

# Data Center High-Speed Computing Products

## CATALOG



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# Flexible Solutions for Evolving Industry Standards

Emerging technologies such as 5G, artificial intelligence, virtual reality, the Internet of Things, and autonomous vehicles generate an enormous amount of data in the network, creating new computing and performance demands in the data center.

Each new generation of high-speed computing standards introduces new features and faster data transfer rates, creating fresh test challenges for digital designers. Because standards evolve quickly, Keysight's data center solutions test specific industry standards, reducing time and ensuring compliance and interoperability of devices.

This catalog covers the following standards:

- Peripheral Component Interconnect Express (PCI Express® or PCIe®)
- Double Data Rate (DDR) memory
- Universal Serial Bus (USB)



# Design and Simulation Software

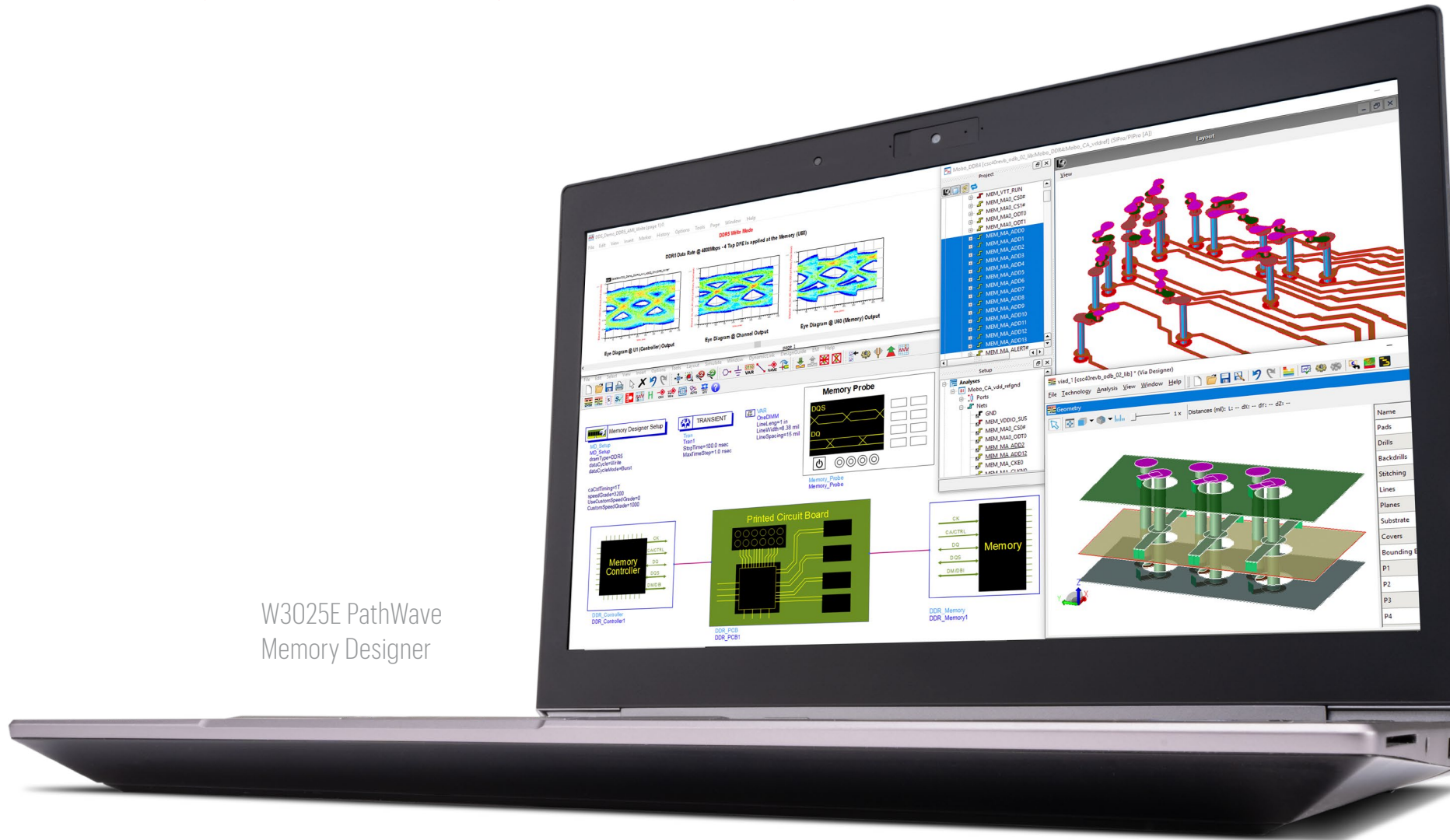
High-speed digital designs become significantly more complex as data rates increase. Channel topologies become more diverse, and you need to tune more parameters for active components. Use simulation to optimize the signal and power integrity of your designs and analyze the electromagnetic (EM) effects of components such as high-speed integrated circuit packages and printed circuit board (PCB) interconnects.

