

# Infiniium 9000 Series Oscilloscopes



Engineered for broadest  
measurement capability



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## If You Haven't Purchased a Keysight Scope Lately, Why Should You Consider One Now?

If you're like most engineers, you never know what your next project will demand from you. You need an oscilloscope that can adapt to a wide variety of debug and test challenges.

That's why we designed our new Infiniium 9000 Series oscilloscope to meet a full range of needs.

First we built in the powerful features you'd expect in any Infiniium scope. Then we engineered the scope for the broadest measurement capability, so it would be the most indispensable tool in your arsenal.

There is no better way to experience the superiority of the Infiniium 9000 Series scopes than to see it. Contact Keysight Technologies, Inc. today to request an evaluation.

There is no better way to experience the superiority of the Infiniium 9000 Series scopes than to see it. Contact Keysight today to request an evaluation. Or visit: [www.keysight.com/find/9000](http://www.keysight.com/find/9000)



The Infiniium 9000 Series offers bandwidths up to 4 GHz. Each model, equipped with a large 15" XGA LCD display, comes in a whisper-quiet package that is just 9" (23 cm) deep and weighs only 26 pounds (11.8 kg).

Model	Analog bandwidth	Analog sample rate 4-channel/2-channel	Standard memory 4-channel/2-channel	Scope channels	Logic channels
DS09064A	600 MHz	5 GSa/s/10 GSa/s	20 Mpts/40 Mpts	4	–
MS09064A	600 MHz	5 GSa/s/10 GSa/s	20 Mpts/40 Mpts	4	16
DS09104A	1 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	–
MS09104A	1 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	16
DS09254A	2.5 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	–
MS09254A	2.5 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	16
DS09404A	4 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	–
MS09404A	4 GHz	10 GSa/s/20 GSa/s	20 Mpts/40 Mpts	4	16

# What Makes The Infiniium 9000 Series The Go-To Scope For A Whole Range of Test And Debug Challenges?

## It's three instruments in one

1. Scope: The powerful features of our Infiniium Series oscilloscopes coupled with superior specifications give you precise signal representation.
2. Logic analyzer: Fast deep-memory digital channels let you see critical data values and timing relationships.
3. Protocol analyzer: The world's first scope-based protocol viewer with multi-tab viewing. Quickly drill and move between protocol and physical layers.

## It offers the widest range of debug and compliance application software

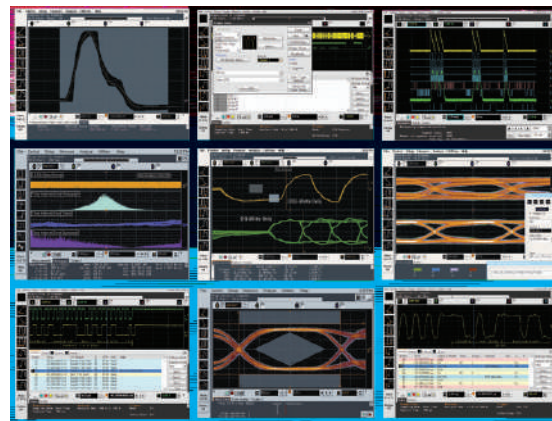
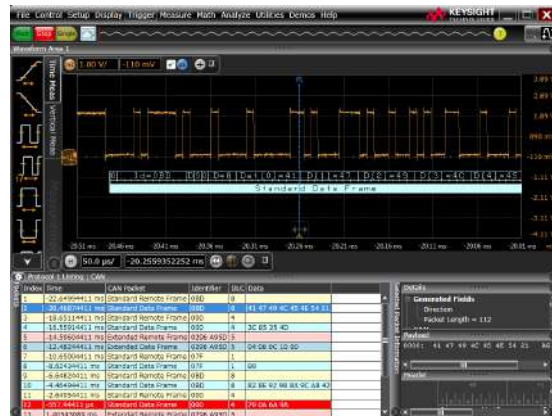
Need accurate answers to your measurement questions? The Infiniium 9000 Series offers the largest range of application-specific software for debug, analysis and compliance testing. Which application is right for you? Take a look at the possibilities on pages 7 to 12.

## It's sized to fit your environment

Limited bench space? It has a small footprint and thin profile  
Height: 12.9" (33 cm); width: 16.8" (43 cm); depth: just 9" (23 cm)

Need to share the scope? It's light weight: 26 lbs. (11.8 kg)

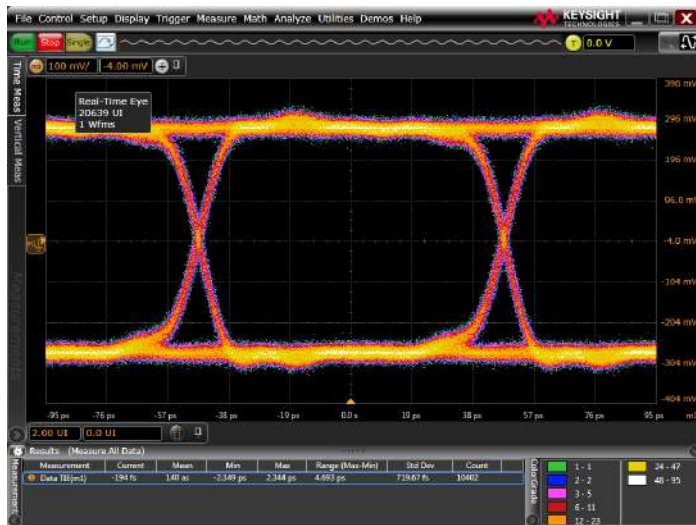
Need to see lots of signals? It has the biggest screen: 15" (23 cm) XGA



# It's Three Instruments in One

## 1. Oscilloscope

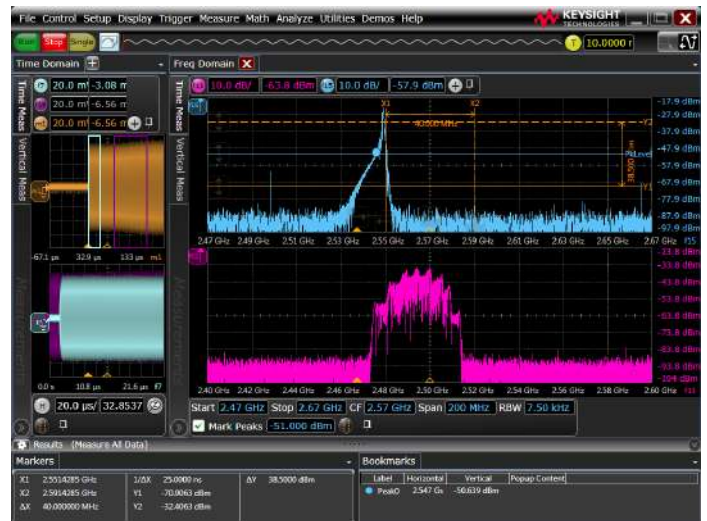
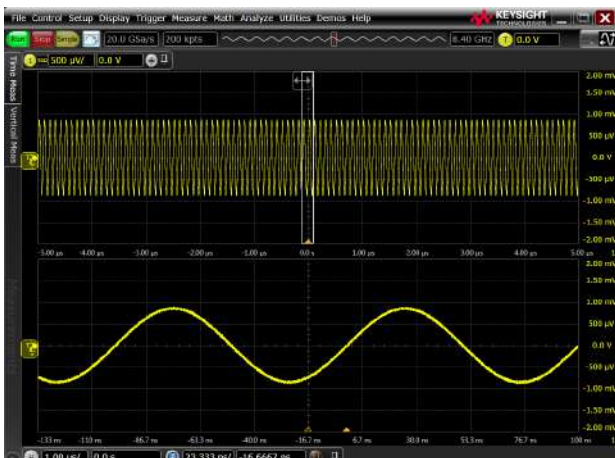
High-performance scope channels ensure superior viewing of signals under test. All models incorporate a powerful, feature-packed Infiniium oscilloscope with responsive deep memory.



Up to 4 GHz bandwidth and 20 GSa/s high sample rates guarantee you'll see a precise representation of the analog characteristics of signals you're testing.

## Responsive deep memory

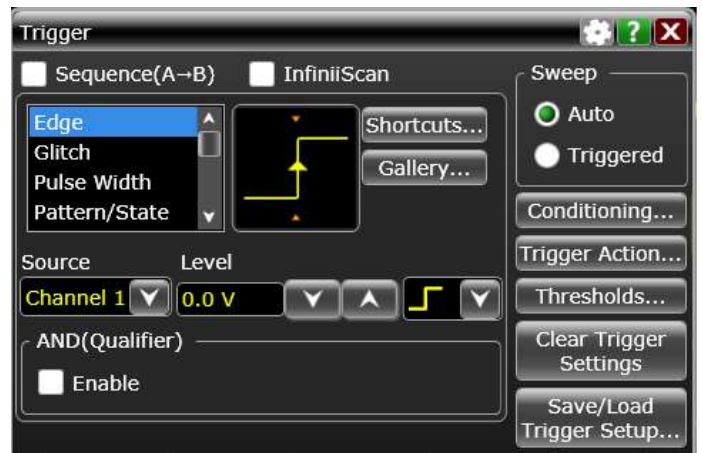
With standard 20 Mpts/ch, and up to 1 Gpts/ch of memory, you can capture long time periods while retaining fast sample rates. Fast update rates mean your scope stays responsive with deep memory on, ensuring precise representation of analog signals.



Mask tests, histograms and a wide variety of functions such as the gated FFTs in the above image provide deep signal analysis.

## Advanced triggering

Advanced triggers are essential when you are investigating suspected problems. Infiniium offers a full range of advanced triggers to help you isolate and capture the condition you need to characterize. The 9000 Series simplifies trigger setups by using intuitive dialog boxes with descriptive graphics.

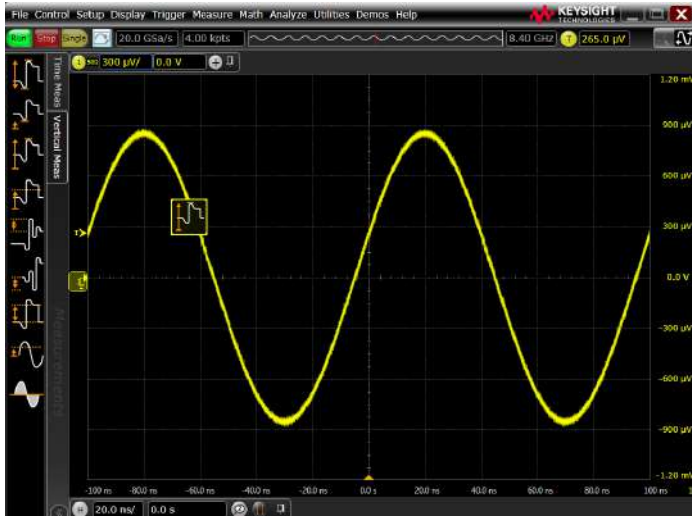


## It's Three Instruments in One (Continued)

### 1. Oscilloscope (Continued)

#### Drag and drop measurements

It's simple: drag an icon from the measurement bar and drop it on the cycle you want to measure. You can make up to ten measurements on your waveforms. All of the measurements appear at the bottom of the display with statistics and are color-coded to the channel you are measuring.

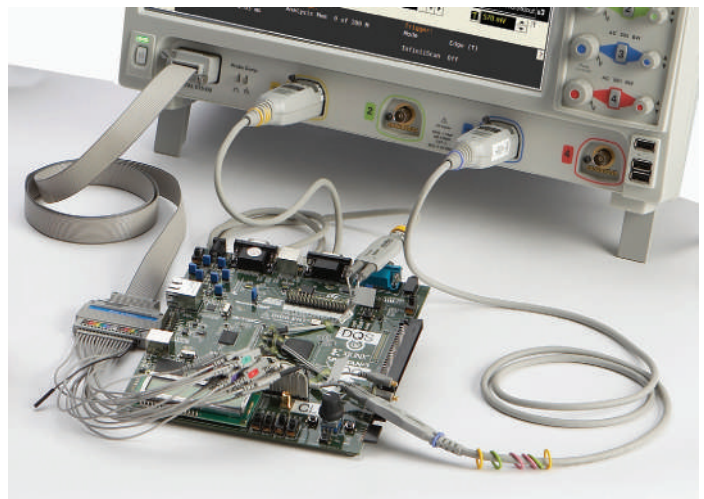


### 2. Logic analyzer

MSO models add 16 high-speed timing channels with standard 128 Mpts digital memory, allowing you to retain fast 2 GSa/s sample rates over long periods of time.



