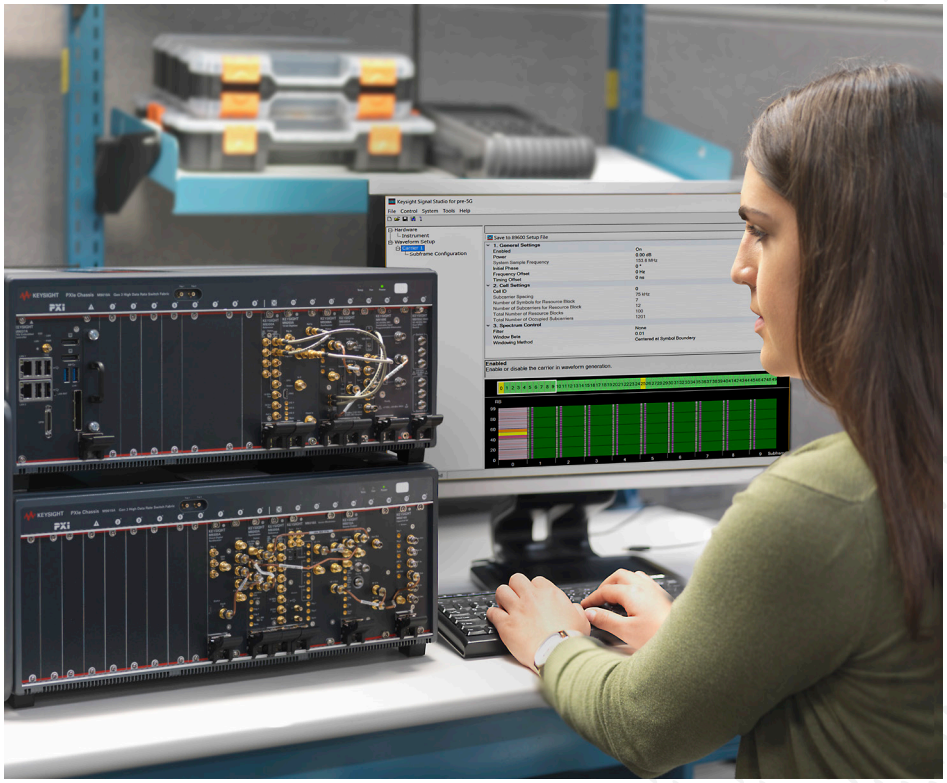
CATALOG

PXI and AXIe Products and Solutions Catalog

September 2020



KEYSIGHT TECHNOLOGIES

Table of Contents

Featured Products

M9383A PXIe Microwave Signal Generator, 1 MHz to 44 GHz

Realize pre-5G signal confidence with 1% EVM at 28 GHz, 800 MHz bandwidth in your design validation test solution, with available upgrades of frequency and bandwidth to 44 GHz and 1 GHz, respectively.

For more information, see page 20

M9421A PXIe VXT Vector Transceiver

Features exceptional EVM performance for dense modulation schemes required by 802.11ax design verification and manufacturing test up to 8x8 MIMO.

For more information, see page 20

M9341B/79A PXIe Modules for Vector Network Analyzer

Purpose-built to improve the noise floor, dynamic range or test throughput for our PXIe VNA test solutions.

For more information, see page 27

M924xA PXIe Oscilloscopes up to 1 GHz Bandwidth

Troubleshoot random and intermittent signals with advanced probing technology and a 1,000,000 waveforms per second update rate.

For more information, see page 17

M8290A Optical Modulation Analyzer & High Speed Digitizer for 400G Coherent

Specifically designed for the 400G speed class, this coherent test solution offers a smaller footprint at a lower price.

For more information, see page 38

Unlocking Measurement Insights

For more than 75 years, Keysight Technologies, Inc. has been unlocking measurement insights. Along the way, we've created industry-leading test equipment in the shapes and sizes you've asked for: full-size benchtop, small benchtop, handheld and modular. Our goal is to integrate our measurement expertise across multiple test platforms so that your teams will stay on the leading edge in your industry.

For modular instruments, our hardware innovations are focused on two specific forms: PXI and AXIe. We're putting our unrivaled performance—and consistent measurement science—into the RF, microwave and high-speed digital instruments in our PXI and AXIe portfolio.

To provide time-saving starting points for test system creation, we're documenting Reference Solutions that address specific application areas that range from power amplifier testing to satellite signal monitoring.

Software is an essential element of any test system—and Keysight software is downloadable expertise. From prototyping to simulation to manufacturing, we deliver the tools your team needs to accelerate from data to information to actionable insight. We also provide soft front panels and essential utilities that make our modular products usable within minutes out of the box, ensuring rapid time to first measurement.

Keysight has the industry's largest network of experienced local application engineers covering RF, microwave and digital—and no one can match their cumulative years of experience.

Our uptime services ensure the ongoing accuracy, performance and availability of your instruments. We can create a customized service plan with response times as fast as four hours. Our network of over 50 service locations worldwide and mobile calibration teams, provide greater convenience and flexibility to keep your products and test systems operating to warranted specifications.

Keysight's modular solutions help you tackle your toughest RF, microwave and digital challenges by delivering unrivaled PXI and AXIe performance. Our foundation is the industry's most accurate measurement science, giving you maximum confidence to achieve your first, best measurement and insight into what's next.

Keysight Premium Used: Like new. For less.

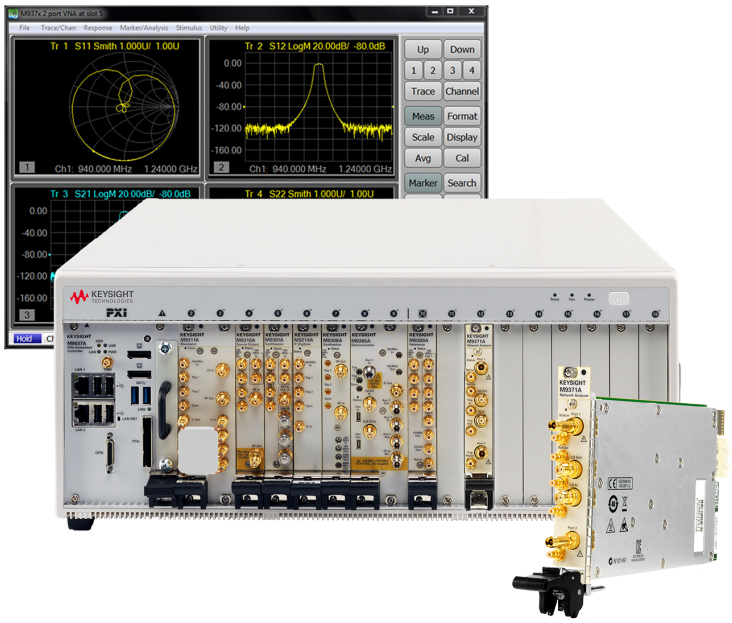
Keysight Premium Used stands for test and measurement equipment, fully manufacturing to like-new specifications and appearance. In addition to the industry's most comprehensive refurbishment process, you get the same features that come with new equipment - at a much lower price.

Like-new features include:

- Hardware and software options, added at the same savings rate
- Standard accessories and a full calibration
- Optional 3- or 5-year calibration plan
- Personal support from Keysight and authorized parthers.

Learn more:
www.keysight.com/find/kpumodular

More Test in Less Space: Driving Down the Size of Test



As silicon wafers, wireless devices and military systems have increased in complexity, multi-port vector network analysis with S-parameters has become an indispensable tool. A few years ago, vector network analysis with 4-port capability was a common need. A variety of next-generation products then entered the market, requiring 8-port measurements, and some manufacturers responded. The trend continued with the following generation requiring 16-port capability, and 32-port requirements in the near future.

A three-part test challenge: Reducing the size of VNA test systems while increasing capacity and capability

Along with this trend, many organizations are seeking to drive down the size of test with more capability per cubic inch in their test stations. This is a subset of the larger need to drive down the cost of test to help ensure ongoing profitability as prices erode in wireless communications or as business models change in aerospace and defense.

These long-term trends highlight three specific needs:

- The need to test highly complex devices in much less time without sacrificing accuracy
- The need to test multiple devices—and test in greater numbers—at a single test station
- The need to reduce the size of the test stations used to test multiple wafer sites or complex devices

The modular solution: Get more into your test system—and get more out of it

Many system developers have implemented multi-function testers within a single PXI chassis. As the chassis fills up, fewer slots are available to incorporate VNA capability. A one-slot PXI vector network analyzer (VNA) is ideal for this situation.

On the production line or in a wafer fab, there is a growing need to test multiple devices or multiple wafer sites at a single test station. Examples include mobile handsets, military radios and increasingly dense silicon wafers. In such situations, one of the key needs is to reduce the overall size of the test solution. The ability to install multiple 2-port PXI VNAs in a single chassis provides a tremendous space reduction when compared to using multiple benchtop analyzers on the production line or alongside a probing station (Figure 1).

As devices become increasingly complex, the need to easily characterize a full set of S-parameters on a large number of ports continues to increase, with 8, 16, or more ports. Examples include RF front-end modules (FEMs), multiple-input/multiple-output (MIMO) antennas, smart antennas and phased-array transceiver modules. Total characterization of an FEM used in mobile

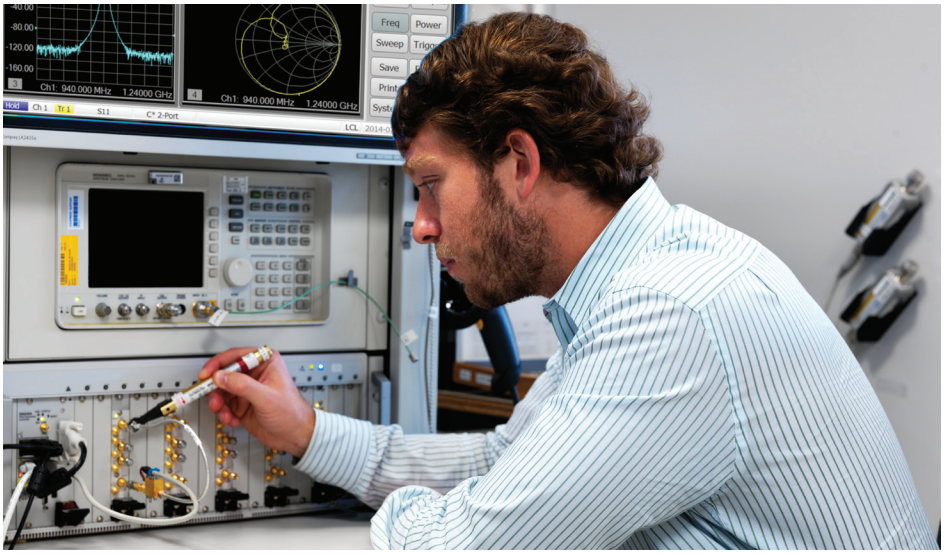


Figure 1. Adding a pair of 2-port PXI VNAs to an existing test station enables powerful device characterization without expanding system height or footprint.

handsets requires S-parameter measurement on 10 or more ports. In addition, full N-port correction is needed to ensure accurate results.

Engineers designing MIMO antennas need to investigate antenna mutual coupling, which can affect system performance. They can do this through channel measurements, and this entails simultaneous S21 measurements for all combinations of transmit and receive antennas. Here, too, full N-port correction is needed to ensure accuracy.

Whether the focus is on multi-site testing or characterization of multi-port devices, the configuration should be easy to change through software instantiations of "N-port" VNA instruments within a single chassis. For example, a single chassis containing eight 2-port VNAs could be configured as four 4-port VNAs, two 8-port VNAs, one 16-port VNA, or a myriad of other combinations.

The advantages of VNA true multiport capability

Multiport devices, requiring more than 4 ports, have historically been tested using a series of 2-port measurements combined with signal routing switches. These switching test sets or simple switch trees use VNA measurements with an RF switching matrix to route the VNA ports to the various port pairs of the DUT. The switch tree multiport solution uses a 2-port measurement for each path from the common port. So a 2-port VNA with one common port and one switch port can make all the required measurements. Since modern devices now include multiple functions with increased complexity they require more thorough multiport characterization of the devices, including more ports and measurements from each port to every other port where the response of any path depends upon the loading or match applied to every other port. Full cross-bar configurations can be used but may be challenging - as every port that is not connected to the VNA needs to be terminated by a switch load. A true multiport VNA solution is a superior alternative to VNA multiport measurement solutions requiring external switching and additional couplers, offering higher test throughput, a smaller footprint and more.

Keysight offers two true multiport PXI VNAs: M937xA and M9485A. Both have independent sources and each test port has independent reference and test receivers. The true multiport solution eliminates the loss associated with switches, and provides simultaneous data capture with multiple receivers. There is no attenuation between the DUT and measurement receivers resulting in measurements that are both highly accurate and stable. True multiport measurement sweep time, as well as the number of sweeps required for devices, is drastically improved compared to a switch matrix-based solution.

Ultimate VNA flexibility

Keysight's M937xA 1-slot PXI VNAs (Figure 2) offer remarkable speed, trace noise, stability and dynamic range. Six models are available, spanning from 300 kHz to 26.5 GHz. The M9485A multi-port VNA solution (Figure 3) provides up to 9 GHz with faster measurement speed and wide dynamic range for high-volume manufacturing applications. Flexible and reconfigurable, the M9485A goes from 4-port to 24-ports to easily meet changing test needs.

Keysight's legacy of measurement science is reflected in the instrument's hardware design, software algorithms and automated calibration procedures. Our worldwide network of service locations use consistent procedures to ensure your instruments operate to warranted specifications so you maintain ongoing measurement accuracy.

For more information, see page 26.

Figure 2. This versatile multi-port configuration uses eight 2-port PXI VNAs in a single chassis.

Figure 3. New M9485A multi-port VNA.

PXI & AXIe Reference Solutions

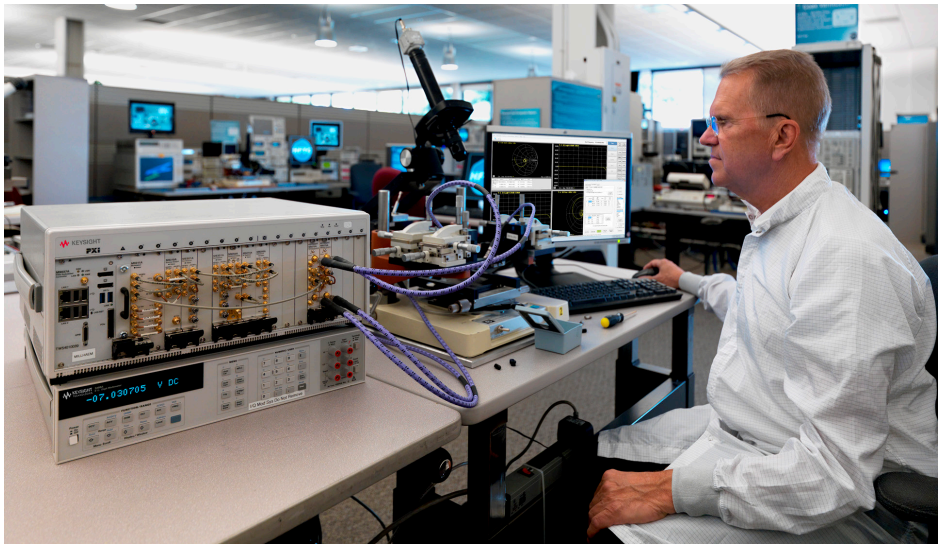
www.keysight.com/find/solution-modular

Gain insights faster with Keysight Reference Solutions, proven test systems for specfic applications. Developed to solve critical test issues for specific applications, the reference solutions provide a starting point for a test system, including:

- Hardware configurations - PXI, AXIe or benchtop instruments.
- Application software, such as 89600 VSA, Signal Studio and more.
- Open source programming commands provided to perform specific tests and optimize test speed and throughput.

The catalog includes a sample of the reference solutions offered by Keysight. For a complete list visit:

www.keysight.com/find/solution-modular



Using Keysight's M937xA PXIe vector network analyzer, M9381A PXIe vector signal generator and M9391A PXIe vector signal analyzer with measurement application software for power amplifier test.

