \text{ sec}_{\text{rms}}}$
Trigger sources	Channel 1, channel 2, channel 3, channel 4, aux, and line
Trigger modes	
Edge	Triggers on a specified slope (rising, falling or alternating between rising and falling) and voltage level on any channel or auxiliary trigger.
Edge transition	Trigger on rising or falling edges that cross two voltage levels in > or < the amount of time specified. Edge transition setting from 250 ps.
Edge then edge (time)	The trigger is qualified by an edge. After a specified time delay between 10 ns to 10 s, a rising or falling edge on any one selected input will generate the trigger.
Edge then edge (event)	The trigger is qualified by an edge. After a specified delay between 1 to 16,000,000 rising or falling edges, another rising or falling edge on any one selected input will generate the trigger.
Glitch	Triggers on glitches narrower than the other pulses in your waveform by specifying a width less than your narrowest pulse and a polarity. Triggers on glitches as narrow as 125 ps. Glitch range settings: < 250 ps to < 10 s.
Line	Triggers on the line voltage powering the oscilloscope.
Pulse width	Trigger on a pulse that is wider or narrower than the other pulses in your waveform by specifying a pulse width and a polarity. Triggers on pulse widths as narrow as 125 ps. Pulse width range settings: 250 ps to 10 s. Trigger point can be “end of pulse” or “time out”.
Runt	Triggers on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Can be time qualified with minimum setting of 250 ps.
Timeout	Trigger when a channel stays high, low, or unchanged for too long. Timeout setting: from 250 ps to 10 s.
Pattern/pulse range	Triggers when a specified logical combination of the channels is entered, exited, present for a specified period of time or is within a specified time range or times out. Each channel can have a value of High (H), Low (L) or Don't care (X).
State	Pattern trigger clocked by the rising, falling or alternating between rising and falling edge of one channel.
Setup/hold	Triggers on setup, hold, or setup and hold violations in your circuit. Requires a clock and data signal on any two inputs (except aux or line) channels as trigger sources. Setup and/or hold time must then be specified.

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics (Continued)

<b>Hardware trigger (Continued)</b>	
Trigger modes (Continued)	
Window	Triggers on an event associated with a window defined by two-user adjustable thresholds. Event can be window “entered,” “exited,” “inside (time qualified),” or “outside (time qualified)” voltage range. Trigger point can be “cross window boundary” or “time out.” Time qualify range: from 250 ps to 10 s.
Video	Triggers from negative sync composite video, field 1, field 2, or alternating fields for interlaced systems, any field, specific line, or any line for interlaced or non-interlaced systems. Supports NTSC, PAL-M (525/60), PAL, SECAM (625/50), EDTV (480p/60), EDTV (576p/50), HDTV (720p/60), HDTV (720p/50), HDTV (1080i/60), HDTV (1080i/50), HDTV (1080p/60), HDTV (1080p/50), HDTV (1080p/30), HDTV (1080p/25), HDTV (1080p/24), and user-defined formats.
Trigger sequences	Three stage trigger sequences including two-stage hardware (Find event (A) and Trigger event (B)) and one-stage InfiniiScan software trigger. Supports all hardware trigger modes except “edge then edge” and “video,” and all InfiniiScan software trigger modes. Supports “delay (by time)” and “reset (by time or event)” between two hardware sequences. The minimum latency between “find event (A)” and “trigger event (B)” is 3 ns.
Trigger qualification and qualifier	Single or multiple channels may be logically qualified with any other trigger mode
Trigger holdoff range	100 ns to 10 s
Trigger actions	Specify an action to occur and the frequency of the action when a trigger condition occurs. Actions include e-mail on trigger and execute “multipurpose” user setting.
Trigger shortcuts	Provides easy shortcuts to all trigger features
<b>Software trigger (Requires InfiniiScan event identification software – N5415A)</b>	
Trigger modes	
Generic serial	Software triggers on NRZ-encoded data up to 8.0 Gbps, up to 80-bit pattern. Support multiple clock data recovery methods including constant frequency, 1st-order PLL, 2nd-order PLL, explicit clock, explicit 1st-order PLL, explicit 2nd-order PLL, Fibre Channel, FlexRay receiver, FlexRay transmitter (requires E2688A except for the constant frequency clock data recovery mode).
Measurement limit	Software triggers on the results of the measurement values. For example, when the “pulse width” measurement is turned on, InfiniiScan measurement software trigger triggers on a glitch as narrow as 75 ps. When the “time interval error (TIE)” is measured, InfiniiScan can trigger on a specific TIE value.
Non-monotonic edge	Software triggers on the non-monotonic edge. The non-monotonic edge is specified by setting a hysteresis value.
Runt	Software triggers on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Unlike hardware runt trigger, InfiniiScan runt trigger can be further qualified via a hysteresis value.
Zone qualify	Software triggers on the user defined zones on screen. Zones can be specified as either “must intersect” or “must not intersect.” Up to four zones can be defined.

# Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

## Performance characteristics (Continued)

Measurements and math	
Maximum measurement update rate	> 42,000 measurement/sec (one measurement turned on) > 122,000 measurement/sec/measurement (five measurements turned on)
Measurement modes	Standard, Measure All Edges mode
Waveform measurements	
Voltage	Peak to peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, preshoot, upper, middle, lower
Time	Rise time, fall time, period, frequency, positive width, negative width, duty cycle, burst width, Tmin, Tmax, Tvolt, setup time (requires Option 002 or 004), hold time (requires Option 002 or 004), channel-to-channel delta time, channel-to-channel phase
Mixed	Area, slew rate
Frequency domain	FFT frequency, FFT magnitude, FFT delta frequency, FFT delta magnitude
Level qualification	Any channels that are not involved in a measurement can be used to level-qualify all timing measurements
Eye-diagram measurements	Eye height, eye width, eye jitter, crossing percentage, Q factor, and duty-cycle distortion
Jitter analysis measurements	Requires E2681A or N5400A
Clock	Time interval error (TIE) clock with TIE band, high, low-pass filter, cycle-cycle jitter, N-cycle jitter, cycle-cycle + width, cycle-cycle width, cycle-cycle duty cycle
Data	Time interval error (TIE) data with TIE band, high, low-pass filter, data rate, unit interval, clock recovery rate Two sources: Setup time, hold time, phase, advanced
Timing	One source: Period, frequency, + width, width, duty cycle, burst width, rise time, fall time, slew rate
Statistics	Displays the current, mean, minimum, maximum, range (max-min), standard deviation, number of measurements value for the displayed automatic measurements
Histograms	
Source	Waveform or measurement
Orientation	Vertical (for timing and jitter measurements) or horizontal (noise and amplitude change) modes, regions are defined using waveform markers
Measurements	Mean, standard deviation, mean $\pm$ 1, 2, and 3 sigma, median, mode, peak-to-peak, min, max, total hits, peak (area of most hits), X scale hits, and X offset hits
Mask testing	Allows pass/fail testing to user-defined or Keysight-supplied waveform templates. Automask lets you create a mask template from a captured waveform and define a tolerance range in time/voltage or screen divisions. Test modes (run until) include test forever, test to specified time or event limit, and stop on failure. Executes "multipurpose" user setting on failure. "Unfold real time eye" feature will allow individual bit errors to be observed by unfolding a real time eye when clock recovery is on. Communications mask test kit option provides a set of ITU-T G.703, ANSI T1.102, and IEEE 802.3 industry-standard masks for compliance testing.
Waveform math	
Number of functions	Four
Operators	Absolute value, add, average, Butterworth <sup>9</sup> , common mode, differentiate, divide, FFT magnitude, FFT phase, FIR <sup>9</sup> , high pass filter, integrate, invert, LFE <sup>9</sup> , low pass filter (4th-order Bessel Thompson filter), magnify, max, min, multiply, RT Eye <sup>9</sup> , smoothing, SqrtSumOfSquare <sup>9</sup> , square, square root, subtract, versus, and optional user defined function (Option 010)
FFT	
Frequency range <sup>4</sup>	DC up to 20 GHz (at 40 GSa/s) or 10 GHz (at 20 GSa/s)
Frequency resolution	Sample rate/memory depth = Resolution
Best resolution at maximum sample rate	91308A/91208A/90808A: 800 Hz
Frequency accuracy	(1/2 frequency resolution) + (1 x 10 <sup>-6</sup> )(signal frequency)