## Reduce design and simulation time

Design and simulation software enables you to optimize transmitter (Tx), receiver (Rx), and channel designs for the best performance and reliability at the desired speed grade. You can design to resolve signal integrity issues, ensure power efficiency, and stay within tight error margins before the first prototype.



PathWave ADS bundle for high-speed digital design	Signal Integrity EM Analysis Element (SIPro)	Power Integrity EM Analysis Element (PIPro)	Memory Designer
Software for high-speed digital designers	Signal integrity analysis software for high-speed PCBs	Accurate and efficient net-driven power integrity analysis	Software to analyze memory designs faster and link to compliance applications
<a href="#">Get a Quote &gt;</a>	<a href="#">Get a Quote &gt;</a>	<a href="#">Get a Quote &gt;</a>	<a href="#">Get a Quote &gt;</a>



W3025E PathWave  
Memory Designer

# Infiniium UXR-Series Oscilloscopes

Keysight's Infiniium UXR-Series oscilloscopes offer ultra-high-performance acquisition with 10 bits of high-definition resolution. Designed for upgradability, the UXR will support current and future design and test needs.

- up to 110 GHz bandwidth
- 10-bit hardware analog-to-digital converter (ADC)
- maximum bandwidth on all channels
- industry's lowest noise and best interchannel jitter performance
- up to 256 GSa/s sample rate
- two or four phase-coherent channels per frame
- up to 40 synchronized channels via MultiScope support



# Infiniium UXR-Series Oscilloscopes

Industry-best ENOB and less than 10 fsrms of inter-channel intrinsic jitter enables precise capture of multi-channel applications and measurements like:

- Datacom system debug
- 802.11ad and 802.11ay
- PCIe debug and compliance
- USB 3.x and Thunderbolt
- Next-Gen DDR5
- LTE and 5G technologies
- HDMI and Display port
- Power supply sequencing

Shown: UXR0134A Infiniium UXR-Series 13 GHz 4 channel oscilloscope



# Infiniium UXR-Series Oscilloscopes

Specifications (at max bandwidth)	3.5 mm models UXR0104A, UXR0134A, UXR0164A, UXR0204A, UXR0254A, UXR0334A	1.85 mm models UXR0402A, UXR0404A, UXR0502A, UXR0504A, UXR0592A, UXR0594A, UXR0702A, UXR0704A	1 mm models UXR0051AP*, UXR0252AP, UXR0254AP, UXR0402AP, UXR0404AP, UXR0592AP, UXR0594AP, UXR0702AP, UXR0704AP, UXR0802A, UXR0804A, UXR1002A, UXR1004A, UXR1102A, UXR1104A
<b>Bandwidth</b>	10 - 33 GHz	40 - 70 GHz	5 - 110 GHz
<b>Maximum sample rate</b>	128 GSa/s	256 GSa/s	256 GSa/s
<b>Noise at highest sensitivity and bandwidth</b>	< 0.3 mV (rms)	< 0.5 mV (rms)	< 0.9 mV (rms)
<b>ENOB at <math>\geq 400</math> mV<sub>fs</sub> (millivolts full scale) average value from DC to full licensed bandwidth of model</b>	from 6.8 to 5.9	from 5.8 to 5.4	from 5.5 to 5.0
<b>Maximum multiframe channels</b>	40 maximum (10 oscilloscopes)		
<b>Maximum detectable symbol rate (at full licensed bandwidth of model)</b>	26 Gbaud to 66 Gbaud	80 Gbaud to 140 Gbaud	50 Gbaud / 220 Gbaud
<b>Vertical sensitivity (HW) Vertical sensitivity (with zoom)</b>	40 mV to 8 V full scale 1 mV/div to 1 V/div	60 mV to 4 V full scale 1 mV/div to 500 mV/div	60 mV to 4 V full scale 1 mV/div to 500 mV/ div
<b>Hardware acquisition / acceleration system</b>	<ul style="list-style-type: none"> <li>• 1,000,000 wfms/sec</li> <li>• 2.16 GHz digital downconversion (DDC analysis bandwidth)</li> <li>• 5 to 10 GHz mmWave frequency extensions</li> <li>• equalization and clock recovery</li> <li>• real-time eye plotting and averaging</li> </ul>		
<b>Upgradability</b>	<ul style="list-style-type: none"> <li>• bandwidth (from 5 GHz to 13, 16, 20, 25, 33, 40, 50, 59, 70, 80, 100 through 110 GHz)</li> <li>• memory from 200 Mpts/ch to 1 Gpts or 2 Gpts per channel</li> <li>• 2 to 4 channels</li> <li>• (*1 to 2 channels)</li> </ul>		



Keysight offers a wide variety of advanced measurement, analysis, compliance, and decode software applications for the Infiniium UXR-Series oscilloscope. Software is available with a wide variety of flexible licensing options to fit your needs and budget.