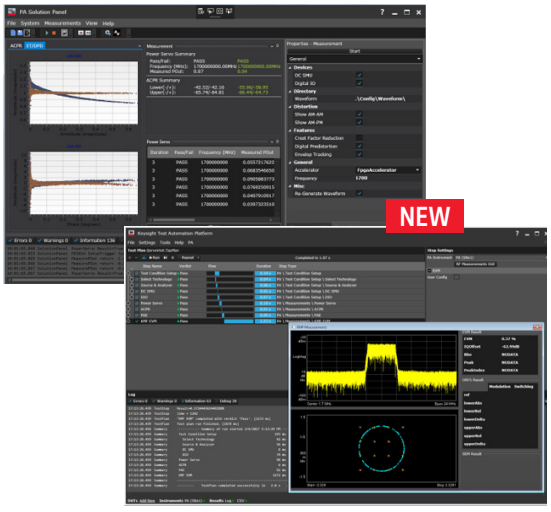
RF PA/FEM Characterization & Test

www.keysight.com/find/s8900a

Rapidly characterize next-generation RF power amplifiers/front-end modules for wireless mobile devices with Keysight's S8900A test software and PXI hardware. Significantly reduce your test system software development and maintenance effort by implementing our ready-to-use test sequences for PA/FEM design validation and manufacturing test. You don't have to be a programmer to execute fast and reliable automated RF PA/FEM tests.

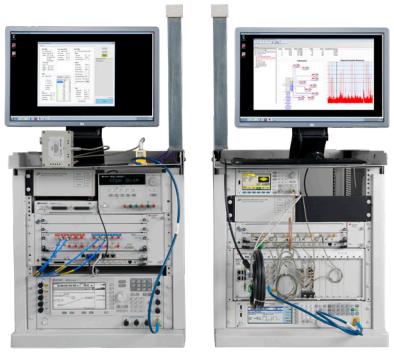
- Ready-to-use software fully supporting key PA test parameters
- Optimized measurement methods and algorithms
- Easily customizable test sequences
- Noise figure measurements
- ET/DPD measurements

The ready-to-use S8900A test software bundle includes Keysight's Test Automation Platform, or TAP (KS8400A), which provides powerful, flexible and extensible test sequence and test plan creation. For more information, see page 43.



5G Channel Sounding

www.keysight.com/find/solution-5Gsounding

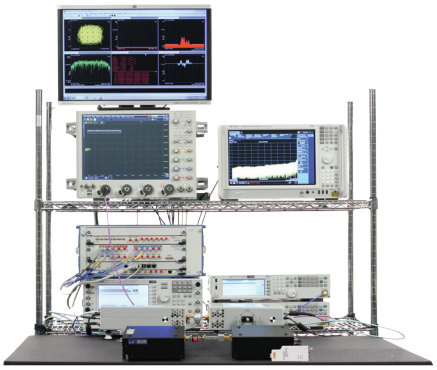


Accelerate 5G channel sounding research with mmWave, ultra-broadband and MIMO solution.

- Fastest data capture with real-time correlation and wideband MIMO channel processing
- System-wide calibrations, precise timing, and synchronization
- Flexible and scalable evolving MIMO channel count
- Tx/Rx up to 44 GHz with 1 GHz bandwidth for 4 or 8 MIMO channel
- Capture multiple, phase coherent channels for real-time processing of Channel Impulse Response (CIR) in on-board FPGAs

5G Waveform Generation and Analysis Testbed

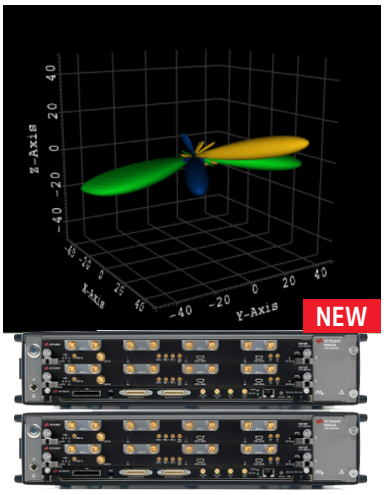
www.keysight.com/find/solution-5Gtestbed



Generate and analyze emerging 5G candidate waveforms at RF, microwave, and millimeter-wave frequencies with modulation bandwidths of up to 2 GHz. The flexible testbed includes a precision AWG, vector signal generator with wideband I/Q inputs and signal-creation software capable of generating wideband test signals with up to 2 GHz of modulation bandwidth at frequencies up to 44 GHz (and higher with upconverters). The 89600 VSA software can be used for signal demodulation and analysis, from inside the simulation software, or on a signal analyzer, oscilloscope or PC.

Full Dimension MIMO Multi-Channel

www.keysight.com/find/solution-fd-mimo

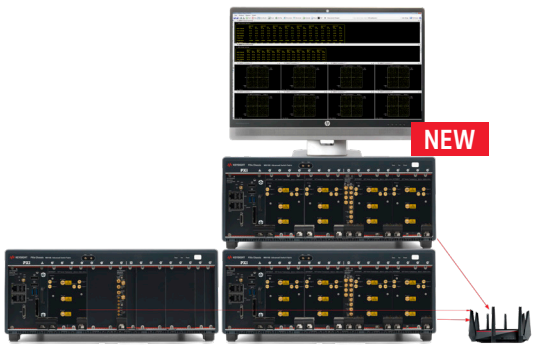


As MIMO extends to full-dimension azimuth and elevation beam steering, with 64, 128 and more antenna elements, practical and comprehensive measurement techniques are needed to verify and qualify designs. Keysight's multi-channel, phase coherent test solutions can be configured to quickly and precisely align active antenna array elements, in amplitude, phase and time.

This reference solution allows you to evaluate cellular MIMO beamforming performance, corrected for fixturing offsets, with ready-to-use RF parametric tests and 3D beamforming visualization. Rapidly verify your beamforming algorithms and hardware performance - let Keysight take care of MIMO test development and optimization.

802.11ax Test Solution

www.keysight.com/find/802.11ax

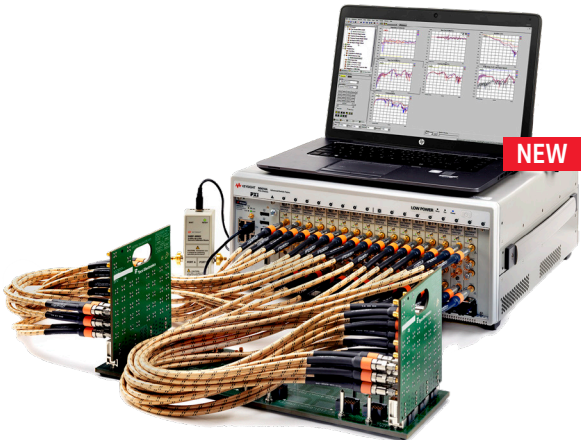


Deploy ready-to-use software that fully supports required 802.11ax test parameters, from SISO to 2x2/4x4/8x8 MIMO test, across R&D, design verification, and manufacturing test. The common user interface and software control across hardware platforms means you can easily reuse test procedures across R&D, design verification, and manufacturing, saving valuable development time.

Digital Interconnect Test

www.keysight.com/find/diref

Quickly test high port count DUTs with our turnkey 32-port, 26.5 GHz Vector Network Analyzer-based solution, built for testing of cables, backplanes, PCBs, daughter cards, IC packages, and connectors. This reference solution provides full signal integrity characterization of interconnects with multi-domain analysis including time, frequency, eye diagram, crosstalk and more in one, compact instrument. Easily transform the intuitive digital interface for use in production test with a customizable API wrapper.



Small Cell Test

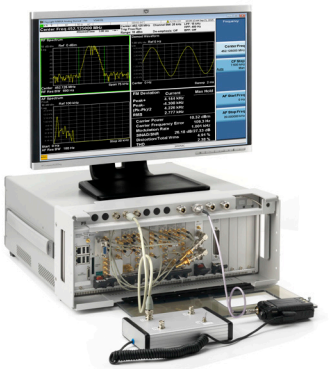
www.keysight.com/find/solution-smallcell

Proven receiver and transmitter test methodology for calibration and verification of small cell devices. Comprehensive test automation examples with instrument control, helps you simplify test development and optimize throughput. With up to 16 RF ports in a single 19" rack instrument, the reference solution can be scaled to provide superior port density and connect to multiple multi-port DUTs simultaneously.

Radio Test

www.keysight.com/find/solution-radiotest

This complete, efficient and cost-effective radio test solution provides RF and audio signal generation and analysis with a combination of PXI hardware and software in a single, flexible, scalable chassis with the same look and feel as a benchtop instrument. It delivers standard analog and digital Tx and Rx quality measurements such as modulation quality, hum and noise, sensitivity and audio quality (SINAD, THD).

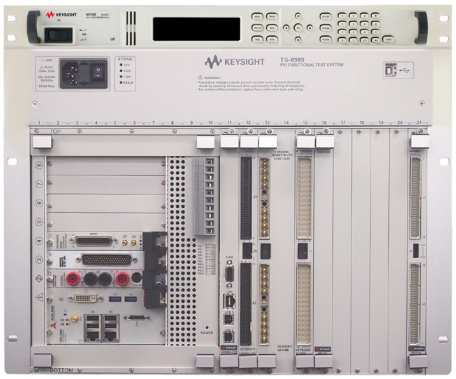


Automotive Functional Test

www.keysight.com/find/ts8989ref

This unique, flexible test configuration is designed for reliable automotive body and safety testing. It features 8 PXI slots and 11 slots of sensor signal emulation, waveform analysis, discrete input switching or high-power load switching for a complete functional test solution in a compact space.

- Load switching: current handling of 2 to 40 A, up to 48 channels per card
- Pin matrix channels: up to 64 channels per card
- Analog input channels: 30 V, 16 channels, voltage and current output
- Data acquisition: ±250 V, 2 channels, 20 MSa/s, achievable with LXI digitizer L4532A/L4534A



PXI Chassis & Controllers

www.keysight.com/find/pxi-chassis

Meet our family of PXI chassis, ranging from low-cost to high-performance

Because one-size does not always fit all, we developed a series of chassis to meet different needs. Our high-performance Gen3 chassis, available in 10-slot and 18-slot sizes provide a superior, high-speed platform for R&D and multi-channel applications. Our popular Gen2 18-slot chassis has been updated to provide more power for next generation PXIe modules. And, finally, we are offering a low-cost, portable 5-slot chassis with an integrated system module.

Multi-chassis configurations

Choose from M9022A, M9023A or M9024A system modules to build multi-chassis systems. Up to four chassis can be connected together depending on the controller and operating system used. Various configurations are possible including cascade and star topologies. For more information, visit: www.keysight.com/find/pxie-multichassis

Tested computer list

For a list of supported and tested PCs and embedded controllers, please see literature number 5990-7632EN.

Keysight M9010A/19A

PXIe Gen3 Chassis 10-slot & 18-slot

www.keysight.com/find/m9010a
www.keysight.com/find/m9019a

The M9010A/19A PXIe chassis, Gen3 offer maximum data bandwidth of 8 GB/s per slot, with individual x8 PCIe links. The 2-link system slot has a maximum data bandwidth of 24 GB/s when all 24 PCIe lanes are used.

Technical overview	M9010A	M9019A
Module compatibility	PXIe, PXI-Hybrid, PXI-1 (J1 only, cPCI (J1 only)	
Number of slots	10 total, 8 hybrid, 1 PXIe system, 1 PXIe timing	18 total, 16 hybrid, 1 PXIe system, 1 PXIe timing
Backplane fabric	Gen3 (PCIe 3.0)	Gen3 (PCIe 3.0)
Data bandwidth	24 GB/s max (system slot), 8 GB/s max (slot to slot)	
Usable DC module power	470 W (100-120 V) 830 W (220-240 V)	650 W (100-120 V) 800 W (220-240 V)
Power dissipation	140 W (system slot), 42 W per slot (depending on configuration)	
Multi-chassis power sync	Yes	Yes
Front panel trigger ports	Yes	Yes

Keysight M9005A/18B

PXIe Chassis, 5-slot & 18-slot

www.keysight.com/find/m9005a
www.keysight.com/find/m9018b

Keysight offers a M9018B Gen2 and M9005A Gen1 chassis. The 18-slot M9018B delivers 16 hybrid slots with industry-leading usable DC power and cooling per slot. It's ideal for large systems when Gen3 performance ins not required. The M9005A PXIe 5-slot chassis, Gen1 is perfect for small, low-cost, low channel count test applications.

Technical overview	M9005A	M9018B
Module compatibility	PXIe, PXI-Hybrid, PXI-1 (J1 only, cPCI (J1 only)	
Number of slots	5 total, 2 PXIe, 3 hybrid	18 total, 16 hybrid, 1 PXIe controller, 1 PXIe timing
Backplane fabric	Gen1 (PCIe 1.0)	Gen2 (PCIe 2.0)
Data bandwidth	250 MB/s slot to slot	8 GB/s system slot 4 GB/s slot to slot
Usable DC module power	150 W	100-120 V: 708 W 220-240 V: 858 W
Power dissipation	38 W per slot	140 W system slot, 42 W per slot, depending on configuration
Multi-chassis power sync	No	Yes
Front panel trigger ports	No	Yes

Keysight M9036-37A

PXIe Embedded Controller, Gen2 & Gen3

www.keysight.com/find/m9036a
www.keysight.com/find/m9037a

Keysight offers the M9036A Gen2 and M9037A Gen3 embedded controllers. The high performance M9037A is designed for complex, multi-channel and multi-chassis systems. It offers a removable 240 GB solid state drive for secure environments. Built upon the high-performance Intel i7-4700EQ 2.4 GHz Quad-core processor with hyper-threading technology and low power consumption, it is ideal for complex test applications.

Technical overview	M9036A	M9037A
Size	3-slot	4-slot
CPU	Intel dual-core i5-520E (2.4 GHz) 2244 Passmark	Intel quad-core i7-4700EQ (2.4 GHz) 7417 Passmark
Memory and storage	4 GB std, 8 GB max (1,066 MHz) 160 GB SSD	4 GB std, 16 GB max (1,600 MHz) 240 GB SSD
Removable SSD	No	Yes
Backplane link	2x8 or 4x4 (Gen2 backplane link, Gen1 CPU link)	1x8, 1x16, or 4x4 (Gen3)
Front panel link	ExpressCard x1	x8 (Gen3 [2])
Backplane link speed max	4 GB/s peer-to-peer [1] 2 GB/s from CPU to module slot	16 GB/s system (Gen3) 8 GB/s (Gen2)
I/O	USB (4), 10/100/1000/LAN (2), DVI, GP-IB	USB 3.0 (2), USB 2.0 (4), 10/100/1000/LAN (2), DisplayPort (2), PCIe x8, GP-IB

1. 2x8 mode used with M9018B for peer-to-peer without involving CPU, link to CPU is Gen1.
2. Front panel PCIe connector is rated up Gen3 with M9037A serial number ≥ TW57010001.

Keysight PXIe interface modules and host adapters

Keysight M9021A

PCIe Cable Interface, Gen2

www.keysight.com/find/m9021a

The M9021A PCIe cable interface provides a Gen2 link between the M9018B PXIe chassis, Gen2 and an external host computer.

Technical overview	
Size	1-slot 3U
PCIe link configuration	Gen2 x8 link
Data bandwidth (max)	4 GB/s to external controller 4 GB/s to M9018B backplane
Front panel connector	x8 PCIe cable connector
Front panel indicators	LEDs for PCIe lane status
Power consumption	5 W (typical)
Cable length	Up to a 2-meter passive cable supported
Only supported in the M9018B	

Keysight M9022-24A

PXI Single and Dual Port System Modules, Gen3

www.keysight.com/find/m9022a
www.keysight.com/find/m9023a
www.keysight.com/find/m9024a

The M9022A, M9023A and M9024A interface modules provide Gen3 links to a Gen3 chassis and Gen2 links to a Gen2 chassis. Configure high-performance links to a single computer, multiple chassis, or from AXIe chassis to PXI chassis. The M9024A adds I/O connectivity with a single cable connection to the host PC.