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics (Continued)

<b>Measurements and math (Continued)</b>	
FFT (Continued)	
Signal-to-noise ratio <sup>5</sup>	60 to > 100 dB depending on settings
Window modes	Hanning, flattop, rectangular
Measurement modes	
Automatic measurements	Measure menu access to all measurements, five measurements can be displayed simultaneously
Multipurpose	Front-panel button activates five pre-selected or five user-defined automatic measurements
Drag-and-drop measurement toolbar	Measurement toolbar with common measurement icons that can be dragged and dropped onto the displayed waveforms
Marker modes	Manual markers, track waveform data, track measurements
<b>External display (Not included)</b>	
Intensity grayscale	256-level intensity-graded display
Resolution XGA	1024 pixels horizontally x 768 pixels vertically
Annotation	Up to 12 labels, with up to 100 characters each, can be inserted into the waveform area
Grids	One, two or four waveform grids, each with 8 bit vertical resolution
Waveform styles	Connected dots, dots, infinite persistence, color graded infinite persistence. Includes up to 256 levels of intensity-graded waveforms.
Waveform update rate	
Maximum waveform update	> 400,000 waveforms per second (when in the segment memory mode)
<b>Computer system and peripherals, I/O ports</b>	
Computer system and peripherals	
Operating system	Windows XP Pro
CPU	Intel Pentium 4 3.4-GHz microprocessor
PC system memory	2 GB DDR2 (standard) 4 GB DDR2 (optional N5413A)
Drives	≥ 250-GB internal hard drive Optional removable hard drive (2 standard) Optional USB external DVD-RW drive (Option 820)
Peripherals	Logitech optical USB mouse, compact USB keyboard and stylus supplied. All Infiniium models support any Windows-compatible input device with a serial, PS/2 or USB interface.
File types	
Waveforms (supported max memory size)	Compressed internal format (*.wfm (200 Mpts)), comma-separated values (*.csv (1 Gpts)), tab separated values (*.tsv (1 Gpts)), public binary format (.bin (500 Mpts)), Y value files (*.txt (1 Gpts))
Images	BMP, PNG, TIFF, GIF or JPEG
I/O ports	
LAN	RJ-45 connector, supports 10Base-T, 100Base-T, and 1000Base-T. Enables Web-enabled remote control, e-mail on trigger or demand, data/file transfers and network printing (VXI-11). Recommended Web remote control tool: Ultra VNC ( <a href="http://www.ultravnc.com/">http://www.ultravnc.com/</a> ).

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Performance characteristics (Continued)

#### Computer system and peripherals, I/O ports (Continued)

##### I/O ports (Continued)

GPIB	IEEE 488.2, fully programmable (optional – Option 805)
RS-232 (Serial)	COM1, printer and pointing device support
Parallel	Centronics printer port
PS/2	Four ports, supports PS/2 pointing and input devices
USB 2.0 hi-speed (Host)	Eight USB 2.0 Hi-Speed host ports on rear panel
Dual-monitor video output	15 pin XGA (1024x768), full color output of scope waveform display or dual monitor video output
Auxiliary output	DC ( $\pm 2.4$ V); square wave (~715 Hz and ~456 MHz); trigger output (255 mV p-p into 50 $\Omega$ )
Trigger output	5 V 50 $\Omega$ back-terminated
Time base reference output	10 MHz filtered sine wave with all harmonics $\leq -40$ dBc. Amplitude into 50 $\Omega$ : 800 mV p-p to 1.26 V p-p (4 dBm $\pm 2$ dB) if derived from internal reference. Tracks external reference input amplitude $\pm 1$ dB if applied and selected.
Time base reference input	Must be 10 MHz, input Z0 = 50 $\Omega$ . Minimum 500 mV p-p ( $-2$ dBm), maximum 2.0 V p-p (+10 dBm).
LXI compliance	Functional Class C

