KEYSIGHT TECHNOLOGIES

High-Performance Digital Products Catalog

TABLE OF CONTENTS

Physical-Layer Characterization, Validation, and Compliance Testing Systems

Today's enterprise and consumer products are driving the need for faster processing at lower power consumption and pushing your design margins to the extreme. Consumer technologies, communication infrastructure, data centers, pure science, electronic warfare, and quantum computing are driving measurement limits.

Today's laboratory requires best-in-class measurement and stimulus tools that can help validate test needs now and in the future. The Keysight Infiniium UXR-Series oscilloscope, Infiniium MXR-Series oscilloscope, M8100A Series arbitrary waveform generators (AWG), the J-BERT M8020A and M8040A high-performance bit error ratio testers (BERT) and Infiniium DCA sampling oscilloscopes are invaluable tools for testing and validating complex signals.

From physical-layer characterization to validation and compliance testing solutions, Keysight's high-performance digital test tools enable you to design, verify, and characterize each step of your design workflow.

UXR1104A Infiniium UXR-Series oscilloscope

Infiniium UXR-Series Oscilloscope

The Infiniium UXR is the first series of real-time oscilloscopes to offer ultra-high-performance acquisition with 10 bits of high-definition resolution. Designed with upgradability in mind, the UXR will support your current and future designs 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 Keysight's MultiScope support
- ENOB from 6.8 to 5.0 (13 GHz to 110 GHz)

Learn more about the UXR-Series

Specifications (at max bandwidth)	3.5 mm Models	1.85 mm Models	1 mm Models
Bandwidth	13 to 33 GHz	40 to 70 GHz	5 to 110 GHz
Maximum sample rate	128 GSa/s	256 GSa/s	256 GSa/s
Noise at highest sensitivity and bandwidth	< 0.3 mV (rms)	< 0.5 mV (rms)	< 0.9 mV (rms)
ENOB at >=400 mVfs average value from DC to full licensed bandwidth of model	from 6.8 to 5.9	from 5.8 to 5.4	from 5.5 to 5.0
Max multiframe channels	40 channels maximum (10 oscilloscopes)		
Detectable symbol rate (licensed / at maximum bandwidth)	66 Gbaud / 66 Gbaud	100 Gbaud / 140 Gbaud	80 Gbaud / 220 Gbaud
Vertical sensitivity (hardware) Vertical sensitivity (with zoom)	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
Hardware acquisition / acceleration system	• 10-bit ADC • 1,000,000 wfms / sec • 2.16 GHz digital downconversion (DDC analysis bandwidth) • 5 to 10 GHz mmWave frequency extensions • Equalization and clock recovery • Real-time eye plotting and averaging		
Upgradability	• Bandwidth (from 13 to 16, 20, 25, 33, 40, 50, 59, 70, 80, 100 to 110 GHz) • Memory from 200 Mpts / CH to 1 Gpts or 2 Gpts • 2 to 4 channels		
	GET A QUOTE	GET A QUOTE	GET A QUOTE

Infiniium UXR-Series mmWave Wideband Analysis Acceleration and Frequency Extension (N2163A)

The UXR-Series supports new mmWave measurement capabilities. In combination with its analysis, compliance, and protocol applications, the Infiniium UXR-Series oscilloscope offers up to four phase-coherent channels, each with up to 110 GHz of usable bandwidth. The UXR-Series comes standard with hardware-accelerated digital downconversion (DDC) capabilities, so even the most demanding multiple input / multiple output (MIMO), mixed-signal, radar, Satcom, or high-frequency, high-bandwidth designs are no challenge.

