CONFIGURATION GUIDE

M981xAS Series PXIe Vector Component Analyzer

100 kHz to 26.5/32/44/53 GHz

Drive Down the Size of Test

M9815AS 100 kHz to 26.5 GHz
M9816AS 100 kHz to 32 GHz
M9817AS 100 kHz to 44 GHz
M9818AS 100 kHz to 53 GHz

KEYSIGHT TECHNOLOGIES

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PXI Vector Component Analyzer (VCA)

It’s not easy to characterize multiport antenna arrays and front-end modules (FEM) with traditional test equipment when they require network measurements like gain and S-parameters along with modulated signal measurements like EVM and ACP. Juggling a network analyzer, signal analyzer, and a switch matrix not only takes up valuable time, but also threatens the integrity of your measurements by introducing extra potential sources of error.

What if you combine all your measurements into a single instrument? The M981xAS PXIe Vector Component Analyzer (VCA) brings flexible component characterization to a scalable PXI form factor. With the capabilities of an advanced network analyzer combined with modulated signal measurements, you can fully characterize highly integrated wireless components with a single connection. Easily perform network and spectrum measurements with wizards to guide you through advanced measurements.

The scalable PXI form factor provides exceptional multiport performance no matter how many ports you use. All test ports are fully synchronous, so multiple ports can be measured simultaneously with multiport error correction applied.

This configuration guide describes standard configurations, options, accessories, upgrade kits and compatible peripherals for the Keysight M981xAS Series PXIe VCA.

M981xAS Series:

- M9815AS 100 kHz to 26.5 GHz
- M9816AS 100 kHz to 32 GHz
- M9817AS 100 kHz to 44 GHz
- M9818AS 100 kHz to 53 GHz

M981xAS Vector Component Analyzer Configurations

Model	Description	Test port connectors
M9815AS	100 kHz to 26.5 GHz	3.5 mm (f)
M9816AS	100 kHz to 32 GHz	2.4 mm (f)
M9817AS	100 kHz to 44 GHz	2.4 mm (f)
M9818AS	100 kHz to 53 GHz	1.85 mm (f)

Test set options

Choose one of the frequency models, and one test set option for the M981xAS Series. Option 491 indicates direct receiver access (DRA) configuration on one port. Option 691 indicates DRA configuration on both port 1 and port 2. To add options to a product, order the corresponding item number (M981xAS-xxx).

Option number	Description	Additional information
Option 491	Direct receiver access configuration on port 1	Includes one M980xA PXI VNA (2-port, option 200) and one M981xA receiver-only module [1, 2]. Includes interconnect cables (1 semi-rigid cable and 1 flexible control cable) for connecting PXI modules together.
Option 691	Direct receiver access configuration on port 1 and port 2	Includes one M980xA PXI VNA (2-port, option 200) and two M981xA receiver-only modules [1, 2]. Includes interconnect cables (2 semi-rigid cables and 2 flexible control cables) for connecting PXI modules together.

1. The M981xA receiver module is provided as a test set option of the M981xAS (Option 491 or 691). Cannot be purchased separately.
2. The maximum frequency of the M980xA VNA or M981xA receiver module corresponds to the maximum frequency of M981xAS (x = 5 to 8).

Vector adapter

The M981xAS option 750 or 751 (PXI vector adapter) includes a 1-slot baseband Arbitrary Waveform Generator (AWG) and a 2-slot vector modulator in a PXI form factor. The vector modulator takes a CW signal from the PXI VNA and turns it into a fully modulated signal with maximum bandwidth up to 1.08 GHz. This option enables single-connection measurements of both vector network analysis and modulated distortion analysis (ex. EVM, ACP) using the M981xAS PXI VCA.

Option number[1]	Description	Additional information
Option 750	PXI vector adapter, 22 GHz to 44 GHz	Includes one M9336A PXI AWG and one M9810A vector modulator.[2, 3]
Option 751	PXI vector adapter, 22 GHz to 44 GHz, limited	Includes one M9336A PXI AWG and one M9810A vector modulator.[2, 3, 4]

1. Option 750 and 751 are not available with the 26.5 GHz M9815AS.
2. All necessary interconnect cables are included in the option 750 or 751: 1) One semi-rigid cable (1.85-mm (m) connectors, P/N: M9180-61606) for connection between M980xA's Port 1 and M9810A's RF Input, 2) two flexible cables (SMA (m) to SMB (f), P/N: M9810-61616) for connection between M9336A and M9810A's I/Q Input ports, and 3) one flexible cable (SMB (f) to MCX (m), P/N: 5012-9084. Also included in Y1730A-800) for connection between M9336A and M980xA for synchronizing frequency reference.

3. A high-pass filter is required during power calibration process to get better power measurement accuracy with option 750 or 751. See “Accessories” for recommended components.
4. The maximum bandwidth of option 751 is frequency dependent. (The maximum bandwidth is 550 MHz for 31.8 GHz to 37 GHz, and 1.08 GHz for the rest of specified frequency ranges).

Hardware options

Option number	Description	Additional information
Option 021	Pulse modulation hardware	This option enables the internal pulse modulator on the M980xA’s source. S95025B application software is required for pulsed-RF measurements.
Option 090	Spectrum analysis hardware	This option enables spectrum analysis on all modules of the M981xAS (i.e. M980xA VNA and receiver modules). S95090B application software is required for spectrum analysis.
Option 870 [1]	Coupler and test cable for direct receiver access configuration	Includes 3 test cables (male-male), 2 directional couplers (female connectors), and 1 male-male adapter. Order one for option 491 and order two for option 691.

1. M9815AS Option 870 includes: Three 3.5-mm test cables (male-male, 36 inch), two 87300C directional couplers (3.5-mm, 1 GHz to 26.5 GHz) and one 83059A 3.5-mm male-male connector. M9816AS/M9817AS/M9818AS Option 870 includes: Three 2.4-mm test cables (male-male, 36 inch), two 87301E directional couplers (2.4-mm, 2 GHz to 50 GHz) and one 11900A 2.4-mm male-male connector.

Application software

Model number [1, 2, 3]	Description	Additional information
S95007B	Automatic fixture removal	
S95010B	Time domain analysis	
S95011B	Enhanced time domain analysis with TDR	Includes all capability of S95010B.
S95025B	Basic pulsed-RF measurements	Requires hardware option 021.
S95029B [5]	Noise figure measurements with vector correction	Standard receivers are used.
S95070B [5]	Modulation distortion	Requires hardware option 090. Requires a supported vector signal generator [4].
S95082B [5]	Scalar mixer/converter measurements	Provides SMC measurement class.
S95083B [5]	Vector and scalar mixer/converter measurements	Provides SMC + phase measurement class and vector mixer characterization.
S95084B [5]	Embedded -LO capability	
S95086B [5]	Gain-compression measurements	
S95089B [5]	Differential and I/Q device measurements	Requires multiple module measurements with S95551B.
S95090B [5]	Spectrum analysis	Requires hardware option 090.
S95551B [6, 7]	Multiple instruments/modules measurements	Provides multiport calibrated measurements using multiple M980xA PXI VNA modules. DRA configurations using a single M980xA VNA do not require the software.
S95552B	Multiport calibration assistant	Provides a tool to flexibly define cal sets of multiport measurements. Requires one ECal module.
S95553B	Multiport calibrated measurements with switch instruments	Provides multiport calibrated measurements using M916x PXI Solid-State Switch matrix. [8]
S94701A, S94702A, KS8400A	Automated Measurement Expert (AMX)	A smart software solution for automated multiport S-parameter measurements with the PXI VNAs. Order each software model and install in a PC or PXI embedded controller.

1. The S95xxxB and S95xxxA offer the same functionalities.
2. The S95xxxB software has six license types, please refer to “Keysight Software Licensing Options Provide Flexibility and Support” for more detail.
3. All license options have to be ordered as separate items and installed in a PC or PXI embedded controller.
4. See the S95070B description in “Measurement Application Software” for the supported signal generators.
5. Provides frequency offset mode (FOM) to independently set the frequency of internal source and receivers, and to configure external sources using External Device Configuration.
6. When configuring a multiport VNA using multiple M980xA modules, the Y1730A is recommended for each additional multiport interconnection.
7. A 4-port ECal module (i.e. N4431/32/33D) is recommended for multiport measurements (n > 4).
8. Only the 4-port ECal modules (i.e. N4431/32/33D) are supported for calibration with S95553B.

Additional PXI modules

Model number	Description	Additional information
M9155C [1, 2, 3]	PXI dual SPDT switch module, DC to 26.5 GHz, unterminated	
M9155CH40 [1, 2, 3]	PXI dual SPDT switch module, DC to 40 GHz, unterminated	
M9156C [1, 2, 3]	PXI dual transfer switch module, DC to 26.5 GHz	
M9156CH40 [1, 2, 3]	PXI dual transfer switch module, DC to 40 GHz	
M9157C [1, 2, 3]	PXI single SP6T switch module, DC to 26.5 GHz	
M9157CH40 [1, 2, 3]	PXI single SP6T switch module, DC to 40 GHz	
M9161D [1, 2]	PXI solid state dual SP4T switch module, 50 MHz to 20 GHz	
M9164A [1, 4]	PXI solid-state switch matrix module, 2x16 full crossbar, 300 kHz to 6.5 GHz	• S95553B application software is required for multiport calibrated measurements.
M9164B [1, 4]	PXI solid-state switch matrix module, 2x16 full crossbar, 300 kHz to 9 GHz	
M9165A [1, 4]	PXI solid-state switch matrix module, 2x8 full crossbar, 300 kHz to 6.5 GHz	
M9165B [1, 4]	PXI solid-state switch matrix module, 2x8 full crossbar, 300 kHz to 9 GHz	
M9379A [5]	RF amp module, 50 MHz to 13.5 GHz	• Includes two amplifiers, RF switches, and a programmable step attenuator designed to operate with the M981xAS. • When used as an external preamp, the M9379A improves the M981xAS's noise floor for noise figure measurements up to 13.5 GHz.
M9341A [6]	Digital I/O	• Includes a 24-bit digital I/O connector and triggering ports to provide communication signals between the M981xAS and an external handler.
M9341B [6]	Digital I/O and analog I/O	• Includes a 24-bit digital I/O and an 8-bit digital I/O to allow users to control the device under test (DUT) directly with serial or parallel digital signals. • The M9341B has four analog input connectors to allow sensing of DC voltages from the DUT. The measured DC voltage can be displayed on the firmware. The M9341B also supports two variable DC source outputs to control the DUT, while the DC source current can be monitored during measurements.

