# E5080B ENA Series
# Vector Network Analyzers

9 kHz to 53 GHz, 2/4-port

## Drive Down the Cost of Test

9 kHz to 4.5/6.5/9/14/18/20 GHz
100 kHz to 26.5/32/44/53 GHz



**KEYSIGHT**
TECHNOLOGIES

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# E5080B ENA Series Vector Network Analyzer Configurations

This configuration guide describes standard configurations, options, accessories, upgrade kits and compatible peripherals for the Keysight E5080B ENA Series vector network analyzer (VNA). All documentation of the E5080B is available on the product page at: www.keysight.com/find/e5080b

## Test set options

Choose one of the frequencies and test set options for the E5080B. Option 2xx indicates two test ports and option 4xx indicates four test ports. To add options to a product, order the corresponding item number (E5080B-xxx).

| Option number | Description | Test port connectors |
|---|---|---|
| **2-port Options** | | |
| E5080B-240 | 2-port test set, 9 kHz to 4.5 GHz | Type-N (f) |
| E5080B-260 | 2-port test set, 9 kHz to 6.5 GHz | Type-N (f) |
| E5080B-290 | 2-port test set, 9 kHz to 9 GHz | Type-N (f) |
| E5080B-2D0 | 2-port test set, 9 kHz to 14 GHz | Type-N (f), 3.5 mm (m) |
| E5080B-2H0 | 2-port test set, 9 kHz to 18 GHz | Type-N (f), 3.5 mm (m) |
| E5080B-2K0 | 2-port test set, 9 kHz to 20 GHz | 3.5 mm (m) |
| E5080B-2L0 | 2-port test set, 100 kHz to 26.5 GHz | 3.5 mm (m) |
| E5080B-2M0 | 2-port test set, 100 kHz to 32 GHz | 2.4 mm (m) |
| E5080B-2N0 | 2-port test set, 100 kHz to 44 GHz | 2.4 mm (m) |
| E5080B-2P0 | 2-port test set, 100 kHz to 53 GHz[1] | 1.85 mm (m) |
| **4-port Options** | | |
| E5080B-440 | 4-port test set, 9 kHz to 4.5 GHz | Type-N (f) |
| E5080B-460 | 4-port test set, 9 kHz to 6.5 GHz | Type-N (f) |
| E5080B-490 | 4-port test set, 9 kHz to 9 GHz | Type-N (f) |
| E5080B-4D0 | 4-port test set, 9 kHz to 14 GHz | Type-N (f), 3.5 mm (m) |
| E5080B-4H0 | 4-port test set, 9 kHz to 18 GHz | Type-N (f), 3.5 mm (m) |
| E5080B-4K0 | 4-port test set, 9 kHz to 20 GHz | 3.5 mm (m) |
| E5080B-4L0 | 4-port test set, 100 kHz to 26.5 GHz | 3.5 mm (m) |
| E5080B-4M0 | 4-port test set, 100 kHz to 32 GHz | 2.4 mm (m) |
| E5080B-4N0 | 4-port test set, 100 kHz to 44 GHz | 2.4 mm (m) |
| E5080B-4P0 | 4-port test set, 100 kHz to 53 GHz[1] | 1.85 mm (m) |
| **4-port Options with internal second source** | | |
| E5080B-442 | 4-port test set, 9 kHz to 4.5 GHz with second source | Type-N (f) |
| E5080B-462 | 4-port test set, 9 kHz to 6.5 GHz with second source | Type-N (f) |
| E5080B-492 | 4-port test set, 9 kHz to 9 GHz with second source | Type-N (f) |
| E5080B-4D2 | 4-port test set, 9 kHz to 14 GHz with second source | Type-N (f), 3.5 mm (m) |
| E5080B-4H2 | 4-port test set, 9 kHz to 18 GHz with second source | Type-N (f), 3.5 mm (m) |
| E5080B-4K2 | 4-port test set, 9 kHz to 20 GHz with second source | 3.5 mm (m) |
| E5080B-4L2 | 4-port test set, 100 kHz to 26.5 GHz with second source | 3.5 mm (m) |
| E5080B-4M2 | 4-port test set, 100 kHz to 32 GHz with second source | 2.4 mm (m) |
| E5080B-4N2 | 4-port test set, 100 kHz to 44 GHz with second source | 2.4 mm (m) |
| E5080B-4P2 | 4-port test set, 100 kHz to 53 GHz with second source[1] | 1.85 mm (m) |

1. Frequency is settable up to 54 GHz.

## Spectrum analysis hardware options

Choose one of spectrum analysis hardware to the E5080B (Option 09x). The frequency of Option 09x must match with the operation frequency of test set options. S96090B/A application software is required for spectrum analysis using the Option 09x.

| Option number | Description | Additional Information |
|---|---|---|
| E5080B-090 | Spectrum analysis hardware, 9 kHz to 4.5 GHz | |
| E5080B-091 | Spectrum analysis hardware, 9 kHz to 6.5 GHz | |
| E5080B-092 | Spectrum analysis hardware, 9 kHz to 9 GHz | |
| E5080B-093 | Spectrum analysis hardware, 9 kHz to 14 GHz | |
| E5080B-094 [1] | Spectrum analysis hardware, 9 kHz to 20 GHz | |
| E5080B-095 | Spectrum analysis hardware, 100 kHz to 26.5 GHz | |
| E5080B-096 | Spectrum analysis hardware, 100 kHz to 32 GHz | |
| E5080B-097 | Spectrum analysis hardware, 100 kHz to 44 GHz | |
| E5080B-098 | Spectrum analysis hardware, 100 kHz to 53 GHz | |

1. Order Option 094 for 18 GHz options (opt.2H0/4H0/4H2). The maximum frequency of spectrum analysis is limited at 18 GHz.

## Internal bias tees options

Choose one of internal bias tees options. [1]

| Option number | Description | Additional Information |
|---|---|---|
| E5080B-120 | Add internal bias tees for 2-port E5080B | Available with 4.5/6.5/9/14/20 GHz options only |
| E5080B-140 | Add internal bias tees for 4-port E5080B | Available with 4.5/6.5/9/14/20 GHz options only |

1. Internal bias tees options can not be combined with 14 or 18 GHz options with Type-N connectors.

## Hardware options

| Option number | Description | Additional information |
|---|---|---|
| E5080B-021 | Add pulse modulator to internal 1st source | This option adds the internal pulse modulators on the analyzer's source. On the single source models, the pulse modulation works at port 1 and 2 (on 2-port models) and at all four ports (on 4-port models). On the second source models, opt. 021 pulse modulation works only for the port 1 and 2. S96025B/A application software is required for pulsed-RF measurements. |
| E5080B-022 | Add pulse modulator to internal 2nd source | This option adds the internal pulse modulators on the analyzer's source. This option is available only on the second source models (opt. 4x2) and pulse modulation works for the port 3 and 4. S96025B/A application software is required for pulsed-RF measurements. |
| E5080B-1E5 | Add high stability time base | Adds higher stability time base reference. |

| | | |
|---|---|---|
| E5080B-1NC | Equipped with Type-N connectors | Adds Type-N connectors for 14 and 18 GHz options (opt.2D0/4D0/4D2/2H0/4H0/4H2). Can not be combined with internal bias tees options (opt.120 or 140). |
| E5080B-172 | Add GPIB interface | |
| E5080B-175 | Add analog input and output | Provides two DC sources and four input ports for DC measurements. |