#### General characteristics

Temperature <sup>11</sup>	Operating: 5 to +40 °C; Non-operating: -40 to +70 °C
Humidity	Operating: up to 95% relative humidity (non-condensing) at +40 °C; Non-operating: up to 90% relative humidity at +65 °C
Altitude	Operating: up to 4,000 meters (12,000 feet); Non-operating: up to 15,300 meters (50,000 feet)
Vibration	Operating: random vibration 5 to 500 Hz, 10 minutes per axis, 0.3 g(rms); Non-operating: random vibration 5 to 500 Hz, 10 minutes per axis, 2.41 g(rms); resonant search 5 to 500 Hz, swept sine, 1 octave/minute sweep rate, (0.75 g), 5 minute resonant dwell at 4 resonances per axis
Power	Two, 100 to 240 VAC at 50/60 Hz inputs; maximum input power 800 Watts each
Weight	Net: 44.6 kg (98.3 lbs.) Shipping: 30.4 kg (67 lbs.)
Dimensions (excluding handle)	Height: 283 mm (11.13 inch); Width: 432 mm (17.02 inch); Depth: 506 mm (19.91 inch)
Safety	Meets IEC 61010-1 +A2, CSA certified to C22.2 No.1010.1, self-certified to UL 3111

\* Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period, and  $\pm 5$  °C from annual calibration temperature.

1. Full scale is defined as 8 vertical divisions. Magnification is used below 5 mV/div. Below 5 mV/div, full-scale is defined as 40 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V.
2. Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.
3. 13 GHz DSP enhanced bandwidth not applicable at 5 mV/div.
4. FFT amplitude readings are affected by scope and probe bandwidth limitations and input amplifiers roll-off (e.g. 3 dB roll-off at specified bandwidth of scope/probe).
5. The FFT signal to noise ratio varies with volts/division setting, memory depth and use of time or frequency averaging.
- 6a. Noise is the displayed noise floor. SlewRate is the displayed slew rate of the signal at the threshold crossings. Sample rate = max, sin(x)/x interpolation enabled.
- 6b. Measurement threshold = fixed voltage at 50% level.
- 6c. Time ranges  $\leq 10$   $\mu$ s.
7. Values represent time error between two edges on a single channel. Standard deviation value refers to the standard deviation of 256 consecutive measurements performed using an individual instrument. Reading is the displayed DTMA measurement value. TimeScaleAccy is the oscilloscope's specified time scale accuracy.
8. Internal edge trigger mode. Trigger threshold = fixed voltage at 50% level. The slew rate independent value in the formula represents the traditional trigger jitter.
9. Requires N5430A user defined function.
10. 11.8 GHz analog bandwidth at 5 mV/div for DSO91308A and DSO91208A models.
11. Calculated from the bandwidth.
12. Typically triggers as low as 5 mV/div sensitivity.

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Infiniium DSO90000A Series oscilloscopes

Model	Bandwidth	Channels	Sample rate	Standard memory
DSO91308A	13 GHz	8	40 GSa/s	10 Mpts
DSO91208A	12 GHz	8	40 GSa/s	10 Mpts
DSO90808A	8 GHz	8	40 GSa/s	10 Mpts

Note: The DSO91308A uses DSP enhancement software to achieve 13 GHz bandwidth. It also adds a valuable DSP noise reduction and bandwidth control feature to reduce noise at bandwidths of 10, 8, 6, 4, 2, and 1 GHz. The non-DSP enhanced bandwidth of the DSO91308A is 12 GHz.