Model numbers	Measurement and analysis software options
<b>D9010ASIO</b>	Infiniium Offline – Advanced signal integrity software (InfiniiSim Adv / EQ / crosstalk)
<b>D9010BSEO</b>	Infiniium Offline – Base software
<b>D9010HSPO</b>	Infiniium Offline – High-speed protocol software bundle
<b>D9010JITO</b>	Infiniium Offline – EZJIT Complete software
<b>D9010LSP0</b>	Infiniium Offline – Low-speed protocol software bundle
<b>D9010DMBA</b>	De-embedding software (Precision Probe, InfiniiSim basic)
<b>D9010EXMA</b>	External mixer assistant software
<b>D9010PAMA</b>	Pulse amplitude modulation PAM-N analysis software
<b>D9010POWA</b>	Power integrity analysis software
<b>D9010UDAA</b>	User-defined application software
<b>D9020JITA</b>	EZJIT Complete – Jitter and vertical noise analysis software for V / Z / UXR-Series oscilloscope
<b>D9020SCNA</b>	InfiniiScan vent identification software for V / Z / UXR-Series
<b>D9020ASIA</b>	Advanced signal integrity software (EQ, InfiniiSimAdv, crosstalk)

Model numbers	Protocol decode and triggering software options
<b>D9010AUTP</b>	Automotive protocol decode / trigger software (CAN, LIN, CAN-FD, FlexRay)
<b>D9020AUTP</b>	High-speed automotive protocol decode / trigger software (100 / 1000BASE-T1)
<b>D9010BDLP</b>	Protocol decode / trigger software bundle (low speed, auto, MIPI®, military)
<b>D9010EKRP</b>	10G / 100G Base-KR 64b / 66b and link training decode / trigger software
<b>D9010EMBP</b>	Embedded protocol decode / trigger software (USB2.0, 10 / 100 ETH, PCIe® 2 / 1)
<b>D9010LSSP</b>	Low-speed protocol decode / trigger software (I2C, SPI, RS232, I2S, JTAG)
<b>D9010MCDP</b>	MIPI, CSI, and DSI protocol decode / trigger software (C-PHY and D-PHY)
<b>D9010MILP</b>	Military protocol decode / trigger software (ARINC 429, MIL-STD 1553, SpaceWire)
<b>D9010MPLP</b>	Low-speed MIPI protocol decode / trigger software (RFFE, I3C, SPMI)
<b>D9010MPMP</b>	MIPI M-PHY protocol decode / trigger software (DigRF, LLI, CSI-3, UniPro, UFS, SSIC)
<b>D9010PCIP</b>	Advanced PCIe protocol decode / trigger software (PCIe 5 / 4 / 3 / 2 / 1, SATA / SAS)
<b>D9010USBP</b>	USB 3.x protocol decode / trigger software (USB 3.1 to 5 and 10 Gbps)

Model numbers	Protocol decode and triggering software options
<b>D9010SFPC</b>	SFP+ and QSFP+ compliance test application
<b>D9010XAUC</b>	XAUI compliance test with 10GBASE-CX4, CPRI, OBSAI, and Serial RapidIO support
<b>D9010BJAC</b>	Ethernet 40GBASE-CR4 and 100GBASE-CR10 compliance test application
<b>D9010ETHC</b>	10M / 100M / 1GBASE-T and energy efficient ethernet
<b>D9010EBZC</b>	Ethernet 10GBASE-T, NBASE-T, and MGBASE-T compliance test application
<b>D9010EAPC</b>	Ethernet 10GBASE-KR and 40GBASE-KR4 compliance test application
<b>D9010BJBC</b>	Ethernet 100GBASE-KR4 compliance test application
<b>D9010BJCC</b>	Ethernet 100GBASE-CR4 compliance test application
<b>D9010CAUC</b>	Ethernet CAUI-4 compliance test application
<b>D9010EBSC</b>	IEEE802.3bs / cd compliance test application
<b>D9010CEIC</b>	OIF-CEI 4.0 compliance test application
<b>D9050CEIC</b>	Electrical TX test software for OIF-CEI-112G VSR / MR / LR
<b>D90103CKC</b>	IEEE 802.3ck compliance test application
<b>D90100NFC</b>	Open NAND flash interface (ONFI) compliance test application
<b>D9010UHSC</b>	SD UHS-II compliance test application
<b>D9020DDRC</b>	DDR2 and LPDDR2 compliance test application
<b>D9030DDRC</b>	DDR3 and LPDDR3 compliance test application
<b>D9040DDRC</b>	DDR4 and LPDDR4 compliance test application