## Application software

| Model number[1,2,3] | Description | Additional information |
|---|---|---|
| S96007B/A | Automatic fixture removal | |
| S96010B/A | Time domain analysis | |
| S96011B/A | Enhanced time domain analysis with TDR | Includes all capability of S96010B/A |
| S96025B/A | Basic pulsed-RF measurements | Requires hardware option 021 at least. |
| S96029B/A[4] | Noise figure measurements with vector correction | Standard receivers are used. |
| S96082B/A[4] | Scalar mixer/converter measurements | Provides SMC measurement class. |
| S96083B/A[4] | Vector and scalar mixer/converter measurements | Provides SMC + phase measurement class. Provides vector mixer characterization. |
| S96084B/A[4] | Embedded-LO capability | |
| S96086B/A[4] | Gain-compression measurements | |
| S96089B[4] | Differential and I/Q device measurements | Requires option 4x2 (internal second source option). |
| S96090B/A[4] | Spectrum analysis | Requires hardware option 09x. |
| S96552B | Multiport calibration assistant | Provides a tool to flexibly define cal sets of multiport measurements. Requires one ECal module. |
| S94701A S94702A KS8400A | Automated Measurement Expert (AMX) | A smart software solution for automated multiport S-parameter measurements with the E5080B and E5092A[5]. Order each software model and install in a PC or the analyzer. |

1. The S96xxxB and S96xxxA offer the same functionalities.
2. The S96xxxB software has six license types, please refer to "Keysight Software Licensing Options Provide Flexibility and Support" for more detail.
3. The S96xxxA software has these software license types: node-locked perpetual (1FP), node-locked 12 month (1FL), transportable perpetual (1TP) and transportable 12 month (1TL). 1FP is the only type that can be ordered as part of the instrument. The other types have to be ordered as separate items and installed from the web after the receipt of the instruments.
4. Provides frequency offset mode (FOM) to independently set the frequency of internal source(s) and receivers, and to configure external sources using External Device Configuration.
5. A 4-port ECal module (i.e. N4431D or N4433D) is recommended for multiport measurements.

## Calibration options

| Option number | Description | Additional information |
|---|---|---|
| E5080B-1A7 | ISO 17025 compliant calibration | |
| E5080B-A6J | ANSI Z540 compliant calibration | |

## Accessories

| Option number | Description | Additional information |
|---|---|---|
| E5080B-1CM | Rack mount kit for installation without handles | Adds a rackmount flange kit and a rail kit for use without handles. |
| E5080B-1CP | Rack mount kit for installation with handles | Adds handles, a rack mount flange kit, and a rail kit for use with handles. |
| E5080B-181 | Add keyboard | |
| E5080B-182 | Add mouse | |