Technical overview	M9022A	M9023A	M9024A
Size	1-slot	1-slot	3-slot [1]
PXIe backplane	Gen3 4x4 or x8, x16	Gen3 4x4 or x8, x16	
PCIe cable link	Gen3 x8	Gen3 2x8 or x16	
Data bandwidth (max) To external PC To PXIe backplane Between chassis	 8 GB/s 8 GB/s (Gen3) N/A	 16 GB/s 16 GB/s (Gen3) 8 GB/s (Dual x8 mode)	
Front panel connector	1 x8 PCIe iPass	2 x8 PCIe iPass	2 x8 PCIe iPass, GP-IB, 2 USB 3.0, 4 USB 2.0, 2 RJ45 (GbE)
Power consumption	27.5W (max) 2A at 12V, 1A at 3.3V, 0.05A at $5V_{AUX}$	33.5W (max) 2.5A at 12V, 1A at 3.3V, 0.05A at $5V_{AUX}$	67.7W (max) 4.4A at 12V, 2.5A at 3.3V, 0.5A at $5V_{AUX}$

1. Uses 2 controller expansion slots.

Keysight M9048A/B, M9049A

PCIe Host Adapters

www.keysight.com/find/m9048a
www.keysight.com/find/m9048b
www.keysight.com/find/m9049a

Technical overview	M9048A	M9048B	M9049A
Card format	PCIe half-card	Low profile	Standard profile
PCIe cable link	Gen2 x8	Gen3 x8	Gen3 2x8 or x16
Slot compatibility	x8 and x16, Gen1, 2, or 3	x8 Gen 2/Gen 3, x16, Gen 2/Gen 3	x16, Gen 2/Gen 3
Data bandwidth (max)	4 GB/s	8 GB/s	16 GB/s (x16 mode)
Connector	x8 PCIe IPASS cable connector	One x8 PCIe iPass cable connector	Two x8 PCIe iPass cable connector
Power consumption	7 W (typ)	9 W (max) 0.68 A at 12 V, 0.33 A at 3.3 V	16.8 W (max) 1.4 A at 12 V

PXI Data Acquisition

www.keysight.com/find/pxi-data-acquisition | www.keysight.com/find/pxi-converters

Keysight M9185A

PXI 8/16-Channel Isolated D/A Converter

www.keysight.com/find/m9185a

The M9185A is a fully independent, isolated digital/analog converter (D/A converter) that is capable of supplying high-voltage levels in parallel of up to 8 or 16 channels. Each channel is able to output up to 16 V as stimulus signals to device under tests (DUTs). The M9185A also provides a built-in SENSE mechanism, which detects output voltage levels and feeds the information to the circuitry of the converter to compensate for the voltage drop at the receiving end of a DUT. This feature ensures the accuracy of the stimulus signals being provided to the DUT for better test performance.

Technical overview			
Size	2-slot for 8-channel, 3-slot for 16-channel, 3U		
	Range	**Resolution**	**Accuracy**
DC voltage	±16 V up to 10 mA	16-bit = 500 µV	± (0.05% + 3.0 mV)
DC current	±20 mA	16-bit = 630 nA	± (0.09% + 5.0 µA)
Temperature range	Operating: 0° C to 55° C Storage: –40° C to 70° C		
Relative humidity	80%, 0° C to 40° C (non condensing)		

Keysight M9186A

PXI Isolated Single Channel Voltage/Current Source

www.keysight.com/find/m9186a

The M9186A 2-slot, PXI V/I source module enables the sourcing of a voltage or current to perform measurements on the resultant current or voltage through another module. It consists of two separate amplifiers – one low voltage and one high-voltage – that share a common output connection. Both amplifiers can sense the amount of current flowing while forcing a constant voltage.

A unique safety interlock feature automatically disables the high-voltage amplifier and opens all relays when the interlock circuit is broken, providing protection to the DUT during the presence of high voltages.

Technical overview	
Size	2-slot, 3U
Resolution	16-bit
Accuracy	±16 V up to 200 mA: 0.02% + 3 mV –10 to + 100 V at up to 20 mA: 0.02% + 40 mV
Voltage source accuracy (% of output + offset)	
16 V range	Up to 200 mA 0.02% to 3 mV
Current source accuracy (% of output + offset)	
± 200 mA range	0.3% + 500 µA (over ± 16 V)

Keysight M9188A

PXI Dynamic Analog Output

www.keysight.com/find/m9188a

M9188A is a PXI, 1-slot 16-channel analog output capable of supplying typical waveforms at high voltages. High-voltage sensor emulation, such as for automotive electronic control unit functional testing, are addressed with the M9188A's output voltage of 0 V to +30 V preventing the need for additional signal conditioning circuitries. Its dynamic current source signal up to +20 mA simulates Hall effect sensors, such as the wheel speed sensor in transmission control unit test.

Technical overview	
Size	1-slot, 3U
Resolution	16 bit
Number of isolated banks	4 (4 channels in each bank)
Output polarity	Unipolar
Output voltage/current	0 to +30 V 0 mA to +20 mA
Memory	1 MSa/channel
Update rate/channel	500 kSa/s

Keysight M9216A

PXI 32-channel High Voltage Data Acquisition

www.keysight.com/find/m9216a

The M9216A is a high-voltage data acquisition module that allows simultaneous measurement of eight channels of positive voltages ranging from 1 mV to 100 V. Each channel in the module comes with concurrent 5 and 100 V measurement ranges – each channel capable of acquiring digital signals that fluctuate between very low and very high-voltage levels without switching ranges and doing separate measurements.

The built-in 4 to 8 multiplexer enables 32 measurement ports to be connected to the 8 acquisition channels expanding it to a full 32-channel acquisition module. The fast parallel voltage level measurements with guaranteed accuracy are ideal for the automotive applications. The 16-bit ADC enhances the resolution and accuracy.

Technical overview	
Size	2-slots, 3U
Resolution	16 bit
Accuracy	Zero offset: 5 V range – 200 µV, 100 V range – 1 mV Gain (% of reading): 5 V range – 0.05%, 100 V range – 0.05% Noise at 3 sigma: 5 V range – 200 µV, 100 V range – 2 mV

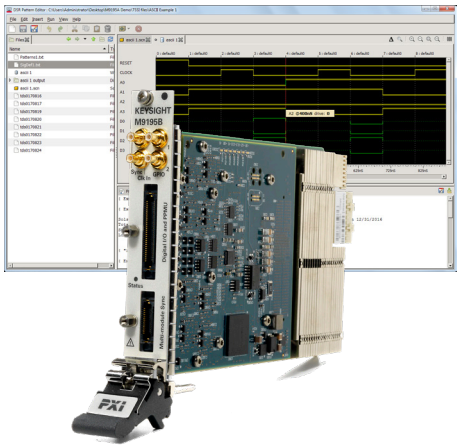
PXI Digital Input Output

www.keysight.com/find/pxi-dio

Keysight M9195B, M9192A/93A

PXIe Digital Stimulus/ Response with Pattern Editing Software

www.keysight.com/find/m9195b



The M9195B digital stimulus/response (DSR) provides speed, configuration flexibility and multi-site capability for RF chipset emulation and device characterzation. The DSR synchronizes up to 12 modules or 192 channels. With the M9192A or M9193A DSR pattern editing software packages, the M9195B offers high performance, time saving per channel parametric measurements, programmable delay and more.

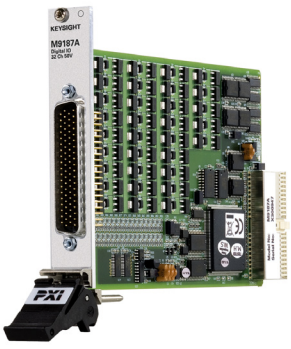
The M9192A DSR pattern editor software and M9193A pattern editor software with data converters enable engineers to create and edit waveform patterns. The M9193A software enables import of patterns created by automatic test program generators.

Technical overview - M9195B	
Maximum pattern rate	250 MHz
Number of channels per module	16 bidirectional, 4 high-voltage, 4 open drain
Data channel configuration (per pin/ per cycle)	Delay, direction, PPMU, logic levels
Vector memory	Up to 125 M vectors per channel
Edge placement resolution	1 ns minimum

Keysight M9187A

PXI Digital I/O

www.keysight.com/find/m9187a



The M9187A digital I/O control module has 32 input/output channels. The input channels can be used for comparing inputs to user-defined thresholds between 0.3 and 50 V, with 12.5 mV setting resolution. Each input is protected up to 100 V. The 32 output channels can drive high or low outputs, and are capable of sourcing 0.4 A from the high-side or sink 0.5 A from the low-side of each channel. These outputs are protected against over-voltage or over-current conditions.

Technical overview	
Input specifications	
Input impedance	1 MΩ
Max input voltage (typ)	+50 Vpk, with 100 Vpk over voltage protection
Thresholds	Dual programmable 0.3 to 50 V, 12.5 mV resolution
Output specifications	
Max voltage (typ)	+50 Vpk
Max current	0.5 A for low-side drivers, 0.4 A for high-side drivers 10 A module total
Output states	Driven high, driven low, or off
Low-side driver output voltage	0.3 V at Isink = 0.5 A
High-side driver output voltage	Vext – 1.5 V at Isource = 0.4 A

PXI Digital Multimeters

www.keysight.com/find/pxi-dmm

Keysight M9181A
PXI Basic DMM

www.keysight.com/find/pxi-dmm

The M9181A 6½ digit PXI digital multimeter (DMM) offers the most common measurement functions at an affordable price. The M9181A provides six built-in measurement types with all the reliability and stability you would expect from a Keysight PXI DMM.

Measurement ranges		
DCV, ACV; 4 ranges	200 mV to 200 V	
DCI, ACI; 4 ranges	2 mA to 2 A	
2- and 4-wire resistance; 6 ranges	200 Ω to 20 MΩ	
Function	**Lowest range**	**Sensitivity**
DCV	200.0000 mV	100 nV
ACV	200.0000 mV	100 nV
Resistance	20.0000 Ω	100 µΩ
DCI	2.000000 mA	10 nA
ACI	2.000000 mA	1 nA

Keysight M9182A, M9183A
PXI High Performance DMMs

www.keysight.com/find/pxi-dmm

The M9182A and M9183A 6½ digit high-performance PXI digital multimeters offer fast development, fast operation, and reliable results. The M9182A provides nine built-in measurement types with all the accuracy and stability you would expect from a Keysight 6½ DMM. The M9183A provides the same capabilities as the M9182A plus market-leading measurement speed, additional range and advanced triggering.

Measurement ranges	M9182A	M9183A
DCV, ACV	200 mV to 300 V	200 mV to 300 V
DCI	2 mA to 2 A	200 nA to 2 A
ACI	2 mA to 2 A	2 mA to 2 A
2 & 4-wire resistance	200 Ω to 20 MΩ	20 Ω to 200 MΩ
Frequency/period	1 Hz to 300 kHz	1 Hz to 300 kHz
Capacitance	1 nF to 10 mF	1 nF to 10 mF
Temperature	Thermocouple (B, E, J, K, N, R, S, T), RTD (6 types), Thermistor (2.25 kΩ, 5 kΩ, 10 kΩ)	
Function	**Lowest range**	**Sensitivity**
DCV	200.0000 mV	0.1 µV
ACV	200.0000 mV	0.1 µV
Resistance (M9183A)	20.00000 Ω	10 µΩ
DCI (M9183A)	200.0000 nA	0.1 pA
ACI	2.000000 mA	1 nA

PXI Digitizers

www.keysight.com/find/pxi-digitizers

Keysight M3100A/02A *

PXIe 14-bit FPGA Digitizer

www.keysight.com/find/m3100a

* Digitizer/AWG combination units available (M3300/02A)

Non-programmers can customize and accelerate test with FPGA-programmable digitizers while accessing the full performance of the FPGA. Real-time sequencing and multi-module synchronization provide phase coherency for complex configurations.

Technical overview	M3100A/M3300A	M3102A/M3302A
Size	3U, M3100A/M3102A: 1-slot, M3300A/M3302A: 2-slot	
Resolution	14-bit	14-bit
Sample rate	100 MS/s	500 MS/s
Bandwidth	100 MHz (undersampling)	200 MHz
Channels	Up to 8 channels	Up to 4 channels
Impedance	50Ω / 1MΩ	50Ω / 1MΩ
Coupling	AC / DC	AC / DC
Full-scale (FS) range	Continuous: ±200 mV to ±3V (50Ω) Continuous: ±100 mV to ±10V (1MΩ)	7 scales: ±62.5 mV to ±4V (50Ω) 7 scales: ±100 mV to ±8V (1MΩ)
SFDR	79 dBc @ 30 MHz (1.5 Vpp 50Ω)	79 dBc @ 95 MHz (1 Vpp 50Ω)

Keysight M9203A

PXIe 12-bit FPGA Digitizer, Wideband Digital Receiver

www.keysight.com/find/m9203a

The M9203A is a dual-slot 3U PXIe 12-bit wideband digital receiver running up to 3.2 GS/s, with up to 2 GHz instantaneous analog bandwidth. It includes a large 4 GB DDR3 acquisition memory and with streaming and recording option, allows up to 320 MHz instantaneous bandwidth.

Technical overview	
Size	2-slot 3U
Resolution	12 bits
Sample rate	Up to 3.2 GS/s
Bandwidth	Up to 2 GHz
Impedance	50 Ω (nominal)
Coupling	DC
Full scale (FS) range	1 V and 2 V
Spurious-free dynamic range (SFDR)	64 dBc (nominal) at 410 MHz

Keysight M9217A

PXIe 2-channel, High Voltage, Isolated Digitizer

www.keysight.com/find/m9217a

The M9217A is a high-voltage digitizer offering 2 channels of simultaneous sampling up to 20 MSa/s. For high-voltage applications, such as solenoid drivers, the input channels are able to measure up to ±256 V without attenuation. Precise results are achieved with 16-bit resolution and a choice of input ranges.

Technical overview	
Size	1-slot 3U
Resolution	16 bits
Sample rate	20 MS/s
Memory	32 MSa per channel
Isolation voltage	+40 V
11 input ranges	From ±250 mV to ±256 V
Programmable sample rates	From 1 kSA/s to 20 MSa/s

PXI Oscilloscopes

www.keysight.com/find/pxi-oscilloscopes

The Power of a Benchtop Oscilloscope in a Modular Package

The InfiniiVision M924xA Series redefines PXI oscilloscopes. It gives you the most signal detail with maximum investment protection and is built with technology that leverages decades of Keysight's high performance oscilloscope expertise.

Keysight M9241-43A
PXI Oscilloscopes

www.keysight.com/find/m9241a
www.keysight.com/find/m9242a

Many PXI users have been using digitizer hardware with software that simulates an oscilloscope for testing and troubleshooting. The limitations of this approach are often overlooked, but they can cause significant problems. Keysight delivers full-featured M924xA PXIe oscilloscopes with a 1,000,000 waveforms per second update rate. This gives you a higher probability of catching random glitches and provides common oscilloscope measurements - waveform averaging, advanced waveform tiriggers and more.

Technical Overview	M9241A	M9242A	M9243A
Bandwidth	200 MHz	500 MHz	1 GHz
Calculated rise time (10 to 90%)	≤ 1.75 ns	≤ 700 ps	≤ 450 ps
Input channels	2	2	2
Maximum sample rate	5 GSa/s one channel, 2.5 GSa/s two channels		
Maximum memory depth	Standard 4 Mpts, standard segmented memory		
Waveform update rate	≥ 1,000,000 waveforms/second		
Special triggers	Zone trigger, mask, pulse width, rise/fall time, runt, pattern, nth, burst, video, I2C, CAN, LIN, Manchester and many more		
Key features	Averaging, peak detection, protocol analysis, arbitrary waveform generation, wide variety of probing options		

Keysight M9240A
PXIe AutoProbe

www.keysight.com/find/m9240a

Keysight offers probing solutions for the most challenging test applications. The M924xA PXIe oscilloscopes support standard 50 Ω or 1 MΩ connections. They also support a wide range of passive and active probes. The M924xA oscilloscopes require the M9240A PXIe AutoProbe power module to use Keysight active probes. The M9240A provides power and the communication circuit required for proper operation of the active probes.