Model numbers	Protocol decode and triggering software options
<b>D9050DDRC</b>	DDR5 TX compliance test application
<b>D9010CPHC</b>	MIPI C-PHY compliance test application
<b>D9020DPHC</b>	MIPI D-PHY compliance test application
<b>D9040MPHC</b>	MIPI M-PHY compliance test application
<b>D9040PCIC</b>	PCIe 1.0 to 4.0 transmitter electrical performance validation and compliance
<b>D9050PCIC</b>	PCI Express 5.0 transmitter electrical performance validation and compliance
<b>D9010USBC</b>	USB 2.0 transmitter compliance test application
<b>D9020USBC</b>	USB 3.2 for 5 Gbps and 10 Gbps transmitter compliance
<b>D9040USBC</b>	USB 4 transmitter compliance test software
<b>D9030TBTC</b>	Thunderbolt 3 transmitter compliance
<b>D9030SATC</b>	SATA 6Gb/s compliance test application
<b>D9040SASC</b>	SAS-4 (serial attached SCSI-4) compliance test application
<b>D9040DPPC</b>	DisplayPort 1.4 compliance and validation
<b>D9042DPPC</b>	DisplayPort UHBR Tx compliance test software
<b>D9040EDPV</b>	Embedded DisplayPort 1.4 (eDP) electrical performance and characterization
<b>D9021HDMC</b>	HDMI 1.4 and HDMI 2.1 electrical performance, validation, and compliance
<b>D9010AGGC</b>	Compliance test software measurement server license

# Bit Error Ratio Testers (BERTs)

Whether you are working on data center or computing interface technologies, Keysight BERTs support manufacturing test to high-performance characterization and compliance test:

- supports symbol rates up to 64 Gbaud with both non-return-to-zero (NRZ) and pulse amplitude modulation (PAM4) coding schemes
- supports digital interfaces such as PCI Express, USB, MIPI®, Thunderbolt, DisplayPort, SATA / SAS, electrical and optical Ethernet 10G / 100G / 400G, OIF-CEI, Fibre Channel, and PON



M8040A BERT

**M8020A J-BERT**  
high-performance BERT

- data rate: 32 Gbit/s NRZ
- channels: 1, 2, 4

[Get a Quote >](#)

**M8040A**  
high-performance BERT

- data rate: 64 Gbaud NRZ, PAM3, and PAM4
- channels: 1, 2

[Get a Quote >](#)

**M8070B software**

The M8070B system software controls all modules for the M8000 Series BERTs and is free with instrument purchase.

**Measurement and analysis software options**

The M8070ADVB package offers advanced features like automated jitter tolerance test and parameter sweeps, eye diagram measurement or the integration of external equipment such as electrical and optical clock recovery, or error analysis using a real-time scope.

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**M8070EDAB error distribution analysis software**

The M8070EDAB package offers features like burst mechanism detection and analysis, frame loss ratio estimation, and error mapping.

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M8070B System Software



# PCI Express Test

PCIe is a core technology used in many types of computer servers and endpoint devices. The PCI Special Interest Group (PCI-SIG®) defines specifications and compliance tests that guarantee the interoperability of PCIe systems. Each generation of the PCIe standard doubled the data transfer rate and increased the complexity of test. The PCI-SIG approves test solutions to ensure that tested products comply with the standard.

## PCI express transmitter test

Test the performance of a PCIe transmitter device to ensure that it meets the specifications defined by the PCIe standard.

As PCIe moves from Gen4 to Gen5 and eventually Gen6, PCIe receivers use strong equalization. Although the equalizer can compensate for intersymbol interference (ISI), uncorrelated transmitter jitter remains a challenge as companies work to bring PCIe devices to market.

To ensure the performance of PCIe transmitter designs, Keysight solutions include a real-time oscilloscope (**Infiniium UXR**) plus electrical performance validation and compliance software.

### D9050PCIC PCI Express transmitter test compliance software for PCI Express 5.0

Test, debug, and characterize PCIe Gen5 designs. The software automatically configures the oscilloscope for each test and generates an HTML report upon test completion.

- PCI Express Tx analysis of PCIe 5.0 signals at speeds up to 32 GT/s
- uncorrelated jitter, preset testing, uncorrelated PWJ, and more
- configurable pass / fail margin reporting
- HTML summary report

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### D9040PCIC PCI Express transmitter test compliance software for PCI Express 5.0

Verify and debug PCIe 4.0, 3.0, 2.0, and 1.1 / 1.0a designs for silicon validation and for PCIe 3.0, 2.0, and 1.1 / 1.0a add-in cards and motherboard systems.

- workshop compliance mode for rapid PCISIG compliance testing
- support for de-embedding of test fixtures, high-speed switches, and cables
- automate testing of multilane devices under test (DUTs)
- test setup wizard
- pass / fail margin analysis

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## PCI express receiver test

Extracting digital content from the PCIe signal is significantly more challenging as PCIe speeds exceed 8 GT/s. At these high data transfer rates, PCIe receivers often get a heavily degraded signal because of the channel's high-frequency-loss characteristics, resulting in unacceptable bit error ratios. To overcome this, you must design and validate a robust receiver that can tolerate these distorted signals, using equalization techniques that restore the quality of the transmitted signal:

The Keysight **M8020A J-BERT** and **N5991 receiver compliance test automation platform** for computer applications cover PCIe transfer rates of 2.5 and 16 GT/s.

The Keysight **M8040A high-performance BERT-based solution** for data center applications covers PCIe transfer rates of 32 GT/s, as well as 16 GT/s and 8 GT/s.