# E5080B Test set options and Block Diagrams

## E5080B Option 240/260/290/2D0/2K0 (2-port base options)
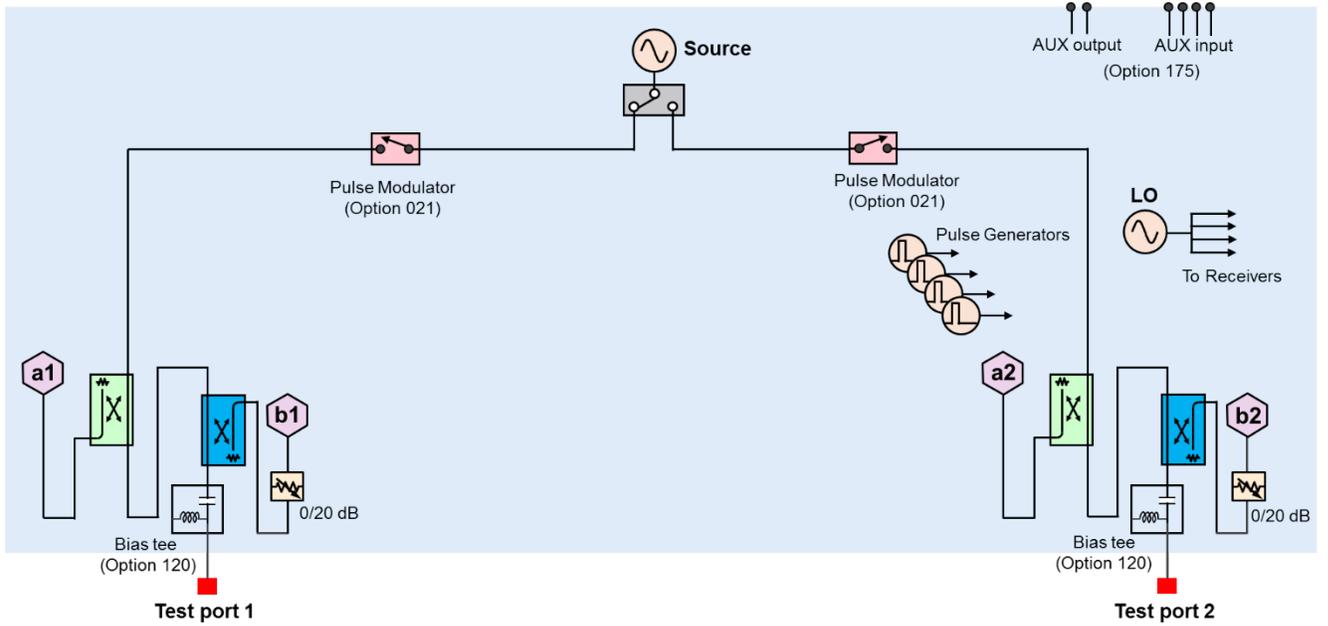


## E5080B Option 2L0/2M0/2N0/2P0 (2-port base options)
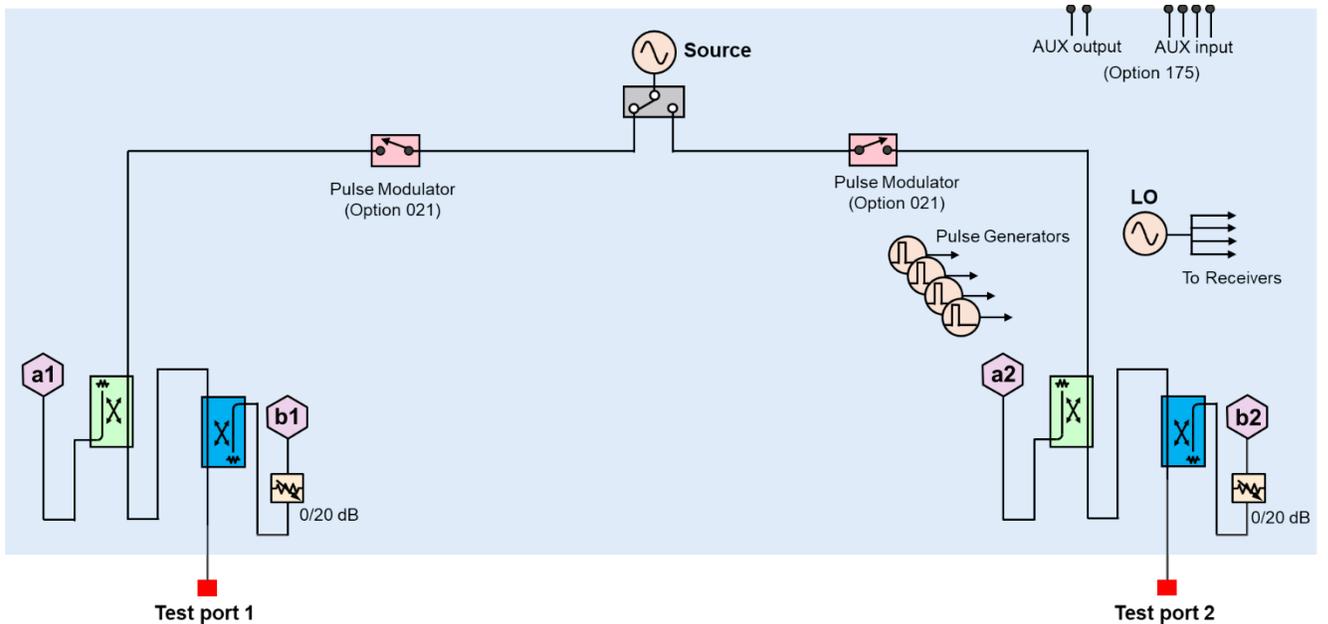
## E5080B Option 440/460/490/4D0/4K0 (4-port base options)
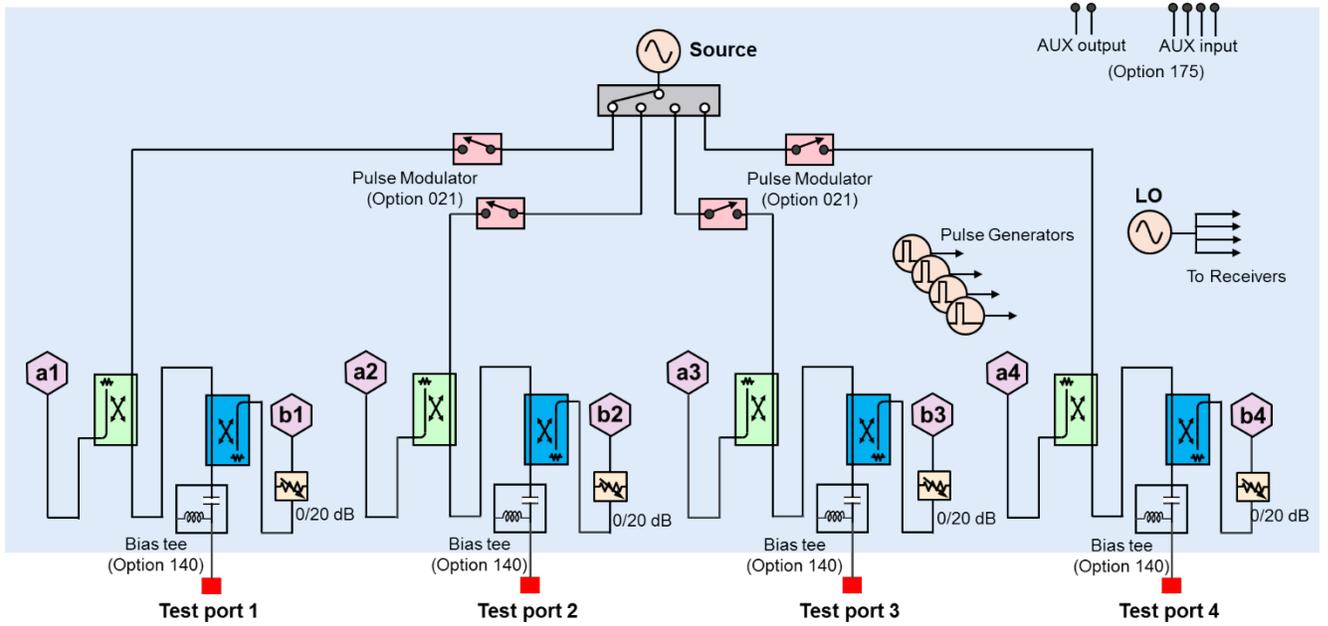