Use the timing channels to evaluate control signal relationships and data buses up to 16 bits wide. Use symbols to more quickly interpret waveforms.



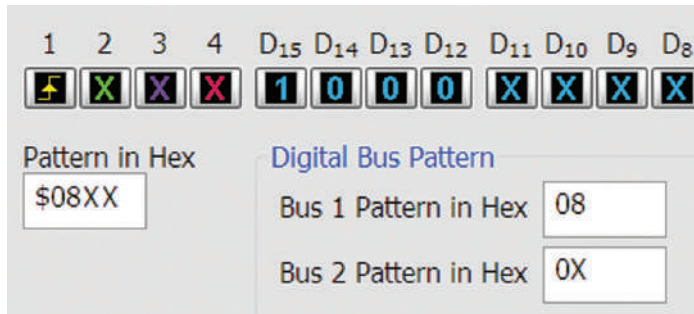
Designing with Xilinx FPGAs? Use the FPGA dynamic probe for rapid internal FPGA measurements. Using I<sup>2</sup>C, SPI, RS-232, or low- or full-speed USB? Use the digital channels to acquire and decode these buses, preserving analog channels for other time-correlated measurements.

# It's Three Instruments in One (Continued)

## 2. Logic analyzer (Continued)

### Digital and mixed-signal trigger

Trigger on and display individual signals or buses. With precise time-correlation between analog and digital signals, confidently trigger across any combination of analog and digital signals simultaneously.



### Waveform and listing windows

View buses as waveforms or easily follow events in the listing window expandable to the entire display. A blue tracking marker provides time-correlation between waveform and listing displays.



### Industry's only segmented memory for both analog and digital channels

Capture short bursts without consuming memory during periods when the trigger condition is not met. Keysight is the only vendor that supports segmented memory capture on both analog and digital channels.



# It's Three Instruments in One (Continued)

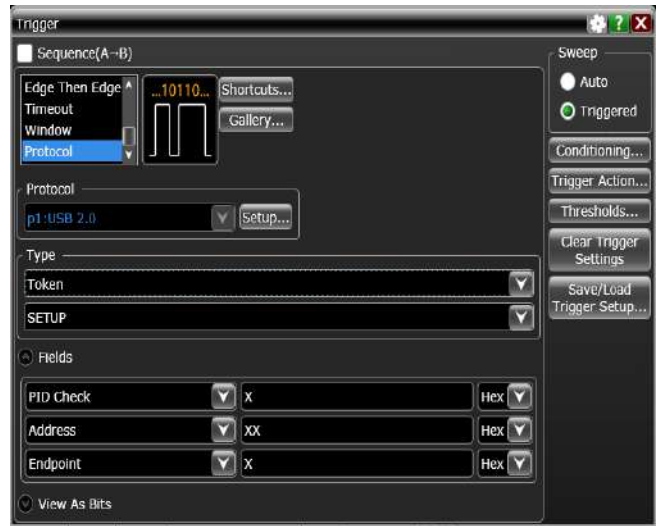
## 3. Protocol analyzer

Does your design include a serial bus that is a key point for testing or debugging? Add protocol analysis capability to your scope for:

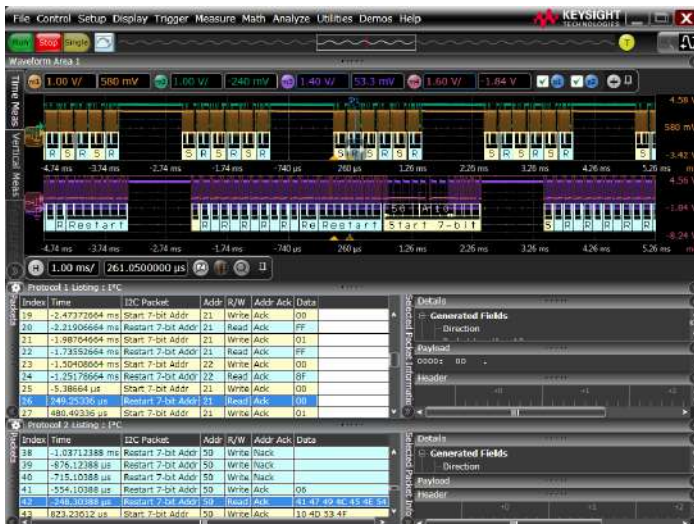
- CAN
- PCIe
- digRF
- FlexRay
- RS-232/UART
- I<sup>2</sup>C
- SATA
- JTAG
- SPI
- LIN
- USB
- MIPI D-PHY
- 8B/10B



Quickly move between physical and protocol layer information using the time-correlated tracking marker. Display protocol content using waveform symbols and the industry's first multi-tab protocol viewer. The packets tab shows a high level view of the packet over time.



Protocol-level triggering makes it easy to isolate events with pinpoint accuracy.



Use any combination of analog or digital channels for serial protocol decode, with up to four buses decoded simultaneously.

The screenshot shows the Payload Header tab in the protocol analyzer. It displays a databook format for the packet header. The header is divided into four sections: PID, PID Check, Address, and Endpoint, each with a CRC field. The CRC values are 0x0, 0x2, 0x00, and 0x02 respectively.

+0							+1							+2							+3													
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0			
PID							PID Check							Address							Endpoint							CRC						
0xD							0x2							0x00							0x0							0x02						

Header tab shows packets in a databook format. Hovering on any tab reveals additional detail.



# Keysight Infiniium 9000 Series Oscilloscopes

Comprehensive built-in information system gives you fast answers to your questions. The task-oriented setup guide provides step-by-step instructions for several measurement procedures.

15" XGA display makes it easier to view analog, digital and serial signals.

Touchscreen display comes standard for mouse-free operation.

Drag-and-drop measurements from the measurement bar provide an intuitive way to make a measurement on a particular cycle of your waveform.

Mixed-signal oscilloscope (MSO) models seamlessly integrate four analog scope channels with 16 digital channels.

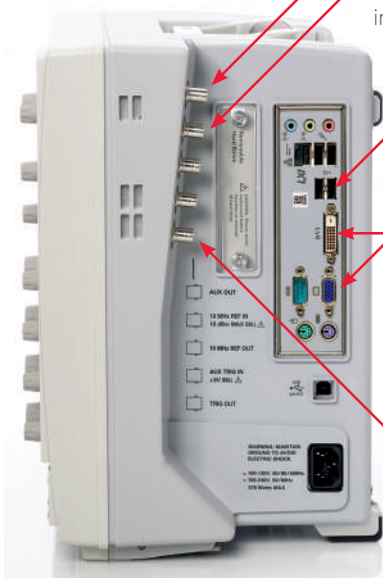
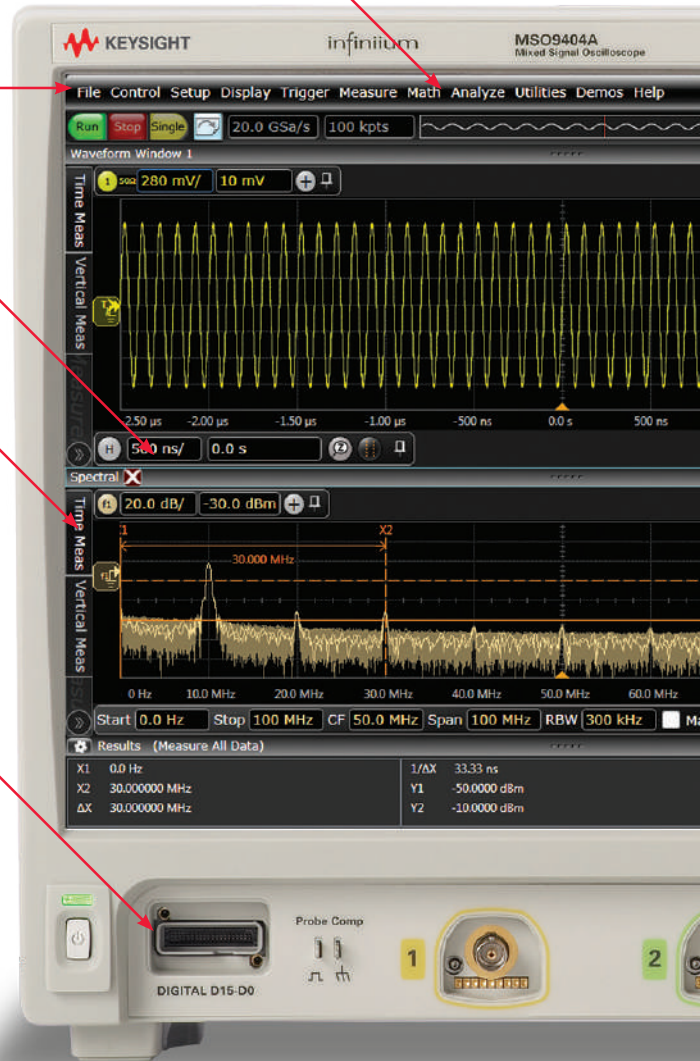
AUX OUT for calibration

Built-in 10-MHz reference in/out port synchronizes multiple measurement instruments in a system.

Standard USB and LAN ports provide PC and printer connectivity.

XGA and DVI video output port lets you connect to an external monitor.

Trig in/out ports provide an easy way to synchronize your scope to other instruments.



Dedicated **single acquisition button** provides better control to capture a unique event.

**MegaZoom instant response and optimum resolution** allows you to pan and zoom quickly.

Pressing **horizontal delay knob** sets the delay to zero. A **zoom button** provides quick access to two screen-zoom modes.

**Autoscale** lets you rapidly display any analog or digital active signals, automatically setting the vertical, horizontal and trigger controls for the best display, while optimizing memory.

**Digital channel button** provides quick setup access.

**Serial decode button** enables quick setup access.

**Dedicated per-channel front panel controls** make it easy to access the vertical and horizontal scaling and offset.

**Quick access to fine/vernier control** by pressing the horizontal and vertical sensitivity knobs.

**AutoProbe interface** automatically configures the attenuation ratio of the probe and provides probe power for Keysight's active probes.

**Built-in USB ports** makes it easy to save your work and update your system software quickly.

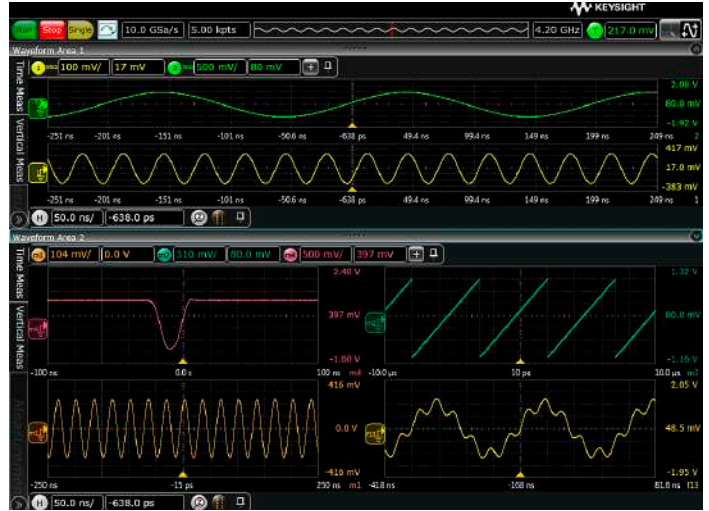


Accessory pouch detaches easily.