1. PXI switch modules are directly controlled by the M981xAS firmware.
2. Can be used as an RF source switch to isolate the M981xAS's source signal during noise figure measurements.
3. Requires M981xAS firmware revision A.13.90 or above for the operation.
4. Requires M981xAS firmware revision A.14.10 or above for the operation.
5. For more information on the M9379A, see the data sheet, literature number 5992-1795.
6. For more information on the M9341A/B, see the data sheet, literature number 5992-1856EN.

Additional hardware

Model number	Description	Additional information
U7227A/U7228A [1]	USB preamplifier, 10 MHz to 4 GHz	
U7227C/U7228C [1]	USB preamplifier, 100 MHz to 26.5 GHz	
U7227F/U7228F [1]	USB preamplifier, 2 GHz to 50 GHz	

1. Can be used as an external preamp for noise figure measurements. For more information on the U722x USB preamplifiers, see the technical overview, literature number 5991-4246EN.

Accessories

Model/Option	Description	Additional information
Y1730A	Interconnect cables for multiport configuration	
Y1730A-001	Interconnect cables for 1-slot M980xA (Opt.200) and M981xA receiver module	Includes 1 semi-rigid cable and 1 flexible control cable for connecting 1 M980xA (Option 200) and 1 M981xA receiver module together. Add one kit for each additional M980xA or M981xA module.
Y1730A-800	SMB (f) to MCX (m) cable assembly, 300 mm	For connection with 10 MHz external reference ports (Ref In/Ref Out) of the M980xA or M981xA module.
Y1730A-801	SMB (f) to MCX (m) cable assembly, 1000 mm	For connection with 10 MHz external reference ports (Ref In/Ref Out) of the M980xA or M981xA module.
Y1730A-810	BNC (f) to MCX (m) cable assembly, 320 mm	For connection with 10 MHz external reference ports (Ref In/Ref Out) of the M980xA or M981xA module.
Y1731A	PXI adapter module	
Y1731A-001	I/O adapter module	Includes PXI module to enable coaxial connections with control signals of the M980xA or M981xA module. Includes 2 flexible control cables (500 mm and 175 mm) for connection with the control port of the M980xA or M981xA module.
Y1731A-800	BNC (m) to SMB (f) cable assembly, 1000 mm	For connection with BNC connectors on external peripherals (ex. pulse generators)
11636B	Power divider, DC to 26.5 GHz, 3.5 mm connectors	Required for modulation distortion measurements with the S95070B using an external vector signal generator.
11636C	Power divider, DC to 50 GHz, 2.4 mm connectors	Required for modulation distortion measurements with the S95070B using an external vector signal generator.
K281C [1]	Coaxial waveguide adapter, 3.5 mm (f), 18 to 26.5 GHz	Two adapters are required for power calibration with the M981xAS option 750 or 751 [2]. Select either option 006 or 301 with 3.5 mm (f) connector.

R281A [1]	Coaxial waveguide adapter, 2.4 mm (f), 26.5 to 40 GHz	Two adapters are required for power calibration with the M981xAS option 750 or 751 [3].
Q281A [1]	Coaxial waveguide adapter, 2.4 mm (f), 33 to 50 GHz	Two adapters are required for power calibration with the M981xAS option 750 or 751 [4].

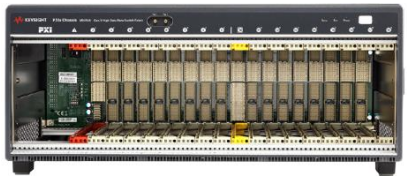
1. Two cascaded adapters can be used as a high-pass filter (HPF) which is necessary during power calibration process with the M981xAS option 750 or 751 (PXI vector adapter) to get better power measurement accuracy.
2. Equivalent filter(s) such as Eravant P/N: SCF-15312340-42KFKF-H1 (1ea) can be used for power calibration.
3. Equivalent filter(s) such as Eravant P/N: SCF-22318340-28KFKF-H1 (1ea) can be used for power calibration.
4. Equivalent filter(s) such as Eravant P/N: SCF-27324340-222F2F-H1 (1ea) can be used for power calibration.

Test cables

Option number	Description	Additional information
Y1740A-100	Cable Assembly, 3.5 mm (m) to 3.5 mm (m), 26.5 GHz, 36 inch	
Y1740A-200	Cable Assembly, 2.92 mm (m) to 2.92 mm (m), 40 GHz, 36 inch	
Y1740A-300	Cable Assembly, 2.4 mm (m) to 2.4 mm (m), 50 GHz, 36 inch	
Y1740A-310	Cable Assembly, 2.4 mm (m) to 2.92 mm (m), 40 GHz, 36 inch	
Y1740A-400	Cable Assembly, 1.85 mm (m) to 1.85 mm (m), 67 GHz, 1 m	

Chassis and accessories

Step 1. Select a chassis [1, 2]

Model	Description	Additional information
M9010A	10-slot PXIe chassis	
M9018A [3]	18-slot PXIe chassis Gen 2	
M9018B	18-slot PXIe chassis Gen 2	
M9019A	18-slot PXIe chassis Gen 3	

1. Select the right PXI chassis depending on required DC output power.
2. The M9005A PXIe chassis is not supported for the operation with the M981xAS Series.
3. The M9018A PXIe chassis supports the operation with maximum six PXI modules (M980xA or M981xA).

Step 2. Choose enough slot blocker kits and EMC filler panels to fill every open slot. Recommended to achieve data sheet specifications.

Model	Description	Additional information
Y1212A	Slot blocker kit: 5 slots	
Y1213A	PXI EMC filler panel kit: 5 slots [1]	

1. Non-EMC filler panels are included with the M9018B or M9019A PXIe 18-slot chassis.

Step 3. Choose a rack mount kit (optional) [1]

Model	Description	Additional information
Y1271A	Rack mount kit for M9010A and Y1217A rail kit	
Y1215C	Rack mount kit for M9018B or M9019A 18-slot PXIe chassis	
Y1216B	Rack mount kit for M9018B or M9019A 18-slot PXIe chassis	

1. For more information on the rack mount kit, see the chassis data sheet, literature number 5992-1481EN.

Step 4. Choose an air inlet kit (optional) [1]. Recommended for rack mounted systems with less than 1U space below chassis.

Model	Description	Additional information
Y1214B	Air inlet kit: M9018B or M9019A 18-slot chassis	

1. For more information, please visit www.keysight.com/find/m9018b

Select Controller (Either Embedded Controller or via PC)

Step 1. Select embedded controller [1]	
M9037A High-performance embedded controller, Gen 3 Intel i7-4700EQ quad-core processor, 2.4 GHz, 8 thread, 4 GB RAM Select M9037A for the best performance if you have memory intensive applications, multiple applications running in parallel or if a lot of data is sent to the PC from the PXIe chassis. Features removable SSD drive for security and x8 PCIe® connector on front for connection to second chassis	

1. The M9010A 10-slot chassis or M9018B / M9019A 18-slot chassis includes empty space to the left of the 1st functional slot. The embedded controller occupies that empty space and the 1st functional slot.

Step 2. Upgrade from standard memory size (optional)	
M9037A-M08	Memory upgrade from 4 GB to 8 GB RAM (Win 7, 64-bit only)
M9037A-M16	Memory upgrade from 4 GB to 16 GB RAM (Win 7, 64-bit only)

Step 3. Select an operating system		
M9037A-WE3	Microsoft Windows Embedded Standard 7 (32-bit)	
M9037A-WE6	Microsoft Windows Embedded Standard 7 (64-bit)	
M9037A-W16	Microsoft Windows 10 IoT Enterprise LTSB (64-bit)	

To Use Your Desktop PC as a Controller

Model [1, 2]	Description	Additional information
M9048A	PCIe Host Adapter: Gen 2, x8	
M9048B	PCIe Host Adapter: Single Port (x8), Gen 3	
M9049A	PCIe Host Adapter: Single Port (x16), Gen 3	
Y1202A	PCIe cable	
M9021A [3]	PCIe Cable Interface: Gen 2, x8	
M9022A	PXIe System Module: Single Port (x8), Gen 3	
M9023A	PXIe System Module: Single Port (x16), Gen 3	
M9024A	PXIe System Module with Connectivity Expansion: Dual Port (x16) Gen 3	

1. For list of qualified external controllers, please see Test Computer List Technical Note literature number 5990-7632EN.
2. For more detailed chassis configuration information including multi-chassis, see Interface Modules and Adapters for PXIe and AXIe Systems literature number 5992-0377EN.
3. The M9021A can only be used with the Keysight M9018B.