SIMULTANEOUSLY CAPTURE ON UP TO FOUR CHANNELS

- ability to set different center frequencies on each channel
- MIMO 4x4 support (1 UXR) or MIMO 8x8 with MultiScope

<1S UPDATE RATE WITH DDC

- captures >2s of 5G frames with max memory and DDC

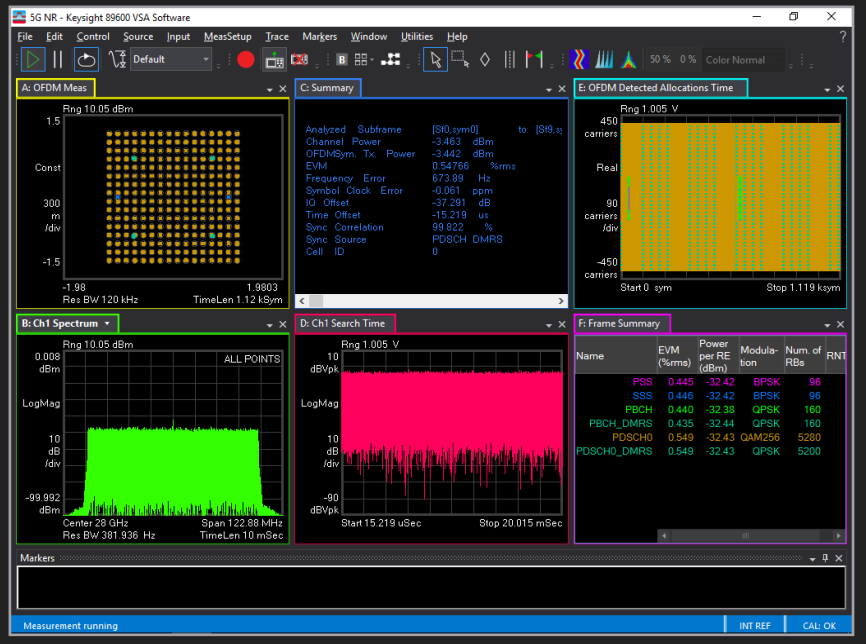
SUPPORTS ALL 5G NEW RADIO (NR) FREQUENCY BANDS

- FR1 (450 MHz – 6000 MHz)
- FR2 (24250 MHz – 5260 MHz)
- supports CC BW >400 MHz
- DDC support for multi-CC aggregation up to 2 GHz BW

SUPERIOR EVM PERFORMANCE

- equal to or better than a spectrum analyzer in FR2 bands
- 0.54766% error vector magnitude (EVM) at 28 GHz center frequency (CF)

Learn more about the mmWave Wideband Analysis Acceleration and Frequency Extension



5G NR FR2 28 GHz CF, 100 MHz BW CC, 256QAM fully filled

UXR Hardware Acceleration

- 1 mm input UXR-Series oscilloscope 5, 25, 40, 59, 70, 80, 100, 110 GHz AP models
- Analyze up to 5 GHz or 10 GHz wide bands / channels from DC up to 110 GHz
- 2.16 GHz DDC for real-time IQ data demodulation compatible VSA for RF and vector analysis (IQ data processing)

GET A QUOTE

UXR10004A real-time oscilloscope

Infiniium MXR-Series Oscilloscopes

SEE MORE. DO MORE. SAVE TIME.

You want your design to shine, and that means seeing more signals in new ways. Be ready with a Keysight Infiniium MXR-Series oscilloscope: it's your window into the intricate interactions of complex designs. Get from symptom to resolution fast by coupling an 8-in-1 bench solution's efficiency with unprecedented simultaneous eight-channel performance.

- Get faster test speeds than ever before with ASICs from Keysight's 110 GHz oscilloscopes.
- Make accurate measurements with effective number of bits (ENOB) up to 9.0 and noise as low as 43 µV.
- Extend your oscilloscope's capabilities with 8-in-1 instrument integration.
- Protect your investment with complete upgradeability; add options, bandwidth, and more channels at any time.