# User Interface

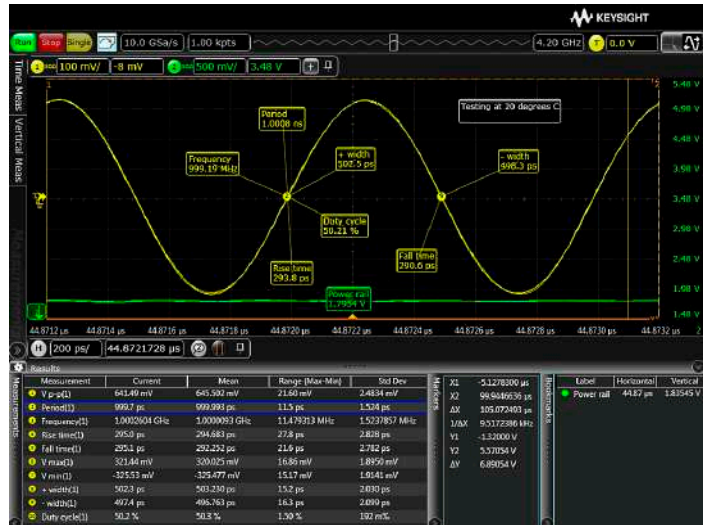
## Personalized viewing

- Determine how much space to give to results versus waveforms using sliders
- View waveforms on the same graticule or separate them with up to 16 waveform viewing areas
- Plug in a second monitor for even more customization of the interface



## Faster and better documentation

- Select from over 50 measurements. View up to 20 measurements at once, with statistics
- Select from over 40 automatic math functions, and display up to 16 at once on screen
- Vertical and horizontal scales on axes
- Add annotations using bookmarks, measurement callouts, and dynamic delta marker readouts
- Right-click to copy image without ever having to save to a file
- Quickly save all waveforms, memories, functions, and setups in a single .osc file for later recall on an oscilloscope or PC
- Save screen images as .jpg, .png, .gif, or .tiff



## Best usability, including touch screen

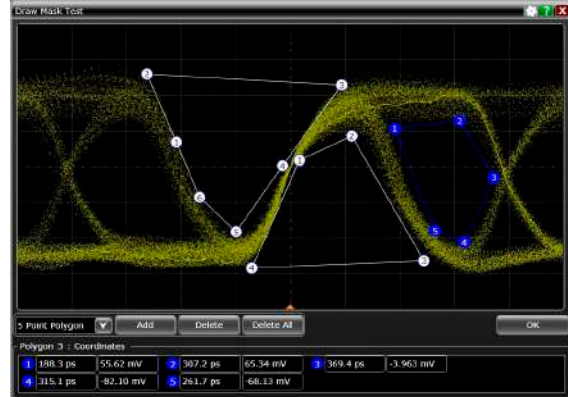
Extensive research testing led to several touch-screen innovations not found in other oscilloscopes.

- Click once to see handles that enable touch manipulation of markers, trigger level, and waveform-tasks that previously required a mouse
- Multi-touch support for multi-touch (gestures) such as zooming and panning
- Auto-sizing when touch button is turned on/off optimizes fields for fingers or a mouse
- Traditional menu operation to quickly find settings or advanced features



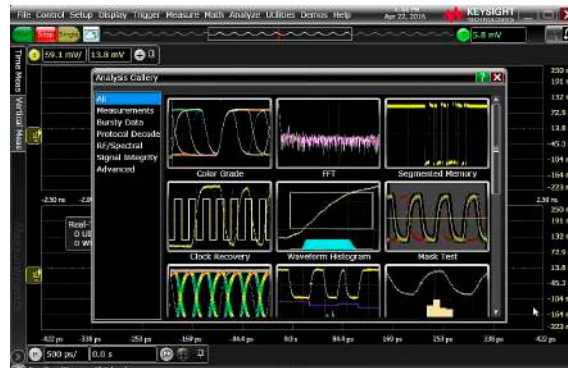
## Custom mask editor

Drag and drop up to 15 points on screen to create mask files in seconds.



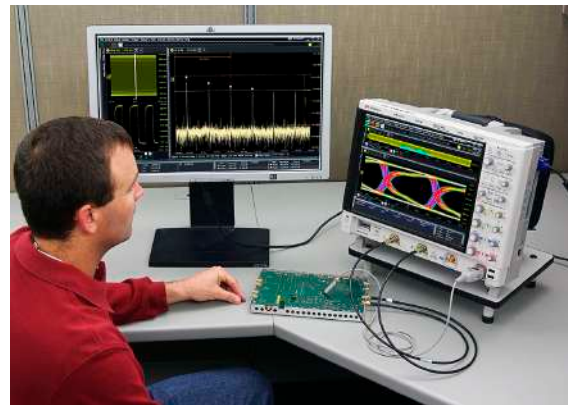
## Analysis gallery

Easily find and run the test you need from the list of analysis/measurement options represented graphically in the analysis gallery.



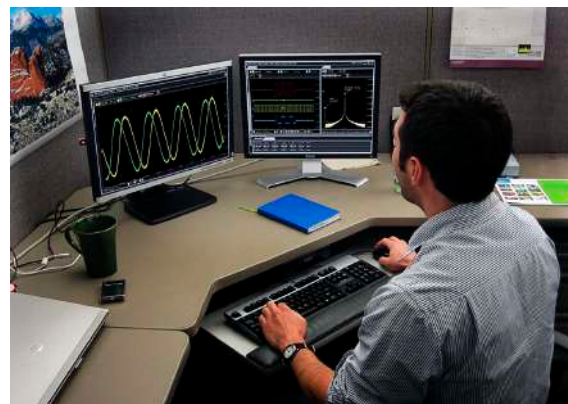
## Using an external monitor

Undock and move a window to an external monitor using tabbed layout. The S-Series supports both VGA and DisplayPort IO.



## Infiniium offline application

View and analyze results at your desk. Save your oscilloscope file, then view and analyze on your PC without needing additional access to your scope. Use waveform math, filtering, and FFT spectral analysis and to get more insight. Need to see protocol decode, analyze jitter, or view eye diagrams? Infiniium Offline helps you get insight into all of these areas. See the ordering guide for details.

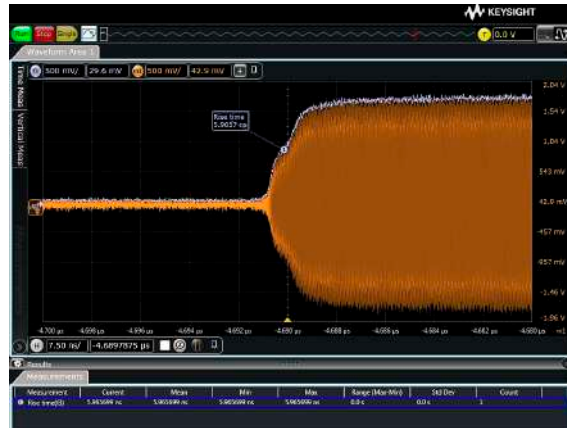


# RF Measurement Capabilities

With a built-in spectral viewer, controls, gated FFTs, 10-bit ADCs, and excellent SFDR values, the S-Series oscilloscopes provide an excellent scope platform for FFT measurements.

## FFTs

Need to see frequency domain in addition to time domain? The standard spectral viewer includes FFT controls like start/stop RBW and CF/span. Readout includes power and frequency axis annotation and a peak table.



## Gated FFTs

Infiniium supports gated math and analysis including FFTs. Use any of the standard 16 independent gates to narrow FFT computations to a specific time window. Drag the gate in the time domain and see time correlated FFT measurements for specified time periods. The example at the right shows two simultaneously gated FFTs.



## Envelope measurements

Need to see the rise time of a burst? Add a rise time measurement to an envelope function that provides an AM demodulation of a burst.

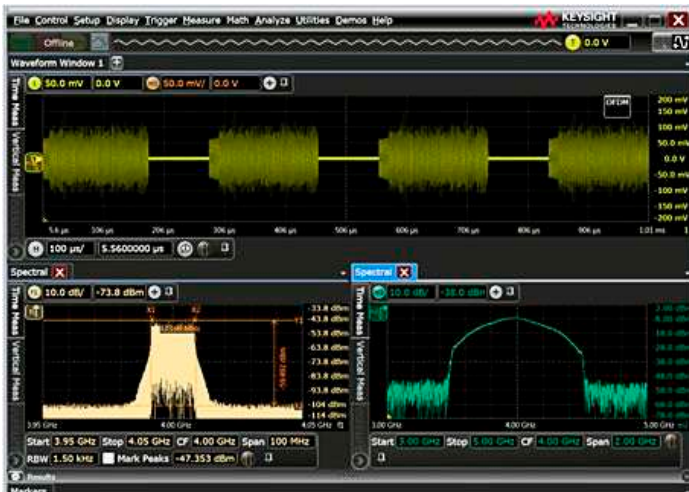


# Wideband and Multi-Channel FFTs

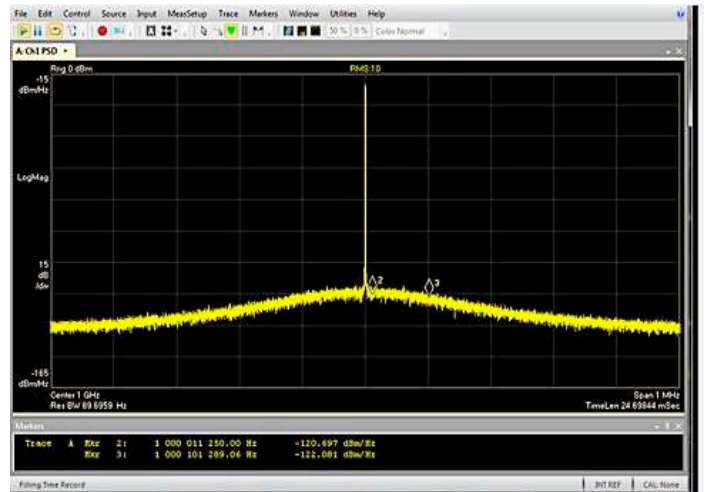
Need to see >1 GHz signal spectral bandwidth and/or multiple FFTs simultaneously? Oscilloscopes offer wider bandwidth than spectrum analyzers and come standard with four ports (channels) per instrument. The Infiniium S-Series enables users to make wideband measurements up to 8 GHz and view up to 16 simultaneous FFTs. Analyze even higher bandwidth signals by using a downconverter.

Trying to interpret traditional oscilloscope time-domain specifications can be challenging in determining if a specific scope can be recommended for RF/uW/mmW measurements. With correction filters, low-noise front end, and the 10-bit ADC, S-Series oscilloscopes can be used for wideband RF applications. Typical RF characteristics for the S-Series are listed in the performance characteristics section, with graphs below showing some characterization results.

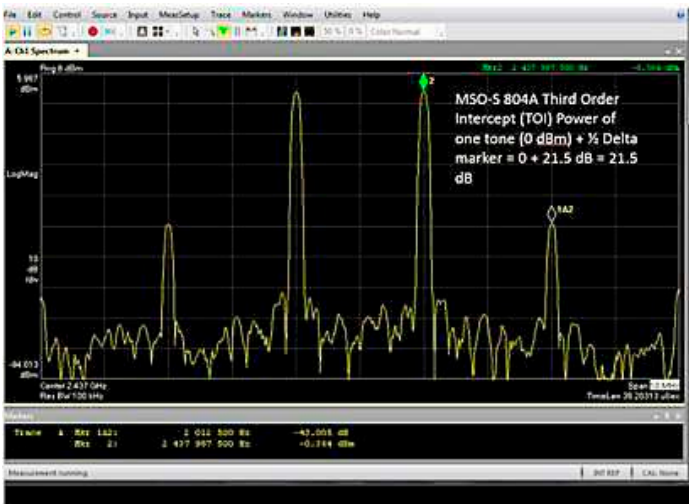
Additionally, you can expand your oscilloscope with the 89601B vector signal analysis software. This application takes data from the scope and provides spectrum analysis and digital modulation analysis for wireless communication.