Probes	
N2843A	Passive probe, 500 MHz, 10:1, 1 MΩ, 11 pF
N2870A	Passive probe, 35 MHz, 1:1, 1 MΩ
10076C	Passive probe, 500 MHz, 100:1 (4 kV)
N2804A	300 MHz, 100:1 differential, 4 MΩ, 4 pF, ±300 V DC+peak AC
N2805A	200 MHz, 100:1 differential, 4 MΩ, 4 pF, ±100 V, 5 m cable
N2790A	100 MHz, 50:1/500:1 high voltage differential, 8 MΩ, 3.5 pF, ±1400 V
See data sheet for more probe options	

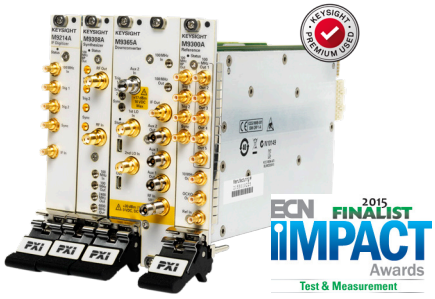
PXI Signal Analyzers & Signal Generators

www.keysight.com/find/pxi-vsa | www.keysight.com/find/pxi-vsg

Keysight M9393A

PXIe Performance Vector Signal Analyzer

www.keysight.com/find/m9393a



Standard configuration includes: M9214A PXIe IF digitizer, M9308A PXIe synthesizer, M9365A PXIe downconverter and M9300A PXIe frequency reference.

For the extended frequency configuration, option FRX (3.6 to 50 GHz), we recommend adding the M9169E. For more information on the M9169E, see page 30.

The M9393A is the realization of our microwave measurement expertise in modular form. It integrates hardware speed and accuracy with stepped FFT based spectrum analysis to measure harmonics and spurs. The M9393A's extensible modular architecture enables you to tailor your system for you needs today and tomorrow.

- Characterize spurs and harmonics with 27 GHz sweep in 1 second at 10 kHz resolution bandwidth
- Analyze up to 50 GHz with superior DANL, using frequency range extension option
- Quickly test multiple frequencies with tuning as fast as 135 µs
- Access up to 800 MHz IF bandwidth with external digitizer (option WB1)
- Compact multi-channel analysis with up to 4 time-synchronous channels in one 18-slot PXI chassis

Technical overview	
Frequency range Standard configuration: Extended frequency configuration:	 9 kHz to 8.4, 14, 18 or 27 GHz 3.6 or 50 GHz
Analysis bandwidth	40, 100, 160 MHz
Absolute amplitude accuracy	±0.13 dB
Frequency switching	< 135 µs
Displayed average noise level (DANL)	-168 dBm/Hz
Third-order intermodulation (TOI)	+31 dBm

Keysight M9290A

CXA-m PXIe Signal Analyzer

www.keysight.com/find/m9290a

In test system development, one of your crucial requirements is doing more in less space – but this often means tradeoffs between footprint and precision in signal analysis. The Keysight X-Series has been expanded to include the CXA-m, a PXI signal analyzer that offers fully-specified performance up to 26.5 GHz. It lets you handle RF and microwave signals in four slots, and you can leverage your existing code. The CXA-m supports testing of components, boards and systems in a variety of applications.

- Optimize the balance between speed, sensitivity and accuracy with swept and FFT modes
- Achieve precise amplitude accuracy with automatic internal alignment
- Perform fast stimulus reponse measurements with industry's first modular tracking generator up to 26.5 GHz
- Simplify the transition from box instruments to PXI through code compatibility

Technical overview	
Frequency range	10 Hz to 3, 7.5, 13.6 or 26.5 GHz
Analysis bandwidth	10, 25 MHz
Absolute amplitude accuracy	±0.6 dB (95th percentile)
Displayed average noise level (DANL)	-163 dBm at 1 GHz, typical
Third-order intermodulation (TOI)	+17 dBm, typical

Keysight M9391A
PXIe Vector Signal Analyzer

www.keysight.com/find/m9391a

Includes: M9214A PXIe IF digitizer, M9350A PXIe downconverter, M9301A PXIe synthesizer and M9300A PXIe frequency reference.

In the evolution of modular RF test solutions, the M9391A PXIe VSA is the next logical step in signal analysis. Optimized for RF device design validation and manufacturing test environments, the M9391A delivers proven results faster with raw hardware speed and X-Series measurement applications. Built on a flexible, PXI platform, the M9391A is the low-risk way to manage change.

- Scalable platform fits up to 4 channels in one chassis, and 8 channels in multi-chassis configuration
- Channels time synchronized to within 1 ns and phase coherent to within 1 degree
- Easily integrate into test environments with IVI-COM, IVI-C, LabVIEW and MATLAB drivers

Technical overview	
Frequency range	1 MHz to 3 or 6 GHz
Analysis bandwidth	40, 100, 160 MHz
Amplitude accuracy	±0.45 dB, typical
RF switching speed	320 µs, nominal (frequency) 136 µs, nominal (amplitude)
Phase noise	-120 dBc/Hz, nominal (1 GHz, 10 kHz offset)
Repeatability	< 0.05 dB, nominal
EVM	-47.5 dB, nominal (2-ch WLAN 802.11ac, 160 MHz)
ACLR	-64.2 dBc, nominal (LTE-FDD, 10 MHz BW)

Keysight M9260A
PXIe Audio Analyzer

www.keysight.com/find/m9260a

The fast and high performance M9260A, was designed for audio measurement and for easy integration into an audio test system. The M9260A differs from general purpose PXI digitizer modules, typically used for audio measurement.

It comes with a large one million arbitrary waveform and input buffers, as well as five-gain amplifiers, super-linear/low noise digital to analog converters. This enables M9260A's ultra-low signal residual distortion (THD) of -106 dB and 1% amplitude accuracy with uncompromised test speed. The M9260A also includes the following built-in waveforms: Sine, Dual Sine, Variable Phase, Gaussian Noise, Rectangular Noise, Pink Noise.

Technical overview	Signal generation	Signal analysis
Channels	2	2
Frequency range	5 Hz to 79.8 kHz (up to 0.47f_s)	--
Measurement BW	--	90 kHz @ 192 kS/s (up to 0.47 SR)
Max input amplitude	--	46Vp
AC/DC accuracy	±1% (-0.087dB to 0.086dB)	±0.58% for AC, ±1% for DC, (-0.087dB to 0.086dB)
Residual THD+N @ 1 kHz, 20 kHz BW	< 0.0007% (< -103 dB) @ 1Vp, 3.16Vp, 10Vp	< 0.00085% (< -101 dB) @ 1Vp, 3.16Vp, 10Vp
Residual THD @ 1 kHz, 20 kHz BW	< 0.0005% (< -106 dB) @ 0.316Vp, 1Vp, 3.16Vp, 10Vp	< 0.00085% (< -101 dB) @ 0.316Vp, 1Vp, 3.16Vp, 10Vp

Keysight M9421A *

PXIe VXT Vector Transceiver

www.keysight.com/find/m9421a

* M9420A PXIe VXT is also available new and as a premium used product.

The M9421A 4-slot PXIe VXT vector transceiver provides signal generation and analysis with real-time FPGA accelerated measurements for faster throughput in manufacturing test of wireless components, power amplifiers and RF front-end modules. Open source test libraries and reference solutions help to reduce development time. The X-Series measurement applications and Signal Studio software ensure specific wireless standards testability.

Key features include:

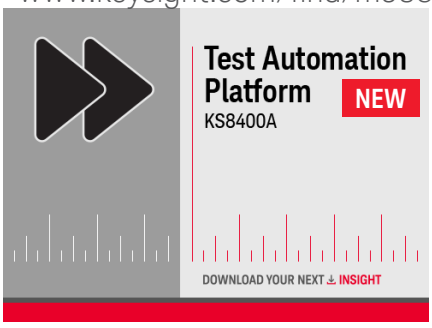
- Built-in FPGA accelerated measurements
- Proven power amplifier and front end module test configurations
- Standard specific software for signal creation and analysis
- Real-time FFTs for fast power and adjacent channel power ratio measurements
- Built-in servo routine to set PA output power quickly and accurately
- Supports 802.11ax 8x8 MIMO measurements

Technical overview	Signal generation	Signal analysis
Frequency range	60 MHz to 3.8 or 6 GHz	60 MHz to 3.8 or 6 GHz
Analysis bandwidth	40, 80, 160 MHz	40, 80, 160 MHz
RF switching speed	2 ms	--
Phase noise	-112 dBc/Hz, typical (900 MHz, 10 kHz offset)	-111 dBc/Hz, typical (900 MHz, 10 kHz offset)
Amplitude accuracy	±0.20 dB, typical	±0.20 dB, typical
Output power	-120 to +20 dBm (+25 dBm settable)	--
EVM 802.11ax, 5.8 GHz, 80 MHz, -10 dBm	< -50 dB, nominal	< -49 dB, nominal

Keysight M9383A

PXIe Microwave Signal Generator

www.keysight.com/find/m9383a



Shown above: 20 GHz vector signal generator

Includes: M9316A PXIe vector modulator, M9312A PXIe source output, M9303A PXIe synthesizer

Realize pre-5G signal confidence with 1% EVM at 28 GHz, 800 MHz bandwidth. The M9383A, available in several configurations, provides optimal flexibility for design validation test at microwave frequencies that can be leveraged into manufacturing test environments. The M9383A solves immediate test needs and is fully upgradable for what comes next - high frequencies, wider I/Q bandwidths or a rapid shift to high volume production. Key specifications:

- 40 MHz to 1 GHz internal modulation bandwidth
- 1 MHz to 44 GHz frequency range
- 1% EVM for pre-5G waveforms at 28 GHz, 800 MHz bandwidth

Technical overview	
Frequency range	1 MHz to 14, 20, 32 or 44 GHz
Amplitude range	-90 to +19 dBm
Amplitude accuracy	±0.8 (Pout > -90 dBm)
Internal modulation bandwidth	40, 160, 500 MHz, 1 GHz
Tuning speed	250 µs in list mode, ALC off 400 µs in list mode, ALC on
Phase noise (1 GHz, 20 kHz offset)	< –115 dBc/Hz at 10 kHz offset, 10 GHz (Option ST4)
Harmonic at 1 GHz	-30 to -55 dBc
Analog modulation	AM, FM, PM, pulse, multitone
Sweep mode	List, step
Baseband generator mode	Waveform playback
Waveform playback memory	1024 MSa

Keysight M9381A
PXIe Vector Signal Generator

www.keysight.com/find/m9381a

Includes: M9311A PXIe digital vector modulator, M9310A PXIe source output, M9301A PXIe synthesizer and M9300A PXIe frequency reference.

Optimized for RF device design validation and manufacturing test environments, the M9381A PXIe vector signal generator delivers a combination of speed, performance, and multi-channel capability. Built on a flexible, scalable modular platform, the M9381A is the low-risk way to manage change and be ready for tomorrow—today.

- Fast amplitude and frequency switching to reduce test time
- Scalable platform fits up to 4 channels in one chassis, and 8 channels in multi-chassis configuration
- Channels time synchronized to within 1 ns and phase coherent to within 1 degree
- Up to 160 MHz RF bandwidth
- Easily integrate into test environments with IVI-COM, IVI-C, LabVIEW, and MATLAB drivers

Technical overview	
Frequency range	1 MHz to 3 or 6 GHz
Analysis bandwidth	40, 100, 160 MHz
RF switching speed	240 µs, nomimal
Phase noise (1 GHz, 20 kHz offset)	< –122 dBc/Hz, typical
Output power	+19 dBm (at 1 GHz)
Amplitude accuracy	±0.4 to 1 dB
Modulation	AM, FM, PM, pulse, multitone
EVM	–47.8 dB, nominal (WLAN 802.11ac, 160 MHz)
ACLR	–70 dBc, typical (W-CDMA 64 DPCH)
Channel-to-channel synchronization	Timing alignment: ≤ 1 ns, nominal Phase alignment: ≤ 1°, nominal

Keysight M9380A
PXIe CW Source

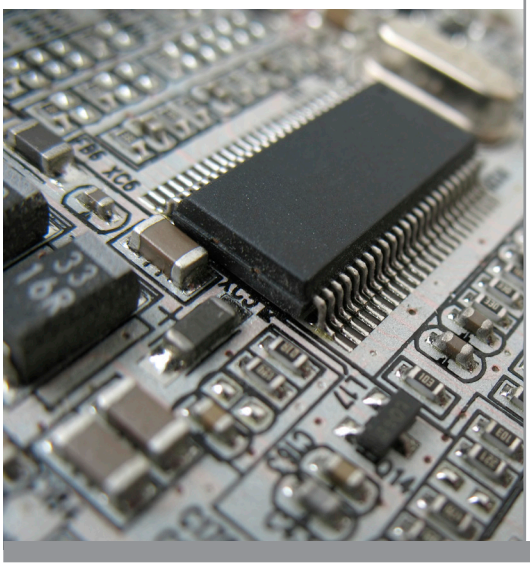
www.keysight.com/find/m9380a

Includes: M9310A PXIe source output, M9301A PXIe synthesizer and M9300A PXIe frequency reference.

With high output power and accurate amplitude control, the M9380A PXIe CW source is a compact, cost-effective analog source, ideal for LO substitution, interference injection, and wireless component test. With fast PXI architecture and multiple drivers and programmatic interfaces, the M9380A is designed for high-speed automated test.

Technical overview	
Frequency range	1 MHz to 3 or 6 GHz
RF switching speed	5 ms
Phase noise (1 GHz, 20 kHz offset)	< –122 dBc/Hz, typical
Output power	+19 dBm (at 1 GHz)
Amplitude accuracy	±0.4 to 1 dB

7 TIPS for PXI & AXIe test solutions



1 Scale to the future

We live in a dynamic world and you may need more bandwidth, more antennas, or better synchronization than you did just a year ago. Selecting PXI or AXIe instruments that can evolve with your test requirements will help future-proof a test system. To make it easier, check out our super convenient license-key upgrades.

2 Write code once, use it twice

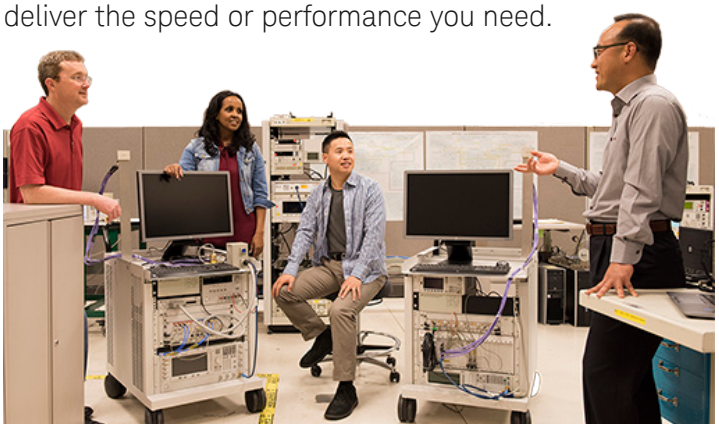
Share measurements across your product lifecycle. Use common application measurement software embedded with the same algorithms and get comparable test results with benchtop and PXI instruments so you can share with others in your organization. This not only saves development time, but also guarantees consistent, reliable test-result validation – from R&D to manufacturing.

```
public void extractDpdModel(bool getMetric
{
    int numSamples = 0;
    double sampleRate = 0;
    int dataFormat = 0;
    double scaleFactor = 0;
    bool overload = false;
    long numBytes = 0;

    // Check to see if Peer to Peer is supp
    bool peer2PeerSupport = true;
    try
    {
```

3 Use an open software platform

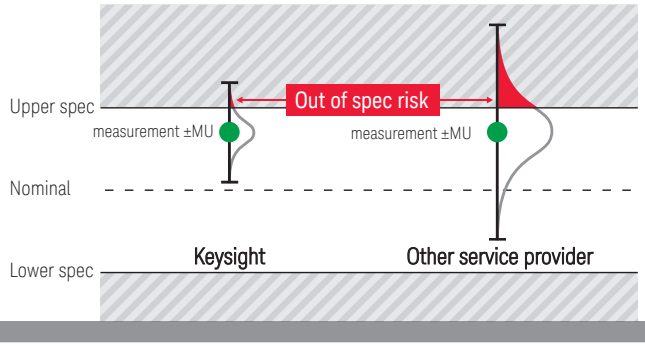
As you work across departments in your organization, ensure that your test platform is open to accomodate the different programming languages commonly used by engineers. Don't be locked into one solution. Choose a flexible, open software platform so that you can work with multiple languages and switch between driver-based cases and measurement applications to deliver the speed or performance you need.