Learn more about the MXR-Series

Infiniium MXR-Series 8-channel oscilloscope

INFINIIUM MXR-SERIES OSCILLOSCOPES

Specifications		MXR05XA	MXR10XA	MXR20XA	MXR25XA	MXR40XA	MXR60XA
Bandwidth (-3 dB)	50 Ω	500 MHz	1 GHz	2 GHz	2.5 GHz	4 GHz	6 GHz
	1 MΩ	500 MHz	500 MHz	500 MHz	500 MHz	500 MHz	500 MHz
Typical rise / fall time	10 / 90%	860 ps	430 ps	215 ps	172 ps	107.5 ps	71.7 ps
	20 / 80%	620 ps	310 ps	155 ps	124 ps	77.5 ps	51.7 ps
Channels		4 or 8 channels analog, 16 channels digital (optional)					
Sample rate		16 GSa/s, all analog channels					
Memory		Standard: 200 Mpts / channel (all channels) / Optional: 400 Mpts / channel (all channels)					
Integrated instruments		Digital channels, protocol analysis, arbitrary waveform generator (50 MHz), frequency response analysis (50 MHz), 4-digit digital multimeter (10-digit counters), logic analysis (16 channels), real-time signal analyzer, and phase noise analysis					
Noise floor		100 µVrms noise floor at 1 mV / div (2.5 GHz), 43 µVrms noise floor at 1 mV / div (20 MHz)					
Serial protocol options		I^2C, SPI, SR232 / UART, JTAG, CAN, CAN-FD, LIN, FlexRay, SVID, USB 2.0, USB-PD, MIPI RFFE, eSPI, I^2S, Ethernet 10 / 100BASE-T, SpaceWire, SPMI, 100BASE-T1, Manchester, ARINC429, MIL-STD1553, 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					
Triggering		Edge, edge transition, edge then edge (time / event), pulse width, glitch, runt, timeout, pattern / state, setup / hold, window, protocol, generic protocol, burst, Nth edge, OR'd edges, Zone touch trigger, measurement limit, and non-monotonic edge					
		GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE

M8199A 256 GSa/s arbitrary waveform generator

M8100A Series Arbitrary Waveform Generators

The Keysight family of AWGs offers stimulus sources that address a wide range of applications. The precision, high speeds, and flexibility of the M8100A Series AWGs help meet your most difficult challenges.

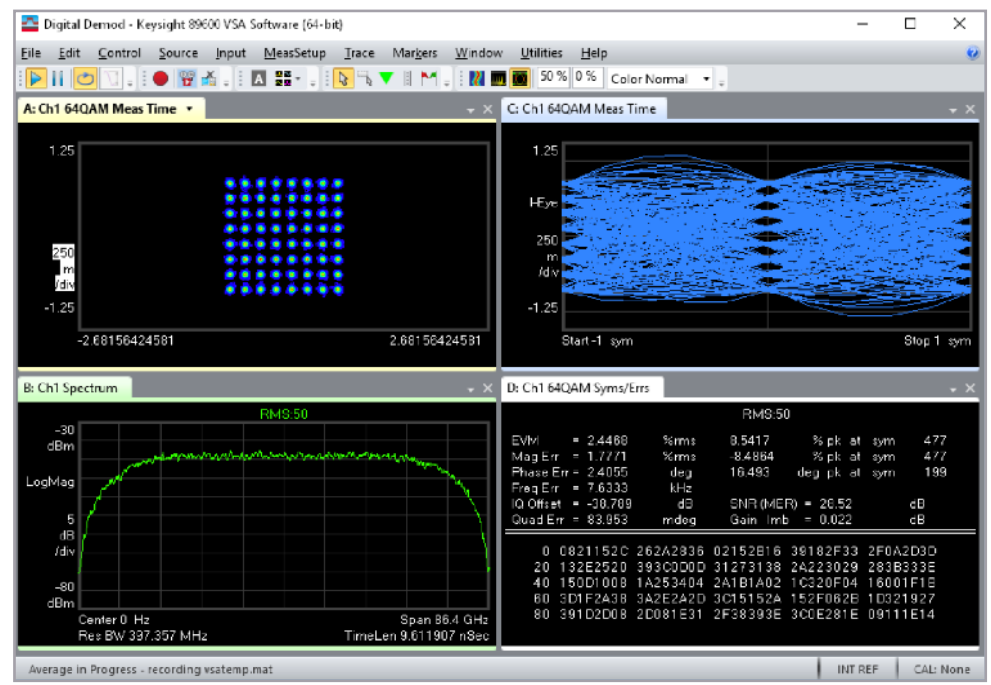
The M8190A, M8194A, M8195A, and M8199A high-performance AWGs support all of today's applications, from low-observable radar to 64QAM optical signals.