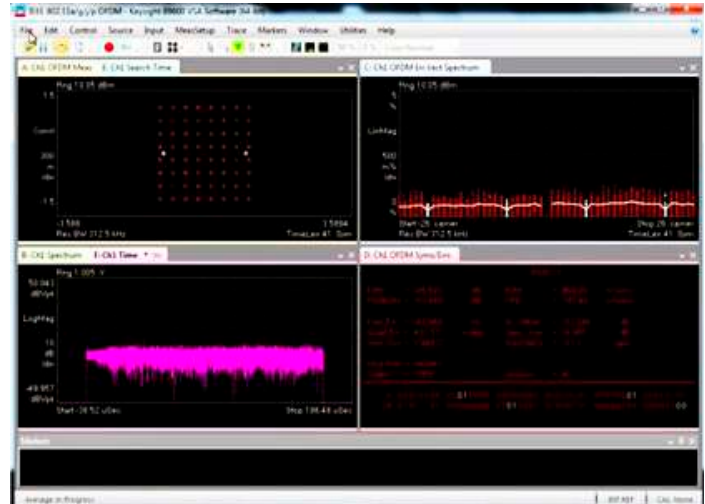
Use Infiniium capture and analysis of radar bursts, as shown in this OFDM example.



Using data acquired from S-Series, VSA shows phase noise of -121 dBc/Hz at 10 kHz and -122 dBc/Hz at 100 kHz.



Using data acquired from S-Series, VSA shows an excellent TOI value of 25 dBm.



Using data acquired from S-Series, VSA shows an EVM for IEEE 802.11 QAM 64 of 0.47%.

## Analysis Applications

The S-Series scope comes with a variety of analysis capabilities standard, but some more specialized tools are available as options. These are specialty tools designed to help you gain additional, rapid insight to your designs. See the ordering guide section for ordering information.

### Serial data analysis

Provided standard on all S-Series oscilloscopes, High-speed Serial Data Analysis (SDA) software provides you with a fast and easy way to pinpoint signal integrity problems and validate performance for serial interface designs. A wizard walks you quickly through the steps required to setup and perform a measurement. Intuitive displays and clear labeling of information make it easy to comprehend measurement results. Perform mask testing, characterize serial data that employs embedded clocks, and decode 8b/10b data.

### Eye mask tests

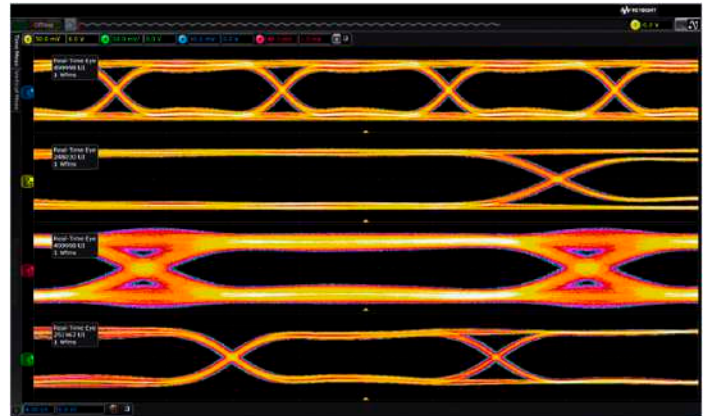
If you identify a failure of an eye mask, you can unfold the eye diagram to show the specific unit interval that caused the failure. When used with the 8b/10b decoding feature you can identify data dependent errors that result in eye mask violations caused by Inter-Symbol Interference (ISI).

### Real time eye diagrams

SDA provides a real-time eye menu. The menu is located in the display menu under color grade view. Use this menu to change scaling, look only at worst case edges, and decide which bits you want to include in your real-time eye.

### Clock recovery

You can choose constant-frequency, first-order phase-locked loop (PLL), or second-order PLL clock recovery. You can adjust the center frequency and bandwidth, and in the case of second-order PLL, the damping factor. For PCI Express, the clock recovery algorithm specified by the PCI-SIG® is provided. A specific clock recovery algorithm is also available for SATA, HDMI, MHL, DisplayPort, USB, PCI Express, CEI, Fibre Channel, FlexRay, and MIPI® technologies. When you choose PLL clock recovery, the clock recovery algorithm requires some time at the start of each record to lock to the data. This interval cannot be viewed or analyzed. The serial data wizard will indicate the required time period for the clock recovery algorithm to lock.



## User defined function

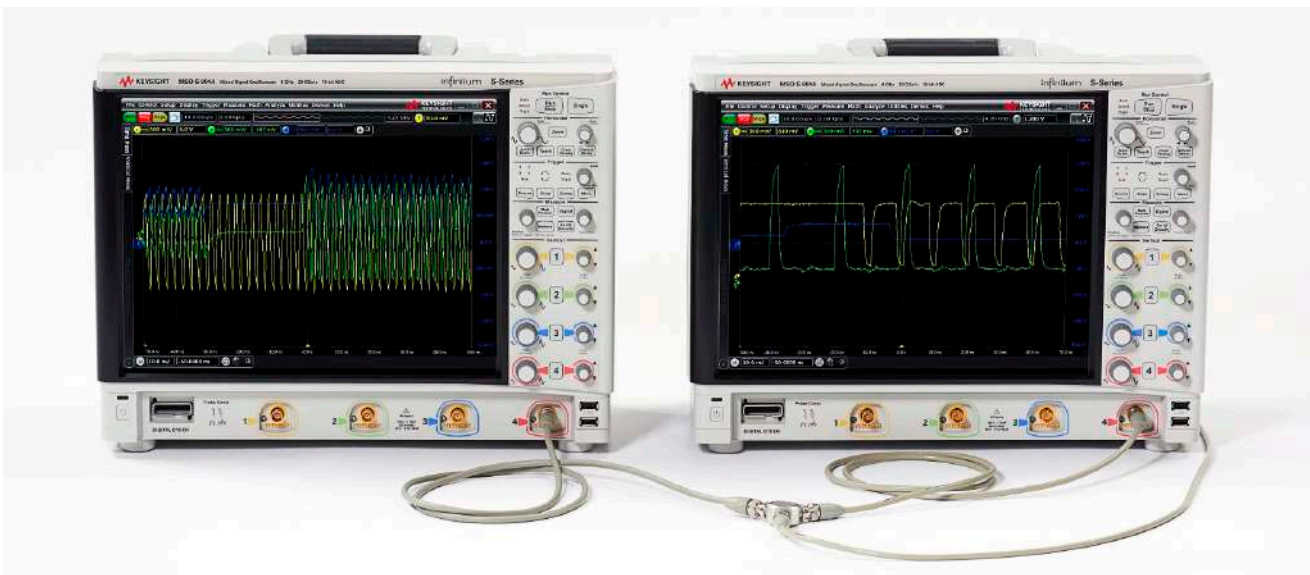
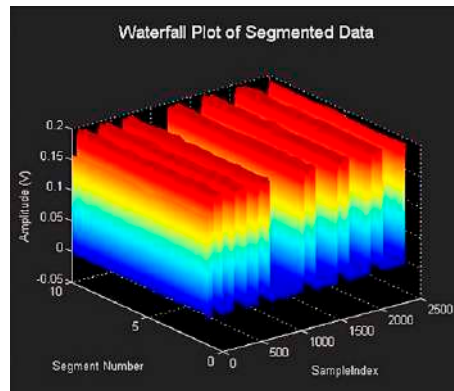
Have you ever wanted to create your own math functions or filters for your specific needs? Now, Keysight and MathWorks have teamed up to offer the perfect solution to meet your specific needs – on demand. User Defined Function for editing and execution allows you to create and execute your own custom math and analysis functions using the power of the MATLAB software environment all in a single software package. Keysight's UDF allows you to display your math and analysis functions created in MATLAB live on the oscilloscope screen, just like any of the scope's standard functions. Or, you can interactively analyze and visualize your results in the MATLAB environment, with capabilities such as graphically plotting results or automatically generating reports. View the page and datasheet for N6171A to determine what version of MATLAB is right for you if you don't have a license already.

## MultiScope

Need more than four simultaneous oscilloscope channels? MultiScope allows connection of 2 to 10 oscilloscopes to achieve up to 40 channels on a single timebase. Each oscilloscope is daisy chained via cables and power splitters to the first oscilloscope, called the leader.

Automated calibration is available to allow channel correlation across frames down to less than 1 ps. All oscilloscopes connect to a control PC via LAN or USB. The PC runs the Infiniium user interface and shows all waveforms, measurements and analysis in addition to controlling the oscilloscope settings. The leader can also work as the controller in the absence of a control PC. If your need for more than four simultaneous channels goes away, each oscilloscope can be used independently and then brought back together when there are future needs for more than four channel measurements.

```
Editor - D:\Applications\MATLAB\R2006a\work\Butterworth.m
File Edit Text Go Cell Tools Debug Desktop Window Help
1 % -----
2 % Filter developed in the
3 % MATLAB software environment.
4
5 % Filter order
6 - N = 2;
7
8 % Determine cutoff frequency
9 - BitRate = Control1;
10 - Fc = BitRate/2;
11
```





## Jitter and Phase Noise

D9010JITA offers advanced statistical analysis of high speed digital interfaces in the vertical (voltage) and horizontal (time) domains, as well as phase noise analysis. The result: the industry's most complete jitter and noise analysis software for real-time oscilloscopes.



## Power Integrity

D9010POWA is a powerful tool for analyzing power supply induced jitter or switching current loads on a DC supply due to its ability to analyze adverse interactions and their effects without the need for simulation or complex modeling. Together with an N7020A or N7024A power rail probe, you get an even more powerful means of measuring and analyzing power integrity.



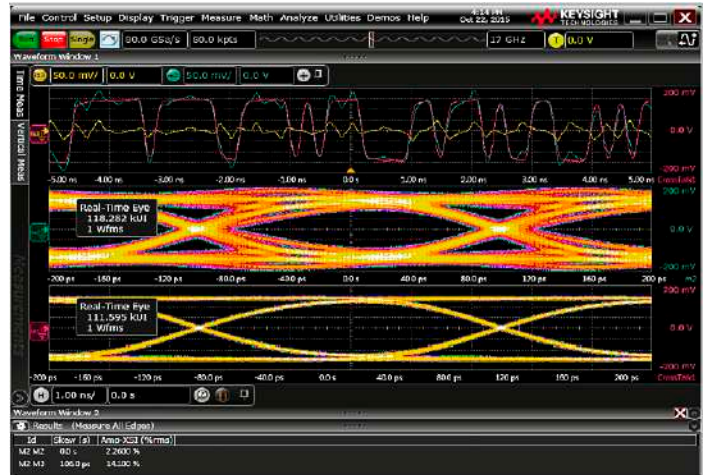
## De-Embedding

D9010DMBA includes PrecisionProbe and InfiniiSim Basic, two tools designed to de-embed the effect of cables and fixtures from measurements. PrecisionProbe allows you to characterize the response of a probe or cable; InfiniiSim basic lets you model out probes or cables from a measurement.



## Crosstalk and Equalization

D9020ASIA is intended for anyone working in high speed digital applications where eyes are closed. As data rates go up, the signal deteriorates from the transmitter to the receiver due to ISI, noise, and other factors. The more loss that occurs, the more difficult it is for a receiver comparator to distinguish a “1” from a “0”. A high data rate coupled with a lossy channel will cause an open eye at a transmitter to be closed at the receiver. Equalization, InfiniiSim Advanced, and Crosstalk/Power Integrity packages enable deep analysis as to why an eye is closed, and what it will take to open it.



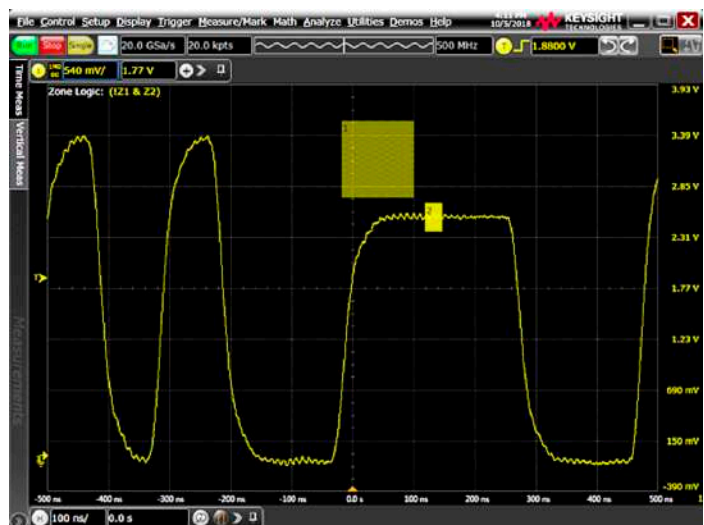
## PAM-N

The Keysight D9010PAMA PAM-N analysis software extends the ease-of-use advantages of the Infiniium oscilloscopes to the analysis of PAM-3 or PAM-4 signals. A wizard walks you quickly through the steps required to setup measurements for a PAM encoded signal, to select methods for clock recovery, and then the measurements you wish to have performed on your PAM signal. Our PAM software is also able to accurately set the individual threshold levels of your PAM signal and render each individual eye.