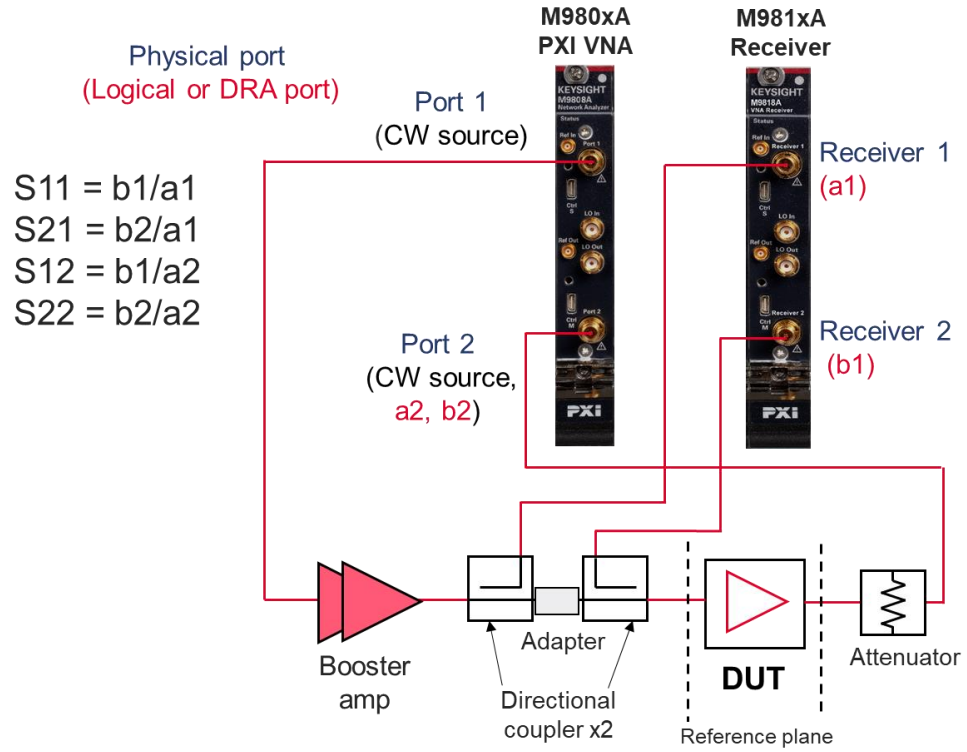
M981xAS Series configurations

The M981xAS supports direct receiver access (DRA) configurations to flexibly set up test systems with optimized performance by integrating with external components[1] such as booster amplifiers, attenuators, or directional couplers. This function (included in the M981xAS's firmware) combines three physical test ports of the M980xA VNA or M981xA receiver module(s) and defines as a single logical port. You can perform measurements including calibration and post processing using the logical ports.

DRA configuration on port 1 with high-power

This configuration is used for S-parameter measurements with high power. When you need an input level higher than the VNA's source can provide, pre-amplifiers are necessary to boost the power level prior to the DUT. However, the reference signal is measured before the booster amp in a standard configuration of a 2-port VNA, and temperature drift or high reverse isolation of a booster amp will prevent accurate reflection measurements of DUT's input.

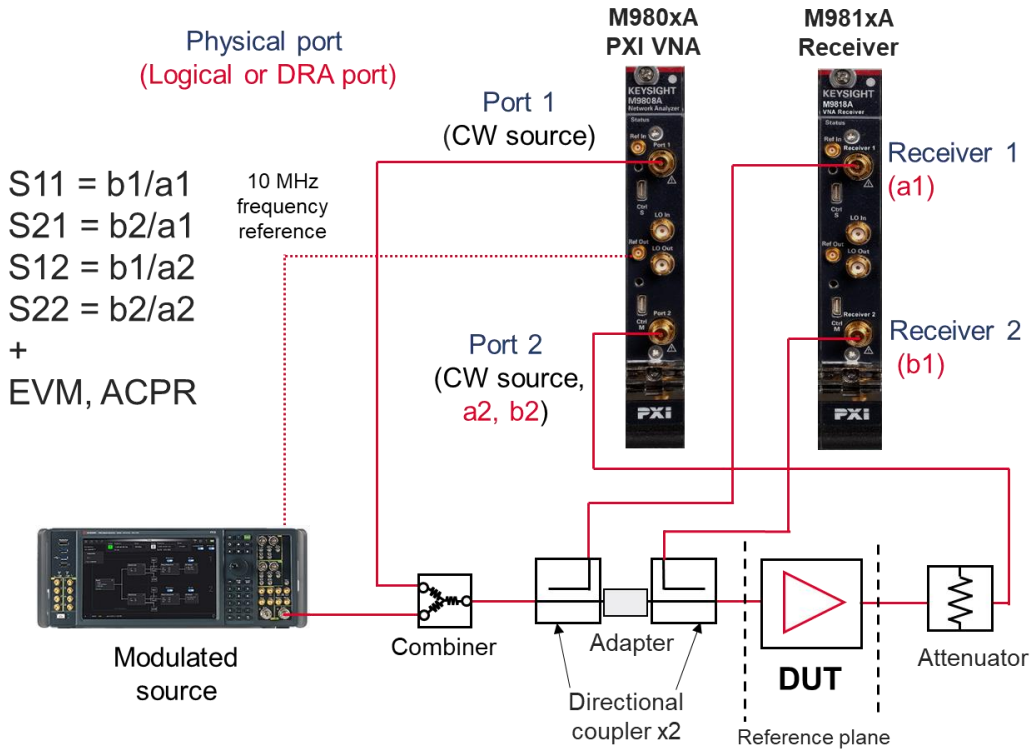
One M980xA PXI VNA and one M981xA receiver module (included in the M981xAS Option 491) are configured along with a booster amp, directional couplers, and an optional attenuator to avoid compression or damage of the receivers. One M981xAS Option 870 includes two directional couplers, one adapter, and three test cables for the connection with the PXI modules. Attenuators[1] or booster amps are not included in the M981xAS.



1. Large attenuation at DUT's output may degrade Signal-to-noise (S/N) ratio of two S-parameters, S12 and S22. The M981xAS Option 691 (DRA configuration on port 1 and port 2) is recommended.

DRA configuration on port 1 with modulated source

One M981xAS Option 491 and one modulated source are combined with this configuration to support both vector network analysis and modulation distortion analysis with a single connection. The S95070B Modulation Distortion Analysis software and M981xAS option 090 (spectrum analysis hardware) are necessary to measure the nonlinear behavior of DUTs under wideband modulated stimulus conditions. The VNA-based vector correction extends the reference planes of the signal source to the DUT's planes. As a result, you can achieve excellent signal fidelity for accurate and repeatable modulated distortion measurements such as EVM or ACPR at mmWave frequencies.

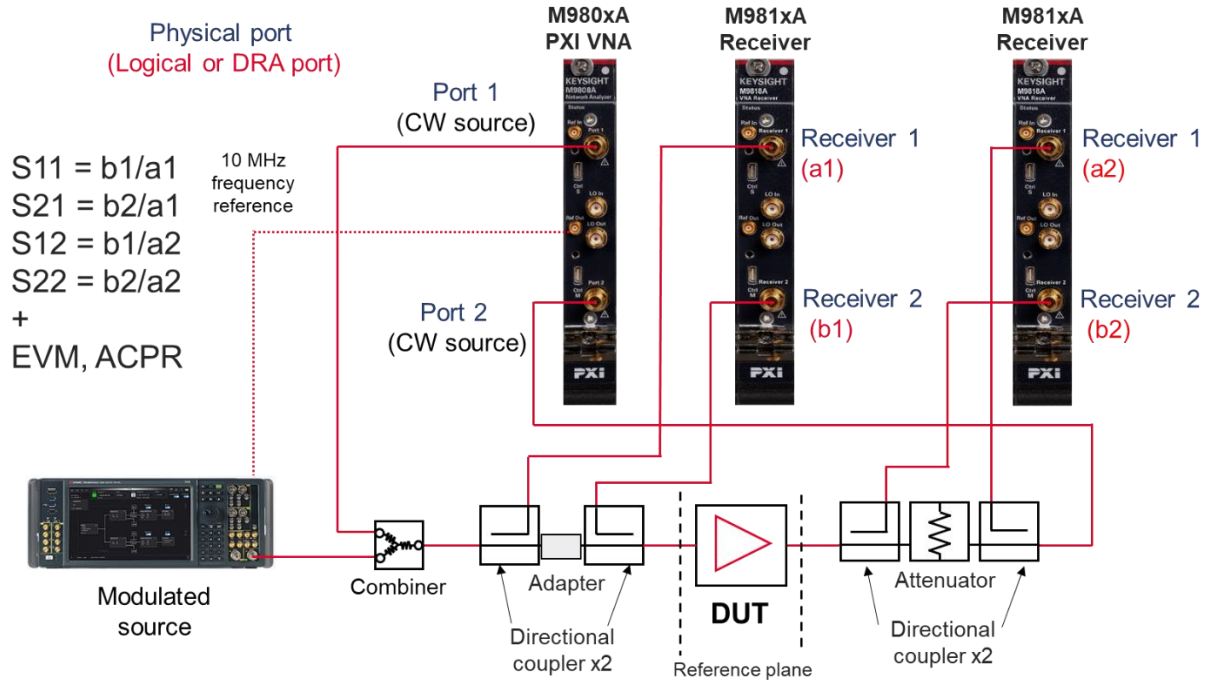


A combiner (ex. 11636B or 11636C) and optional attenuator are not included in the M981xAS. Must be purchased separately.

DRA configuration on port 1 and port 2 with modulated source

One M981xAS Option 691 provides one M980xA PXI VNA and two M981xA receiver modules to configure the DRA ports for both port 1 and port 2 of the DUT. Signal-to-noise (S/N) ratio of two S-parameters, S12 or S22, can be improved.

One M981xAS Option 691 and one modulated source is combined with this configuration to support both vector network analysis and modulation distortion analysis with a single connection. The S95070B Modulation Distortion Analysis software and M981xAS option 090 (spectrum analysis hardware) are necessary to measure the nonlinear behavior of DUTs under the wideband modulated stimulus conditions. Two M981xAS Option 870 are recommended for the configuration including four directional couplers, two adapters, and six test cables for the connection with the PXI modules. Order the Y1740A cable assembly if additional test cables are needed.



A combiner (ex. 11636B or 11636C) and optional attenuator are not included in the M981xAS. Must be purchased separately.