## E5080B Option 4L0/4M0/4N0/4P0 (4-port base options)
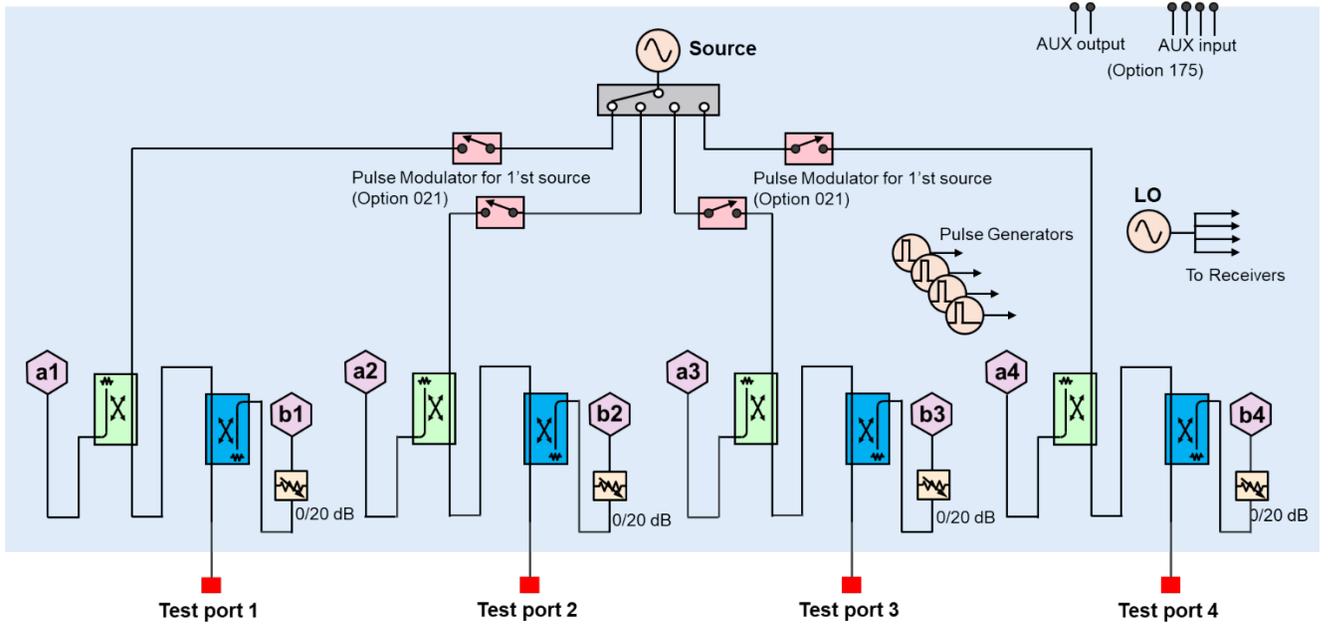
## E5080B Option 442/462/492/4D2/4K2 (4-port second source option)
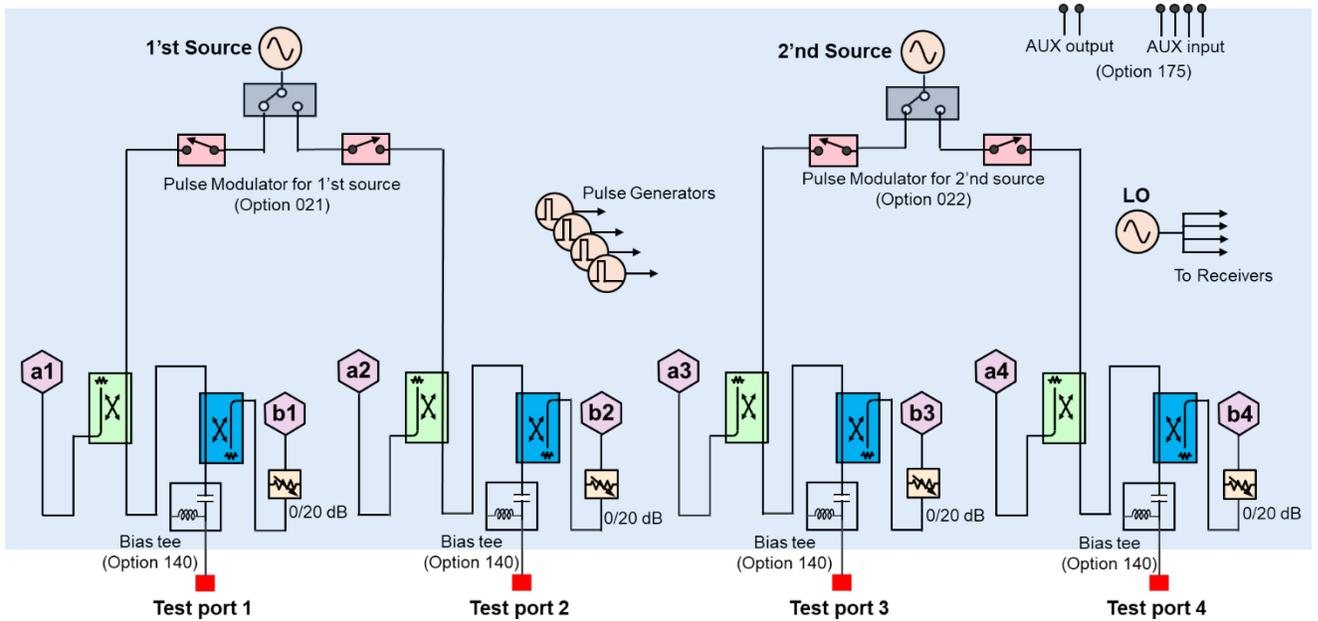


## E5080B Option 4L2/4M2/4N2/4P2 (4-port second source options)
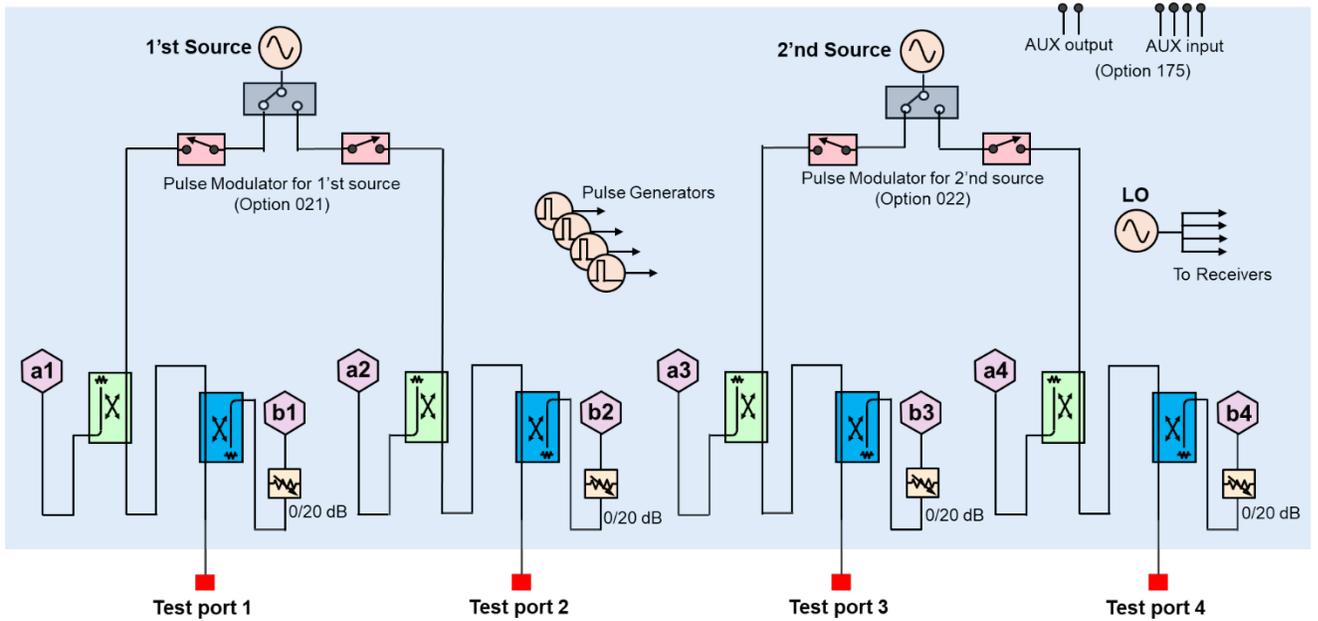
# Measurement Application Software

## Automatic fixture removal (S96007B/A)

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 (S96010B/A)

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 (S96011B/A)

This application enables the analyzer to perform enhanced time domain analysis for high-speed data applications. All functionality of the S96010B/A are included (TDR/TDT mode). In addition, the S96011B/A 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 S96011B/A 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 (S96025B/A)

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.