Standard accessories
USB optical mouse (2)
USB keyboard (2)
User's quick-start guide
Power cord
High-performance calibration cable
E2655B probe deskew and performance verification kit
High-performance calibration cable
E2655B probe deskew and performance verification kit
Eight 54855-67604 BNC-compatible to precision 3.5 mm (f) adapters
One-year warranty
GPIB Card-interface (2)
Removable hard drive (2)
Rack mount kit

Note: No probes are included with the DSO90008A Series oscilloscopes. The InfiniiMax Series probes or any other probes must be purchased separately.

Post-sales upgrades	
DSO90000A-01G	1 G memory/CH upgrade
DSO90000A-100	100 M memory/CH upgrade
DSO90000A-200	200 M memory/CH upgrade
DSO90000A-20M	20 M memory/CH upgrade
DSO90000A-500	500 M memory/CH upgrade
DSO90000A-50M	50 M memory/CH upgrade

Additional options and accessories	
DSO90000A-820	DVD-RW
DSO90000A-822	External Touchscreen Monitor for Infiniium
N2896A	Removable hard disk drive

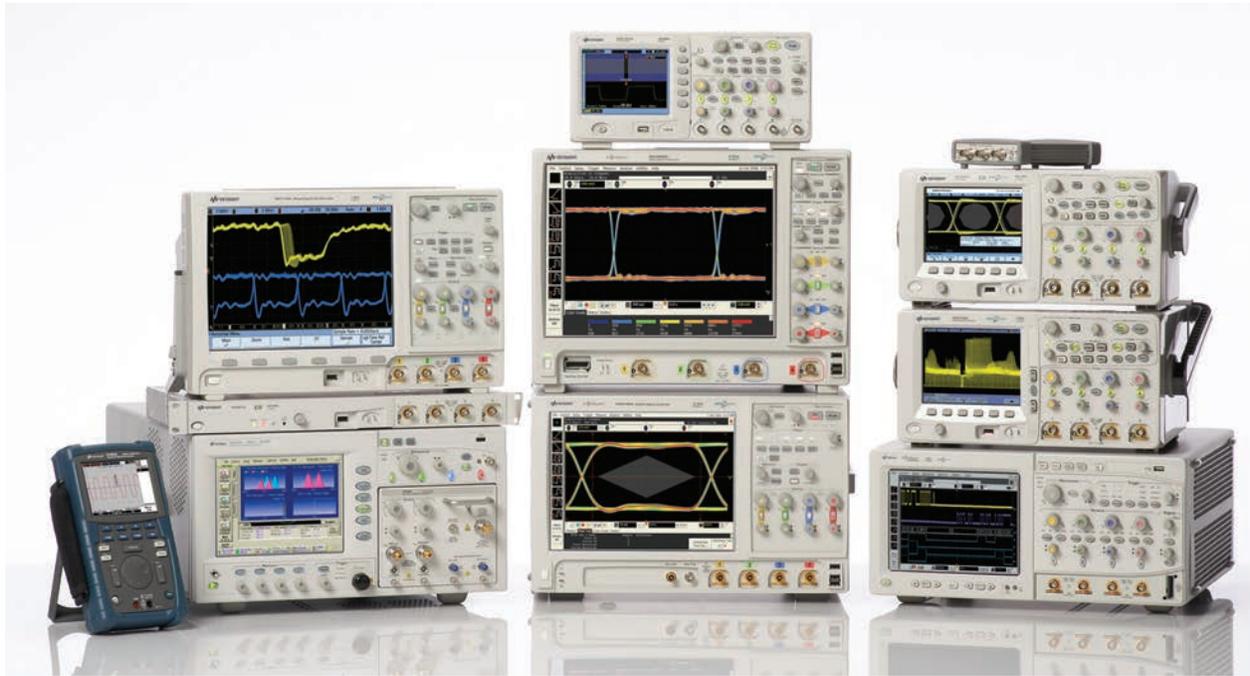


Quickly remove your hard drive for additional security.