## InfiniiScan

D9010SCNA uses software to overcome the limitations of hardware triggering. InfiniiScan inspects individual waveforms and lets you know where the anomalies are, moving an oscilloscope a few steps closer to the ideal of a “Find Problem” button. InfiniiScan can also isolate events as narrow as 35 ps – well beyond the limitations of hardware-based approaches. InfiniiScan consists of two key components: software finders and measurement limit testing. An added benefit is the ability to add InfiniiScan as an extra trigger stage, allowing up three-stage triggering.



## User Defined Application

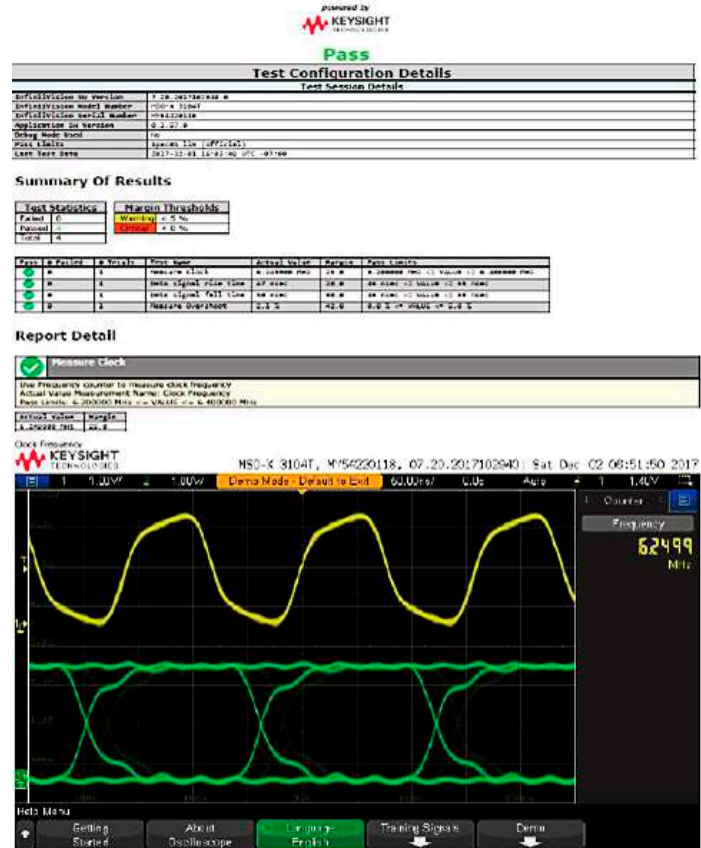
D9010UDAA is an easy-to-use tool that lets you generate custom GUIs for test automation applications with minimum programming. It provides full automation, including the ability to control other Keysight instruments, external applications such as MATLAB, and your DUT software. UDA also provides the ability to add custom tests to your compliance applications. You can automate testing, generate reports, test consistently across your organization, control switch matrices for multi-lane testing, all while adding analysis to your compliance or debug software.

## External Mixing Assistant (for E-band test)

The E-band signal analysis reference solution combines the power of Keysight software and hardware to deliver an integrated solution.

Using an S-Series oscilloscope, D9010EXMA software, an external mixer, and signal generator provides an integrated block down-conversion system that delivers 2.5 GHz of analysis bandwidth over the E-band frequency range of 55 to 90 GHz.

### User Defined InfiniVision. Test Report



## Protocol Applications

Does your design include a serial bus that is a key point for debug or test? Use one of Keysight's protocol decoding and triggering application packages for increased productivity. The software converts DSO or MSO physical layer acquisitions into packets for specific protocols. Specify trigger conditions at the packet level. Quickly move between physical and protocol layer information using the time-correlated tracking marker. Display protocol content in waveforms and/or listing.

The table below shows what protocols are available for the S-Series; refer to the configuration guide to learn what specific option model numbers to order. Use those model numbers to find respective data sheets for protocol specifications.

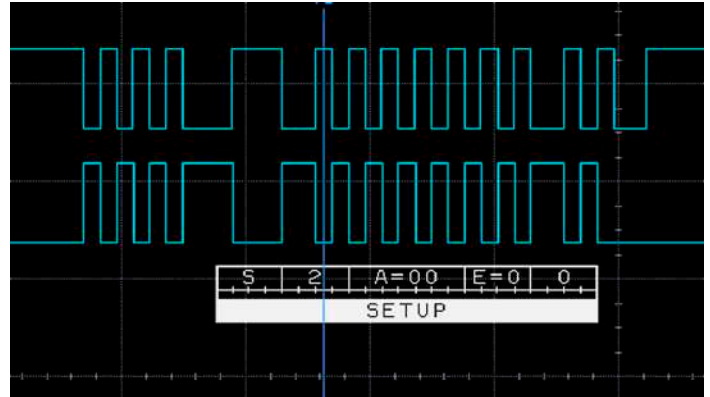
Low Speed Protocols	MIPI
I2C	C-PHY
SPI	D-PHY
Quad SPI	RFEE
eSPI	I3C
Quad eSPI	SPMI
RS232/UART	LLI
I2S	UFS
SVID	M-PHY CSI-3
JTAG	DigRF v4
Manchester	UniPro

Automotive	Military / Aero
CAN / CAN FD	ARINC 429
LIN	MIL STD 1553
FlexRay	SpaceWire
SENT	
Automotive Ethernet	

USB	Embedded
USB 2.0	PCIe Gen 1/2
USB 3.0	10/100 Ethernet
USB 3.1	
USB-PD	
USB SSIC	



## Oscilloscope Portfolio Comparison

Keysight offers a wide range of oscilloscopes at all performance levels, from 70 MHz to 110 GHz. See below for similar oscilloscopes to the 9000 Series or visit our website for the full portfolio.



	6000 X-Series	S-Series	V-Series
Optimized for	Fastest update rate	Signal integrity	Signal integrity
Bandwidth	1 GHz – 6 GHz	500 MHz – 8 GHz	8 GHz – 33 GHz
Max memory (2 ch)	4 Mpts	820 Mpts	2 Gpts
ADC Bits	8	10	8
Inputs	50Ω, 1 MΩ	50Ω, 1 MΩ	50Ω
Operating System	Embedded	Windows 10	Windows 10
Hard drive	None	256 GB Removable SSD	512 GB Removable SSD
Motherboard	N/A	Quad core i5, 8 GB RAM	Quad core i5, 16 GB RAM
Data offload	USB 2.0, 100BASE-T LAN	USB 3.0, 1000BASE-T LAN	USB 3.0, 1000BASE-T LAN



## Infiniium 9000 Series Ordering Guide and Information

Ordering your 9000 Series oscilloscope couldn't be easier. Select a model, memory options, probes, accessories, and software. These pages will describe your options. Contact your Keysight representative or authorized partner for more information, or to place an order: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

### Standard accessories

All models ship standard with four N2873A 500 MHz passive probes, probe accessory pouch (mounts on rear of instrument), Keysight I/O libraries suite, localized power cord, front panel cover, keyboard, mouse, and stylus. User guide and programmer's guide ship on oscilloscope hard drive. Service guide available on Keysight.com. MSO models additionally ship with channel flying lead set logic probe, MSO cable and calibration fixture.

### Main model configuration

All 9000 Series models have 4 analog channels. MSO models include 16 digital channels. Bandwidth can be upgraded post-purchase by returning the unit to a Keysight service center. MSO upgrades ship with a license key and MSO cable. For information on bandwidth and MSO upgrades, see the post-purchase upgrades section of this ordering guide.

9000 Series Model Numbers				
Model <sup>1</sup>	Bandwidth	Sample Rate <sup>2</sup>	Memory Depth <sup>3</sup>	10/90% rise time <sup>4</sup>
DSO9064A / MSO9064A	600 MHz	5/10 GSa/s	100 / 200 Mpts	540 ps
DSO9104A / MSO9104A	1 GHz	10/20 GSa/s	100 / 200 Mpts	253 ps
DSO9254A / MSO9254A	2.5 GHz	10/20 GSa/s	100 / 200 Mpts	142 ps
DSO9404A / MSO9404A	4 GHz	10/20 GSa/s	100 / 200 Mpts	85 ps

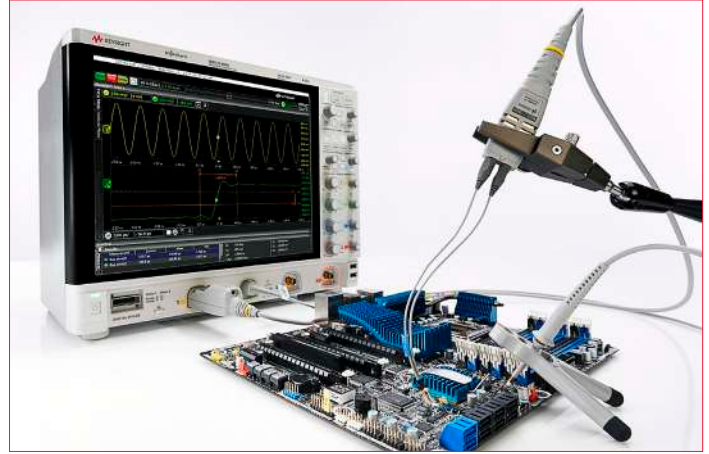
1. DSO and MSO models have 4 analog channels. MSO models include 16 digital channels.
2. Sample rate drops in half for four-channel use.
3. Memory depth drops in half for four-channel use.
4. Calculation based on 0.43/BW.

All 9000 Series models come standard with 100 Mpts of memory on four channels simultaneously, or 200 Mpts of memory when only two channels are active. That can be increased with these options:

9000 Series Memory Options	
200 / 400 Mpts (4 channel / 2 channel)	DSO/MSO9000A-200
500 / 1000 Mpts (4 channel / 2 channel)	DSO/MSO9000A-500

## Probes and Accessories

9000 Series oscilloscopes include both 1 M $\Omega$  and 50  $\Omega$  paths. This expands their flexibility by making them compatible with a wider range of probes than high-performance oscilloscopes that only support a 50  $\Omega$  path. All 9000 Series models ship standard with four 700 MHz passive probes and support a wide range of about 100 compatible current and voltage probes. The table below highlights probes commonly used with the 9000 Series. Read The Infiniium Oscilloscope Probes and Accessories guide for additional information, or visit the Probe Resource Center at [prc.keysight.com](http://prc.keysight.com).



### Infiniium Probes<sup>1</sup>

Description	Model(s)
Standard (free w/ scope)	N2873A
General purpose passive	N287xA, 10070D, 10073D, 1165A, N7007A
High voltage passive	10076C
Current	1146/47B, N2780/81/82/83B, N2893A, N7026A, N282xA, N704xA
Single ended active	N2795/96/97A, N7020/24A
Differential active	N2790/91A, N2818/19A, N2804/05A
InfiniiMode	N2750/51/52A
InfiniiMax	N2830A/31B/32B, 1130/31/32/34B, 1168/69B

1. Please reference document 5968-7141EN for a complete list of compatible probes and information.

### Calibration and Accessories

Description	Model(s)
ANSI-Z540 compliant calibration	DSO/MSO9000A-A6J
8U Rackmount kit	DSO/MSO9000A-1CM (or N2902B if purchased separately)
Removable 512GB SSD	DSO/MSO9000A-801
Additional 512 GB SSD (requires above)	N2155A
GPIB / LAN adapter	N4865A
Hard shell transit case	Sold separately by Gemstar, contact them directly for info

## Analysis software packages

Analysis Software Packages		
Option <sup>1</sup>	Description	Details
D9010JITA	EZJit Complete	Timing jitter, vertical noise, and phase noise analysis
D9010SCNA	InfiniiScan Trigger	InfiniiScan visual- and measurement-based triggering
D9010UDAA	User Defined Application	Remote measurement automation and test reports
D9010DMBA <sup>1</sup>	De-Embedding	PrecisionProbe and InfiniiSim Basic for modeling cables, probes and fixtures
D9010ASIA <sup>1</sup>	Advanced Signal Integrity	Equalization, InfiniiSim Advanced, Crosstalk, and Power Integrity
D9010POWA <sup>1</sup>	Power Integrity	Power integrity analysis (PSIJ, SSN, victim/aggressor, etc.)
D9010PAMA	PAM-N Analysis	PAM-4 measurements
D9010EXMA <sup>2</sup>	External Mixer Assistant	Wideband RF signal measurements

1. D9010ASIA is a superset of D9010DMBA and D9010POWA. You do not need to purchase both.
2. D9010EXMA is part of a larger E-Band signal analysis solution. Reference document 5992-1420EN to learn more.