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, the E5080B is a complete pulsed-RF measurement solution, eliminating the need for external test sets and pulse generators. S96025B/A also controls external pulse generators and modulators and can synchronize to external master pulses. The application I/O connector on the rear panel of the analyzer is recommended if using external master pulses or external pulse modulators.

## Noise figure measurements with vector correction (S96029B/A)

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[1] 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. S96029B/A controls N469x Series ECal modules configured as impedance tuners for use with the E5080B. 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 E5080B's source signal during noise figure measurements. A 50-ohm load must be connected to the DUT's input using the switch.

The analyzer's standard receivers are used for noise figure measurements with the S96029B/A. 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.
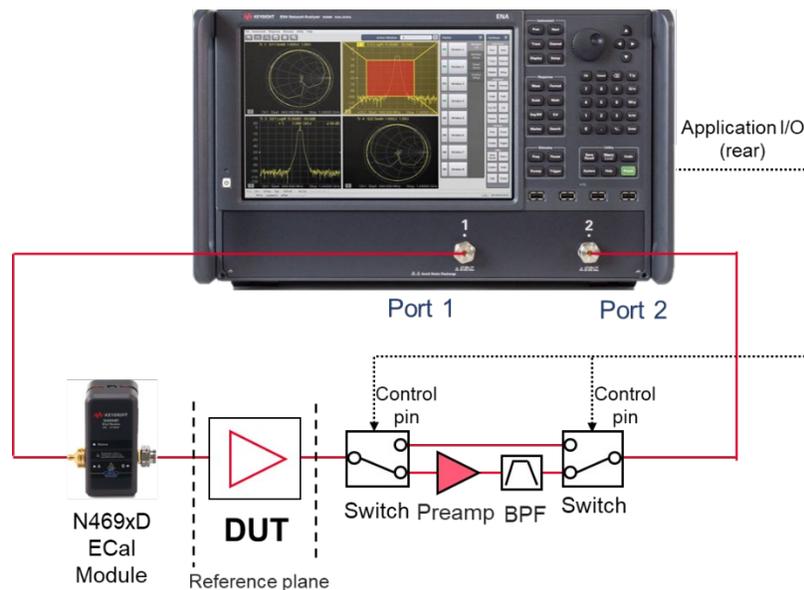


For calibration, a standard mechanical cal kit or ECal module is required for the S-parameter portion of the cal (an ECal used as a tuner cannot be shared for calibration). To calibrate a standard receiver for noise figure measurements, a power meter is required. All calibration accessories and external hardware must be ordered separately.

Noise figure measurements with the E5080B are verified between 50 MHz and 45 GHz. Noise figure measurements of frequency converting devices are not supported with the S96029B/A.

1.  8509x, N443x or N755xA Series ECal modules are not supported.

## Scalar mixer/converter measurements (S96082B/A)

The S96082B/A provides frequency offset mode (FOM) to set the frequency of the internal source(s) independently from where the receivers are tuned, and to configure external sources using External Device Configuration. This functionality is also included with S96029/083/084/086/089/090, 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. S96082B/A 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.

S96082B/A is compatible with S96084B/A, which enables measurements of converters with internal LOs.

## Vector and mixer/converter measurements (S96083B/A)

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 vector mixer characterization (VMC) is also included for measuring group delay of frequency converting devices. VMC is used to characterize a calibration mixer supplied by the user.

SMC+Phase with the S96083B/A 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(s) 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. S96083B/A is a superset of S96082B/A, so they should not be installed together. S96083B/A is compatible with S96084B/A, 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 (S96084B/A)

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. S96084B/A is intended to work with S96082B/A and S96083B/A measurement applications.

## Gain compression measurements (S96086B/A)

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 S96086B/A.

## Differential and I/Q device measurements (S96089B)

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. S96089B only works on the E5080B with option 4x2 (internal second source options).

## Spectrum analysis (S96090B/A)

The spectrum analyzer (SA) application adds high-performance microwave spectrum analysis to the analyzer. 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 S96090B/A software requires option 09x spectrum analysis hardware of the E5080B.

## Multiport calibration assistant (S96552B)

This S96552B 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 S96552B.

## 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: $\varepsilon_r'$, $\varepsilon_r''$, tand, $\mu_r'$, $\mu_r''$, tand$_\mu$, and Cole-Cole.

## N1930B 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.

## Automated Measurement Expert (AMX)

This software package is a smart software solution for automated multiport S-parameter measurements with the 4-port E5080B and E5092A. 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.

A 4-port ECal module (i.e. N4431D or N4433D) is recommended for calibration wizard.

Figure 1. Multiport setup using the E5092A

## E5080B Hardware Configurations
### Pulse modulation hardware (Option 021)

Internal pulse modulator hardware on Source 1. On the single source models, the pulse modulation works for the port 1 and 2 (on Option 2x0 2 port models) and all four ports (on Option 4x0 4 port models). On the second source models, Option 021 pulse modulation works only for the port 1 and 2. The modulators can be controlled via the Application I/O D-sub connector on the rear panel of the analyzer using an external pulse generator, or by using one of the internal pulse generators. The S96025B/A is required to enable the internal pulse modulators.

## Pulse modulation hardware (Option 022)

Internal pulse modulator hardware on Source 2 on the second source models (Option 4x2). Option 022 pulse modulation works for the port 3 and 4. The modulators can be controlled via the Application I/O D-sub connector on the rear panel of the analyzer using an external pulse generator, or by using one of the internal pulse generators. The S96025B/A is required to enable the internal pulse modulators.

## High stability time base (Option 1E5)

The option improves specification of frequency accuracy within $\pm$ 0.45 ppm.

## Internal bias tees (Option 120 or 140)

Broadband internal bias tees are integrated for each test port with Option 120 or 140. Order Option 120 for 2-port options and order Option 140 for 4-port options. DC power can be provided via BNC female connectors on the rear panel of the analyzer for the operation of active components under test such as tower mounted amplifiers (TMAs). Internal bias tees are available on the models with the highest frequency is equal or lower than 20 GHz.

## Analog input and output (Option 175)

The E5080B Option 175 adds analog input and output ports with BNC female connectors on the rear panel of the analyzer to enable DC measurements with the E5080B. Two integrated variable DC sources provide ± 10 VDC with maximum current of 200 mA. Synchronized DC voltage sweep is performed using the E5080B's firmware.

For more comprehensive analysis, four analog inputs with BNC female connectors are provided to allow sensing of DC voltages from the DUT.

## Device Test I/O

Device test I/O with a 25-pin D-sub connector on the rear panel of the analyzer allows users to control the device under test (DUT) directly with serial or parallel digital interface. Signals from the I/O are applied to select operation modes of the RF front-end module which integrates power amplifiers, switches, low noise amplifiers, duplexers or filters in a single component.