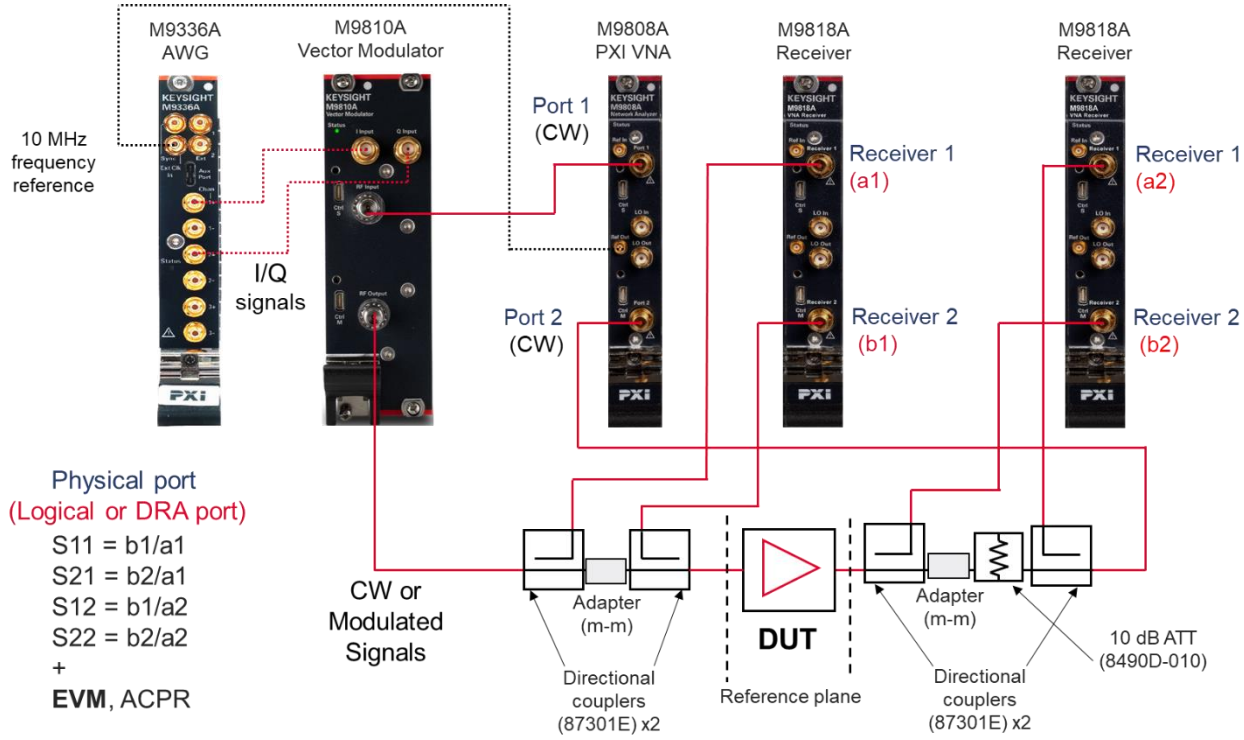
DRA configuration on port 1 and port 2 with PXI vector adapter (option 750/751)

One M981xAS Option 691 and one Option 750 or 751 (PXI vector adapter) are combined with this configuration to support both vector network analysis and modulation distortion analysis (ex. EVM, ACPR) with a single connection.

Option 750 or 751 includes two PXI modules – the M9336A PXI AWG generates baseband I/Q signals which are added to the M9810A PXI vector modulator. The M9810A takes a CW signal from port 1 of M980xA VNA and turns it into a fully modulated signal for the frequency range of 22 to 44 GHz. A common output port of the M9810A switches between CW and modulated signals, enabling single-connection multiple measurements including return loss, P1dB gain compression, harmonics distortion, EVM, and ACP.

The S95070B Modulation Distortion Analysis software and M981xAS option 090 (spectrum analysis hardware) are necessary to measure the nonlinear behavior of DUTs under wideband modulated stimulus conditions. The VNA-based vector correction extends the reference planes of the signal source to the DUT's planes. As a result, you can achieve excellent signal fidelity for accurate and repeatable modulated distortion measurements such as EVM or ACPR at mmWave frequencies.

Two M981xAS Option 870 are recommended for the configuration including four directional couplers (87300C or 87301E), two male-male adapters, and six male-male cable assemblies for the connection with the PXI modules. Order the Y1740A cable assembly if additional test cables are needed. A typical configuration using the M9818AS with option 750 is shown.



Optional attenuators (ex. 8490D) are not included in the M981xAS. Must be purchased separately.

Measurement Application Software

Automatic fixture removal (S95007B)

Many devices do not have coaxial connectors and are put in fixtures in order to measure them in a coaxial environment. Accurately removing the effects of the fixture is required to get a good measurement of the device under test (DUT). This application adds a powerful application wizard to guide you through characterizing a fixture and removing it from the measurement. Devices can be single-ended or differential. Files can be saved in a variety of formats for later use in ENA, PNA, PXI VNA, USB VNA, ADS, and PLTS.

Time domain analysis (S95010B)

This application enables the analyzer to view reflection and transmission responses in time or distance. Use time domain to tune filters, gate out the response of fixtures and cables, characterize the impedance of transmission lines and more.

Enhanced time domain analysis with TDR (S95011B)

This application enables the analyzer to perform enhanced time domain analysis for high-speed data applications. All functionality of the S95010B are included (TDR/TDT mode). In addition, the S95011B enables more detailed measurements and evaluations, such as eye-diagram/mask modes, without adding PLTS software. Jitters and/or emphasis/equalization capabilities enables simulation of real-world signals and environment. The S95011B covers up to 53 GHz bandwidth with 8.42 psec rise time. Full calibration is available and the automatic deskew ensures easy removal of fixture and probe effects. To get the best accuracy, mechanical calibration kits or ECal with DC option (i.e. N443xD or N469xD with Option 0DC) are recommended.

Basic pulsed-RF measurements (S95025B)

This application enables internal pulse generators that can be used to control the internal pulse modulators, and it provides an integrated pulse application that uses the wideband-detection method. The software requires hardware option 021 pulse modulator hardware of the M981xAS.

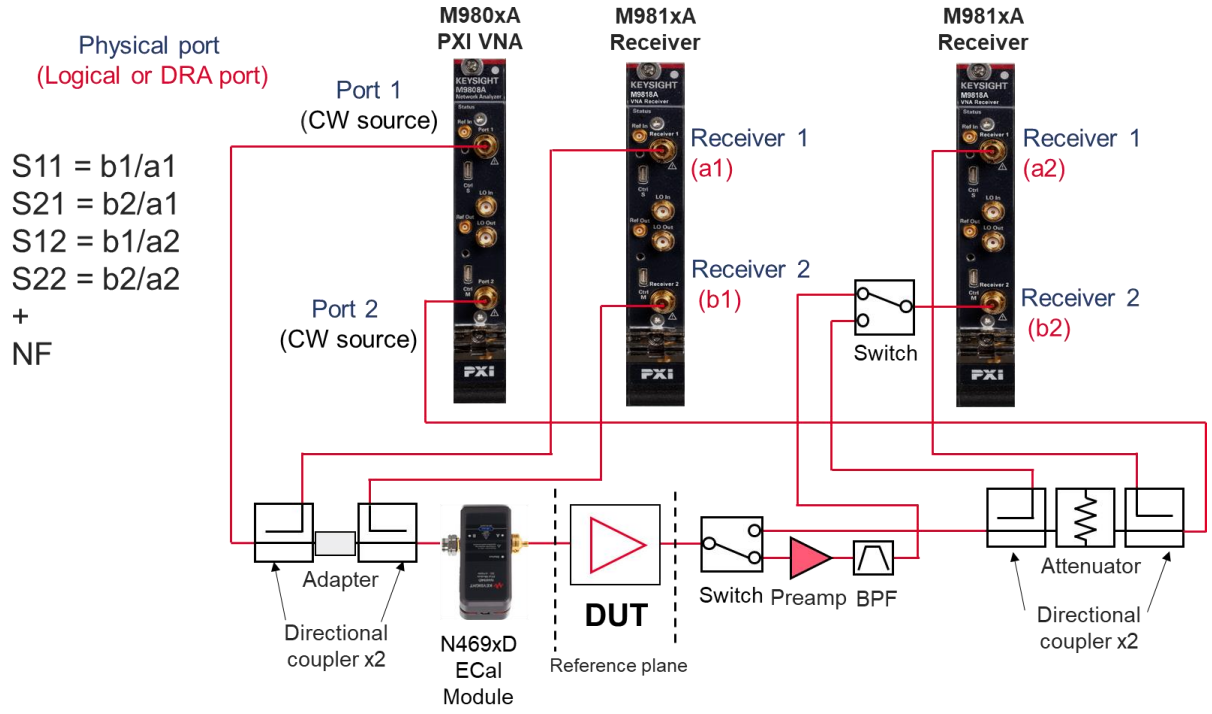
The pulse application provides an easy way to set up point-in-pulse measurements with pulse width as narrow as 1 us, and pulse-profile measurements with 40 ns minimum timing resolution. Using the built-in pulse modulators of the M980xA PXIe VNA eliminates the need for external test sets and pulse generators. S95025B also controls external pulse generators and modulators and can synchronize to external master pulses. The Y1731A PXI Adapter Module is recommended to access pulse signals with SMB connectors if using external master pulses or external pulse modulators.

Noise figure measurements with vector correction (S95029B)

This software application enables high-accuracy noise figure and noise-power measurements of amplifiers utilizing Keysight's unique vector-source-correction technique that uses Keysight N469x series ECal module as a source-impedance tuner to remove the effects of imperfect system-source match. This approach yields accuracy that surpasses that provided by the Y-factor method and other cold-source implementations, especially for in-fixture, on-wafer, and automated-test environments. S95029B controls N469xD Series ECal modules configured as impedance tuners for use with the M981xAS.

A scalar-calibrated method is also available that offers less accuracy but is faster and does not require an impedance tuner. This method requires an external switch to isolate the M980xA's source signal during noise figure measurements. A 50-ohm load must be connected to the DUT's input using the switch.

The instrument's standard receivers are used for noise figure measurements with the S95029B. An external preamplifier, filter(s) and switches are required for devices with < 30 dB of excess noise (gain plus noise figure in dB). A typical block diagram of vector-calibrated noise figure measurements is shown.



For calibration, a standard mechanical cal kit or ECal module is required for the S-parameter portion of the cal (an ECal used as a tuner cannot be shared for calibration). To calibrate a standard receiver for noise figure measurements, a power meter/sensor is required. A 346-serires noise source (Keysight 346C or 346C-K01 recommended) can be used for noise calibration of the instrument's receiver, when a preamplifier is located before the receiver. All calibration accessories and external hardware must be ordered separately.

Noise figure measurements with the M980xA are verified between 50 MHz and 45 GHz. Noise figure measurements of frequency converting devices are not supported with the S95029B.

Modulation distortion (S95070B)

This application software with the M981xAS and a vector signal generator measures the in-channel and out-of-channel nonlinear behavior of power amplifiers under modulated stimulus conditions. It employs a new frequency-domain measurement method that quickly measures EVM or ACPR and performs VNA calibration to make accurate measurements.