4 Make measurements you can stand behind

Electronic test equipment drifts over time and requires periodic performance verification and adjustments to continue to meet warranted specifications. The actual instrument accuracy you depend on is only as good as the measurement uncertainty of your last calibration. To avoid false pass/fail of your products, select test equipment that provides periodic calibration options with measurement uncertainties towards warranted specifications.

Low measurement uncertainty (MU) matters

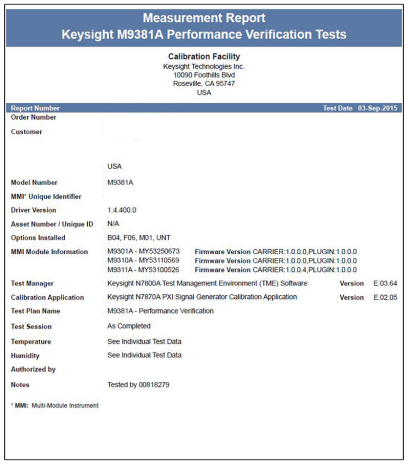


5 Get a running start with a reference solution

Keysight Reference Solutions are market-validated hardware and software configurations for specific test applications. Use them to rapidly evaluate new test configurations or augment your existing test system with open source shortcuts.

6 Minimize system downtime

Select a test platform that has longer duration standard and optional calibration plans, low failure rates, and flexible delivery choices providing you fast turnaround times when your equipment needs calibration or repair. This will help you minimize the disruption to your design or production schedules in times of unplanned equipment maintenance.



Measurement Report
Keysight M9381A Performance Verification Tests

Calibration Facility
Keysight Technologies Inc.
10090 Foothills Blvd
Roseville, CA 95747
USA

Report Number	Test Date 03-Sep-2015
Order Number	
Customer	
	USA
Model Number	M9381A
MMI* Unique Identifier	
Driver Version	1.4.400.0
Asset Number / Unique ID	N/A
Options Installed	B04, F06, M01, UNT
MMI Module Information	M9301A - MY53250673 Firmware Version CARRIER:1.0.0.0,PLUGIN:1.0.0.0 M9310A - MY53110569 Firmware Version CARRIER:1.0.0.0,PLUGIN:1.0.0.0 M9311A - MY53100526 Firmware Version CARRIER:1.0.0.4,PLUGIN:1.0.0.0
Test Manager	Keysight N7800A Test Management Environment (TME) Software Version E.03.64
Calibration Application	Keysight N7870A PXI Signal Generator Calibration Application Version E.02.05
Test Plan Name	M9381A - Performance Verification
Test Session	As Completed
Temperature	See Individual Test Data
Humidity	See Individual Test Data
Authorized by	
Notes	Tested by 00818279

* MMI: Multi-Module Instrument

7 Lower your cost of test

Lower the cost of test through increased test throughput. Benefit from high-speed Gen 3 backplanes that come with PXI and AXIe test systems. You'll also get high density multi-port and multi-site tests, and accelerated on-board measurements through features such as list mode, DDC, integrated measurements, FPGA customization and more.

Learn how you can reduce test development time and speed your production tests with a free series of application notes

www.keysight.com/find/pxi-fundamentals

PXI Switches

www.keysight.com/find/pxi-switch

Keysight M9101-03A
PXI Multiplexer Switches

The PXI multiplexer modules deliver high-speed signal routing of many different channels to a single point, and are ideal for routing multiple analog signals to a measurement device in Automated Test Environments (ATE) or data acquisition systems.

Technical overview	M9101A	M9102A	M9103A
Channels	64	128	99
Switch type	2-wire, reed	1-wire, reed	2-wire, armature
Max volts (CAT 1)	100 Vrms		
Max current switch/carry	0.5 A/1.0 A	0.5 A/1.0 A	1 A
Max power (nom)	10 W	10 W	60 W
Bandwidth (nom)	5 MHz	5 MHz	1 MHz
Connectors	200 LFH		

Keysight M9120-22A
PXI Matrix Switches

The PXI matrix switch modules deliver medium- to high-density switching of multiple channels in a single instance. Any row can be connected to any column—ideal for routing multiple signals between the device under test and instruments.

Technical overview	M9120A	M9121A	M9122A
Channels	4x32	4x64	8x32
Switch type	2-wire, armature	2-wire, reed	1-wire, armature
Max volts (CAT 1)	100 Vrms	100 Vrms	100 Vrms
Max current switch/carry	2.0 A	0.5 A	2.0 A
Max power (nom)	60 W	10 W	60 W
Bandwidth (nom)	7.5 MHz	10 MHz	5 MHz
Connectors	78 Dsub block/cable	200 LFH block/cable	50 Dsub block/cable

Keysight M9128A, M9146-49A
PXI RF Switches

The PXI RF switch modules deliver high-performance, bi-directional switching up to 3 GHz, available in multiple configurations. Modern RF relay technology delivers low insertion loss and VSWR for excellent RF signal integrity and dynamic range when routing RF signals into your measurement equipment. Each switch path is carefully designed to ensure repeatable RF performance.

Technical overview			
Switch	Configuration	Insertion loss (typ)	Isolation (typ)
RF 300 MHz, 50 Ω matrix switch			
M9128A	8x12	2 dB	40 dB
RF 3 GHz, 50 Ω multiplexer switches			
M9146A	Dual 1x4	0.8 dB	45 dB
M9147A	Quad 1x4	1 dB	40 dB
M9148A	1x8	0.8 dB	40 dB
M9149A	1x16	1.2 dB	40 dB

Keysight M9130-33A, M9135A

PXI General Purpose Switches

The PXI general-purpose switch modules deliver fast, reliable switching in a variety of configurations. Cycle power to products under test, control indicator, and status lights, or actuate external power relays and solenoids with independent, single-pole, double-throw (Form C) or single-pole, single-throw (Form A) switches in a single PXI module. The line also includes a module that can handle up to 300/1250 W for switching heavy loads or power supplies.

Technical overview	Max volts (CAT 1) (typ)	Max switch/ carry rating (typ)	Max power (nom)
M9130A 26-ch SPDT, Form C, armature	250 Vrms	2 A/2 A	60 W
M9131A 64-ch SPDT, Form C, reed	100 Vrms	0.25 A/1 A	3 W
M9132A 50-ch SPST, Form A, reed	100 Vrms	1 A/1 A	25 W
M9133A 100-ch SPST, Form A, reed	100 Vrms	1 A/1 A	25 W
M9135A 20-ch SPST, Form A, armature	250 Vrms/ 125 Vdc	5 A/5 A	300 W

Keysight M9155-57C/CH40

PXI Hybrid Switches DC to 26.5 or 40 GHz

M9155-57C/CH40 is a series of PXI microwave switch modules based on the PXI Hybrid platform. The M9155-57C operate from DC to 26.5. The M9155-57CH40 operate from DC to 40 GHz. Both series of switches come with guaranteed 0.03 dB insertion loss repeatability throughout the operating life.

Technical overview	M9155C M9155CH40	M9156C M9156CH40	M9157C M9157CH40
Size	1-slot	2-slots	3-slots
Frequency C Series CH Series	 DC to 26.5 GHz DC to 40 GHz		
Insertion loss	0.42 dB at 8 GHz	0.57 dB at 18 GHz	0.70 dB at 26.5 GHz
Insertion loss repeatability	< 0.03 dB		
Guaranteed operating life	5 million cycles	2 million cycles	2 million cycles
Typical operating life	10 million cycles	5 million cycles	5 million cycles
VSWR	1.35 at 8 GHz	1.45 at 18 GHz	1.70 at 26.5 GHz
Impedance	50 Ω		
RF connector C Series CH Series	 3.5 mm (f) 2.92 mm (f)	 SMA (f)	 SMA (f)

Keysight M9161D

PXI Dual SP4T Solid State 50 MHz to 20 GHz

The M9161D is a one slot PXI Dual SP4T solid state switch module, operating from 50 MHz to 20 GHz. The M9161D has an unmatched ultra-long life cycle, fast switching speed and high isolation, all within a single slot enclosure.

Technical overview	
Size	1-slot
Insertion loss	8 dB at 10 GHz, 11.5 dB at 20 GHz
Isolation	100 dB at 9 GHz, 71.5 dB at 20 GHz
Return loss	7.5 dB at 20 GHz
RF connector	SMA(f)
Switching speed	60 µs

PXI Vector Network Analyzers

www.keysight.com/find/pxivna

Keysight M9370-75A

PXIe Vector Network Analyzers

www.keysight.com/find/pxivna

The M9370-75A PXIe VNAs are full 2-port vector network analyzers that fit in just one slot. They perform fast, accurate measurements and can reduce your cost-of-test by letting you simultaneously characterize many devices – 2-port or multi-port – using a single chassis.

Each module is a completely independent analyzer that can also be cascaded to measure multi-port devices. Because all ports are fully synchronous, multiple ports can be measured simultaneously and multi-port error correction applied. As an example, a single chassis containing 16 M937xAs can be configured as eight 4-port VNAs, four 8-port VNAs or one 32-port VNA.

Keysight M9485A

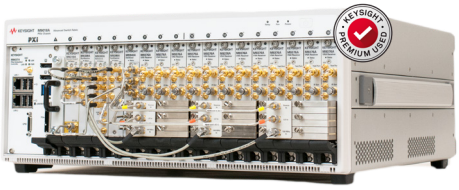
PXIe Multiport Vector Network Analyzer

www.keysight.com/find/pxivna

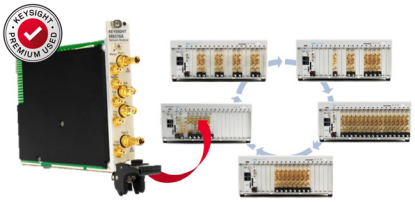
The M9485A supports three types of characteristic receivers and provides frequency offset mode, time domain analysis, basic RF pulse, gain compression and N-port calibrated measurements. Using the same measurement science and calibration as the trusted PNA/ENA network analyzers, the M9485A allows you to customize your test system, benefitting from PXI's speed, size and scalability.

The M9485A provides best-in-class performance with fast measurement speed and wide dynamic range. It also delivers low trace noise as well as high stability, output power and receiving power.

Keysight Premium Used units are available for PXI VNA models M9372A, M9375A, M9485A.



High-performance multiport
True modular expands capabilities



2-port VNA in 1 slot
Flexible, scalable, re-configurable

Technical overview	M9485A	M9370/71/72/73/74/75A
Frequency range	1 MHz to 9 GHz	300 kHz to 4, 6.5, 9, 14, 20, 26.5 GHz
Dynamic range, typ @ 10 Hz IFBW	160 dB	122 dB
Trace noise, typ @ 10 kHz IFBW	0.001 dBrms	0.001 dBrms
Max source power	17 dBm	7 dBm
# of test ports	Up to 24-ports, 12-ports maximum per chassis	Up to 32-ports in a single chassis
Multi-site test	Yes, with same stimulus, one for one system	Yes, with independent stimulus one for 2-port VNA
Software options	Option 007: Automatic fixture removal	Option 007: Automatic fixture removal
	Option 009: Frequency offset mode	Option 009: Frequency offset mode
	Option 010: Time domain analysis	Option 010: Time domain analysis
	Option 025: Basic RF pulse measurement	
	Option 028: Noise figure measurement	
	Option 086: Gain compression application	
	Option 551: N-port calibrated measurement, required for > 4-ports	Option 551: N-port calibrated measurement, required for > 2-ports
Remote control command	Compatible with E5080A ENA and PNA family vector network analyzers (N522x/N523x/N524xB)	

PXI Modules for Vector Network Analysis Systems

These modules were purpose-built to add specific capabilities to our award-winning PXIe vector network analysis test systems.

Keysight M9341A/B

PXIe Digital I/O
PXIe Digital/Analog I/O

www.keysight.com/find/m9341a
www.keysight.com/find/m9341b

The M9341A and M9341B with the 24-bit digital I/O connector and triggering ports provide communication signals between the PXI vector network analyzer (VNA) installed in the same PXI chassis and an external handler. This allows the PXI VNA such as the Keysight M937xA and M9485A to be used in an automated test environment. An 8-bit digital I/O of the M9341B allows to control the DUT such as the multiport RF front-end module directly with serial or parallel digital signals. For more comprehensive analysis, the M9341B has four analog input connectors to allow sensing of DC voltages from the DUT.

Technical overview	M9341A	M9341B
Digital I/O	24-bit digital I/O (for external device handler)	24-bit digital I/O (for external device handler) 8-bit digital I/O (for DUT control)
Analog I/O	--	4 input ports, 2 output ports
Output voltage range	--	±10 V
Maximum output current	--	Mode 1: ±500 mA (Port 1) ±100 mA (Port 2) Mode 2: ±50 mA (Port 1 and 2)

Keysight M9379A

PXIe RF Amp Module

www.keysight.com/find/

The M9379A includes two amplifiers, RF switches, and a programmable step attenuator designed to operate with the M9485A PXIe vector network analyzer (VNA). When combined with the direct receivers and high-power coupler in the M9485A, the M9379A can improve the noise floor of the measurement system. For example, the system dynamic range can be increased with the VNA system, making it an ideal solution for high-rejection filter measurements.

Technical overview	
Number of amplifiers	2 (programmable gain amplifier and fixed gain amplifier)
Frequency range	50 MHz to 13.5 GHz
Saturated output power @ 3 GHz	+21 dBm (typ)
Forward gain @ 3 GHz	25 dB (typ)
Noise figure @ 3 GHz	25 dB (typ)

PXI Waveform Generators

www.keysight.com/find/pxi-awg

Keysight M3201-02A *

PXIe FPGA Arbitrary Waveform Generators

www.keysight.com/find/m3201a

* AWG/digitizer combination units available (M3300/02A)

Part of the M3xxxA family of FPGA-programmable AWGs and digitizers, these AWGs allow non-programmers to customize and accelerate test while accessing the full performance of the FPGA. Real-time sequencing and multi-module synchronization provide phase coherency for complex, multi-channel configurations.

Technical overview	M3201A/M3300A/M3302A	M3202A
Size	3U [1]	3U, 1-slot
Resolution	16-bit	14-bit
Sample rate	500 MS/s	1 GS/s
Bandwidth	200 MHz (400 MHz IQ)	400 MHz (800 MHz IQ)
Channels	Up to 4 channels	Up to 4 channels
Impedance	50Ω	50Ω
Output voltage	±1.5V	±1.5V
Noise floor	-145 dBm/Hz, typical	-145 dBm/Hz, typical
Spurious-free dynamic range (SFDR)	65 dBc @ 120 MHz (0 dBm 50Ω), typical	54 dBc @ 160 MHz (0 dBm 50Ω), typical

1. M3201A AWG: 1-slot
   M3300A and M3302A combination AWG + digitizer: 2-slot

Keysight M9336A

PXIe IQ Arbitrary Waveform Generator 540 MHz

www.keysight.com/find/m9336a

The M9336A is a wide-bandwidth arbitrary waveform generator (AWG) capable of creating the ideal waveforms for compliance testing of digital radios targeted for use with communication standards such as MB-OFDM ultra wideband, 802.11ac/ax, MIMO, and proprietary wideband formats. Easily playback or generate waveforms, including 802.11ac/ax, using Signal Studio software.