AWG APPLICATIONS INCLUDE THE FOLLOWING:

- Multilevel / multichannel digital signals up to 100 Gbaud PAM4, such as 400GbE or 1TbE
- Coherent optical applications up to 100 Gbaud / 64QAM (quadrature amplitude modulation)
- 5G, HDMI, MIPI
- Radar, electronic warfare, satellite, and general RF applications

AVAILABLE IN: HIGH SPEED AND HIGH FIDELITY

- The M8194A/95A/96A/99A AWGs are ideal for simulating multilane high-speed interfaces with high channel density, supporting up to 120 GSa/s.
- The M8190A AWG provides superior signal fidelity with up to 14 bits of resolution and a spurious free dynamic range (SFDR) up to 90 dBc, ensuring your signals clearly stand out of noise.
- All modules for the M8100A Series arbitrary waveform generators are controlled via the M8070B system software.



View all of Keysight's arbitrary waveform generators

Key specifications	High-signal-fidelity AWG	High-speed AWG			
	 M8190A	 M8195A	 M8196A	 M8194A	 M8199A
Max. sample rate	12 GSa/s	65 GSa/s	92 GSa/s	120 GSa/s	256 GSa/s
Bandwidth	5 GHz	25 GHz	32 GHz	45 GHz	70 GHz
Max. baud rate	~10 GBd	~50 GBd	~64 GBd	~100 GBd	~140 GBd
Resolution	12 / 14 bits	8 bits			
Max. amplitude	2 Vpp	2 Vpp	2 Vpp	1.6 Vpp	1.6 Vpp
Random jitter (RMS)	5 ps	200 fs	130 fs	125 fs	75 fs
Rise / fall time (20%/80%)	< 60 ps (typ)	18 ps (typ)	9 ps (typ) corrected	6 ps (typ.) corrected	5 ps
Max. ENOB (charts in datasheets)	12.25 bits	7.9 bits	8.5 bits	5.8 bits	5.7 bits
Max. SFDR	-90 dBc	-80 dBc	-73 dBc	-35 dBc	-33 dBc
# of channels	1 or 2	1, 2, or 4			
Max. memory and functions	2 GSa, with sequencer, accurate trigger	16 GSa, with sequencer, accurate trigger	256 kSa, no sequencer, limited trigger	512 kSa, no sequencer, limited trigger	1,024 kSa, no sequencer, limited trigger
Synchronization	Up to 12 channels using 6 M8190A modules and the M8192A sync module	Up to 16 channels using 4 M8195A modules and the M8197A sync module	Multi-module sync is possible using a scope for time alignment	Up to 16 channels using 4 M8194A modules and the sync cable kit	Up to 16 channels using 4 M8199A modules and a M8008A clock module
Output type	Single-ended or differential				
Size	2-slot AXIe	1-slot AXIe			2-slot AXIe
Key applications	• Radar, satellite, electronic warfare, multilevel signals • ADC testing, jitter margin testing • Digital video, noise power ratio • Measurement, wireless HD, MHL • IEEE 802.11ad, CaTV, OFDM, software-defined radio	• Coherent optical • Multilevel / multichannel digital signals • Physics, chemistry and electronics research • 5G, HDMI, MIPI • Random interference (RI) in BERT system	• Coherent optical • Multilevel / multichannel digital signals up to 64 Gbaud PAM4 • 200 GbE, 400 GbE • Quantum physics and advanced research • Random interference (RI) in BERT system	• Coherent optical up to 64QAM • Multilevel / multichannel digital signals up to 100 Gbaud PAM4 • 200 GbE, 400 GbE, 1 TbE • Quantum physics and advanced research	• Coherent optical • Wideband RF signal generation in wireless and aerospace / defense • Physics, chemistry, and general-purpose electronics research
	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE

M8040A High-Performance BERT, J-BERT M8020A, and M8070B Software

Whether you are working on data center or computing technologies, Keysight BERTs enable physical layer characterization, verification, and compliance testing for both NRZ (non-return-to-zero) and PAM4 (pulse amplitude modulation 4-level) coding schemes. Master your next design with flexible modules, intuitive software, advanced analysis applications, and expert-level support.

M8040A HIGH-PERFORMANCE BERT

- Up to 64 Gbaud PAM4 and NRZ
- Serve both data center (PAM4) and computing (NRZ) with the same two hardware modules via software upgrades

J-BERT M8020A

- Up to 32 Gbit/s NRZ
- Only capable of NRZ generation and analysis

All modules for the M8040A and M8020A are controlled via the M8070B system software.

View all of Keysight's BERTs

M8040A 64 Gbaud high-performance BERT

J-BERT M8020A high-performance BERT

Key specifications	M8040A		M8020A		
	M8045A	M8046A	M8041A	M8051A	M8062A
Module type	Pattern generator	Error analyzer	Pattern generator, error analyzer	Pattern generator, error analyzer (channel extender)	Pattern generator, error analyzer
Data format	NRZ, PAM3, and PAM4	NRZ and PAM4	NRZ		
Data / symbol rate	2 Gbaud to 64 Gbaud	NRZ: 5 Gbaud to 64 Gbaud PAM4: 5 Gbaud to 58 Gbaud	0.256 to 16 Gbit/s		0.512 to 32 Gbit/s
Channels	1 or 2	1	1 or 2	1 or 2 channels (extending the system to 3 or 4 channels total)	1
Amplitude differential	0.08 to 0.9 Vpp (single ended) 0.16 to 1.8 Vpp (differential)	N/A	0.05 to 1.2 Vpp (single ended) 0.1 to 2.4 Vpp (differential)		
Input sensitivity	N/A	Per eye: 12% of input range setting + 40 mV eye height (from 5 to 64 Gbd NRZ and 32 Gbd PAM4) and +15 mV eye height (from 32 to 53 Gbd PAM4)	50 mV (single ended and differential)		
Software upgradeable	Yes		Yes		
Integrated FEC (forward error correction)	Yes	N/A	No		
Integrated de-emphasis	Yes	N/A	Yes		
Integrated equalization	N/A	Yes: FFE	Yes: CTLE (continuous time linear equalizer)		
Jitter injection	RJ, PJ1, PJ2, SJ, BUJ, and clk/2	N/A	RJ, PJ1, PJ2, SJ, BUJ, sinusoidal level interference,SSC, clk/2		LFPJ, HF PJ, Clk/2, BUJ, RJ, SSC
Interactive link training / SKPOS filtering	Link training and SKPOS filtering: PCIe, USB, SATA, SAS, CCIX		Link training: PCIe, USB; No SKPOS filtering		No
Clock recovery	N/A	Up to 64 Gbaud	Up to 16.2 Gbit/s		Up to 32 Gbit/s
Connector type	1.85 mm (clk & trig out — 3.5 mm)	2.4 mm	3.5 mm		
Size	3-slot	1-slot	3-slot	2-slot	2-slot

GET A QUOTE

GET A QUOTE

Infiniium DCA Series oscilloscopes

Infiniium DCA Sampling Oscilloscopes

DCA-X SERIES

The DCA-X wide-bandwidth sampling oscilloscopes are part of Keysight's digital communication analyzer (DCA) family. These modular platforms provide accurate and precise measurements of high-speed digital designs from 50 MBd to more than 80 GBd. DCA modules provide a wide range of configurations and performance options to interchange the bandwidth, channel count, and features.