## Infiniium 90008 Low-Profile Oscilloscopes/Digitizers

### Infiniium DSO90000A Series oscilloscopes (Continued)

Factory installed option for new purchases	User installed standalone product number	SW applications
	E2681A	EZJIT jitter analysis software
	E2688A	High-Speed serial data analysis with clock recovery and 8b/10b decoding
	N5400A	EZJIT Plus jitter analysis software
	N5403A	Noise reduction and bandwidth control option
	N5391A	Low-speed serial data analysis for I <sup>2</sup> C/SPI
	N5402A	Automotive serial data analysis for CAN/FlexRay
	N5414A	InfiniiScan event identification software
	N5430A	Infiniium user-defined function application software
	N5452A	Infiniium application remote program interface software
	N5461A	Serial Data Equalization
	N5465A	Basic InfiniiSim Waveform Transformation Toolset
	N5465A	Advanced InfiniiSim Waveform Transformation Toolset
	N5462A	RS-232/UART serial decode and trigger
	N5464A	USB serial trigger and protocol viewer
	N5463A	PCI Express® serial trigger and protocol viewer
	N8801A	SATA triggering and decode
	N8802A	MIPI™ D-PHY <sup>SM</sup> trigger and decode
	N5392A	Ethernet electrical performance validation and compliance software
	N5393B	PCI EXPRESS electrical performance validations and compliance software
	N5399A	HDMI electrical performance validation and compliance software
	N5409A	Fully buffered DIMM compliance applications
	N5410A	Fibre channel compliance applications
	N5411A	Serial ATA electrical performance validation and compliance software
	N5412A	Serial attached SCSI (SAS) electrical performance validation and compliance
	U7232A	DisplayPort compliance test software
	N5416A	USB 2.0 compliance test software
	N5431A	XAUI electrical validation with 10GBASE-CX4, CPRI, OBSAI, and Serial RapidIO
	U7233A	DDR1 compliance test applications
	N5413A	DDR2 compliance test applications
	U7231A	DDR3 compliance test applications
	N5394A	DVI compliance application
	U7238A	MIPI compliance test application
	U7236A	10GBASE-T Ethernet Electrical Compliance Application
	N5411B	SATA 6G Compliance Test Software
	N5467A	User-definable application
	U7243A	USB 3.0 Compliance Test Software
061		MATLAB - Basic Digital Analysis Package
062		MATLAB - Standard Digital Analysis Package



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Multiple form factors from 20 MHz to > 90 GHz | Industry leading specs | Powerful applications

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U1061A	U1064A	U1062A	DSO6104L	U1065A	DSO90808A	DSO91208A	DSO91308A
							
1 GHz	1 GHz	2 GHz	1 GHz	3 GHz	8 GHz	12 GHz	13 GHz
2 GSa/s	4 GSa/s	4 GSa/s	4 GSa/s	8 GSa/s	40 GSa/s	40 GSa/s	40 GSa/s
8 bits	8 bits	10 bits	8 bits	10 bits	8 bits	8 bits	8 bits
2 channel	4 channel	2 channel	4 channel	4 channel	8 channel	8 channel	8 channel
16 M	32 M	512 M	8 M	1 G	1 G	1 G	1 G



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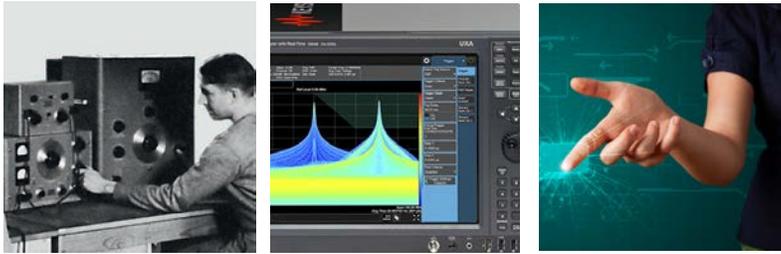


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