The software provides a full integrated measurement setup including the modulation signal generation and allows the user to easily configure and make the measurements.

The S95070B requires option 090 spectrum analysis hardware of the M981xAS.

The signal generators supported by this application are:

- M9383/84B VXG Microwave Signal Generator, 1 MHz to 44 GHz
- M9410A/11A/20A/21A VXT PXIe Vector Transceiver
- N5182B MXG X-Series RF Vector Signal Generator, 9 kHz to 6 GHz
- N5192A/94A UXG X-Series Vector Adapter Modified Version, 50 MHz to 20 GHz, with U3039ACK 6 GHz Reference Source
- M9383A PXIe Microwave Signal Generator, 1 MHz to 44 GHz

Scalar mixer/converter measurements (S95082B)

The S95082B provides frequency offset mode (FOM) to set the frequency of the M980xA VNA's internal source independently from where the receivers are tuned, and to configure external sources using External Device Configuration. This functionality is also included with S95029/070/083/084/086/089/090, both B and A models.

With a simple setup and calibration, this application delivers the highest accuracy for scalar conversion-loss/gain measurements by combining one-port and power-meter calibrations to remove mismatch errors. S95082B provides an intuitive and easy-to-use user interface for setting up mixer and converter measurements, with single or dual conversion stages. It can control external signal generators for use as LO signals. Supported external sources include the Keysight ESG, PSG, EXG, and MXG Series, as well as other SCPI-controlled signal generators.

S95082B is compatible with S95084B, which enables measurements of converters with internal LOs.

Vector and scalar mixer/converter measurements (S95083B)

This application includes the scalar mixer/converter plus phase (SMC+Phase) measurement class that provides fully calibrated conversion gain/loss, relative phase, and absolute group delay measurements of mixers and converters without the need for reference or calibration mixers. Eliminating the calibration mixer requires a U9391C/F/G comb generator [1] and an external DC power supply capable of sourcing +15 V and 300 mA for U9391C/F or 800 mA for U9391G. A macro-based series-reference-mixer version of VMC is also included for measuring the phase difference between multiple paths or devices, or for measuring phase shifts within the frequency-converting device. The macro also supports characterization of the calibration mixer that is supplied by the user.

SMC+Phase with the S95083B provides an intuitive and easy-to-use user interface for setting up mixer and converter measurements, with single or dual conversion stages. It can control the analyzer's built-in source as well as external signal generators for use as LO signals. Supported external sources include the Keysight ESG, PSG, EXG, and MXG Series, as well as other SCPI-controlled signal generators. S95083B is a superset of S95082B, so they should not be installed together.

S95083B is compatible with S95084B, which enables measurements of converters with internal LOs.

1. When a comb generator is used as a phase reference for calibration and the start frequency of the measurement is less than 630 MHz, a user-supplied calibration mixer is required.

Embedded LO capability (S95084B)

This application tunes the analyzer's receivers to the output frequency of the converter under test without the need for access to internal LOs or a common reference signal. S95084B is intended to work with S95082B and S95083B measurement applications.

Gain compression measurements (S95086B)

The gain compression application (GCA) provides input power, output power, gain, and phase at the compression point of an amplifier over a specified frequency range. GCA's SMART Sweep is very fast and easy-to-use. GCA also includes a guided calibration that corrects for absolute power levels, frequency response, and mismatch errors.

Gain compression measurements of frequency converting devices are not supported with the S95086B.

Differential and I/Q device measurements (S95089B)

This application combines source-phase control of multiple internal or external sources with frequency-offset mode, enabling simplified test of I/Q modulators/converters and differential mixers, and harmonic measurements of differential amplifiers. The phase difference between sources can be fixed (for example, at 90 or 180 degrees), or swept between two specified phase values. Providing accurate control of the relative phase between sources eliminates the need for hybrid couplers and baluns to create quadrature or differential signals. After achieving the desired phase alignment, the instrument's receivers can be tuned to all frequencies needed to characterize the DUT. On an I/Q modulator for example, measurements can be made of both the desired and suppressed conversion bands, along with LO leakage, harmonics and other spurious signals. Phase sweeps can be used to determine a DUT's phase imbalance versus frequency. Users can specify measurements with individual receivers or multiple receivers combined with a wide range of mathematical operators. Power measurements can employ match correction for increased accuracy. S95089B only works on a multiport VNA using multiple M980xA modules with S95551B.

Spectrum analysis (S95090B)

The spectrum analyzer (SA) application adds high-performance microwave spectrum analysis to the M980xA VNA and M981xA receiver modules. With fast stepped-FFT sweeps resulting from optimized data processing, the SA application provides quick spurious searches over broad frequency ranges. Simultaneous spectrum measurements can be done using test and reference receivers. This multi-channel SA can be used with the internal swept-signal generators for efficient measurements of spurious signals emanating from mixers and frequency converters. The SA application employs source-power and receiver-response calibration as well as fixture de-embedding, providing in-fixture and on-wafer spectrum measurements with the highest level of accuracy. Accurate and fast noise power ratio (NPR) measurement capability is also included in this software application. It provides the ability of setting up and controlling of external signal generator/arbitrary waveform generators and performing the calibration of the flatness of a wideband signal and distortion signals in notches, and achieving very fast NPR measurements. Optional external attenuators should be connected with the VNA's test ports to avoid receiver compression when measuring large signals.

The S95090B software requires option 090 spectrum analysis hardware of M981xAS.

Multiple instruments/modules measurements (S95551B)

Keysight M981xAS PXIe VCA offers a capability to extend the number of ports for your measurements by using multiple M980xA PXI VNA modules. With the S95551B, multiple M980xA VNA modules may be installed in one or two PXI chassis and identified by the M981xAS firmware as one VNA under a single controller. Operations with a single M980xA VNA combined with multiple M981xA receivers do not require the S95551B for full calibrated measurements.

The S95551B extends the number of internal sources up to two by using multiple M980xA modules. An additional signal (fixed or swept) is used as a local oscillator for testing mixers and frequency converters, or two-tone intermodulation testing of amplifiers using SA measurement class. To independently control the frequency of the two internal sources, one of the following software applications is required: S95029/070/082/083/084/086/089/090, both B and A models.

The frequency of the multiport array is determined by the lowest frequency instrument configured in the array. For example, a 4-port analyzer configuration using an M9805A (26.5 GHz) and a M9808A (53 GHz) would have a maximum frequency of 53 GHz when performing 4-port measurements. This behavior extends to other measurement application software (S95xxxB).

Each M980xA or M981xA module is connected into the array with Keysight cables. A Y1730A Interconnect Cables for Multiport Configuration should be ordered for each additional module.

Multiport calibration assistant (S95552B)

This application software provides a tool to flexibly create and manage cal sets for multiport measurements. For example, two cal sets with independent test ports can be combined as one cal set with a greater number of test ports. The software also offers a way to re-calibrate using a certain set of test ports to refresh the cal set.

At least one ECal module is required for the operation of S95552B.

Multiport calibrated measurements with switch instruments (S95553B)

This application provides a macro which enables full multiport error correction and measurement capabilities using external switch instruments such as the M9164A/B or M9165A/B PXIe Solid-state Switch Matrix. The software delivers an easy-to-use measurement wizard that simplifies measurement procedures and reduces the setup time of complicated multiport measurements. Measured multiport S-parameters are displayed in the VNA viewer.

The 66-port multiport configuration using a 10-port M980xA (with 6-port and 4-port M980xAs) and four 2x16 PXIe switch matrices has been evaluated.

Only the 4-port ECal modules (i.e. N4431/32/33D) are supported for multiport calibration with the S95553B.

Material measurements

The Keysight N1500A materials measurement suite streamlines the process of measuring complex permittivity and permeability with a vector network analyzer. Various type of measurements, such as transmission line and free space, arch reflectivity, resonant cavity, and coaxial probe are available as options. The easy-to-use software guides the user through setup and measurement, instantly converting S-parameter network analyzer data into the data format of your choice and displaying the results within seconds. Results can be charted in a variety of formats: ε_r', ε_r'', tand, μ_r', μ_r'', tand_μ, and Cole-Cole.

N1930xB Physical Layer Test System (PLTS) software

The PLTS software platform has become an industry standard for calibration, measurement, and analysis of linear passive interconnects such as cables, connectors, backplanes, and printed circuit boards. Utilizing either a vector network analyzer (VNA) or a time domain reflectometer (TDR), fast and accurate measurements can be obtained without in-depth knowledge of microwave measurement techniques. Refer to www.keysight.com/find/plts or the technical overview (literature number 5989-6841EN) for more details.

Automatic Measurement Expert (AMX)

This software package is a smart software solution for automated multiport S-parameter measurements with the M980xA. The S94701A AMX test plan builder provides an interactive GUI which helps you edit your multiport DUT test plans and generate test sequence files for the network analyzers. The S94702A and KS8400A software running on the analyzer executes the test sequences according to the optimized test sequence files generated by the S94701A.

Keysight Software Licensing Options Provide Flexibility and Support

Projects ramp up and down, teams grow and shrink, and projects move location. In such a dynamic environment, you need flexible licensing options that allow you to balance your project's requirements. Whether your software will be a staple for years to come or you have a short-term need for a leading-edge measurement application, Keysight's licensing puts you in charge.

Choose your term. Choose your type. Keep control of your budget.

- Select a node-locked, transportable, USB portable or floating license type, depending on how much flexibility you need.
- Select a subscription or perpetual license term, depending on how long you need to use the software.
- Each license is sold with a KeysightCare software support subscription which provides technical support with ensured response time, proactive software updates and enhancements.

Choose a license term and type that best suits your requirements from the table below.

License term

License term	Descriptions
Perpetual	Perpetual licenses can be used indefinitely.
Subscription	Licenses can be used through the term of the subscription (6, 12, 24, or 36 month)

License type

License type	Descriptions
Node locked [1]	License can be used on one specified instrument/computer.
Transportable	License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required).
USB portable	License can be used on one instrument/computer at a time but can be transferred to another using a certified USB dongle (available for additional purchase, Keysight part number E8900-D10).
Floating	Networked instruments/computers can access a license from a server one at a time. Multiple licenses may be purchased for concurrent usage. Three types of floating license are available: Single Site: 1-mile radius from the server Single Region [2]: Americas, Europe, Asia Worldwide (export restriction identified in End User License Agreement (EULA))

1. Node-locked licenses are not recommended for measurements in secured environment where SSD of a host PC must be removed or changed for sanitization process. Select other license types (transportable, USB portable or floating) for more flexibility.
2. Americas (North, Central, and South America, Canada); Europe (European Continent, Middle Eastern Europe, Africa, India); Asia (North and South Asia Pacific Countries, China, Taiwan, Japan).