Technical overview	
Size	1 slot 3U PXIe
Resolution	3 (single-ended or differential)
Channel impedance	50 Ω (single-ended) or 100 Ω (differential)
Amplitude resolution	16-bit
Maximum amplitude	2 Vpp (channel 1 & 2), 3.4 Vpp (channel 3) without corrections
User sample rate [1]	1 Sa/s to 1.28 GSa/s
Maximum channel bandwidth [1]	540 MHz
Maximum modulation (I/Q) bandwidth [1]	1080 MHz
Flatness (DC to 540 MHz)	±0.15 dB
SFDR (without harmonics)	>67 dBc (differential)
802.11ax EVM	0.2%, typical (80 MHz, 1024QAM)
Sample clock	1.28 GSa/s (waveform is re-sampled with Keysight Trueform technology)

1. Option dependent

Keysight M9330A

PXI-H Arbitrary Waveform Generator

www.keysight.com/find/m9330a

The M9330A is a high-resolution, wide-bandwidth arbitrary waveform generator (AWG) capable of creating the most realistic waveforms for radar, satellite, and frequency agile communication systems, thanks to its 15-bit vertical resolution and 1.25 GS/s sampling rate.

Technical overview	
Size	4-slots, 3U
Resolution	15 bits
Maximum sample rate	1.25 GS/s
Bandwidth	500 MHz per channel, 1 GHz modulated (nominal)
Impedance	50 Ω (nominal)
Output spectral purity	Harmonic distortion –65 dBc for DC to 500 MHz (nominal) Non-harmonic spurious –75 dBc for 1 kHz to 500 MHz (nominal)
Phase noise	1 kHz: –95 dBc/Hz (nominal) 10 kHz: –115 dBc/Hz (nominal) 100 kHz: –138 dBc/Hz (nominal) 1 MHz: –150 dBc/Hz (nominal)
Noise floor	–150 dBc/Hz (nominal)
Sample clock	Internal or external

Keysight M9331A

PXI-H Arbitrary Waveform Generator

www.keysight.com/find/m9331a

The M9331A is a wide-bandwidth arbitrary waveform generator (AWG) capable of creating the ideal waveforms for compliance testing of digital radios targeted for use with communication standards such as MB-OFDM ultra wideband, 802.11n, MIMO, and proprietary wideband formats.

Technical overview	
Size	4-slots, 3U
Resolution	10 bits
Maximum sample rate	1.25 GS/s
Bandwidth	500 MHz per channel, 1 GHz modulated (nominal)
Impedance	50 Ω (nominal)
Output spectral purity	Harmonic distortion –50 dBc for DC to 500 MHz (nominal) Non-harmonic spurious –75 dBc for 1 kHz to 500 MHz (nominal)
Phase noise	1 kHz: –95 dBc/Hz (nominal) 10 kHz: –115 dBc/Hz (nominal) 100 kHz: –138 dBc/Hz (nominal) 1 MHz: –150 dBc/Hz (nominal)
Noise floor	–150 dBc/Hz (nominal)
Sample clock	Internal or external

Additional PXI RF/µW & SMU Modules

www.keysight.com/find/pxi

RF and microwave modules benefit from additional or expanded capability when combined with accessory, signal attenuation, and signal conditioning modules as they are integrated into test system solutions. These modules provide the additional and enhanced capabilities required for the higher frequency applications.

M9111A PXIe High-Speed Source/Measure Unit offers high-speed testing for power amplifiers. Source faster and measure faster with superior DC source output stability and response.

M9601A PXIe Precision Source/Measure Unit, 1.25 MSa/s, 10 fA, 210 V, 315 mA enables faster precise measurement from DC to 20 µs pulse up to 210 V/315 mA with the best-in-class 10 fA resolution and low noise.

M9602/03A PXIe Precision Source/Measure Unit, 15 MSa/s, 1 pA/100 fA, 60 V, 3.5 A DC/10.5 A pulse enables dynamic/pulsed measurements for broad emerging applications such as VCSEL optical devices and IC testing.

M9614/15A PXIe 5-ch Precision Source/Measure Unit, 500 kSa/s, 100 pA/10 pA, 30 V, 500 mA is suitable for broad applications requiring high channel density with wide output up to 30 V/500 mA and fast throughput at low cost per channel

M9168C/E and M9169E PXI Programmable Step Attenuator modules operate from DC to 26.5 or 50 GHz, respectively. Superior attenuation accuracy across a wide operating temperature range ensures precise measurements. The modules provide signal conditioning that enhance the measurement accuracy and flexibility of PXI RF and microwave test systems.

M9170A PXI Attenuator/Switch Driver module provides drive control for Keysight's RF and microwave step attenuators and electromechanical switches.

M9300A PXIe Frequency Reference module provides a 10 or 100 MHz reference for PXI solutions. The M9300A is a key PXI instrument in the M9380A CW source and M9381A vector signal generator.

M9352A PXI Hybrid IF Amplifier/Attenuator with 1 GHz analog bandwidth provides IF signal conditioning for use in multi-channel modular solutions.

M9362AD01 PXIe Quad Downconverter is well suited for wideband signal capture where multiple channels are required and can be used to synchronously capture up to 4 signals in up to 1.5 GHz bandwidth.

The **PXIe Optical Extenders, M9403A through M9408A**, offer end-to-end RF/microwave link for applications that require a long signal path. A frequency range of 300 kHz to 26.5 or 50 GHz can be transmitted distances greater than 1000 meters using single mode fiber optic technology. Antenna ranges or earth station application benefit from the elimination of distortion inherent in down conversion techniques.

M9451A PXIe Measurement Accelerator offers up to a 20x speed improvement in data handling for complex envelope tracking and digital pre-distortion measurements, as part of the RF PA/FEM characterization and test reference solution.

IN THIS SECTION

PRODUCTS WHERE THESE MODULES ARE INTEGRATED

M9300A integrated with:

- M9380A CW source (page 21)
- M9381A PXIe VSG (page 21)
- M9391A PXIe VSA (page 20)
- M9393A PXIe performance VSA (page 19)

M9169E an option for:

- M9393A PXIe performance VSA, option FRX (page 19)

M9451A PXIe measurement accelerator:

- PA/FEM reference solution (page 6)

Keysight M9111A

PXIe High-Speed Source/ Measure Unit

www.keysight.com/find/m9111a

The M9111A provides high-speed testing for power amplifiers. It delivers up to 18W of power at up to 13 V, ±1 A or up to 6V, ±3A. As part of the RF PA/FEM reference solution, the M9111A provides superior stability and output response:

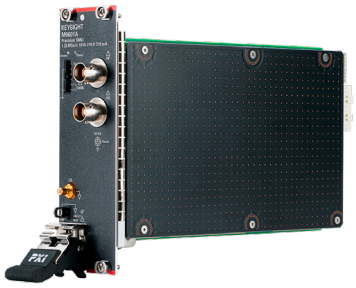
- High-speed changes in voltage with fast settling times
- High-speed recovery with low voltage droop when DUT pulls pulses of current with sharp edges.

Technical overview	
Size	1-slot
DC output ratings	13 V ± 1 A or 6V ± 3 A, 18 W
Speed	Change voltage, stabilize and measure in < 1 ms
Measurement accuracy	
Voltage	0.05% + 1mV
Current, 3 A range	0.05% + 300 µA
Current, 1 A range	0.05% + 100 nA
Current, 100 µ range	0.05% + 10 nA

Keysight M9601A

PXIe Precision Source/ Measure Unit, 1.25 MSa/s, 10 fA, 210 V, 315 mA

www.keysight.com/find/m9601a



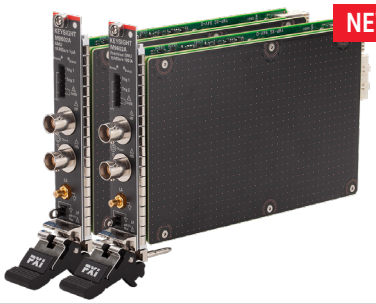
The M9601A is a precision Source/Measure Unit (SMU) with the capability to source and measure both voltage and current. It enables faster precise measurement broadly from DC to pulsed down to 20 µs width up to 210 V/315 mA with the best in class 10 fA resolution, the sampling rate up to 1.25 MSa/s and low noise.

Technical overview	
Size	2-slots
Maximum output	± 21 V/ ± 315 mA/6.6 W or ± 105 V/ ± 105 mA/11 W or ± 210 V/ ± 50 mA/10.5 W
Minimum resolution	500 nV/10 fA
Current measurement noise	30 fArms at 1 PLC (power line cycle)
Minimum pulse width	20 µs
Maximum sampling rate	1.25 MSa/s

Keysight M9602A, M9603A

PXIe Precision Source/ Measure Unit, 15 MSa/s, 1 pA/100 fA, 60 V, 3.5 A DC/10.5 A pulse

www.Keysight.com/find/m9602a
www.Keysight.com/find/m9603a



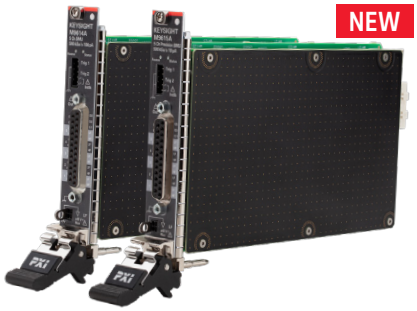
The Keysight M9602A and M9603A are PXIe precision source/measure units (SMUs) featuring best-in-their-class narrow pulse width as narrow as 10 µs, a fast sampling rate of up to 15 MSa/s, and a wide output range. It enables dynamic/pulsed measurements for broad emerging applications across a wide output range of up to 60 V/3.5 A DC/10.5 A pulse, and high resolution up to 6µV/100 fA.

Technical overview	M9602A	M9603A
Size	1-slots	
Number of channels	1	
Maximum DC output	5.5 V/3.5 A/19.2 W or 6.3 V/3 A/18.9 W or 14 V/2 A/28 W or 1.5 A/20 V/30 W or 130 mA/60 V/7.8 W (1st Quadrant)	
Minimum resolution	6 µV/1 pA	6 µV/100 fA
Minimum pulse width	10 µs	
Maximum sampling rate	15 MSa/s	

Keysight M9614A, M9615A

PXIe 5-ch Precision Source / Measure Unit, 500 kSa/s, 100 pA/10 pA, 30 V, 500 mA

www.keysight.com/find/m9614a
www.keysight.com/find/m9615a



The Keysight M9614/15A are PXIe 5-channel precision source/measure units (SMUs) supporting accurate measurement in the range up to 30 V/ 500 mA with the resolution down to 6 µV/10 pA. It enables not only higher channel density on the same footprint with wider output range at lower cost per channel, but also a wide variety of measurements from DC to pulsed down to 100 µs at 500 kSa/s sampling rate.

Technical overview	M9614A	M9615A
Size	1-slot	
Number of channels	5	
Maximum output per channel	±6.3 V/±500 mA/3.2 W or ±30 V/±150 mA/4.5 W	
Minimum resolution	6 µV/100 pA	6 µV/10 pA
Minimum pulse width	100 µs	
Maximum sampling rate	500 kSa/s	

Keysight M9168C/E, 69E

PXI Programmable Step Attenuator

www.keysight.com/find/pxiattenuator

The M9168C/E and M9169E are programmable step attenuator modules operating from DC to 26.5 or 50 GHz with 0.03 dB insertion loss repeatability for each section throughout the 5 million cycles operating life. Their excellent attenuation accuracy across a wide operating temperature range, ensures precise measurement. They also provide signal conditioning that enhances the measurement accuracy and flexibility of PXI RF and microwave test systems.

Technical overview	M9168C/E	M9169E
Size	2-slots	
Frequency	M9168C: DC to 26.5 GHz M9168E: DC to 50 GHz	DC to 50 GHz
Attenuation esolution	1, 5 and 10 dB step	2, 6 and 10 dB step
Repeatability	0.03 dB guaranteed	
Life cycle	5 million cycles per section (guaranteed)	
Maximum input power	1 W (+30 dBm) avg. 50 W peak, (10 µs max)	
Maximum reverse power	1 W avg. 50 W peak (10 µs max)	
RF connector	3.5 mm (f), SMA compatible 2.4 mm (f)	2.4 mm (f)

Keysight M9170A

PXI Attenuator/Switch Driver

www.keysight.com/find/pxidriver

The M9170A attenuator/switch driver module provides drive control for programmable attenuators and electromechanical switches. It is a PXI-hybrid compliant module, that comes with a full-featured graphical interface soft front panel (SFP) for easy control and trigger.

Technical overview				
Size	1-slot			
Voltage	+3.3V	+5V	-12V	+12V
Current	0.5A	30 mA (min) 5.6 A (max)	0	30 mA (min) 0.8 A (max)
Attenuator types	Accepts most attenuators available today			
Switch types	Accepts most switches available today			

Keysight M9300A

PXIe Frequency Reference

www.keysight.com/find/m9300a

The M9300A PXIe frequency reference is a compact modular instrument that can be configured as part of the M9393A PXIe performance vector signal analyzer, M9391A PXIe vector signal analyzer, M9381A PXIe vector signal generator or M9380A CW source. One M9300A can support multiple modular instruments.

Technical overview			
Outputs	Five 100 MHz outputs One 10 MHz output Internal 10 MHz OCXO timebase output		
	Amplitude	**Connectors**	**Impedance**
100 MHz output	≥ 10 dBm	5 SMB snap-on	50 Ω, (nominal)
10 MHz output:	9.5 dBm, (nominal)	1 SMB snap-on	50 Ω, (nominal)
OCXO output:	11.5 dBm, (nominal)	1 SMB snap-on	50 Ω, (nominal)
Size	1-slot		

Keysight M9352A

PXI Hybrid Amplifier/ Attenuator

www.keysight.com/find/m9352a

The M9352A is a 1-slot, 4-channel, PXI Hybrid IF amplifier/attenuator with 1 GHz analog bandwidth providing excellent IF signal conditioning for use in multi-channel modular solutions. Combine with the M9362AD01 PXI quad downconverter, up to four M9202A IF digitizers, and a local oscillator for wideband signal capture where multiple channels are required.

Technical overview	
Size	1-slot
Channels	4
Bandwidth	1 GHz analog
Attenuation Range	31.5 dB in .5 dB steps
Minimum Gain: Maximum Gain:	≥ 5 dB ≥ 36 dB
Noise Figure	3 dB
Input TOI	+43 dBm

Keysight M9362AD01

PXIe Quad Downconverter

www.keysight.com/find/m9362a-d01

The M9362AD01 is a PXIe 3-slot, 4-channel, coherent microwave downconverter with frequency coverage from 10 MHz to 50 GHz, along with 1.5 GHz of instantaneous bandwidth per channel. The M9362AD01 is well suited for wideband signal capture where multiple channels are required for applications such as multi-channel coherent signal analysis, radar, SIGNIT, ELINT, MASINT, EW signal capture and analysis, and RF and microwave recording and analysis.

Technical overview	
Size	3-slot
Operating range	10 MHz to 26.5, 40 or 50 GHz
Bandwidth	1.5 GHz per channel
Noise figure	24 dB, (nominal)
Impedance	50 Ω, (nominal)

Keysight M9403-08A

PXIe Optical Extenders

www.keysight.com/find/pxi-optica-lextenders

The M9403-08A optical extenders for Instruments can deliver your RF or microwave signal without the power loss of coaxial cables, without the unwanted mixing products of downconversion techniques, and with the isolation of fiber at distances up to and beyond 1000 meters.

Technical overview	
Frequency range	Option F26: 300 kHz to 26.5 GHz Option F50: 300 kHz to 50 GHz
Spurious free dynamic range	> 90 dB/Hz > 110 dB/Hz
Noise figure	Opt H01 (unamp): 26.5 GHz, 34 dB; 50 GHz, 42 dB Opt H02 (amp): 26.5 GHz, 8 dB; 50 GHz, 12 dB
Link gain	Option H01: > -30 dB Option H02: > -4 dB
M9406A USB optical data rate	1.5, (USB 1.0), 12, (USB 1.1) and 480 (USB 2.0) Mbps
Optical link RF performance (M9403A, M9404A)	
Min RF input level	-120 dBm
Max optimum RF input level	7 dBm (Option H01) -25 dBm (Option H02)

Keysight M9451A

PXIe Measurement Accelerator

www.keysight.com/find/m9451a

The M9451A PXIe measurement accelerator with Option DPD, digital pre-distortion and envelope tracking gateware, shows what is possible when you combine state-of-the-art FPGA's with Keysight's trusted measurement expertise and PXIe's high-speed data handling. As part of Keysight's RF PA/FEM Characterization and Test, Reference Solution, the M9451A-DPD provides unprecedented performance for complex envelope tracking (ET) and digital pre-distortion (DPD) measurements required for testing modern power amplifiers and front-end modules. Achieve better than 20x speed improvement with closed/open loop DPD and ET measurements taking just tens of milliseconds and overall measurement times less than 70 msec.