## Protocol decode and trigger software packages

Does your design include a serial bus that is a key point for debug or test? Use one of Keysight's protocol decoding and triggering application packages for increased productivity. Specify trigger conditions at the packet level. Reference the table below to find the right solution for you!

Need more than one package? Check D9010BDLP to see if you can get them bundled together!

Protocol Decode/Trigger Packages		
Option	Description	Details
D9010LSSP	Low Speed Serial	I2C, SPI, Quad SPI, eSPI, Quad eSPI, RS232, UART, JTAG, I2S, SVID, Manchester
D9010EMBP	Embedded	PCIe Gen 1/2, USB 1.x and 2.0, 10/100 Mb/s Ethernet, USB-PD
D9010AUTP	Low Speed Automotive	CAN, LIN, CAN-FD, FlexRay, SENT
D9020AUTP	High Speed Automotive	100BASE-T1, formerly BroadR-Reach
D9010USBP	USB	USB 1.x, 2.0, 3.0, 3.1, 3.2 <sup>2</sup>
D9010MPLP	MIPI Low Speed	RFFE, I3C, SPMI
D9010MCDP	MIPI CSI/DSI	C-PHY <sup>2</sup> and D-PHY
D9010MPMP	MIPI M-PHY	DigRF, LLI, CSI-3, UniPro, UFS, SSIC
D9010MILP	Military	ARINC 429, MIL-STD 1553, SpaceWire
D9010PCIP	PCI and Storage	PCIe Gen 1/2/3/4 <sup>2</sup> , SATA, SAS
D9010BDLP <sup>1</sup>	Protocol Decode Bundle	Everything above except: SENT, 100BASE-T1, SpaceWire and Quad SPI <sup>3</sup>

1. D9010BDLP is only offered as a node locked license. See product's datasheet for more information.
2. C-PHY, USB 3.1 Gen2, USB 3.2, and PCIe Gen3/Gen4 it will not work on a 9000 Series. Consider a Keysight oscilloscope with higher bandwidth to test these protocols.



## Protocol Compliance Testing

All compliance applications can be ordered as fixed, floating, or server-based licenses. Many of these compliance applications listed below require other software options installed to work correctly. Please contact Keysight or reference the specific application's datasheet for ordering information. If viewing this document on a computer, all model numbers below are hyperlinks. BW denotes the minimum required bandwidth model to use the application. [SD] means "see datasheet", as there may be many factors that determine the right bandwidth for you.

Display	Option	BW
HDMI 1.4 <sup>1</sup>	N5399F	4 GHz

1. Only supports up to 749 Mbps

USB	Option	BW
USB 2.0	N5416B	2 GHz

Automotive	Option	BW
MOST	N6466B	1 GHz
100BASE-T1	N6467B	1 GHz

Automotive	Option	BW
DDR1 / LPDDR1	U7233B	2 GHz
DDR2 / LPDDR2	N5413C	4 GHz
DDR3 / LPDDR3 <sup>1</sup>	U7231C	4 GHz
DDR4 / LPDDR4 <sup>1</sup>	N6462B	4 GHz
eMMC	N6465B	1 GHz

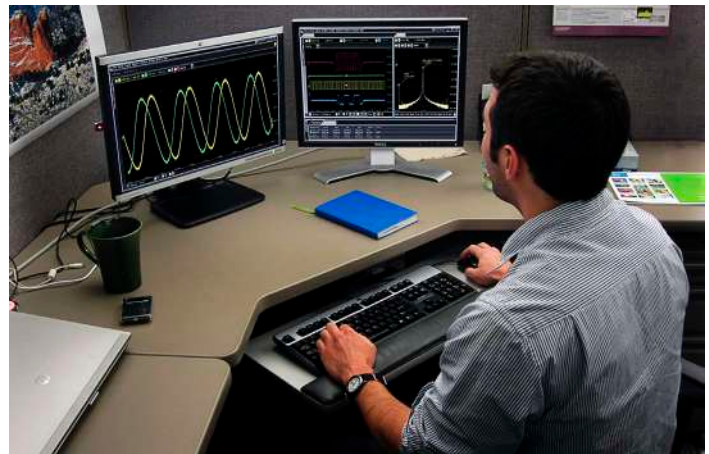
1. DDR3 and DDR4 testing on an 9000 Series is limited to 1600 MT/s.

Ethernet	Option	BW
1000BaseT1 Transmitter	E6960A	1 GHz
10/100/1G Energy Efficient Ethernet	N5392C	[SD]
MGBASE-T (2.5G / 5G)	U7236A	2.5 GHz
NBASE-T (2.5G / 5G)		
10GBASE-T		

MIPI	Option	BW
D-PHY 2.0	U7238E	4 GHz

## Offline Testing

View and analyze test results at your desk! Save an oscilloscope file, the view and analyze on your PC using the full Infiniium user interface without needing additional access to your scope. Use waveform math, filtering, FFT, protocol decoding, jitter analysis, eye diagrams and more to get more insight. Infiniium offline is a truly powerful software tool to help you get your job done faster while freeing up precious hardware resources.



Infiniium Offline Ordering Information		
Option	Description	Details
D9010BSEO	Infiniium Offline base software	Required as baseline software. Prerequisite to all other options.
D9010JITO	EZJit Complete	Timing jitter, vertical noise, and phase noise analysis.
D9010ASIO	Advanced Signal Integrity	Equalization, InfiniiSim, PAM-N analysis, and crosstalk
D9010LSPO	Low Speed Protocol Package	I2C, SPI, SR232/UART, JTAG, CAN, CAN-FD, LIN, FlexRay, SVID, USB 2.0, USB-PD, MIPI RFFE, eSPI, I2S, Ethernet 10/100BaseT, SpaceWire, SPMI, 100BASE-T1, Manchester, ARINC429, MIL-STD1553)
D9010HSPO	High Speed Protocol Package	DDR2/3/4, LPDDR2/3/4, Ethernet 10GBASE-KR 64/66, Ethernet 100Base KR/CR, MIPI [CSI-3, DigRF v4, D-PHY, LLI, RFFE, UniPro], PCIe Gen 1/2/3, SATA/SAS, UFS, USB 2.0, USB 3.0, USB 3.0 SSIC, USB 3.1, C-PHY

# Software License Terms and Support

Keysight offers a variety of flexible licensing options to fit your needs and budget. Choose your license term, license type, and KeysightCare software support subscription.

## License terms

**Perpetual** – Perpetual licenses can be used indefinitely.

**Time-based** – Time-based licenses can be used through the term of the license only (6, 12, 24, or 36 months).

## License types

**Node-locked** – License can be used on one specified instrument/computer.

**Transportable** – License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required).

**USB Portable** – License can be used on one instrument/computer at a time but may be transferred to another using a certified USB dongle (available for additional purchase with Keysight part number E8900-D10).

**Floating (single site)** – Networked instruments/computers can access a license from a server one at a time. Multiple licenses can be purchased for concurrent usage.

## KeysightCare software support subscriptions

Perpetual licenses are sold with a 12 (default), 24, 36, or 60-month software support subscription. Support subscriptions can be renewed for a fee after that. Time-based licenses include a software support subscription through the term of the license.

### Selecting your license

**Step 1.** Choose your software product (eg. D9010AUTP).

**Step 2.** Choose your license term: perpetual or time-based.

**Step 3.** Choose your license type: node-locked, transportable, USB portable, or floating.

**Step 4.** Depending on the license term, choose your support subscription duration.

KeysightCare Software Support Subscription provides peace of mind amid evolving technologies.

- Ensure your software is always current with the latest enhancements and measurement standards.
- Gain additional insight into your problems with live access to our team of technical experts.
- Stay on schedule with fast turnaround times and priority escalations when you need support.

If you selected:	Your quote will look like:	
	Part Number	Description
D9010UDAA	D9010UDAA	User Defined Application Software
node-locked perpetual license with a 12-month support subscription	R-B5P-001-A R-B6P-001-L	Node-locked perpetual license KeysightCare software support subscription, node-locked-12 months
D9010UDAA transportable time-based 6-month license	D9010UDAA R-B4P-001-F	User Defined Application Software 6-months, node-locked KeysightCare software support subscription

To configure your product and request a quote: <http://www.keysight.com/find/software>

## Post-Purchase Upgrades

Are you looking to upgrade a 9000 Series you've already purchased? See below for a list of available options. All probes, accessories, and software are orderable as previously described.

9000 Series Upgrades	
Description	Model(s)
Add 16 MSO logic channels	N2901E
Upgrade memory in incremental steps <sup>1</sup> :	
20 Mpts/ch to 50 Mpts/ch	N2900A-050
50 Mpts/ch to 100 Mpts/ch	N2900A-100
100 Mpts/ch to 200 Mpts/ch	N2900A-200
200 Mpts/ch to 500 Mpts/ch	N2900A-500
Upgrade Windows XP to Windows 7	N2753A (see product datasheet for important details)
Upgrade Windows 7 to Windows 10	N2151A
Bandwidth upgrade to 1 GHz	Not available; minimum upgrade is to 2.5 GHz
Bandwidth upgrades to 2.5 GHz <sup>2</sup>	N2905A-006 (from 600 MHz) N2905A-010 (from 1 GHz)
Bandwidth upgrades to 4 GHz <sup>2</sup>	N2904A-006 (from 600 MHz) N2904A-010 (from 1 GHz) N2904A-025 (from 2.5 GHz)

1. The stated numbers are for four channels of operation and double when using only two channels. All new 9000 Series scopes come standard with 100 Mpts./ch, so the first two upgrades are purely for legacy equipment.
2. Bandwidth upgrades are completed at a Keysight authorized service center and include all labor and calibration costs.

## Infiniium 9000 Series Performance Characteristics

Vertical: Scope channels	9064A	9104A	9254A	9404A
Analog bandwidth (-3 dB)				
50 $\Omega$ <sup>1</sup>	600 MHz	1.0 GHz	2.5 GHz	4 GHz
1 M $\Omega$	500 MHz	500 MHz	500 MHz	500 MHz
Typical rise time/Fall Time 10 to 90% at 50 $\Omega$	540 ps	253 ps	142 ps	85 ps
Typical rise time/Fall Time 20 to 80% at 50 $\Omega$	360 ps	174 ps	98 ps	59 ps
Input channels	DSO9000 – 4 analog MSO9000 – 4 analog + 16 digital			
Input impedance <sup>1</sup>	50 $\Omega$ $\pm$ 2.5%, 1 M $\Omega$ $\pm$ 1% (11pF typical)			
Input sensitivity <sup>3</sup>	1 M $\Omega$ : 1 mV/div to 5 V/div 50 $\Omega$ : 1 mV/div to 1 V/div			
Input coupling	1 M $\Omega$ : AC (3.5 Hz), DC 50 $\Omega$ : DC			
Bandwidth limit	20 MHz on 1 M $\Omega$ input; 500 MHz up to full scope bandwidth in increments of 500 MHz			
Vertical resolution <sup>2,3</sup>	8 bits, $\geq$ 12 bits with averaging			
Channel-to-channel isolation	DC to 50 MHz: 50 dB > 50 MHz to 2.5 GHz: 40 dB > 2.5 GHz to 4 GHz: 25 dB			
DC gain accuracy <sup>1,2,3</sup>	$\pm$ 2% of full scale at full resolution on channel scale $\pm$ 5 $^{\circ}$ C from cal temp			
Maximum input voltage <sup>1</sup>	1 M $\Omega$ : 30 V <sub>RMS</sub> or $\pm$ 40 V <sub>MAX</sub> (DC+V <sub>PEAK</sub> ). Probing technology allows for testing of higher voltages; the included N2873A 10:1 probe supports 300 V <sub>RMS</sub> or $\pm$ 400 V <sub>MAX</sub> (DC+V <sub>PEAK</sub> ). 50 $\Omega$ : 5 V <sub>RMS</sub> No transient overvoltage allowed in either the 50 $\Omega$ or 1 M $\Omega$ path, with or without probes.			
Offset range	Vertical sensitivity			Available offset
– 1 M $\Omega$	1 mV to < 10 mV/div 10 mV to < 20 mV/div 20 mV to < 100 mV/div 100 mV to < 1 V/div 1 V to 5 V/div			$\pm$ 2 V $\pm$ 5 V $\pm$ 10 V $\pm$ 20 V $\pm$ 100 V
– 50 $\Omega$				$\pm$ 12 div or $\pm$ 4 V, whichever is smallest

1. Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and  $\pm$  5  $^{\circ}$ C from firmware calibration temperature.
2. Input impedance is valid when V/div scaling is adjusted to show all waveform vertical values within scope display.
3. Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale. 50  $\Omega$  input: Full scale is defined as 8 vertical divisions. Magnification is used below 10 mV/div, full-scale is defined as 80 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V.