The device test I/O has two independent 8-bit digital I/Os (DIOs). Each 8-bit DIO can provide either 8-bit parallel signals or 4-channels of RFFE-like interface. Output DC voltage or clock rate (25 MHz maximum) are selectable according to the specification of DUTs.

Quick and easy setup of DUT control signals can be done with the E5080B's firmware, and the operation of the device test I/O is synchronized with the measurement sweep of the analyzer.

## Application I/O

Application I/O with a 15-pin D-sub connector on the rear panel of the analyzer provides required signals for synchronized measurements using the E5080B and external peripherals such as pulse generators, pulse modulators, RF switches for NF measurements, or signal generators.

The N1966A pulse I/O adapter is recommended if using an external pulse generator. The N1966A enables coaxial connections between the Application I/O D-sub connector on the rear panel of the analyzer and the coaxial inputs and outputs of external pulse generators and external pulse modulators. Coaxial connectors are SMB male. A connector saver (P/N: Z2342-37605) and hex standoff (P/N: 0380-5625) are required for the connection of the E5080B and N1966A.

# Direct Receiver Access (DRA) Configurations

The 4-port E5080B 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 VNA firmware) combines three physical test ports of the E5080B and defines as a single logical port. You can perform measurements including calibration and post processing using the logical ports.

## DRA configuration with high-power

One example using the DRA configuration is S-parameter measurements with high power. When you need an input level higher than the analyzer'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 amplifier with a standard configuration of a 2-port VNA, and temperature drift or high reverse isolation of a booster amplifier will prevent accurate reflection measurements of DUT's input.

A typical configuration for high-power measurements with the 4-port E5080B is shown. Reflected and transmitted signals of DUT are detected with all the logical receivers, and the VNA firmware provides measured high-power S-parameters.



Physical port
(Logical or DRA port)

$S11 = b1/a1$
$S21 = b2/a1$
$S12 = b1/a2$
$S22 = b2/a2$

Port 1
(CW source)

Port 2
(a1)

Port 3
(b1)

Port 4
(a2, b2)

Booster amp

Directional
coupler x2

DUT

Attenuator

Reference plane
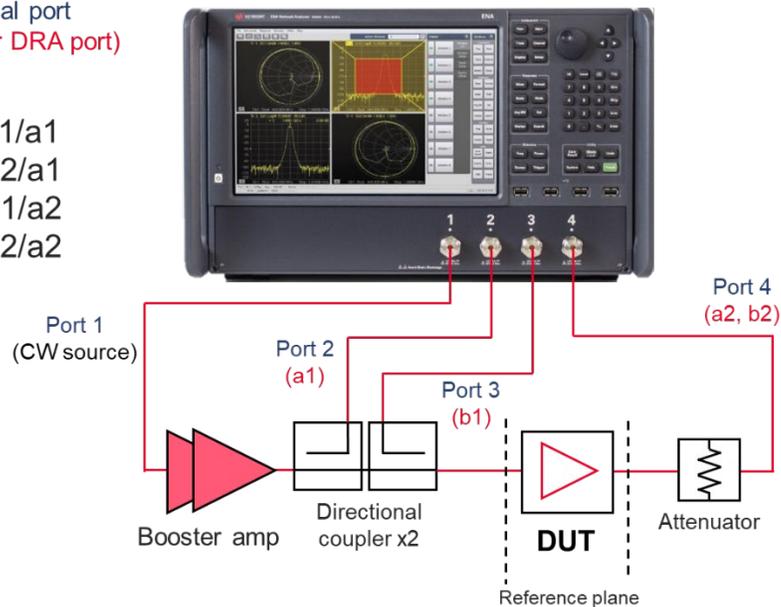
External components should be selected based on their high-power limits or frequency range specifications. Be sure that these components can handle the output power level of the booster amplifier.

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1.  External components are not included in the E5080B. Must be purchased separately.

# 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 time-based 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, enhancements and fixes.

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

**License term**

| License term | Options |
|---|---|
| Perpetual | Perpetual licenses can be used indefinitely. |
| Time-based | Time-based licenses can be used through the term of the license (6, 12, 24, or 36 month) |

**License type**

| License type | Options |
|---|---|
| Node locked | License can be used on one specified instrument/computer. |
| Transportable | License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required). |
| USB portable | License can be used on one instrument/computer at a time but 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:<br>Single Site: 1-mile radius from the server<br>Single Region[1]: Americas, Europe, Asia<br>Worldwide (export restriction identified in End User License Agreement (EULA)) |

1. 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 subscription | 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. |
| | Time-based licenses include a software support subscription through the term of the license. |

# Keysight Software Ordering Information

- Step 1. Choose your software product.
- Step 2. Choose your license term: perpetual or time based.
- Step 3. Choose your license type: node-locked, transportable, USB portable, or floating.
- Step 4. Depending on the license term, choose your support subscription duration.

| | | | | License term | |
|---|---|---|---|---|---|
| Product | License type | | | Perpetual | Time-based |
| | | License | | Support subscription | License and support subscription |
| S96xxxB | Node-locked (fixed) | R-A5B-001-A | + | R-A6B-001-z | R-A4B-001-z |
| | Transportable | R-A5B-004-D | + | R-A6B-004-z | R-A4B-004-z |
| | USB portable[1] | R-A5B-005-E | + | R-A6B-005-z | R-A4B-005-z |
| | Floating (single site) | R-A5B-002-B | + | R-A6B-002-z | R-A4B-002-z |
| | Floating (single region) | R-A5B-006-F | + | R-A6B-006-z | R-A4B-006-z |
| | Floating (worldwide) | R-A5B-010-J | + | R-A6B-010-z | R-A4B-010-z |
| | | | | z = subscription duration | z = subscription duration |
| | | | | L 12 months (default)[2] | 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. For S96xxxB software, the fixed-perpetual with a 12-months, support subscription (R-A6B-001-L) is the only license type that can be ordered as part of the instrument and installed. The other license types for S96xxxB software must be ordered separately and installed from the web after the receipt of the instrument.

# E5092A Configurable Multiport Test Set

The E5092A configurable multiport test set is offered for use with the 4-port E5080B to extend the number of test ports. Multiport measurements from 50 MHz to 20 GHz can be made by connecting the optional interconnect semi-rigid cables to the E5092A's front panel.