Technical overview	
Bus interface and compatibility	PXI Express peripheral module (x1, x4, x8 PCIe specification v 2.1)
FPGA	Altera Stratix V "A7" (5SGXMA7K3F40C2)
Memory	4 GB DDR3 memory 2 independent DDR3 banks at 1200 MT/s (600 MHz) each

AXIe Modular Products

www.keysight.com/find/axie

High-performance AXIe products provide timing, triggering, and module-to-module data movement features that are important to the implementation of high-performance test and measurement systems used in aerospace defense, high-speed digital, high-energy physics, 400 GbE, semiconductor test and other industries.

AXIe products use horizontal configurations for minimal rack space and vertical for larger systems. The chassis and modules compliment LXI and PXI products and include PCIe and LAN interfaces that allow them to act like virtual PXI or LXI instruments.

The AXIe product portfolio includes mainframes and controller, as well as new modules that offer leading performance in their categories: high-speed arbitrary waveform generators (AWG), high-speed Bit Error Ratio Testers (BERTs), high-speed logic analysis modules, PCI Express Gen3 and MIPI D-PHY/M-PHY protocol analyzers.

M8040A 64 GBaud high-performance BERT, M9537A embedded controller in a M9505A 5-slot AXIe chassis.

IN THIS SECTION

Keysight M9502A, M9505A, M9514A

AXIe Chassis

www.keysight.com/find/axie-chassis

The M9502A, M9505A and M9514A AXIe 2-, 5-slot and 14-slot chassis are fully compatible with the AXIe 1.0 and 2.0 (M9514A only) specification.

Technical overview	M9502A	M9505A	M9514A
Size	2U	4U	14U
Number of slots	2	5	14
DC power supply output voltage, (nominal)	50 V	52 V	52 V
Total DC module power	400 W	1000 W	2800 W
System module type	Embedded with Gigabit LAN and x8 PCIe interfaces		M9521A AXIe system module
System module front panel connectors	X8 Gen2 PCIe, multiframe in/out, trigger in/out, clock in/out, and Gbit LAN		Two 8x Gen2 PCIe, multiframe in/out, trigger in/out, clock in/out, and Gbit LAN
Maximum power dissipation per slot	200 W		
ESM USB 2.0	Optional	Optional	--

Keysight M9521A

AXIe System Module

www.keysight.com/find/m9521a

The M9521A AXIe system module is fully compatible with the AXIe 1.0 and 2.0 specifications. The one-slot module is used with the M9514A AXIe chassis and provides the required system communication and synchronization functions including six multi-purpose, synchronization and triggering ports and an external 10 MHz reference clock input/output. The high-performance AXIe provides Fabric 1 (Gen2 x4 lanes to each module slot) and Gigabit LAN switching and Dual Gen2 x8 PCIe interfaces for connecting the chassis to an external computer and other AXIe or PXIe chassis.

Keysight M9537A

AXIe Embedded Controller 2.8 GHz Quad-Core

www.keysight.com/find/m9537a

The high performance, one-slot M9537A embedded controller offers new capabilities such as AXIe-wide PCIe support, multiple 4K video outputs and optional high speed disk cache. The controller easily integrates into hybrid test systems using GP-IB, USB and LAN front panel interfaces. The Intel i7 quad-core process with Hyper-threading Technology makes it the perfect controller for complex, multi-tasking environments.

Technical overview	
Size	1-slot, AXIe module
CPU	Intel i7 6820EQ 2.8 GHz quad-core
Storage type and size	Front removable 2.5" SATA II 240 GB SSD
Memory	8 GB DDR4 RAM with 16 GB option
AXIe PCIe link configuration	Gen 3, x16 PCIe link
AXIe Ethernet fabric channel	10/100/1000BASE-T
Front panel connections	USB 3.0 (4), USB 2.0 (2), LAN 10/100/1000 (2), 4K-capable DisplayPort 1.2, GPIB

Keysight M9703B, M9709A, M9710A

High-Speed Digitizers

www.keysight.com/find/m9703b
www.keysight.com/find/m9709a
www.keysight.com/find/m9710a

Keysight's AXIe digitizers provide high channel density, measurement fidelity and high throughput to build scalable acquisition systems with high channel count for fast, accurate measurements in a compact form factor. The M9703B 8-channel, 12-bit wideband digital receiver/digitizer offers optional real-time digital downconverter (DDC) for tuning and zooming on the analyzed signal, improving the dynamic range, capture time, and measurement speed. It also offers multi-channel, phase coherent streaming and recording. The M9710A 10-bit high-speed digitizer provides high dynamic range across four phase-coherent channels within a single card. Optimized response allows few hundred picoseconds pulse analysis. The M9709A 8-bit digitizer provides 32 synchronous channels within a single card. This digitizer also enables long acquisitions with its very large on-board memory of up to 16 GB.

Technical overview	M9703B	M9710A	M9709A
Size	1-slot	1-slot	1-slot
Resolution	12 bits	10 bits	8 bits
Channels	8 (4 interleaved)	4 (2 interleaved)	32
Max sample rate	1.6 GS/s (3.2 GS/s interleaved)	5 GS/s (10 GS/s interleaved)	1 GS/s
Max bandwidth	DC to 2 GHz (1.4 GHz interleaved)	DC to 2.5 GHz	DC to 500 MHz
Max acquisition memory	16 GB	8 GB	16 GB
On-board processing	(4x) Xilinx FPGA	(2x) Xilinx FPGA	(4x) Xilinx FPGA
Firmware	DGT, DDC, LDC, INT, FDK, TSR	DGT, INT	DGT
Applications	CB1, CB2, B01		

Keysight M8190A, M8195A, M8196A

Arbitrary Waveform Generators

www.keysight.com/find/axie-awg

From low-observable systems to high-density communications, testing is more realistic with precision arbitrary waveform generation. Now you can take reality to the extreme. A Keysight AWG is the source of greater fidelity, delivering high resolution and wide bandwidth—simultaneously. This unique combination lets you create signal scenarios that push your designs to the limit and bring new insights to your analysis.

Technical overview	M8190A	M8195A	M8196A
Size	2-slot	1-slot	1-slot
Channels	1 or 2	1, 2 or 4	1, 2 or 4
Sample rate	Up to 12 GSa/s	Up to 65 GSa/s	Up to 92 GSa/s
Resolution	12 bits to 12 GSa/s 14 bits to 8 GSa/s	8 bits	8 bits
Analog bandwidth	5 GHz	20 GHz	32 GHz
Transition times	50 ps (20/80)	18 ps (20/80)	9 ps (20/80)
Memory depth	Up to 2 GSa	Up to 16 GSa	Up to 512 kSa
Impedance	50 Ω (nom)	50 Ω	50 Ω

Keysight M8020A

High Performance J-BERT

www.keysight.com/find/m8020a

Fast, accurate receiver characterization of single and multilane devices up to 16 and 32 Gb/s. The M8020A streamlines receiver test setup by providing the highest level of integration, ensures accurate and repeatable measurements by automating stressed eye calibration, and supports interactive link training for increased efficiency. The M8020A consists of M8041A, M8051A, M8061/2A modules, depending on configuration.

Technical overview	M8041A	M8051A	M8061/2A
Size	3-slot	2-slot	2-slot
Data rate	0.256 to 16.2 Gb/s	0.256 to 16.2 Gb/s	0.512 to 32 Gb/s
Description	J-BERT generator, analyzer, clock	J-BERT extension generator, analyzer	Mux/32 Gb/s front end
Channels	1 - 2	Extension to 3 - 4	1
Pattern memory	User definable 2 Gbit/ch, pattern sequencer, algorithmic PRBS, scrambler, coding		
Generator capabilities	Jitter injection (RJ,PJ,SSC, BUJ, Clk/2), ISI, 8-tap de-emphasis up to 20 dB, level interference (CMI and DMI)		Jitter injection, 8-tap de-emphasis, ISI
Analyzer capabilities	Tunable CDR, CTLE equalizer, interactive link training for PCIe3		Tunable CDR, CTLE equalizer (M8062A only)
Measurements	BER, SER/FER, BERT Scan, jitter tolerance, output level/Q-factor		BER, jitter tolerance
Data connectors	3.5 mm	3.5 mm	2.4 mm

Keysight M8040A

64 GBaud High Performance BERT

www.keysight.com/find/m8040a

The M8040A is a highly integrated BERT for physical layer characterization and compliance testing. With support for PAM-4 and NRZ signals and data rates up to 64 GBaud it covers all flavors of 400 GbE standards. The M8040A BERT with its true error analysis provides accurate and repeatable results optimizing the performance margins of your devices.

Technical overview	M8045A	M8046A
Size	3-slot AXIe and remote head M8057A	1-slot
Symbol rate	2 GBaud to 64.8 GBaud (NRZ & PAM-4)	5 GBaud to 64.8 GBaud (NRZ) 5 GBaud to 30.0 GBaud (PAM-4)
Data format	NRZ and PAM-4	NRZ and PAM-4
Description	Pattern generator module with clock source	Error analyzer module
Channels per module	1 - 2	1
Pattern memory	2 Gbit/ channel and pattern sequencer	2 Gbit/ channel, pattern sequencer, masking
Generator capabilities	Jitter injection (RJ, PJ, BUJ, SSC, Clk/2), 4 tap de-emphasis, remote head, PAM-4 and NRZ	--
Analyzer capabilities and measurements	--	PAM-4 and NRZ, bit and symbol error analysis, capture, jitter tolerance
Data connectors	1.85 mm	2.4 mm

Keysight M8290A

Optical Modulation Analyzer & High-Speed Digitizer

www.keysight.com/find/m8290a

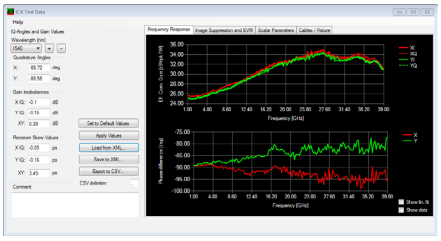
The M8290A rack-mountable modular coherent test system addresses 400G design and test in a much narrower form factor and a lower price point than oscilloscope-based solutions for the 400G speed class. For coherent optical transmitter and receiver testing, the compact optical modulation analyzer module M8292A and the four-channel digitizer module M8296A fill the gap between the portable N4392A integrated optical modulation analyzer for 100G and the real-time oscilloscope-based N4391A optical modulation analyzer supporting speed classes of 400G, 600G and 1 Terabit per second.

Technical overview	M8292A	M8296A
Size	2-slots	1-slot
Signal inputs	Optical input, optional external LO in and output	4 differential electrical input channels, 2.4 mm (female)
Max. symbol rate	74 Gbaud	
Sample data range	83 to 92 GSa/s	
Max. record length	512k samples (511,872 available)	
ADC resolution	8 bit	
Operating range [1]	1 MHz to 40 GHz	50 kHz to 42 GHz
Analog bandwidth	37 GHz (3 dB), uncorrected	
EVM noise floor	< 2.4% EVM rms	--
Optical wavelength	1527.60 to 1570.01 nm	--
Clock, trigger	Trigger input, reference clock input and output, SMA (female)	

1. Adjusted baseband frequency range available for signal analysis.

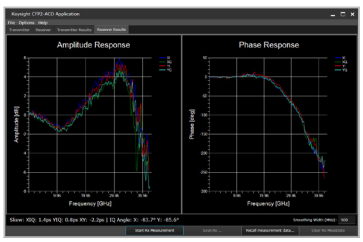
Application Software for M8290A

M8290430A Integrated Coherent Receiver (ICR) Test Solution



Integrated Coherent Receiver (ICR) modules are key components in coherent transmission systems and they are challenging to test. The turnkey ICR test solution software helps you quickly set up S-parameter tests using the M8290A optical modulation analyzer and high-speed digitizer. The setup requires an M8296A high-speed digitizer, two independent tunable lasers (e.g., N7714A multiport tunable laser) and a polarization synthesizer (e.g., N7786B).

M8290440A Analog Coherent Optics (ACO) Test Solution



The Analog Cohrent Optics (ACO) test software provides a turnkey solution for the characterization of ACO modules using the M8290A optical modulation analyzer and high-speed digitizer. The setup requires an M8292A optical modulation analyzer, M8296A high-speed digitizer, M8196A high-speed arbitrary waveform generator, and a polarization synthesizer (such as N7786B). You may also add an optical switch (such as N7731A) or extend the solution to measure more parameters.

Keysight U4164A

4 Gb/s State Mode Logic Analyzer Module

www.keysight.com/find/u4164a

The U4164A 4 Gb/s state mode logic analyzer module combines reliable data capture up to 136 channels with powerful analysis and validation tools so you can quickly and confidently validate and debug high-speed digital designs operating at speeds up to 4 Gb/s.

Technical overview	
Size	1-slot AXIe module
Number of channels	136 (full channel mode) per module
Supported signal types	Single-ended and differential
Max state data rate	2.5 Gb/s on 136 channels, 4 Gb/s on 68 channels
Max state clock	2.5 GHz
Minimum state clock frequency	12.5 MHz (single edge), 6.25 MHz (both edges)
Minimum data valid window	100 ps
Minimum eye height	100 mV
Timing sample rate	2.5 GHz (full channel mode), 5 GHz (half channel mode), 10 GHz (quarter channel mode)

Keysight U4301B

PCIe Protocol Analyzer

www.keysight.com/find/u4301b

Advanced PCIe protocol analysis supporting Gen3.1 with interposers to address all of your PCIe interfaces. The U4301B has an 8 GB buffer with advanced filtering, triggering, and analysis capabilities to support the latest in PCIe analysis needs. Test all link widths from x1 through x16 at all PCIe Gen3 speeds.

Technical overview	
Size	1-slot AXIe module
Number of lanes	Auto link width testing for x1 through x8 with a single module. Up to x16 with 2 modules
Memory depth	8 GB per module, 16 GB for x16 lanes
Supported speeds	Automatic detection 2.5 (Gen1), 5.0 (Gen2) and 8.0 (Gen3) GT/s
Power analysis	LTSSM support for LOs, L1, L1 substates (L1.1 and L1.2) and L2/3
Clocking	Internal, external with or without SSC, SRIS
Interposers	CEM slot up to x16, M.2 (M-key), U.2 (SFF-8639), mid-bus, and flying leads
Protocols	PCIe Gen3.0/3.1, NVMe, AHCI, SATA express, PQI

Keysight U4421A, U4431A

MIPI Protocol Analyzers

www.keysight.com/find/dphy_analyzer
www.keysight.com/find/mphy_analyzer

The U4421A MIPI D-PHY analyzer/exerciser for CSI-2 and DSI provides insight into mobile computing designs with necessary record length to simulate high-definition images and video traffic from a wide variety of device busses of varying signal performance. U4431A supports the MIPI M-PHY specification for next-generation mobile computing designs with analysis of time-correlated 8/10b data.

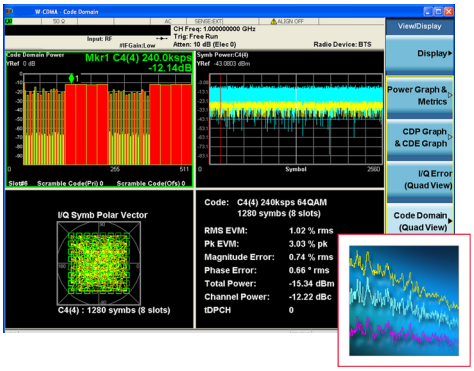
Technical overview	U4421A	U4431A
Lane width	Up to 4 lanes	Up to 4 lanes
Memory depth	1 GB standard Up to 16 GB optional	1 GB standard Up to 16 GB optional
Display protocol support	DSI v1.1, v1.02.00, v1.01.00, 1.20.00 DCS v1.1, v1.02.00, v1.01.00 SDF v1.0	
Camera protocol support	CSI 2 v1.01.00, 2 v1.00	
Max bit rate	1.5 Gbps to 10 Mbps	
Min bit rate	80 Mbps to 800 Kbps	

Software & Programming

www.keysight.com/find/software

X-Series Measurement Applications

www.keysight.com/find/m90xa



X-Series measurement apps transform X-Series and modular signal analyzers into standards-based RF transmitter testers. They provide fast, one-button RF conformance measurements to help you design, evaluate, and manufacture devices and equipment.