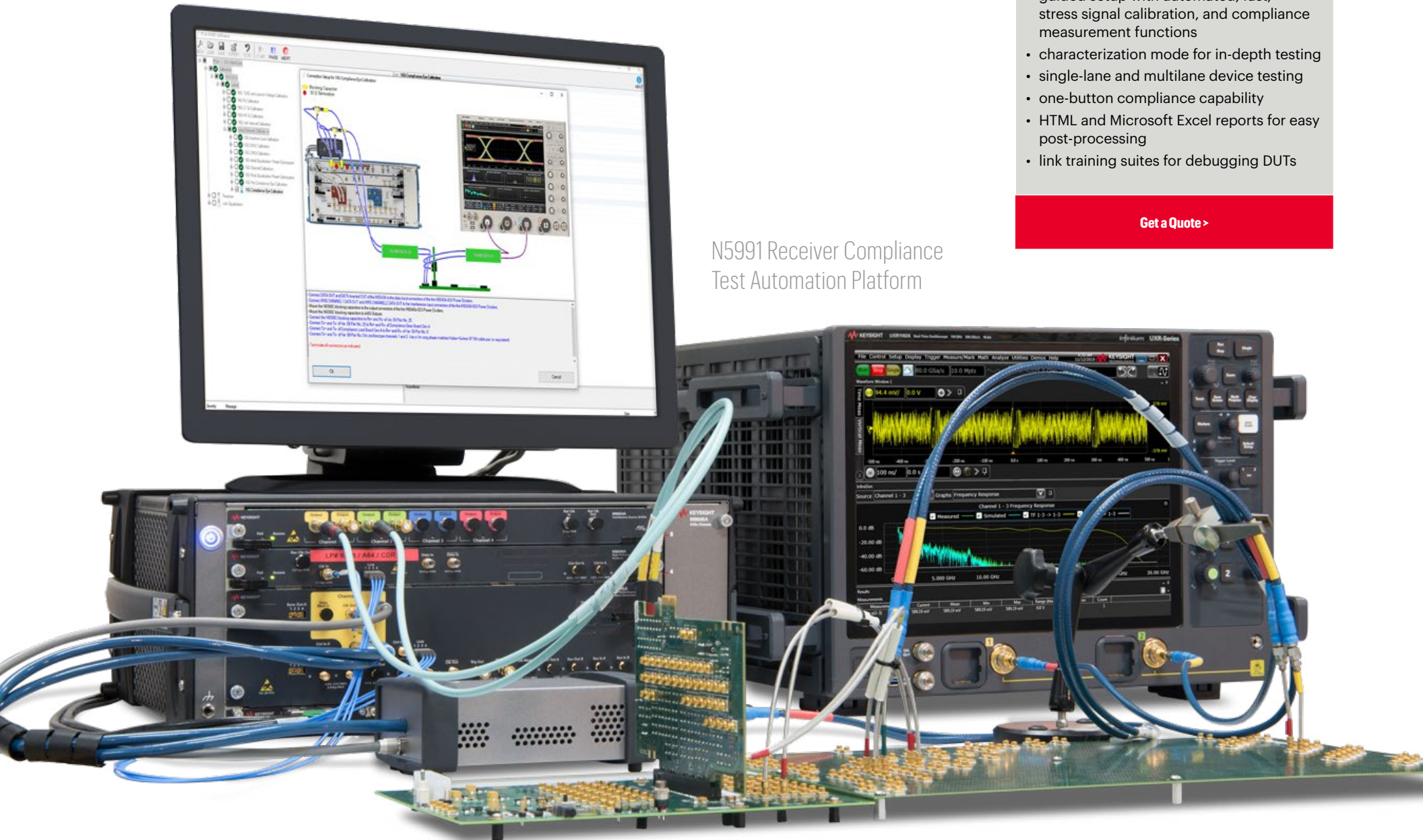
M8020A J-BERT

## N5991 receiver compliance test automation platform

- guided setup with automated, fast, stress signal calibration, and compliance measurement functions
- characterization mode for in-depth testing
- single-lane and multilane device testing
- one-button compliance capability
- HTML and Microsoft Excel reports for easy post-processing
- link training suites for debugging DUTs

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### N5991 Receiver Compliance Test Automation Platform



## PCI express interconnect test

The channel is a key element of PCIe systems. Crosstalk, jitter, and intersymbol interference (ISI) can all cause channel distortion, degrading transmitter-to-receiver signal quality.

Keysight solutions measure loss characteristics across the channel to ensure that they are within the PCIe specification limits.