## Test set options

Choose Option 020. Option 020 is the only test set option for the E5092A.

| Option number | Description | Additional information |
| --- | --- | --- |
| E5092A-020 | 20 GHz switching test set | Up to 22-port or 10-port full crossbar measurement. |

## Cable and adapter options

Choose one of the interconnect cable and adapter set for your 4-port ENA.

| Option number | Description | Additional information |
| --- | --- | --- |
| E5092A-08C | Cables and adapters for connection to E5071C Option 440/445/460/465/480/485 | Adds SMA semi-rigid cables and type-N-to-SMA adapters for connection to the E5071C with type-N connectors. |
| E5092A-20C | Cables and adapters for connection to E5071C Option 4D5/4K5 | Adds SMA semi-rigid cables and 3.5 mm-to -3.5 mm adapters for connection to the E5071C with 3.5-mm connectors. |
| E5092A-09A | Cable and adapters for connection to E5080A Option 445/465/495 | Adds SMA semi-rigid cables and type-N-to-SMA adapters for connection to the E5080A with type-N connectors. |
| E5092A-09B[1] | Cable and adapters for connection to E5080B Option 440/460/490 | Adds SMA semi-rigid cables and type-N-to-SMA adapters for connection to the E5080B with type-N connectors. |
| E5092A-20B[1] | Cable and adapters for connection to E5080B Option 4D0/4K0 | Adds SMA semi-rigid cables and 3.5 mm-to -3.5 mm adapters for connection to the E5080B with 3.5-mm connectors. |

## Accessories, calibration options

| Option number | Description | Additional information |
| --- | --- | --- |
| E5092A-1CM | Rack mount kit only | Adds a rack mount kit for use without handles. |
| E5092A-1CN | Front handle kit only | Adds a front handle kit. |
| E5092A-1CP | Rack mount kit with handle kit | Adds a rack mount and front handle kit. |
| E5092A-1A7 | ISO 17025 compliant calibration | |
| E5092A-A6J | ANSI Z540 compliant calibration | |

1. Docking plates (P/N: E5092-60105 and E5092-60106) are offered for the connection of the E5080B and E5092A.

# 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, 1.0 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.
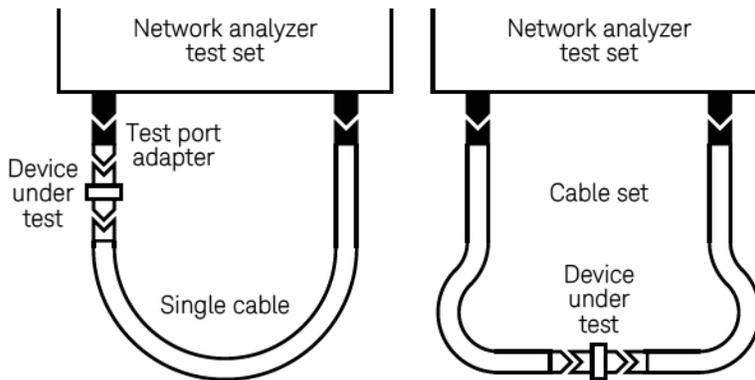


## Calibration kits

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 kit

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


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

Cables

N4697J[1] Single, flexible:1.85 mm (f) to 1.85 mm (f), 96.5 cm, 38 inches
N4697K[1] Set, flexible:
    One 1.85 mm (f) to 1.85 mm (f) cable, 62.2 cm, 24.5 inches, p/n N4697-60100
    One 1.85 mm (f) to 1.85 mm (m) cable, 62.2 cm, 24.5 inches, p/n N4697-60200
N4421B-K67 Single, flexible: 1.85 mm (f) to 1.85 mm (m), 91.4 cm, 36 inches

Adapter set

85130H[1] 1.85 mm to 1.85 mm

1.   Special rugged female connector specifically for connecting to the network analyzer test port, but does not mate with a standard male connector. The N4697J/K replace the N4697E/F, which will be discontinued on June 1, 2020.

## For devices with 2.4 mm connectors

Mechanical calibration kit

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[1] 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

## Cables

Note: Keysight offers the following 2.4 mm test port cables. Adapters will be necessary when using these cables for 2.92 mm measurements.

85133C[1] single, semi-rigid: 2.4 mm (f) to PSC-2.4 mm (f), 81 cm, 32 inches

85133D[1] set, semi-rigid:

    One 2.4 mm (f) to 2.4 mm (m), 53 cm, 21 inches, p/n 85133-60001

    One 2.4 mm (f) to 2.4 mm (f), 53 cm, 21 inches, p/n 85133-60002

85133E[1] single, flexible: 2.4 mm (f) to PSC-2.4 mm (f), 97 cm, 38 inches

85133F[1] set, flexible:

    One 2.4 mm (f) to 2.4 mm (f), 63 cm, 25 inches, p/n 85133-60016

    One 2.4 mm (f) to 2.4 mm (m), 63 cm, 25 inches, p/n 85133-60017

85133H[1] Single, flexible: 2.4 mm (f) to 2.4 mm (m), 63 cm, 25 inches

N4421AK20 Single, flexible: 2.4 mm (f) to 2.4 mm (m), 91.4 cm, 36 inches

## Adapter set

85130E 2.4 mm[1] to 7 mm

85130F 2.4 mm[1] to 3.5 mm

85130G 2.4 mm[1] to 2.4 mm

1.  Special rugged female connector specifically for connecting to the network analyzer test port, but does not mate with a standard male connector.

## For devices with K connectors (2.92 mm)

### Mechanical calibration kits

85056KE01 DC to 40 GHz

For use with user supplied 2.92 mm test port cables.2.92 mm (K connector) calibration kit with fixed and sliding loads. The Keysight 85056KE01 calibration kit is an ordering convenience to allow the pass-through ordering from Keysight for the Maury 8770E47 calibration kit.

85056KE02 DC to 40 GHz

For use with user supplied 2.92 mm test ports cables.2.92 mm (K connector) calibration kit with fixed loads only. The Keysight 85056KE02 calibration kit is an ordering convenience to allow the pass-through ordering from Keysight for the Maury 8770F47 calibration kit.

The 85056KE01 and 85056KE02 contains one NMD 2.4 mm[1] (f) to 2.92 mm (f) and one NMD 2.4 mm[1] (f) to 2.92 mm (m) test port adapter to adapt the 2.4 mm test ports of the PNA to 2.92 mm. It also supplies 2.92 mm to 2.92 mm in-series adapters (3 adapters) and a PNA Cal Coefficients on a USB stick. Users must supply their own 2.92 mm or K-connector test port cables. Also included is a 2.92 mm torque wrench.

Maury Microwave Terms and Conditions for Warranty and Return apply. Maury Microwave Corp. calibration kits are to be returned directly to Maury Microwave for service, repair, or calibration issues and not to Keysight Technologies. For additional information go to www.maurymicrowave.com.

Keysight Technologies does not guarantee the performance of the Maury calibration kits or the system performance when connected to Keysight Vector network analyzers.

1. Special rugged female connector specifically for connecting to the network analyzer test port, but does not mate with standard 2.4 mm male connector

## 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

## Cables

Note: Keysight offers the following 2.4 mm test port cables. Adapters will be necessary when using these cables for 2.92 mm measurements.