- Achieve high bandwidths up to > 110 GHz with jitter as low as 50 fs and noise as low as 275 µV.
- Customize with plug-in modules for optical, electrical, and TDR / TDT / S-parameter analysis.
- Get high test throughput with a module bay that supports up to 16 channels.

Learn more about the DCA-X Series

DCA-M SERIES

Built on Keysight's DCA technology, the DCA-M family is the industry standard for verifying optical transmitter compliance to communications standards. With single to quad optical and electrical channels in a compact form factor, the DCA-M is ideal for both manufacturing and research and development (R&D) applications.

- Analyze a wide range of data rates, from 8.4 GBd through 64 Gbaud.
- Achieve characteristic intrinsic jitter as low as 160 fs RMS.
- Get support for both multimode and single mode for single-to quad-channel models.

Learn more about the DCA-M Series

Key specifications	DCA-X Series							DCA-M Series	
	N1030A	N1030B	N1040A	N1045B	N1046A	N1055A	N1060A	N1092 A/B/C/D/E	N1094A/B
Bandwidth, -3 dBo / -3 dB	65 GHz optical / 95 GHz electrical	65 GHz	60 GHz	60 GHz	> 100 GHz	50 GHz	> 90 GHz	Up to 45 GHz optical / 50 GHz electrical	Up to 50 GHz electrical
Channel	1 optical / 1 electrical (optional)	2 optical	2 electrical	2/4 electrical remote head	1/2/4 electrical remote head	2/4 electrical remote head with TDR / TDT	2 electrical with CRU & PTB	Up to quad channels with the combination of optical and electrical	2/4 electrical
Jitter	≤ 90 fs rms							< 200 fs rms	
RMS noise	16 µW	16 µW	275 µV	310 µV	440 µV	600 µV	700 µV	3 µW	275 µV
Filter range	15.6 to 80 GBd	15.6 to 80 GBd	10 to 70 GHz	10 to 70 GHz	22.5 to 130 GHz	N/A	16.5 to 100 GHz	8.4 to 64 GBd	N/A
Wavelength	1,250 nm to 1,600 nm		N/A					830 to 1,600 nm	N/A
Supported modulation format	PAM4 / NRZ								
Sample rate	Up to 250 kHz								
Key features	• flexible, modular platform • precision measurements on high-speed signals up to 16 channels simultaneously • powerful analysis features in optical, electrical, and TDR / TDT measurements							• high-accuracy, cost-effective solution • low-noise, high-sensitivity calibrated optical reference receivers • small form factor for both manufacturing and R&D applications	
	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE	GET A QUOTE

N1010A FlexDCA Sampling Oscilloscope Software

Keysight's N1010A FlexDCA software runs our DCA family of sampling oscilloscopes (also known as equivalent-time oscilloscopes). A DCA is an instrument that helps visualize and analyze the analog properties of high-speed signals such as those used in wireline telecom and data center links.

While FlexDCA comes installed on DCA-X mainframes, you can also install it on a PC to control a DCA-M or remotely control a DCA-X.

In addition to the N1010A FlexDCA's data acquisition and basic measurement capabilities, Keysight offers a large selection of software tools with powerful capabilities:

- N1010100A R&D package for the FlexDCA sampling oscilloscope software: This package helps R&D engineers who want to characterize their designs and gain more insight into why a signal deviates from the expected performance.
- N1010200A manufacturing package for the FlexDCA sampling oscilloscope software: This package focuses on cost of test in optical transceiver manufacturing applications. Capabilities such as RapidEye and FlexEye enhance measurement speed and flexibility. It includes measurements such as TDECQ.
- N1010300A signal integrity package for the FlexDCA sampling oscilloscope software: This package adds powerful tools to measure impedances, transfer characteristics, and S-parameter calculations to the basic TDR / TDT measurements.