KeysightCare Software Support Subscription provides peace of mind amid evolving technologies

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

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

Ordering Information

Step 1. Choose your software product.

Step 2. Choose your license term: perpetual or subscription.

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

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

		License term			
Product	License type	Perpetual			Subscription
S95xxxB [2]		License		Support	License and support
	Node-locked (fixed)	R-A5E-001-A	+	R-A6E-001-z	R-A4E-001-z
	Transportable	R-A5E-004-D	+	R-A6E-004-z	R-A4E-004-z
	USB portable [1]	R-A5E-005-E	+	R-A6E-005-z	R-A4E-005-z
	Floating (single site)	R-A5E-002-B	+	R-A6E-002-z	R-A4E-002-z
	Floating (single region)	R-A5E-006-F	+	R-A6E-006-z	R-A4E-006-z
	Floating (worldwide)	R-A5E-010-J	+	R-A6E-010-z	R-A4E-010-z
				z = Duration	z = Duration
				L 12 months (default)	F 6 months
				X 24 months	L 12 months
				Y 36 months	X 24 months
				Z 60 months	Y 36 months

1. USB portable license requires a certified USB dongle (available for additional purchase, Keysight part number E8900-D10).
2. The license types for S95xxxB software must be ordered separately and installed from the web after the receipt of the instrument.

Measurement Accessories

A complete list of RF and microwave test accessories is available on our Web site: www.keysight.com/find/mta

Accessories are available in these connector types: 50 Ω Type-N, 3.5 mm, 7 mm, 2.4 mm, 2.92 mm, 1.85 mm, and waveguide. Test port cables and a calibration kit should be added for a complete measurement system. A verification kit is used to verify corrected system performance.

Cable and adapter sets

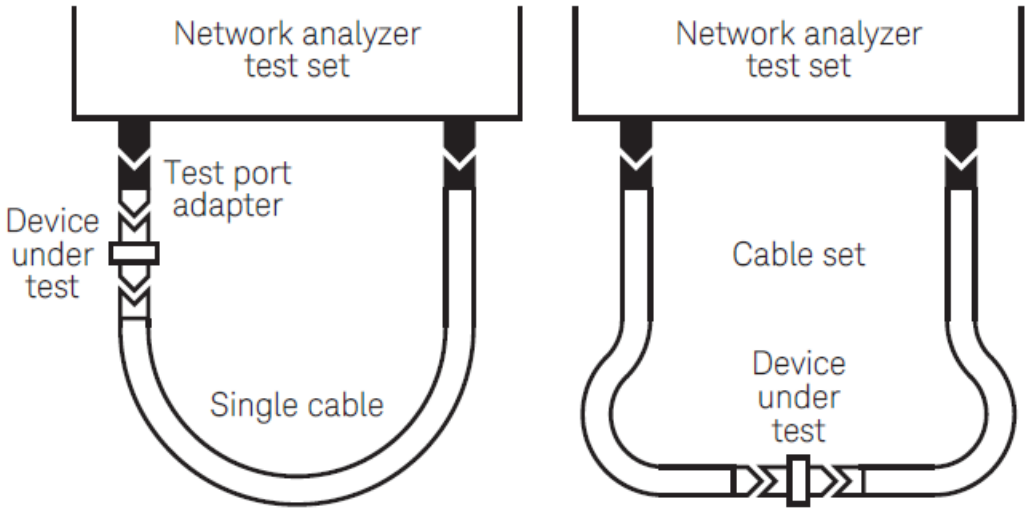
Keysight offers cables in the following types:

- Single cables in semi-rigid and flexible
- Cable sets in semi-rigid and flexible

There are also adapter sets available that protect the test port and convert the port to the desired connector interface. These kits contain:

- One male adapter
- One female adapter

To attain the best mechanical rigidity for device connection, use a single cable and the appropriate special adapter set. To attain the greatest flexibility for device connection, use a cable set.



Calibration kits

Coaxial measurements

Mechanical calibration kits include standards, such as opens, shorts and loads, which are measured by the network analyzer for increased measurement accuracy.

Choose a calibration kit for each connector type to be used.

Economy, includes:

- Open standards (male and female)
- Short standards (male and female)
- Fixed-termination standards (male and female)

Standard, includes the devices in the economy kit and adds:

- Sliding load standards (male and female) or a series of offset shorts

Precision, includes the devices in the economy kit and adds:

- 50 Ω airline(s) for TRL calibration
- TRL adapters

Electronic calibration (ECal) kits replace mechanical calibration standards with one solid-state calibration module that is controlled by the network analyzer via USB, to present many different impedances to the test ports. A full two-port calibration can be performed quickly with a single connection. This technique reduces operator errors and connector wear and abrasion.

For more information about ECal modules, refer to the technical overview 5963-3743E (N4690, 85090, N4430 and N7550 Series).

Waveguide measurements

For waveguide measurements, Keysight offers mechanical calibration kits that include:

- Waveguide-to-coax adapters (X, P, K, R, Q, U, V)
- Precision waveguide section
- Flush short circuit
- Fixed terminations
- Straight section

For devices with 1.85 mm connectors

Mechanical calibration kits

85058B standard: DC to 67 GHz. Includes:

- 85058-60101 1.85 mm (m) short 5.4 mm
- 85058-60102 1.85 mm (m) short 6.3 mm
- 85058-60103 1.85 mm (m) short 7.12 mm
- 85058-60104 1.85 mm (m) short 7.6 mm
- 85058-60105 1.85 mm (f) short 5.4 mm
- 85058-60106 1.85 mm (f) short 6.3 mm
- 85058-60107 1.85 mm (f) short 7.12 mm
- 85058-60108 1.85 mm (f) short 7.6 mm
- 85058-60109 1.85 mm male open
- 85058-60110 1.85 mm female open
- 85058-60111 1.85 mm male load
- 85058-60112 1.85 mm female load
- 85058-60113 1.85 mm (m) to 1.85 mm (m) adapter
- 85058-60114 1.85 mm (f) to 1.85 mm (f) adapter
- 85058-60115 1.85 mm (m) to 1.85 mm (f) adapter

85058E economy: DC to 67 GHz. Includes:

- 85058-60101 1.85 mm (m) short 5.4 mm
- 85058-60105 1.85 mm (f) short 5.4 mm
- 85058-60109 1.85 mm male open
- 85058-60110 1.85 mm female open
- 85058-60123 1.85 mm male load
- 85058-60124 1.85 mm female load
- 85058-60113 1.85 mm (m) to 1.85 mm (m) adapter
- 85058-60114 1.85 mm (f) to 1.85 mm (f) adapter
- 85058-60115 1.85 mm (m) to 1.85 mm (f) adapter

85058B standard: DC to 67 GHz. Includes:

- Option F0F: Both connectors are 1.85 mm female on module
- Option M0F: 1 female and 1 male 1.85 mm connector on module
- Option M0M: Both connectors are 1.85 mm male on module
- Option 0DC: DC to 67 GHz
- Option 100: 10 MHz to 67 GHz
- Option 00A adds:
    - 85058-60113 1.85 mm (m) to 1.85 mm (m) adapter
    - 85058-60114 1.85 mm (f) to 1.85 mm (f) adapter

Electronic calibration kits

N4694D Microwave ECal: DC or 10 MHz to 67 GHz, 2-ports. Includes:

- Option F0F: Both connectors are 1.85 mm female on module
- Option M0F: 1 female and 1 male 1.85 mm connector on module
- Option M0M: Both connectors are 1.85 mm male on module
- Option 0DC: DC to 67 GHz
- Option 100: 10 MHz to 67 GHz
- Option 00A adds:
    - 85058-60113 1.85 mm (m) to 1.85 mm (m) adapter
    - 85058-60114 1.85 mm (f) to 1.85 mm (f) adapter

For devices with 2.4 mm connectors

Mechanical calibration kits

85056A standard: DC to 50 GHz. Includes:

- 00901-60003 2.4 mm (m) fixed broadband load
- 00902-60004 2.4 mm (f) fixed broadband load
- 00915-60003 2.4 mm (m) sliding load
- 00915-60004 2.4 mm (f) sliding load
- 85056-60005 2.4 mm (m) to 2.4 mm (m) adapter
- 85056-60006 2.4 mm (f) to 2.4 mm (f) adapter
- 85056-60007 2.4 mm (m) to 2.4 mm (f) adapter
- 85056-60020 2.4 mm (m) short
- 85056-60021 2.4 mm (f) short
- 85056-60022 2.4 mm (m) open
- 85056-60023 2.4 mm (f) open

85056D economy: DC to 50 GHz. Includes:

- 00901-60003 2.4 mm (m) fixed broadband load
- 00902-60004 2.4 mm (f) fixed broadband load
- 85056-60005 2.4 mm (m) to 2.4 mm (m) adapter
- 85056-60006 2.4 mm (f) to 2.4 mm (f) adapter
- 85056-60007 2.4 mm (m) to 2.4 mm (f) adapter
- 85056-60020 2.4 mm (m) short
- 85056-60021 2.4 mm (f) short
- 85056-60022 2.4 mm (m) open
- 85056-60023 2.4 mm (f) open

Electronic calibration kits

N4693D Microwave ECal: DC or 10 MHz to 50 GHz, 2-ports. Includes:

- Option F0F: Both connectors are 2.4 mm female on module
- Option M0F: 1 female and 1 male 2.4 mm connector on module
- Option M0M: Both connectors are 2.4 mm male on module
- Option 0DC: DC to 50 GHz
- Option 100: 10 MHz to 50 GHz
- Option 00A adds:
    - 85056-60005 2.4 mm (m) to 2.4 mm (m) adapter
    - 85058-60006 2.4 mm (f) to 2.4 mm (f) adapter