1 M  $\Omega$  input: Full scale is defined as 8 vertical divisions. Magnification is used 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 V, 5 V.

## Infiniium 9000 Series Performance Characteristics (Continued)

Vertical: Scope channels (Continued)	
Offset accuracy <sup>1,3</sup>	$\pm (1.25\% \text{ of channel offset} + 1\% \text{ of full scale} + 1 \text{ mV})$
Dynamic range	1 M $\Omega$ : $\pm 8$ div from center screen 50 $\Omega$ : $\pm 8$ div from center screen
DC voltage measurement accuracy <sup>2</sup>	Dual cursor $\pm [(\text{DC gain accuracy}) + (\text{resolution})]$ Single cursor $\pm [(\text{DC gain accuracy}) + (\text{offset accuracy}) + (\text{resolution}/2)]$ V increments

Volts/div	RMS noise floor (V <sub>RMS AC</sub> )			
	9064A	9104A	9254A	9404A
10 mV	213 $\mu$ V	240 $\mu$ V	273 $\mu$ V	402 $\mu$ V
20 mV	470 $\mu$ V	481 $\mu$ V	445 $\mu$ V	627 $\mu$ V
50 mV	1.15 mV	1.24 mV	1.22 mV	1.67 mV
100 mV	2.37 mV	2.43 mV	2.54 mV	3.17 mV
200 mV	4.65 mV	4.85 mV	5.06 mV	6.18 mV
500 mV	11.8 mV	12.3 mV	12.2 mV	15.8 mV
1 V	23.9 mV	24.3 mV	25.2 mV	31.5 mV

Vertical: Digital channels	On all MSO models
Input channels	16 digital channels
Threshold groupings	16 digital channels pod 2: D15 to D8
Threshold selections	TTL (1.4V), CMOS, (5.0 V, 3.3 V, 2.5 V), ECL (-1.3 V), PECL (3.7 V), user defined ( $\pm 8.00$ V in 100 mV increments)
Maximum input voltage	$\pm 40 V_{MAX}$ (DC + $V_{PEAK}$ )
Threshold accuracy	$\pm (100 \text{ mV} + 3\% \text{ of threshold setting})$
Input dynamic range	$\pm 10$ V about threshold
Minimum input voltage swing	500 mV peak-to-peak
Input impedance (flying leads)	100 k $\Omega$ $\pm 2\%$ (~ 8 pF) at probe tip
Resolution	1 bit
Analog bandwidth	400 MHz

1. Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and  $\pm 5$  °C from firmware calibration temperature.
2. Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.
3. 50  $\Omega$  input: Full scale is defined as 8 vertical divisions. Magnification is used below 10 mV/div, full-scale is defined as 80 mV. The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V.

1 M $\Omega$  input: Full scale is defined as 8 vertical divisions. Magnification is used 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 V, 5 V.

# Infiniium 9000 Series Performance Characteristics (Continued)

Horizontal	
Channel-to-channel skew (digital)	2 ns typical
Main time base range	≥ 2.0 ns
Horizontal position range	5 ps/div to 20 s/div
Delayed sweep range	1 ps/div to current main time base setting
Resolution	1 ps
Modes	Main, delayed, roll (200 ms to 20 sec)
Reference positions	Left, center, right
Channel deskew	-1 ms to +1 ms range
Time scale accuracy (internal reference) (External reference clock = off)	Horizontal time base setting ± (Horizontal time base setting) * (0.4 + 0.5* years since calibration) ppm

## Delta-time measurement accuracy <sup>2, 3, 4, 5</sup>

Absolute averaging disabled	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24}} + \frac{TimeScaleAccy * Reading}{2} \text{ sec pk}$	<table border="1"> <thead> <tr> <th></th> <th>x=</th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064</td> <td>4.8 20</td> </tr> <tr> <td></td> <td>9104</td> <td>4.8 15</td> </tr> <tr> <td></td> <td>9254</td> <td>4.0 15</td> </tr> <tr> <td></td> <td>9404</td> <td>5.0 20</td> </tr> </tbody> </table>		x=	y=		9064	4.8 20		9104	4.8 15		9254	4.0 15		9404	5.0 20
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	9064	4.8 20															
	9104	4.8 15															
	9254	4.0 15															
	9404	5.0 20															
Absolute > 256 averages	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24}} + \frac{TimeScaleAccy * Reading}{2} \text{ sec pk}$	<table border="1"> <thead> <tr> <th></th> <th>x=</th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064</td> <td>.33 .1</td> </tr> <tr> <td></td> <td>9104</td> <td>.33 .05</td> </tr> <tr> <td></td> <td>9254</td> <td>.33 .10</td> </tr> <tr> <td></td> <td>9404</td> <td>.35 .15</td> </tr> </tbody> </table>		x=	y=		9064	.33 .1		9104	.33 .05		9254	.33 .10		9404	.35 .15
	x=	y=															
	9064	.33 .1															
	9104	.33 .05															
	9254	.33 .10															
	9404	.35 .15															
Standard deviation averaging disabled	$\sqrt{\left(\frac{1.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	<table border="1"> <thead> <tr> <th></th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064 .75</td> </tr> <tr> <td></td> <td>9104 .65</td> </tr> <tr> <td></td> <td>9254 .75</td> </tr> <tr> <td></td> <td>9404 .80</td> </tr> </tbody> </table>		y=		9064 .75		9104 .65		9254 .75		9404 .80					
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	9104 .65																
	9254 .75																
	9404 .80																
Standard deviation > 256 averages	$\sqrt{\left(\frac{0.1 * Noise}{SlewRate}\right)^2 + 0.01 * 10^{-24}} \text{ sec}_{rms}$																

## Jitter measurements floor <sup>2, 3</sup>

Time interval error <sup>4</sup>	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	<table border="1"> <thead> <tr> <th></th> <th>x=</th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064</td> <td>1.0 1.0</td> </tr> <tr> <td></td> <td>9104</td> <td>1.0 0.5</td> </tr> <tr> <td></td> <td>9254</td> <td>.95 1.1</td> </tr> <tr> <td></td> <td>9404</td> <td>.95 1.2</td> </tr> </tbody> </table>		x=	y=		9064	1.0 1.0		9104	1.0 0.5		9254	.95 1.1		9404	.95 1.2
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	9064	1.0 1.0															
	9104	1.0 0.5															
	9254	.95 1.1															
	9404	.95 1.2															
Period jitter	$\sqrt{\left(\frac{1.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	<table border="1"> <thead> <tr> <th></th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064 .75</td> </tr> <tr> <td></td> <td>9104 .65</td> </tr> <tr> <td></td> <td>9254 .75</td> </tr> <tr> <td></td> <td>9404 .80</td> </tr> </tbody> </table>		y=		9064 .75		9104 .65		9254 .75		9404 .80					
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N-cycle, cycle-cycle jitter	$\sqrt{\left(\frac{2.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	<table border="1"> <thead> <tr> <th></th> <th>y=</th> </tr> </thead> <tbody> <tr> <td></td> <td>9064 1.8</td> </tr> <tr> <td></td> <td>9104 1.4</td> </tr> <tr> <td></td> <td>9254 1.9</td> </tr> <tr> <td></td> <td>9404 2.0</td> </tr> </tbody> </table>		y=		9064 1.8		9104 1.4		9254 1.9		9404 2.0					
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	9104 1.4																
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	9404 2.0																

1. Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ± 5 °C from firmware calibration temperature.
2. 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.
3. Measurement threshold = fixed voltage at 50% level.
4. Time ranges ≤ 10 μs.
5. 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.

## Infiniium 9000 Series Performance Characteristics (Continued)

Acquisition	9104, 9254, 9404		9064														
Maximum real-time sample rate	4 ch x 10 GS/s or 2 ch x 20 GS/s		4 ch x 5 GSa/s or 2 ch x 10 GSa/s														
<b>Memory depth per channel</b>																	
Standard	20 Mpts on 4 channels, 40 Mpts on 2 channels																
Option 50M	50 Mpts on 4 channels, 100 Mpts on 2 channels																
Option 100	100 Mpts on 4 channels, 200 Mpts on 2 channels																
Option 200	200 Mpts on 4 channels, 400 Mpts on 2 channels																
Option 500	500 Mpts/250 Mpts on 4 channels, 1 Gpts/500 Mpts on 2 channels (single/repetitive mode)																
<b>Sampling modes</b>																	
Real-time																	
Real-time with peak detect																	
Real-time with high resolution (user selectable to 9-, 10-, 11-, or 12-bits of resolution)																	
Real-time with roll mode (200 ms to 20 sec.)																	
Equivalent-time (1.0 ps fine interpolator resolution yields a maximum effective sample rate of 1,000 GSa/s)																	
Segmented memory (1 ps time stamp resolution between segments)																	
Maximum time between triggers is 562,950 seconds (6.5 days)																	
Re-arm time (minimum time between trigger events) is 4.5 μs with analog channels, 5.8 μs with digital channels on																	
<b>Memory depth:</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>	<b>2 G</b>										
Max # of segments:	4096	8192	16384	32768	65536	131072	131072										
Filters																	
<b>Acquisition: Digital channels</b>																	
Maximum real time sample rate	2 GSa/s																
Maximum memory depth per channel	128/64 Mpts with 2 GSa/s. 64/32 Mpts with sampling < 2 GSa/s (single/repetitive mode)																
Minimum width glitch detection	2 ns																
<b>Trigger: Scope channels</b>																	
Trigger sources	Channel 1, channel 2, channel 3, channel 4, aux, and line																
Sensitivity	1 MΩ input, edge trigger		DC to 500 MHz: 0.6 div														
	50 Ω		DC to 2 GHz, 0.5 div														
	Auxiliary		2 GHz to 4 GHz: 1.0 div														
			DC to 700 MHz: 300 mVp-p														
Trigger level range	± 4 div from center screen (50 Ω)																
Channel 1, 2, 3 or 4	± 8 div from center screen with max of ± 8 V (1 MΩ)																
Auxiliary	± 5 V (50 Ω up to 500 MHz with at least 500 mV signal swing)																
Sweep modes	Auto, triggered, single																
Display jitter (displayed trigger jitter) <sup>1,2</sup>						<table border="1"> <thead> <tr> <th></th> <th>y=</th> </tr> </thead> <tbody> <tr> <td>9064</td> <td>.50</td> </tr> <tr> <td>9104</td> <td>.35</td> </tr> <tr> <td>9254</td> <td>.50</td> </tr> <tr> <td>9404</td> <td>.40</td> </tr> </tbody> </table>			y=	9064	.50	9104	.35	9254	.50	9404	.40
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	$\sqrt{\left(\frac{1.0 * \text{Noise}}{\text{SlewRate}}\right)^2 + y * 10^{-24} \text{ sec}_{\text{rms}}}$																
Trigger holdoff range	100 ns to 10 s fixed and random																
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 settings																
Trigger coupling	1 MΩ: DC, AC, (10 Hz) low frequency reject (50 kHz high pass filter), high frequency reject (50 kHz low pass filter)																

- Internal edge trigger mode. Trigger threshold = fixed voltage at 50% level. The slew rate independent value in the formula represents the traditional trigger jitter.
- Display jitter example. At 100 mV/div typical noise values are 3.2 mV RMS for 9404 models, 2.5 mV RMS for 9254A models, and 2.4 mV RMS for 9104A models. For slew rate of 500 mVpp sin wave with frequency equal to max analog bandwidth of each model, typical display jitter is .95 ps RMS for 9404A models, .97 ps for 9254A models, and 1.7 ps RMS for 9104A models.