- Install at time of instrument purchase or order as an upgrade for an existing instrument
- Run applications such as MATLAB and 89600 VSA software inside modular signal analyzer

X-Series Measurement Applications for Modular Instruments	
Cellular	LTE/LTE-Advanced FDD & TDD, W-CDMA/HSPA+, TD-SCDMA/HSPA, GSM/EDGE/EDGE Evo, cdma2000®/cdmaOne, 1xEV-DO
Wireless connectivity	WLAN 802.11a/b/g/n/ac/ax, *Bluetooth*®
General purpose	Analog demodulation for AM, FM or PM signals, phase noise, noise figure, I/Q analyzer, VXA vector signal analysis, pulse analysis

89600 VSA Software

www.keysight.com/find/vsa

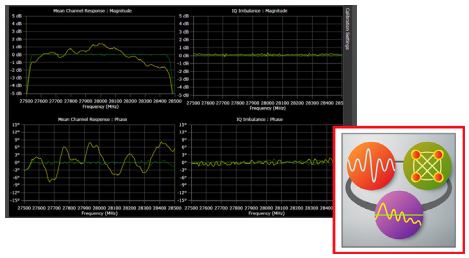
The 89600 VSA software is a comprehensive set of tools for demodulation and vector signal analysis. These tools enable you to explore virtually every facet of a signal and optimize your most advanced designs.

- Supports over 75 signal types for cellular, wireless connectivity, aerospace, defense and general purpose applications
- Verify signal performance quickly with multiple simultaneous views in time, frequency and modulation domains
- Pinpoint the answers to signal problems with troubleshooting tools like coupled markers, advanced triggering, record and playback

Featured Applications. Visit Webpage for Complete List.	
Cellular	Pre-5G, LTE/LTE-Advanced FDD & TDD, W-CDMA/HSPA+, GSM/EDGE/EDGE Evo, cdma2000®, 1xEV-DO, TD-SCDMA/HSPA, MIMO
Wireless connectivity	WLAN 802.11a/b/g/j/p/n/ac/ah/ax, *Bluetooth*®, Mobile/Fixed WiMAX™, Zigbee, Wi-SUN
General purpose	Custom IQ, custom APSK, FSK, BPSK, QPSK, QAM, StarQAM, APSK, VSB, Custom OFDM, SOQPSK, AM/AM, AM/PM, channel quality measurements, spectrum analysis
Aerospace/defense	Pulse analysis, FMCW radar analysis, satellite group delay
Others	DOCSIS 3.1, TEDS, RFID

Signal Optimizer Software

www.keysight.com/find/signaloptimizer

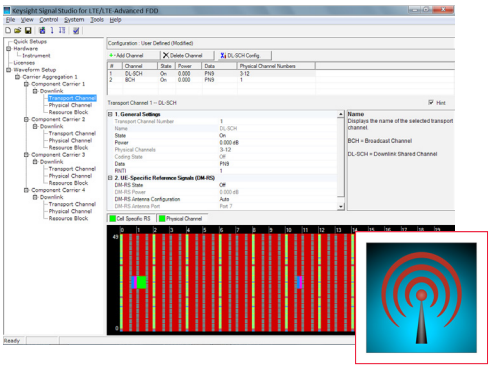


Designed for validation of wide bandwidth, high frequency designs, Signal Optimizer is a unified software platform for calibration, signal creation and analysis. It integrates measurement science and system calibration into an all-in-one task-based interface to enable engineers to confidently validate emerging technology designs such as 5G, automotive, radar, satellite, aerospace and defense applications.

Supported Signal Generators	Supported Signal Analyzers
N5172/82B EXG & MXG	N9020/30/40B MXA, PXA & UXA
M8190A AXIe Arbitrary Waveform Generator	Infiiniium S, V & Z- Series Oscilloscopes
E8267D PSG Vector Signal Generator	M9393A PXIe Vector Signal Analyzer

Signal Studio Software

www.keysight.com/find/signalstudio



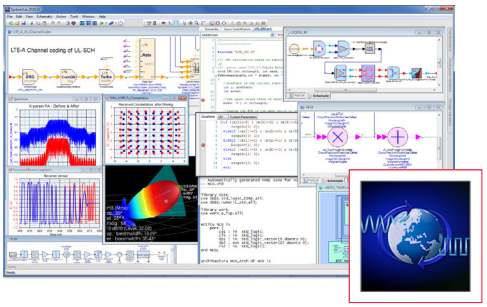
Signal Studio software, reduces the time you spend on signal simulation and simplifies signal creation. Its performance-optimized reference signals – validated by Keysight – enhance the characterization and verification of your devices.

- Generate application-specific test signals, at baseband, RF and microwave frequencies
- Configure signals in an easy-to-use, application-specific graphical interface
- Scale capability and performance to meet your specific test needs

Featured Applications. Visit Webpage for Complete List.	
Cellular	LTE/LTE-Advanced FDD & TDD, NB-IoT/eMTC, W-CDMA/HSPA+, GSM/EDGE/Evo, TD-SCDMA/HSDPA, cdma2000®/1xEV-DO, Pre-5G, 5G candidate modulation, Envelope Tracking/DPD
Wireless connectivity	WLAN 802.11a/b/g/n/ac/ah/ax, *Bluetooth*®, Mobile WiMAX™ Wi-SUN, 802.15.4, ITU-T G.9959
Audio/video broadcasting	Broadcast radio, digital video
Aerospace/defense	NPR multi-tone stimulus, satellite group delay
General purpose	Custom OFDM and custom IQ for analog demodulation (AM/FM/PM), automotive radar (FMCW, MFSK, chirp) and quick setups

SystemVue Software

www.keysight.com/find/systemvue

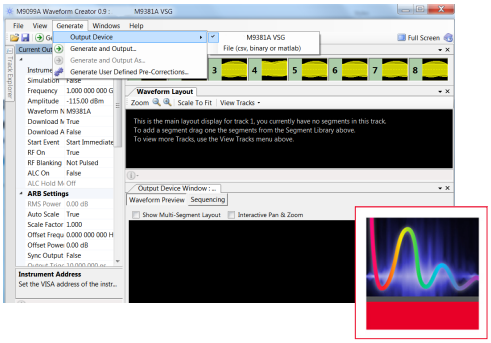


SystemVue is a system-level EDA environment that enables system architects and algorithm developers to innovate the physical layer of next-generation wireless and aerospace defense communications systems. Links to instruments for design verification measurements through SCPI and IVI interface over TCP/IP embedded directly within dataflow simulations, or from a command line. Re-use the same verification set-ups, scripts, test vectors and wireless IP as you move from algorithm into testware. Integrated with Keysight measurement applications such as 89600 VSA software, IO libraries and Command Expert.

Featured Applications. Visit Webpage for Complete List.	
Cellular	5G, LTE-Advanced, LTE, 3G, MIMO channel
Wireless connectivity	802.11a/b/g/p/n/ac/ad/ah/ax, *Bluetooth*®, Zigbee, OFDM, DPD
Defense	GNSS, Digital modem, Radar
Automotive	Automotive radar

Waveform Creator Software

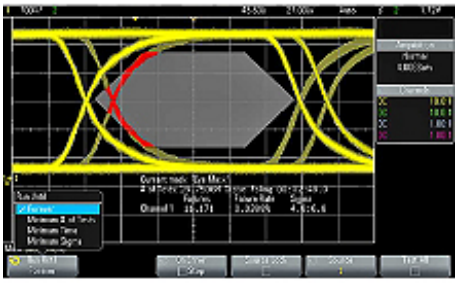
www.keysight.com/find/m9099



Waveform Creator is a modular software application focused on easy development of complex baseband and vector signals used in the validation and test of digital communications products. Built around a drag-and-drop graphical user interface, Waveform Creator allows quick development of multi-format, multi-track waveforms with waveform segments displaced in frequency and time. Its modularity supports multiple waveform types, including Signal Studio waveforms, and VSG/AWG instruments to be "plugged in" for current and future waveform types and instruments.

Featured Plug-ins for Digital Modulation	
89600 VSA recording	Perfect for capturing unknown or complex signals. Enables recording of signals captured with 89600 VSA for combination with other custom data segments
General purpose multi-tone	Single, 2-tone and multi-tone waveforms with configurable baseband filtering. Includes AM/FM/PM modulation
DOCSIS 3.1	Upstream and downstream waveforms with 89600 VSA set up files for demodulation and analysis
SystemVue	Enables import of waveforms created using SystemVue

Software for M924xA PXIe Oscilloscopes

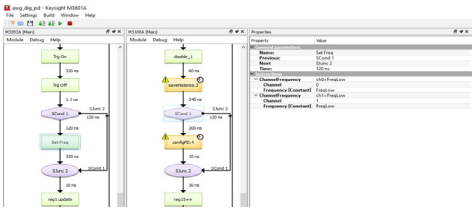


Expand your oscilloscope's capabilities with powerful applications. Hardware-based trigger and decode of low speed serial buses like I²C, SPI, RS232, and NFC. Licenses are also available to enable the integrated arbitrary waveform generator, perform hardware-based waveform mask, frequency response testing and more.

Model	Description
M9240AWGA	WaveGen 20 MHz Function/Arbitrary Waveform Generator
M9240FRAA	Frequency Response Analyzer
M9240MSKA	Mask Limit Testing
M9240PWRA	Power analysis application
M9240PWRA	I2C Triggering and Analysis (I2C)
For a complete list of applications, please visit www.keysight.com	

M3601A Hardware Virtual Instrument Design Environment

www.keysight.com/find/m3601a

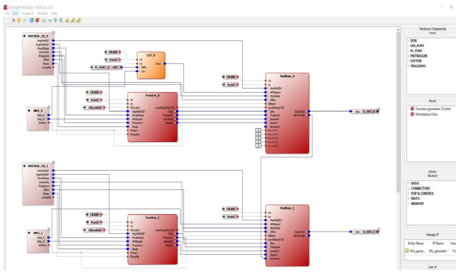


Easily build real time decision making and implement multi-module synchronization and phase coherence onto PXIe AWGs (M3201A/02A) and digitizers' (M3100A/02A) core capabilities. Graphical design environments make it easy to add the synchronization and customization required for emerging technologies, such as beamforming and quantum computing, without sacrificing the performance or speed of the FPGA.

- Intuitive flowchart style design
- Hardware-timed execution with pico-second precision and nano-second resolution
- Fully synchronized execution without need for triggers
- Phase coherent channels

M3602A Graphical FPGA Development Environment

www.keysight.com/find/m3602a

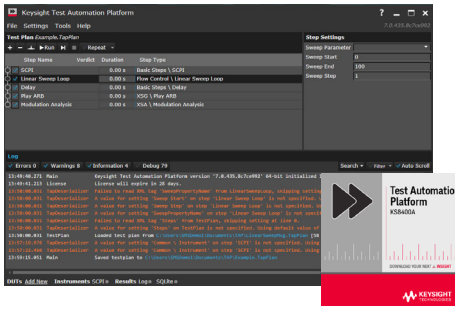


Developed with the non-programmer in mind, the FPGA development environment is compatible with Keysight's PXIe AWGs (M3201A/02A) and digitizers (M3100A/02A). The graphical design environment makes it easy to add customization or insert custom algorithms required for emerging technologies, research and design, while accessing the full performance and speed of the FPGA.

- User-friendly graphical FPGA programming environment
- Full native FPGA code compatibility includes VHDL, Verilog or Xilinx VIVADO/ISE projects and Xilinx CORE Generator IP Cores, MATLAB/SIMULINK code
- One click compiling and programming

KS8400 Test Automation Platform

www.keysight.com/find/tap



Build your test solutions on our powerful, flexible and extensible test automation platform (TAP) based on Microsoft's .NET environment. Maximize the productivity of your team with TAP's speed-optimized core engine, and a platform which enables your team to use existing infrastructure and software development tools.

- Fast execution and test flow analysis
- Graphical user interface for beginning and experienced programmers
- Modular "plug-in" sofware architecture
- Microsoft .NET test step development

KS9000 Keysight Measurement Framework

www.keysight.com/find/kmf

Rapidly develop high-performance, scalable test solutions with the Keysight Measurement Framework (KMF). KMF uses Microsoft's Visual Studio.NET environment to help you deliver high-speed test solutions which take advantage of parallel processing and multi-core CPUs. KMF includes:

- Core framework libraries such as vector math utility, waveform array reader
- Visual Studio developer tools for development and debugging
- Processing plug-ins that deliver Keysight's trusted measurement algorithms in a componentized .dll form. Plug-ins include:
  - WCDMA UL/DL EVM
  - LTE-A FDD UL/DL EVM
  - LTE-A TDD UL/DL EVM
  - TD-SCDMA MS/BTS EVM
  - Spectrum/FFT analysis

IO Libraries Suite 17

www.keysight.com/find/iosuite

The IO Libraries Suite 17 auto discovers more instruments including those that physically connect to your PC (including GPIB, USB, and PXI) and many of those on your local LAN subnet. The PXI/AXIe chassis view in Connection Expert shows the chassis with details of the modules in each slot. IO Libraries Suite 17 makes it easy to connect and control across instrument platforms.

Command Expert Software

www.keysight.com/find/commandexpert

Keysight's Command Expert is complementary software that provides fast and easy instrument control in PC application environments. Command Expert combines instrument commands, documentation, syntax checking and command execution all in one simple interface.

MATLAB Software

www.keysight.com/find/matlab

MATLAB software, available for purchase from Keysight, extends the capabilities of Keysight modular hardware. Three MATLAB configurations are available from basic MATLAB capabilities that allow acquisition and analysis of data to full support for signal processing, communications, filter design and automated testing.

Wireless Test Sets

www.keysight.com/find/wts

Keysight E6640A

EXM Wireless Test Set for Wireless Devices

www.keysight.com/find/exm

The EXM is scalable to meet your production needs and in sync with the latest cellular and WLAN chipsets. Better yet, the EXM delivers the speed, accuracy and port density you need to ramp up rapidly and optimize full-volume manufacturing. Go with the EXM and be ready to solve today and evolve tomorrow.

- Optimize multi-device test with up to 4 TRX channels per EXM
  - Cover up to 6 GHz with 160-MHz bandwidth
  - Create high-density multi-port test stations with two full-duplex and two half-duplex or four full-duplex ports per TRX
  - Independent source and analyzer for efficient use of test resources
- Test multi-format devices including 2G, 3G, 4G cellular and WLAN. See website for list of supported standards.
- Maximize throughput with raw hardware speed and advanced sequencing
- Increase first-pass yield with superior signal purity and measurement accuracy
  - Receiver EVM for 160 MHz 802.11ac: ≤ -43 dB (typical)
  - Absolute level accuracy, 380 MHz to 3.8 GHz: ≤ ±0.2 dB (typical)

The EXM wireless test set can test up to 4 devices at the same time.

Index by Product Number

Index by Product Description

Product description	Model #	Page
VI source – PXI single channel voltage/current	M9186A	12
Vector network analyzers - PXIe	M9370-75A	26
Vector network analyzer, multiport - PXIe	M9485A	26
Vector signal analyzer – PXIe high performance	M9393A	18
Vector signal analyzer – PXIe	M9391A	19

Product description	Model #	Page
Vector signal generator – PXIe	M9381A	21
Vector transceiver (VXT) – PXIe	M9421A	20
Waveform Creator software	M9099	41
Wireless test set	E6640A	44
X-Series measurement applications	Various	40

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

KEYSIGHT TECHNOLOGIES