For devices with 2.4 mm connectors

Electronic calibration kits

N4692D Microwave ECal: DC or 10 MHz to 40 GHz, 2-ports. Includes:

- Option F0F: Both connectors are 2.92 mm female on module
- Option M0F: 1 female and 1 male 2.92 mm connector on module
- Option M0M: Both connectors are 2.92 mm male on module
- Option 0DC: DC to 40 GHz
- Option 100: 10 MHz to 40 GHz
- Option 00A adds:
    - N4692-60021 2.92 mm (m) to 2.92 mm (m) adapter
    - N4692-60022 2.92 mm (f) to 2.92 mm (f) adapter

Adapters

- 11904A 2.4 mm (m) to 2.92 mm (m)
- 11904B 2.4 mm (f) to 2.92 mm (f)
- 11904C 2.4 mm (m) to 2.92 mm (f)
- 11904D 2.4 mm (f) to 2.92 mm (m)
- 11904S 2.4 mm to 2.92 mm: Adapter set, contains 4 matched adapters

For devices with 3.5 mm or SMA connectors

Mechanical calibration kits

85033E economy: DC to 9 GHz. Includes:

- 85033-60016 3.5 mm (m) load
- 85033-60017 3.5 mm (f) load
- 85033-60018 3.5 mm (m) open
- 85033-60019 3.5 mm (f) open
- 85033-60020 3.5 mm (m) short
- 85033-60021 3.5 mm (f) short
- 8710-1761 torque wrench

Option 85033E-100 adds:

- 85027-60005 3.5 mm (f) to 3.5 mm (f) adapter

Option 85033E-200 adds:

- 85027-60007 3.5 mm (m) to 3.5 mm (m) adapter

Option 85033E-300 adds:

- 85027-60006 3.5 mm (m) to 3.5 mm (f) adapter

Option 85033E-400 adds:

- 1250-1744 3.5 mm (f) to 50 Ω Type-N (m) adapter
- 1250-1743 3.5 mm (m) to 50 Ω Type-N (m) adapter
- 1250-1745 3.5 mm (f) to 50 Ω Type-N (f) adapter
- 1250-1750 3.5 mm (m) to 50 Ω Type-N (f) adapter

Option 85033E-500 adds:

- 1250-1746 3.5 mm (m) to 7 mm adapter (two included)
- 1250-1747 3.5 mm (f) to 7 mm adapter (two included)

85052B standard: DC to 26.5 GHz. Includes:

- 00902-60003 3.5 mm (m) fixed load
- 00902-60004 3.5 mm (f) fixed load
- 00911-60019 3.5 mm (m) sliding load
- 00911-60020 3.5 mm (f) sliding load
- 85052-60006 3.5 mm (m) short
- 85052-60007 3.5 mm (f) short
- 85052-60008 3.5 mm (m) open
- 85052-60009 3.5 mm (f) open
- 85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
- 85052-60013 3.5 mm (f) to 3.5 mm (m) adapter
- 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

85052C precision TRL: DC to 26.5 GHz. Includes:

- 00902-60003 3.5 mm (m) fixed load
- 00902-60004 3.5 mm (f) fixed load
- 85052-60006 3.5 mm (m) short
- 85052-60007 3.5 mm (f) short
- 85052-60008 3.5 mm (m) open
- 85052-60009 3.5 mm (f) open
- 85052-60032 3.5 mm (f) to 3.5 mm (f) adapter
- 85052-60033 3.5 mm (m) to 3.5 mm (m) adapter
- 85052-60034 3.5 mm (f) to 3.5 mm (m) adapter
- 85052-60035 3.5 mm short TRL line
- 85052-60036 3.5 mm long TRL line

85052D economy: DC to 26.5 GHz. Includes:

- 00902-60003 3.5 mm (m) fixed load
- 00902-60004 3.5 mm (f) fixed load
- 85052-60006 3.5 mm (m) short
- 85052-60007 3.5 mm (f) short
- 85052-60008 3.5 mm (m) open
- 85052-60009 3.5 mm (f) open
- 85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
- 85052-60013 3.5 mm (f) to 3.5 mm (m) adapter
- 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

Electronic calibration (ECal) modules

85093C RF ECal: 300 kHz to 9 GHz, 2-ports. Standard module includes:

- Option 00F: Both 3.5 mm connectors are female
- Option 00M: Both 3.5 mm connectors are male
- Option M0F: One female and one male connector, both 3.5 mm
- Option 00A adds:
    - 85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
    - 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter
- Option 150: Replaces standard storage container with a wooden box

85093C mixed-connector options

Port A option			Port B option		
Connector type	Female	Male	Connector type	Female	Male
3.5 mm (f)	101	102	Type-N 50 Ω	203	204
			7-16	205	206

N4431B ECal: 300 kHz to 13.5 GHz, 4-ports

Connector type	Port A option	Port B option	Port C option	Port D option
Four 3.5 mm (f)	010			
Four Type-N 50 Ω (f)	020			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402
Type-N 50 Ω (f)	103	203	303	403
Type-N 50 Ω (m)	104	204	304	404
7-16 (f)	105	205	305	405
7-16 (m)	106	206	306	406

- Option 150: Replaces standard storage container with a wooden box

N4431D ECal: DC to 13.5 GHz, 4-ports

Frequency option (mandatory)

- Option 0DC: DC to 13.5 GHz

Connector options

- Option 010: 3.5 mm female connector on four ports on module
- Option 020: Type-N female connector on four ports on module

Connector type	Port A option	Port B option	Port C option	Port D option
Four 3.5 mm (f)	010			
Four Type-N 50 Ω (f)	020			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402
Type-N 50 Ω (f)	103	203	303	403
Type-N 50 Ω (m)	104	204	304	404
7-16 (f)	105	205	305	405
7-16 (m)	106	206	306	406
4.3-10 (f)	107	207	307	407
4.3-10 (m)	108	208	308	408

N4433A ECal: 300 kHz to 20 GHz, 4-ports.

Connector type	Port A option	Port B option	Port C option	Port D option
Four 3.5 mm (f)	010			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402

- Option 150: Replaces standard storage container with a wooden box

N4433D ECal: DC or 300 kHz to 26.5 GHz, 4-ports

Frequency options

- Option 0DC: DC to 26.5 GHz
- Option 003: 300 kHz to 26.5 GHz

Connector option

- Option 010: 3.5 mm female connector on four ports on module

Connector type	Port A option	Port B option	Port C option	Port D option
Four 3.5 mm (f)	010			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402

N4691D Microwave ECal, DC or 300 kHz to 26.5 GHz, 2-ports. Includes:

- Option F0F: Both 3.5 mm connectors are female
- Option M0F: One female and one male connector, both 3.5 mm
- Option M0M: Both 3.5 mm connectors are male
- Option 0DC: DC to 26.5 GHz
- Option 003: 300 kHz to 26.5 GHz
- Option 00A adds:
    - 85052-60012 3.5 mm (f) to 3.5 mm (f) adapter
    - 85052-60014 3.5 mm (m) to 3.5 mm (m) adapter

N755XA Series Economy ECal, 2-ports:

- N7550A DC to 4 GHz, 2-ports
- N7551A DC to 6.5 GHz, 2-ports
- N7552A DC to 9 GHz, 2-ports
- N7553A DC to 14 GHz, 2-ports
- N7554A DC to 18 GHz, 2-ports
- N7555A DC to 26.5 GHz, 2-ports

N755xA Series includes:

- Option 3FF: Both 3.5 mm connectors are female
- Option 3MF: One female and one male connector, both 3.5 mm
- Option 3MM: Both 3.5 mm connectors are male
- Option 150: Plastic storage box
- N7550X-151: 3.5 mm or 2.92 mm torque wrench

For devices with Type-N connectors

Mechanical calibration kits

85032F standard, DC to 9 GHz Includes:

- 85032-60017 Type-N (m) fixed load
- 85032-60018 Type-N (f) fixed load
- 85032-60013 Type-N (m) open
- 85032-60014 Type-N (f) open
- 85032-60016 Type-N (m) short
- 85032-60015 Type-N (f) short

Option 85032F-100 adds:

- 85032-60021 Type-N (f) to Type-N (f) adapter

Option 85032F-200 adds:

- 85032-60019 Type-N (m) to Type-N (m) adapter

Option 85032F-300 adds:

- 85032-60020 Type-N (m) to Type-N (f) adapter

Option 85032F-500 adds:

- 85054-60001 Type-N (f) to 7 mm adapter (two included)
- 85054-60009 Type-N (m) to 7 mm adapter (two included

85054B standard: DC to 18 GHz. Includes:

- 00909-60011 Type-N (m) fixed lowband load
- 00909-60012 Type-N (f) fixed lowband load
- 85054-60025 Type-N (m) short
- 85054-60026 Type-N (f) short
- 85054-60027 Type-N (m) open
- 85054-60028 Type-N (f) open
- 85054-60031 Type-N (f) to 7mm adapter
- 85054-60032 Type-N (m) to 7mm adapter
- 85054-60037 Type-N (f) to Type-N (f) adapter
- 85054-60038 Type-N (m) to Type-N (m) adapter
- 85054-80010 Type-N (f) sliding load
- 85054-80009 Type-N (m) sliding load
- 85054-60050 Type-N (f) connector gage
- 85054-60052 Type-N (f) gage master
- 85054-60051 Type-N (m) connector gage
- 85054-60053 Type-N (m) gage master

85054D economy: DC to 18 GHz. Includes:

- 85054-60025 Type-N (m) short
- 85054-60026 Type-N (f) short
- 85054-60027 Type-N (m) open
- 85054-60028 Type-N (f) open
- 85054-60031 Type-N (f) to 7mm adapter
- 85054-60032 Type-N (m) to 7mm adapter
- 85054-60037 Type-N (f) to Type-N (f) adapter
- 85054-60038 Type-N (m) to Type-N (m) adapter
- 85054-60046 Type-N (m) fixed load
- 85054-60047 Type-N (f) fixed load

Electronic calibration (ECal) modules

85092C RF ECal: 300 kHz to 9 GHz, 2 ports. Includes:

- Option 00F: both Type-N connectors are female
- Option 00M: both Type-N connectors are male
- Option M0F: one female and one male connector, both Type-N
- Option 00A adds:
    - 85054-60037 Type-N (f) to Type-N (f) adapter
    - 85054-60038 Type-N (m) to Type-N (m) adapter

N4431D ECal: DC to 13.5 GHz, 4-ports

Frequency option (mandatory)

- Option 0DC: DC to 13.5 GHz

Connector options

- Option 010: 3.5 mm female connector on four ports on module
- Option 020: Type-N female connector on four ports on module

Connector type	Port A option	Port B option	Port C option	Port D option
Four 3.5 mm (f)	010			
Four Type-N 50 Ω (f)	020			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402
Type-N 50 Ω (f)	103	203	303	403
Type-N 50 Ω (m)	104	204	304	404
7-16 (f)	105	205	305	405
7-16 (m)	106	206	306	406
4.3-10 (f)	107	207	307	407
4.3-10 (m)	108	208	308	408

N4432A ECal: 300 kHz to 18 GHz, 4-ports

Connector type	Port A option	Port B option	Port C option	Port D option
Four Type-N 50 Ω (f)	020			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402
Type-N 50 Ω (f)	103	203	303	403
Type-N 50 Ω (m)	104	204	304	404

- Option 150: Replaces standard storage container with a wooden box

N4432D ECal: DC or 300 kHz to 18 GHz, 4-ports

Frequency options

- Option 0DC: DC to 18 GHz
- Option 003: 300 kHz to 18 GHz

Connector options

- Option 020: Type-N female connector on four ports on module

Connector type	Port A option	Port B option	Port C option	Port D option
Four Type-N 50 Ω (f)	020			
3.5 mm (f)	101	201	301	401
3.5 mm (m)	102	202	302	402
Type-N 50 Ω (f)	103	203	303	403
Type-N 50 Ω (m)	104	204	304	404

N4690D Microwave ECal, DC or 300 kHz to 18 GHz, 2-ports. Includes:

- Option F0F: Both Type-N connectors are female
- Option M0F: One female and one male connector, both Type-N connectors
- Option M0M: Both Type-N connectors are male
- Option 0DC: DC to 18 GHz
- Option 003: 300 kHz to 18 GHz
- Option 00A adds:
    - 85054-60037 Type-N (f) to Type-N (f) adapter
    - 85054-60038 Type-N (m) to Type-N (m) adapter

N755XA Series Economy ECal, 2-ports:

- N7550A DC to 4 GHz, 2-ports
- N7551A DC to 6.5 GHz, 2-ports
- N7552A DC to 9 GHz, 2-ports
- N7553A DC to 14 GHz, 2-ports
- N7554A DC to 18 GHz, 2-ports

N755xA Series includes:

- Option NFF: Both Type-N connectors are female
- Option NMF: One female and one male connector, both Type-N
- Option NMM: Both Type-N connectors are male
- Option 150: Plastic storage box
- N7550X-152: Type-N torque wrench

Adapter sets

11853A 50 Ω Type-N accessory kit. Includes:

- 1250-1472 Type-N (f) to Type-N (f) adapter (two included)
- 1250-1475 Type-N (m) to Type-N (m) adapter (two included)
- 11511A Type-N (f) short
- 11512A Type-N (m) short

11878A Type-N to 3.5 mm adapter kit. Includes:

- 1250-1744 3.5 mm (f) to 50 Ω Type-N (m) adapter
- 1250-1743 3.5 mm (m) to 50 Ω Type-N (m) adapter
- 1250-1745 3.5 mm (f) to 50 Ω Type-N (f) adapter
- 1250-1750 3.5 mm (m) to 50 Ω Type-N (f) adapter

11524A 7 mm to Type-N (f) adapter

11525A 7 mm to Type-N (m) adapter

For devices with 7 mm connectors

Mechanical calibration kits

85050B standard: DC to 18 GHz. Includes:

- 00909-60008 7 mm coax termination
- 85050-60006 7 mm fixed broadband load
- 85050-80007 7 mm short
- 85050-80010 7 mm open
- 85050-80011 7 mm sliding load

85050C precision TRL: DC to 18 GHz. Includes:

- 00909-60008 7 mm coax termination
- 85050-60003 7 mm to 7 mm airline
- 85050-60005 7 mm to 7 mm TRL adapter
- 85050-60006 7 mm fixed broadband load
- 85050-80008 7 mm short
- 85050-80009 7 mm short with collect
- 85050-80010 7 mm open

85050D economy: DC to 18 GHz. Includes:

- 85050-60006 7 mm fixed broadband load
- 85050-80007 7 mm short
- 85050-80010 7 mm open

Electronic calibration (ECal) modules

N4696D Microwave ECal: DC or 300 kHz to 18 GHz, 2-ports, 7 mm connectors. Includes:

- Option 0DC: DC to 18 GHz
- Option 003: 300 kHz to 18 GHz

For devices with waveguide

Mechanical calibration kits

X-Band

X11644A standard, WR-90: 8.2 to 12.4 GHz. Includes:

- 00896-60008 X-band standard section
- 00910-60003 X-band termination
- 11644-20018 X-band short
- 11644-20021 X-band shim
- X281C adapter (included in calibration kit): WR-90 to 7 mm

P Band

P11644A standard, WR-62: 12.4 to 18 GHz. Includes:

- 00896-60007 P-band standard section
- 00910-60002 P-band termination
- 11644-20017 P-band short
- 11644-20020 P-band shim
- P281C adapter (included in calibration kit): WR-62 to 7 mm

K Band

K11644A standard, WR-42: 18 to 26.5 GHz. Includes:

- 00896-60006 K-band standard section
- 00910-60001 K-band termination
- 11644-20016 K-band short
- 11644-20019 K-band shim
- K281C adapter (included in calibration kit): WR-42 to 3.5 mm (f) Option 012 WR-42 to 3.5 mm (m)

R Band

R11644A standard, WR-28: 26.5 to 40 GHz. Includes:

- 00914-20028 R-band termination
- 11644-20005 R-band short
- 11644-20003 R-band shim
- 11644-60001 R-band 10 cm straight waveguide
- 11644-60016 R-band 5 cm straight waveguide

Q Band

Q11644A standard, WR-22: 33 to 50 GHz. Includes:

- 11644-60005 Q-band termination
- 11644-20004 Q-band short
- 11644-20001 Q-band shim
- 11644-60002 Q-band 10 cm straight waveguide
- 11644-60017 Q-band 5 cm straight waveguide

U Band

U11644A standard, WR-19: 40 to 60 GHz. Includes:

- 11644-60006 U-band termination
- 11644-20004 U-band short
- 11644-20002 U-band shim
- 11644-60003 U-band 10 cm straight waveguide
- 11644-60018 U-band 5 cm straight waveguide

Verification kits

All Keysight verification kits include:

- Precision Z0 airline or match thru
- Mismatched airline or mismatch thru
- Fixed attenuators (except 85059V)
- Traceable measured data and uncertainties

85051B 45 MHz to 18 GHz 7 mm kit

Includes attenuators, airline and mismatch airline with data on a USB drive for use in confirming calibrated system performance, traceable to national standards. Test procedure is provided in the service manual.

85053B 300 kHz to 26.5 GHz 3.5 mm kit

Includes attenuators, airline and mismatch airline with data on a USB drive for use in confirming calibrated system performance, traceable to national standards. Test procedure is provided in the service manual.

85055A 300 kHz to 18 GHz Type-N kit

Includes attenuators, airline and mismatch airline with data on a USB drive for use in confirming calibrated system performance, traceable to national standards. Test procedure is provided in the service manual.

85057B 45 MHz to 50 GHz 2.4 mm kit

Includes attenuators, airline and mismatch airline with data on a USB drive for use in confirming calibrated system performance, traceable to national standards. Test procedure is provided in the service manual.

85058V 45 MHz to 67 GHz 1.85 mm kit

Includes attenuators, match thru and mismatch thru with data on a USB drive for use in confirming calibrated system performance, traceable to national standards. Test procedure is provided in the service manual.

Accessories

CalPod calibration refresh modules (8553xB/4xB)

CalPod calibration refresh modules allow in-situ calibration refreshes to be performed at the push of a button without removing the DUT or re-connecting calibration standards. CalPods are designed for any measurement situation where it is desirable to ensure that a valid calibration is present before recording measurement data. For example, they are useful for removing environmental effects such as cable movement and thermal-based changes of cables, connectors, and adapters, as well as connector and switch-matrix repeatability errors. The modules are especially useful in temperature, or thermal-vacuum chamber testing. CalPod modules are equipped with 2.92 mm connectors.

- 85530B 20 GHz ambient-temperature CalPod
- 85531B 20 GHz temperature-compensated CalPod
- 85532B 20 GHz thermal-vacuum compatible CalPod
- 85540B 40 GHz ambient-temperature CalPod
- 85541B 40 GHz temperature-compensated CalPod
- 85542B 40 GHz thermal-vacuum compatible CalPod
- 85523B CalPod controller (provides control for up to 4 CalPods)
- 85556A CalPod drive-cable splitter (allows control for up to 12 CalPods)
- 85554A CalPod drive cable extension (10-meter cascadable extension cable)

System Requirements for M980xA Control

Requirement [1]	Description
Operating systems	Windows 7 SP1 [2] or Windows 10 (64-bit only)
Processor speed	Intel i5 6th generation or newer/Intel Xeon E3 v3 or newer
Available memory	4 GB minimum, 16 GB recommended
Available disk space	2 GB available disk space minimum
Display resolution	1024 X 768 minimum

1. For a list of computers compatible with Keysight M9018A PXIe chassis, refer to Tested Computer Technical Note. (5990-7632EN)
2. For Windows 7 OS, SHA-2 code signing support must be installed.

Literature Information

Title	Pub number
Keysight M981xAS Series PXIe Vector Component Analyzer – Data Sheet	3120-1346EN
Keysight M980xA Series PXIe Vector Network Analyzer – Data Sheet	5992-3596EN
Keysight Vector Network Analyzer – Selection Guide	5980-7603EN
Electric Calibration (ECal) Modules – Technical Overview	5963-7343E

Web Resources

www.keysight.com/find/pxivna

www.keysight.com/find/na

www.keysight.com/find/ecal

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

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