85133C[1] single, semi-rigid: 2.4 mm (f) to PSC-2.4 mm (f), 81 cm, 32 inches

85133D[1] set, semi-rigid: One 2.4 mm (f) to 2.4 mm (m), 53 cm, 21 inches, p/n 85133-60001
One 2.4 mm (f) to 2.4 mm (f), 53 cm, 21 inches, p/n 85133-60002

85133E[1] single, flexible: 2.4 mm (f) to PSC-2.4 mm (f), 97 cm, 38 inches

85133F[1] set, flexible: One 2.4 mm (f) to 2.4 mm (f), 63 cm, 25 inches, p/n 85133-60016
One 2.4 mm (f) to 2.4 mm (m), 63 cm, 25 inches, p/n 85133-60017

85133H[1] Single, flexible: 2.4 mm (f) to 2.4 mm (m), 63 cm, 25 inches

N4421AK20 Single, flexible: 2.4 mm (f) to 2.4 mm (m), 91.4 cm, 36 inches

## 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

1. Special rugged female connector specifically for connecting to the network analyzer test port, but does not mate with a standard male connector.

## 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:

- ○ 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 | 101 | 102 | Type-N 50 Ω | 203 | 204 |
| | | | 7-16 | 205 | 206 |

N4431D Microwave 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 |

N4433D ECal: DC/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 Options:

- 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

## Cables

85131C[1] single, semi-rigid:

- 3.5 mm (f) to PSC-3.5 mm (f), 81 cm, 32 inches

85131D[1] set, semi-rigid:

- 85131-60009 One 3.5 mm (f) to 3.5 mm (m), 53 cm, 21 inches
- 85131-60010 One 3.5 mm (f) to PSC-3.5 mm (f), 53 cm, 21 inches

85131E[1] single, flexible:

- 3.5 mm (f) to PSC-3.5 mm (f), 96.5 cm, 38 inches

85131F[1] set, flexible:

- 85131-60012 One 3.5 mm (f) to 3.5 mm (m), 62.2 cm, 24.5 inches
- 85131-60013 One 3.5 mm (f) to PSC-3.5 mm (f), 62.2 cm, 24.5 inches

85131H[1] single, flexible:

- 3.5 mm (f) to 3.5 mm (m), 62.2 cm, 24.5 inches

85134E[1] single, flexible:

- PSC-3.5 mm (f) to 2.4 mm (f), 96 cm, 38 inches

85134F[1] set, flexible:

- 85134-60004 One 2.4 mm (f) to PSC-3.5 mm (f), 53 cm, 21 inches
- 85134-60003 One 2.4 mm (f) to PSC-3.5 mm (m), 53 cm, 21 inches

85134H[1] single, flexible:

- 2.4 mm (f) to PSC-3.5 mm (m), 53 cm, 21 inches

N4419AK20 single, flexible:

- 3.5 mm (m) to 3.5 mm (f), 91.4 cm, 36 inches

Z5623A-K20 single, flexible:

- 3.5 mm (m) to 3.5 mm (m), 91.4 cm, 36 inches

## Adapter sets

85130D 3.5 mm[1] to 3.5 mm

1. Special rugged female connector specifically for connecting to the network analyzer test port, but does not mate with a standard male connector.

## 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 low-band load
- 00909-60012 Type-N (f) fixed low-band 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 Microwave 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 |

N4432D Microwave ECal: DC/300 kHz to 18 GHz, 4-ports.

Frequency option (mandatory)

- 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

## Cables

N6314A 50 Ω Type-N RF cable, DC to 12.4 GHz Includes:

- 8120-8862 one 610 mm (24 in) cable with male connectors

N6315A 50 Ω Type-N RF cable, DC to 12.4 GHz Includes:

- 8121-0027 one 610 mm (24 in) cable with both female and male connectors

## 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

85130C 3.5 mm to Type-N Includes:

- 85054-60029 3.5 mm to Type-N (f)
- 85054-60030 3.5 mm to Type-N (m)

## 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

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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
- 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)


Spare drive

E5080BU-180 Solid State Drive (SSD) Spare Kit


## Upgrade Your System

Upgrade kits are available to add options after initial purchase. To upgrade the E5080B ENA, order the corresponding item number. To add application software, order the appropriate standalone model numbers (S96xxxB).

A complete list of E5080B upgrade kits is available on our Web site:
www.keysight.com/find/e5080bupgrades

# E5080B and E5071C Comparison

Switching from the E5071C to the E5080B simplifies complex measurements with integrated functionality and applications. You also get reliability and repeatability from best-in-class performance in dynamic range, trace noise, speed, and frequency range.

| Features | E5071C | E5080B |
|---|---|---|
| Frequency range | 9 kHz to 4.5/6.5/8.5 GHz (Option 2x0, 4x0, without bias tees)<br>100 kHz to 4.5/6.5/8.5 GHz (Option 2x5, 4x5, with bias tees)<br>300 kHz to 14/20 GHz (with bias tees) | 9 kHz to 4.5/6.5/9/14/18/20 GHz (option 2x0, 4x0, 4x2, without bias tees)<br>100 kHz to 26.5/32/44/53 GHz (option 2x0, 4x0, 4x2, without bias tees) |
| Test port connectors | Type-N (female) (4.5/6.5/8.5 GHz)<br>3.5 mm (male) (14/20 GHz) | Type-N (female) (4.5/6.5/8.5/14/18 GHz)<br>3.5 mm (male) (14/18/20/26.5 GHz)<br>2.4 mm (male) (32/44 GHz)<br>1.85 mm (male) (53 GHz) |
| High stability timebase | Optional (Option 1E5) | Optional (Option 1E5) |
| GPIB interface | Standard | Optional (Option 172) |
| Analog DC output (DC sources) | None | Optional (Option 175) |
| Internal bias tees | Standard (Option 2x5, 4x5. Up to 20 GHz) | Optional (Option 120, 140. Up to 20 GHz) |
| Data storage | Built-in HDD (standard. Option 019)<br>Removable HDD (Option 017) | Removable SSD (standard) |
| Pulse modulator hardware | None | Optional (Option 021/022) |
| Spectrum analysis hardware | None | Optional (Option 09x) |
| Internal second source | None | Optional (Option 4x2) |
| Frequency offset mode / scaler calibrated mixer measurements | Option 008 | S96082B/A |
| Time domain analysis | Option 010 | S96010B/A |
| Enhanced time domain analysis with TDR | Option TDR | S96011B/A |

## Literature Information

Keysight E5080B ENA Series Vector Network Analyzer – Data Sheet, 5992-3843EN

Keysight E5071C to E5080B Code Migration Guide, 5992-3873EN

Keysight Vector Network Analyzer – Selection Guide, 5989-7603EN

Electric Calibration (ECal) Modules – Technical Overview, 5963-3743E

Drive Down the Cost of Test Using the ENA – Application Note, 5992-0195EN

## Web Resources

www.keysight.com/find/ena

www.keysight.com/find/na

www.keysight.com/find/vnasoftware

www.keysight.com/find/ecal

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