## Infiniium 9000 Series Performance Characteristics (Continued)

<b>Trigger: Digital channels MSO models</b>	
Threshold range	(User defined) $\pm 8.0$ V in 100-mV increments
Threshold accuracy	$\pm (100 \text{ mV} + 3\% \text{ of threshold setting})$
<b>Measurements and math</b>	
Waveform measurements	(Can be made on either min or zoom window with up to 10 simultaneous measurements with statistics)
– Voltage (scope channels)	Peak-to-peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, V overshoot, preshoot, V preshoot, upper, middle, lower, crossing point voltage, pulse top, pulse base, pulse amplitude
– Time (digital channels)	Period, frequency, positive width, negative width, duty cycle, delta time
– Time (scope channels)	Rise time, fall time, period, frequency, positive width, negative width, duty cycle, Tmin, Tmax, Tvolt, channel-to-channel delta time, channel-to-channel phase, count pulses, burst width, burst period, burst interval, setup time, hold time
– Mixed (scope channels only)	Area, slew rate
– Frequency domain	FFT frequency, FFT magnitude, FFT delta frequency, FFT delta magnitude all timing measurements
Eye-diagram measurements	Eye height, eye width, eye jitter, crossing percentage, Q factor, and duty-cycle distortion
Measurement modes	Displays the mean, standard deviation, minimum, maximum range, and number of measurement values for the displayed automatic measurements
– Statistics	
Histograms (scope channels)	Waveform or measurement (histogram on measurement requires EZJIT, EZJIT+, or EZJIT Complete option)
– Source	Vertical (for timing and jitter measurements) or horizontal (noise and amplitude change) modes, regions are defined using waveform markers
– Orientation	
– 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
Waveform math	Manual markers, track waveform data, track measurements
– Number of functions	16
– Operators	Operators absolute value, add, AM demodulation, average, horizontal gating, Butterworth <sup>1</sup> , common mode, differentiate, divide, FFT magnitude, FFT phase, FIR11, high pass filter, integrate, invert, LFE <sup>1</sup> , low pass filter (4th-order Bessel Thompson filter), magnify, max, min, multiply, RT Eye <sup>1</sup> , smoothing, SqrtSumOfSquare <sup>1</sup> , square, square root, subtract, versus Chartstate (MSO models), charttiming (MSO models)
Automatic measurements	Measure menu access to all measurements, ten measurements can be displayed simultaneously
Multipurpose	Front-panel button activates up to ten pre-selected or ten user-defined automatic measurements
Drag-and-drop	Measurement toolbar with common measurement icons that can be dragged and dropped onto the measurement toolbar displayed waveforms
FFT	Manual markers, track waveform data, track measurements
– Frequency range	DC to 10 GHz (at 20 GSa/s) or 5 GHz (at 10 GSa/s)
– Frequency resolution	Resolution = sample rate/memory depth
– Window modes	Hanning, flattop, rectangular, Blackman Harris, Force

1. Requires MATLAB software.



## Infiniium 9000 Series Performance Characteristics (Continued)

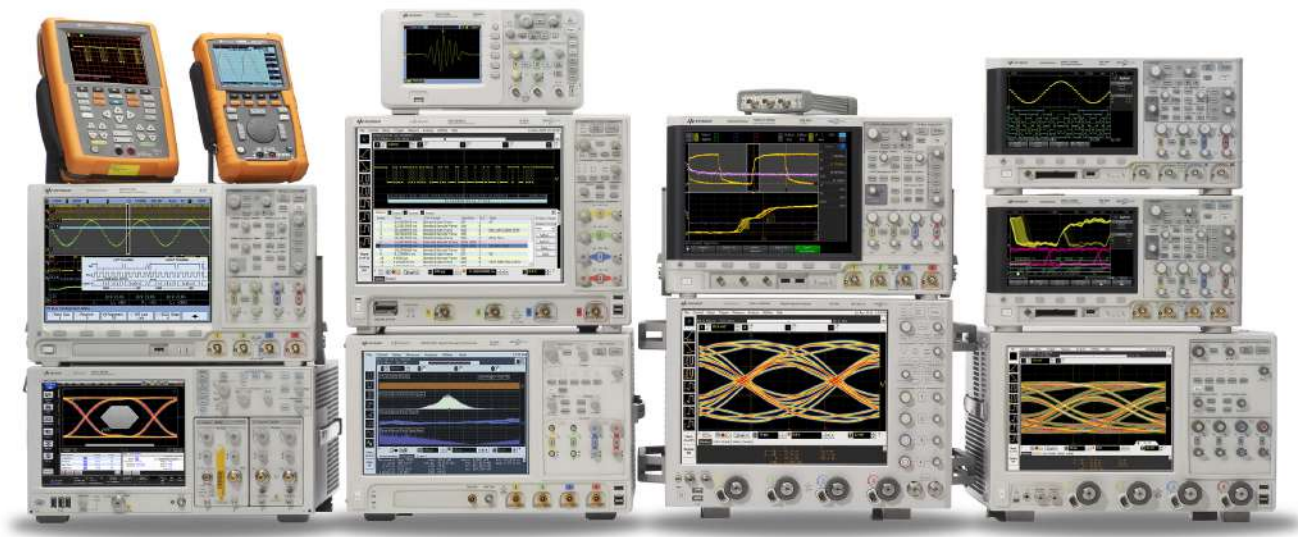
Trigger modes	On all MSO models
Edge (analog and digital)	Triggers on a specified slope (rising, falling or alternating between rising and falling) and voltage level on any channel.
Edge transition (analog)	Trigger on rising or falling edges that cross two voltage levels in > or < the amount of time specified. Edge transition setting from 250 ps.
Edge then edge (time) (analog and digital)	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) (analog and digital)	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 (analog and digital)	Triggers on glitches narrower than the other pulses in your waveform by specifying a width less than your narrowest pulse and a polarity. Glitch range settings equal pulse width settings.
Line	Triggers on the line voltage powering the oscilloscope.
Pulse width (analog and digital)	Trigger on a pulse that is wider or narrower than specified.
– 4 GHz model	Minimum detectable pulse width: 125 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 250 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
– 2.5 GHz model	Minimum detectable pulse width: 200 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 350 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
– 1 GHz and 600 MHz model	Minimum detectable pulse width: 500 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 700 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
Runt (analog)	Triggers on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Runt settings equal pulse width settings.
Timeout (analog and digital)	Trigger when a channel stays high, low, or unchanged for too long. Timeout settings equal pulse width settings.
Pattern/pulse range (analog and digital)	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 (analog and digital)	Pattern trigger clocked by the rising, falling or alternating between rising and falling edge of one channel.
Setup/hold (analog)	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.
Window (analog)	Trigger on entering, exiting, or inside specified voltage range.
Video (analog)	NTSC, PAL-M(525/60), PAL, SECAM(625,50) EDTV(480p/60), EDTV(576/50), HDTV(720p/60), HDTV(720p/50) HDTV(1080i/60).
Serial (analog and digital)	Requires specified serial software option, I <sup>2</sup> C, SPI, CAN, LIN, FlexRay, RS-232/UART, JTAG, USB, PCIe, MIPI D-PHY, generic 8B/10B.
Zone-qualified	Requires InfiniiScan software option. SW-based triggering across up to 8 user-drawn zones. For each zone, user specifies "must intersect" or "must not intersect." Zones can be drawn on multiple channels and combined using Boolean expressions.

## Infiniium 9000 Series Performance Characteristics (Continued)

<b>Display</b>	
Display	15 inch color XGA TFT-LCD with touch screen
Display intensity grayscale	64-level intensity-graded display
– Resolution	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	Can display 1, 2 or 4 waveform grids
– Waveform styles	Connected dots, dots, variable persistence, infinite persistence, color graded infinite persistence. Includes up to 64 levels of intensity-graded waveform
Waveform update rate (10 GS/s, 50 ns/div, sin(x)/x: on)	Segmented mode: Maximum up to 250,000 waveforms/sec Real time mode: – Typical of 700 waveforms/sec with 1 kpts memory – Typical of 230 waveforms/sec with 100 kpts memory – Typical of 130 waveforms/sec with 1 Mpts memory
<b>Computer system and peripherals, I/O ports</b>	
Computer system and peripherals	
– Operating system	Windows 10
– CPU	Intel® Core 2 Duo, M890, 3.0 GHz microprocessor
– PC system memory	4 GB
– Drives	≥ 250-GB internal hard drive (optional removable hard drive)
– Peripherals	Optical USB mouse and compact keyboard supplied. All Infiniium models support any Windows-compatible input device with a PS/2 or USB interface.
File types	
– Waveforms	Compressed internal format (*.wfm), comma separated values (*.csv), .hdf5, .bin, tab separated values (*.tsv), ability to save .osc (composite including both setup and waveform. and Y value files (*.txt)
– Images	BMP, TIFF, GIF, PNG 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, data/file transfers and network printing
– RS-232 (serial)	9-pin, COM1, printer and pointing device support
– PS/2	Two ports. Supports PS/2 pointing and input devices.
– USB 2.0 Hi-Speed	Three 2.0 high-speed ports on front panel plus four ports on side panel. Allows connection of USB peripherals like storage devices and pointing devices while the oscilloscope is on. One device port on side for instrument control.
– Video output	15 pin XGA on side of scope, full output of scope display or dual monitor video output, DVI
– Auxiliary output	DC ( $\pm 2.4$ V); square wave ~755 Hz with ~200 ps rise time
Time base reference output	10 MHz, Amplitude into 50 ohms: 800 mV pp to 1.26 V pp (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 Z = 50 ohms. Minimum 500 mV pp (–2 dBm), maximum 2.0 V pp (+10 dBm)
LXI compliance	LXI Class C

## Infiniium 9000 Series Performance Characteristics (Continued)

<b>General characteristics</b>	
<b>Temperature</b>	
Operating	5 to + 40 °C
Non-operating	-40 to + 65 °C
<b>Humidity</b>	
Operating	Up to 95% relative humidity (non-condensing) at +40 °C
Non-operating	Up to 90% relative humidity at +65 °C
<b>Altitude</b>	
Operating	Up to 3000 meters
Non-operating	Up to 15,300 meters
<b>Vibration</b>	
	Operating random vibration 5 to 500 Hz, 10 minutes per axis, 0.21 g(rms)
	Non-operating random vibration 5 to 500 Hz, 10 minutes per axis, 2.09 g(rms); resonant search 5 to 500 Hz
	Swept-sine, 1 octave/minute sweep rate, 0.5 g (0-peak), 5 minute resonant dwells at 4 resonances per axis
<b>Power</b>	
	100 to 120 V, ± 10% 50/60/400 Hz
	100 to 240 V, ± 10% 50/60 Hz
	Max power dissipated: 375 W
<b>Typical operator noise</b>	
	30 dB at front of instrument
<b>Weight</b>	
	Net: 11.8 kg (26 lbs.) Shipping: 17.8 kg (39 lbs.)
<b>Dimensions (with feet retracted)</b>	
	Height: 12.9 in (33 cm); width: 16.8 in (43 cm); depth: 9 in (23 cm)
<b>Safety</b>	
	IEC 61010-1:2010; CAN/CSA-C22.2 No. 61010-1-12; EN 61010-1:2010; UL61010-1 3rd Ed. and the following National Differences: United States and Canada



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