E5080B ENA Vector  
Network Analyzer

### E5080B ENA vector network analyzer (VNA)

Completely characterize passive components, amplifiers, mixers, and frequency converters with a single instrument with integrated measurement capabilities

- 9 kHz to 4.5 / 6.5 / 9 / 14 / 20 GHz, 100 kHz to 26.5 / 32 / 44 / 53 GHz
- most flexible, integrated ENA network analyzer
- wide range of measurement applications
- second source available on 4-port models

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### N1930B physical-layer test system (PLTS) 2020 software

Industry-standard solution for signal integrity measurements and data post-processing of high-speed interconnects such as cables, backplanes, PCBs, and connectors

- 64-bit PLTS code for huge S-parameter files
- PAM4 eye diagram decision feedback equalization automatic tap optimization for multichannel simulation
- mode-conversion analysis for early insight into EMI problems
- advanced error-correction techniques

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### M9375A PXIe vector network analyzer

- pay for only the frequency range you need, with a choice of six frequency ranges up to 26.5 GHz
- improve accuracy, yield, and margins with the best PXI VNA speed, dynamic range, trace noise, and stability
- add functionality to your test system with a scalable VNA that can accommodate up to 32 channels in a single chassis
- cascade multiple models for multiport applications

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# DDR Test

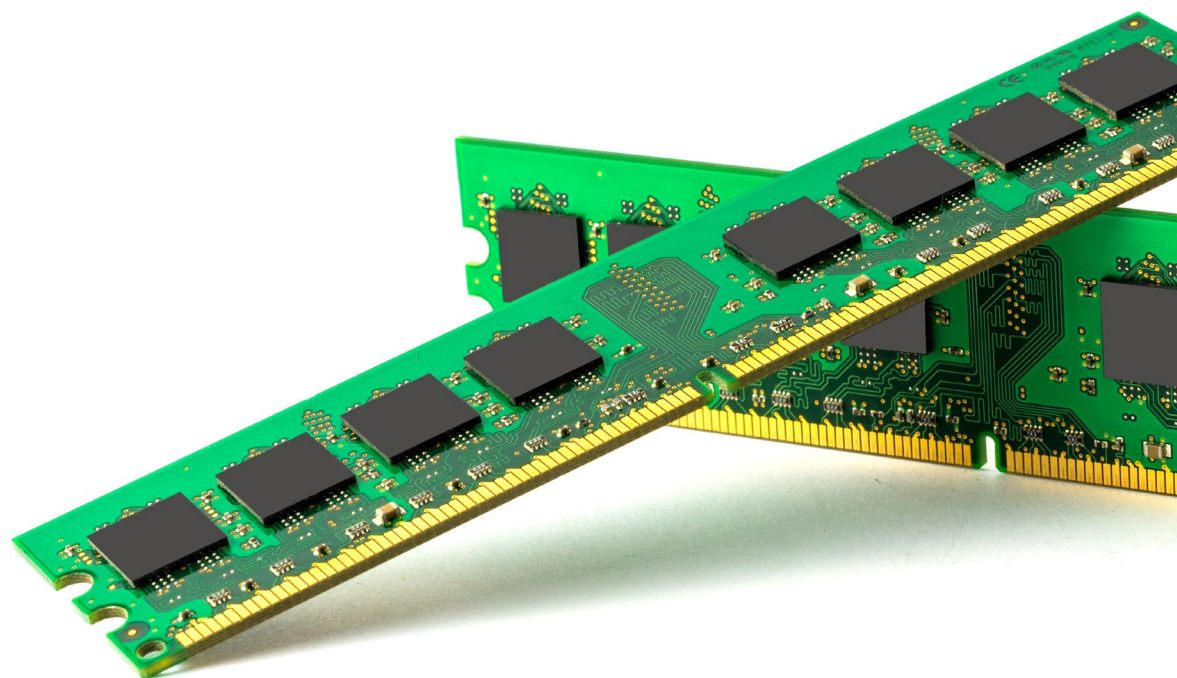
PCIe is a core technology used in many types of computer servers and endpoint devices. The PCI Special Interest Group (PCI-SIG®) defines specifications and compliance tests that guarantee the interoperability of PCIe systems. Each generation of the PCIe standard doubled the data transfer rate and increased the complexity of test. The PCI-SIG approves test solutions to ensure that tested products comply with the standard.

## DDR transmitter test

Keysight's DDR Tx test solutions include a real-time oscilloscope, such as the **Infiniium UXR**, and electrical performance validation and compliance software for the version of DDR that you need to test to precise industry specifications.

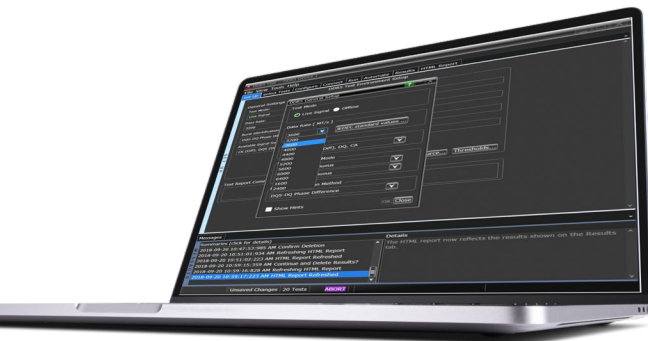
## DDR transmitter compliance test software

Keysight's DDR Tx compliance software tests, debugs, and characterizes your DDR and Low-Power DDR (LPDDR) designs quickly and easily. It automatically configures the oscilloscope for each test and generates an HTML report at the end of the test. The application compares the results with the specification test limit and includes margin analysis, indicating how closely the device passes or fails each test.

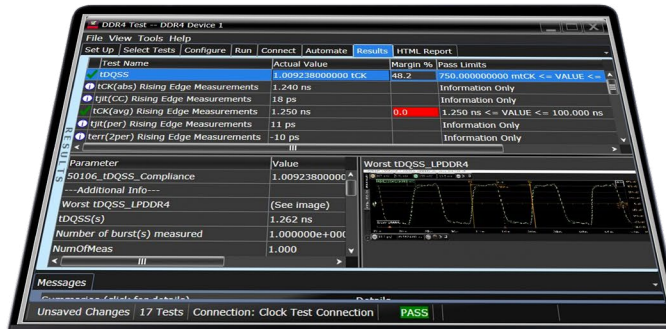


Key features include the following:

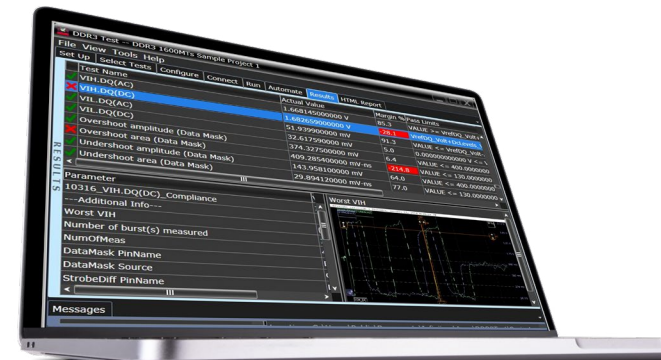
- validation and characterization of clock jitter, electrical, and timing measurements according to JEDEC specifications
- automated JEDEC test measurement
- comprehensive debug mode
- statistical analysis on read and write data for margin testing
- data analytics capabilities — data import into data repository server and aggregate test results viewing



**D9050DDRC DDR5 Tx  
compliance test software**



**D9040DDRC DDR4 and LPDDR4  
compliance test software**



**D9030DDRC DDR3 and LPDDR3  
compliance test software**

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# DDR receiver test

DDR 5.0 introduces receiver compliance tests that previous generations of the standard did not require. Keysight's DDR5 receiver test solution includes the **M8020A J-BERT high-performance BERT** and **M80885RCA compliance software**, which allows you to use the M8020A J-BERT to perform automated testing and margin analysis on DDR5 receiver designs:

- automatically configure the J-BERT for each test and get an informative test result
- margin analysis indicates how close your device passes or fails each test parameter
- automate the measurement as defined in the test specification

M8020A J-BERT  
High-Performance BERT



## M80885RCA DDR5 receiver conformance and characterization test application

Assist and simplify stress signal calibration for testing the inputs of DDR5 SDRAM devices, including DIMM, DRAM, RCD, and buffer devices at the physical layer. This ensures minimum required performance and interoperability.

- remote control of the test instruments
- automatic programming of your DUT into test mode for each test
- automated calibration following the procedure recommended in the specification
- automatic and unattended conformance testing and characterization measurements
- quick and easy measurement results to assess the performance of your DUT without expertise in BERT and DDR5 standard
- support for data analytics using **Keysight's PathWave Measurement Analytics**

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## DDR protocol validation

When DDR memory systems do not behave as expected, functional debug, analysis, and protocol compliance validation solutions provide trace capture and analysis capabilities.

### DDR protocol validation solution

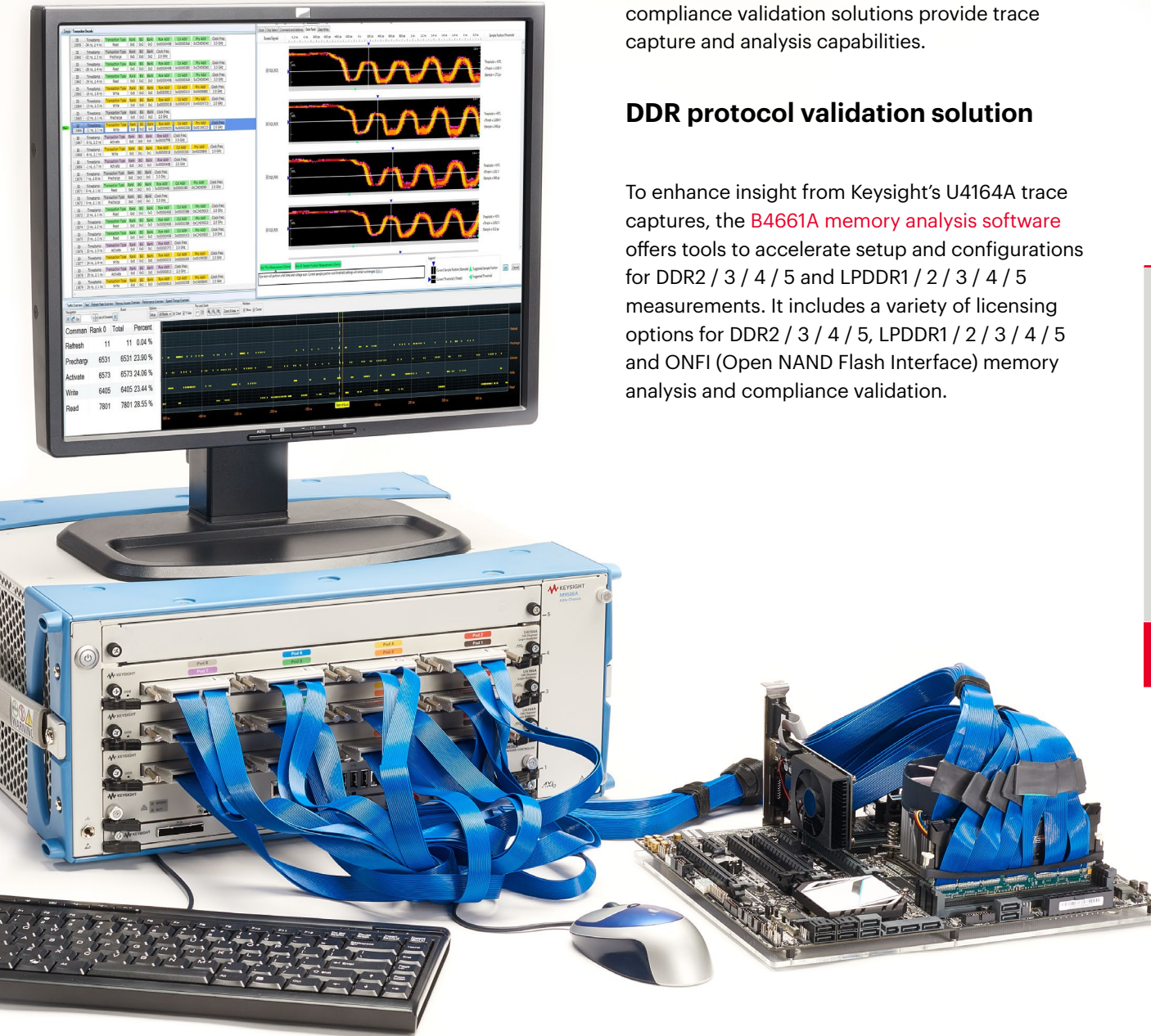
To enhance insight from Keysight's U4164A trace captures, the **B4661A memory analysis software** offers tools to accelerate setup and configurations for DDR2 / 3 / 4 / 5 and LPDDR1 / 2 / 3 / 4 / 5 measurements. It includes a variety of licensing options for DDR2 / 3 / 4 / 5, LPDDR1 / 2 / 3 / 4 / 5 and ONFI (Open NAND Flash Interface) memory analysis and compliance validation.

#### U4164A logic analyzer module

Combine reliable data capture with analysis and validation tools to validate and debug high-speed digital designs operating at speeds up to 4 Gb/s state speed mode options up to 4 Gb/s

- quad sample state mode provides four samples at two thresholds from a single probe point
- clock hysteresis settings for state mode
- full memory depth timing modes up to 10 GHz
- up to 400 Mb memory depth options (400 Mb full channel timing, 800 Mb half-channel timing, 1.6 Gb quarter-channel timing)
- deskew interface for timing modes

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# USB Test

The USB Type-C connection includes four sets of transmit and receive pairs, which enables one, two, or all four channels to transfer data simultaneously at any time. Enhanced power delivery provides up to 100 watts (W) for bidirectional device charging. These combined Type-C features and enhancements significantly increase the complexity of USB Tx / Rx conformance testing. Automated compliance test software can help you quickly and accurately validate your USB interfaces. Keysight's USB transmitter and receiver test solutions can help you seamlessly integrate USB Type-C into your devices:

- USB transmitter test solutions include a real-time oscilloscope, such as the [Infiniium UXR-Series](#), and compliance test software appropriate for the version of USB that you need to test to precise industry specifications
- USB receiver test solutions include either the [M8020A J-BERT high-performance BERT](#) or the [M8040A high-performance BERT](#), plus compliance test software



**Transmitter compliance test software**

**Receiver compliance test software**

**Related products**

D9040USBC USB4 Tx compliance test software

D9020USBC USB 3.2 Tx compliance test software

U7243C USB 3.1 transmitter compliance software

N5991U40A USB4 receiver compliance test software

N5991U32A USB 3.2 receiver compliance test software

N7019A USB4 Type-C active link test fixture

D9010USBP USB4, USB 3.x, USB 2.0 and eUSB2 protocol decode / trigger software





Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at [www.keysight.com](http://www.keysight.com).

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