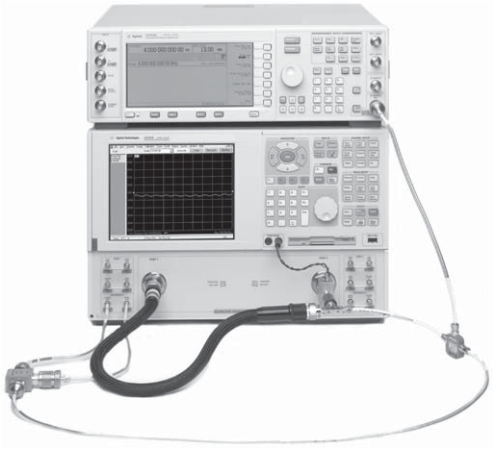
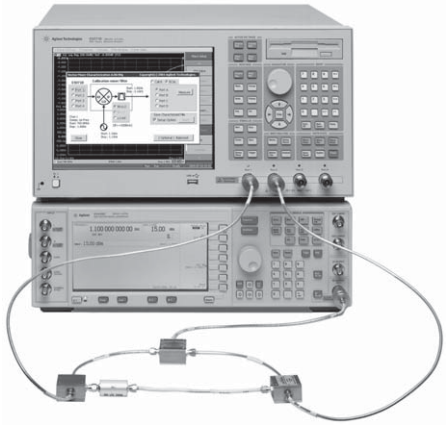
Agilent
PNA and ENA Network Analyzers
Frequency Converter and Mixer Test

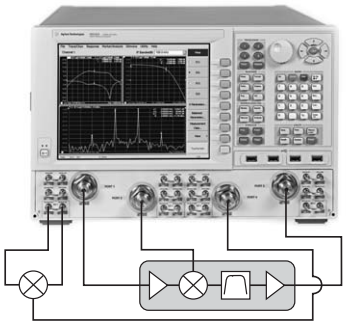
Selection Guide



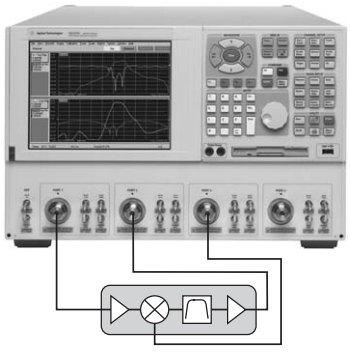
PNA Network Analyzers
(10 MHz to 20, 40, 50 or 67 GHz)



ENA Network Analyzers
(9 kHz to 4.5 or 8.5 GHz)



PNA-X Network Analyzers
(10 MHz to 26.5 GHz)



PNA-L Network Analyzers
(300 kHz to 6, 13.5 or 20 GHz)
(10 MHz to 20, 40 or 50 GHz)

Agilent Technologies

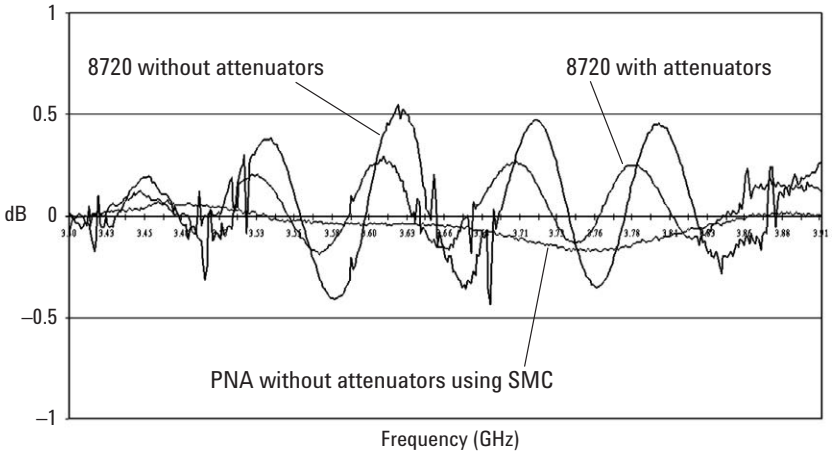
Agilent offers a variety of network analyzers with the frequency, performance, and versatility to meet your measurement needs. This selection guide is designed to aid in selecting the required instruments and options to perform calibrated frequency-offset measurements using the PNA and ENA network analyzers.

The PNA and ENA frequency-offset mode options allow the source stimulus and the response receivers to be independently tuned to different frequencies which enable measurements on frequency-translating devices.

Built-in second source

For PNA-X (2- and 4-port) and 4-port PNA-L models, a built-in second source is available to simplify mixer measurement setups eliminating the need for an external LO source, and allowing for LO match, fixed and swept-LO testing. Plus, the internal second source improves sweep speed by at least 20 times compared to using an external source.

Comparing Conversion Loss Measurements



The PNA with SMC greatly reduces mismatch ripple, even when compared to an 8720 with attenuators

Advanced calibrations

The PNA and ENA implement two unique calibration techniques. The scalar-mixer calibration (SMC) is used for high-accuracy, magnitude-only conversion gain/loss measurements and requires a compatible power meter and power sensor. The vector-mixer calibration (VMC) is used for both magnitude and phase conversion gain/loss measurements.

Vector-mixer calibration is optimized for system calibration when phase and absolute group delay measurements are desired. This technique requires a reciprocal calibration mixer. This mixer is specific to each test configuration and must be acquired separately. In addition, the PNA also requires a reference mixer, which need not be reciprocal.

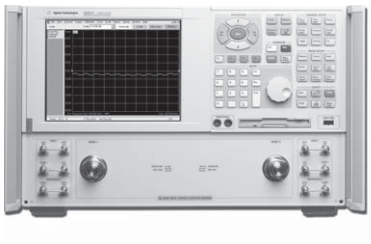
Agilent's scalar- and vector-mixer calibrations provide you with the tools necessary to determine the characteristics of frequency-translating devices with exceptional accuracy.

Selecting the correct mixer configuration

	ENA Series E5071C	PNA-L Series N5230A	PNA Series E8361A, E8362/3/4B	PNA-X N5242A
Frequency	9 kHz to 4.5 or 8.5 GHz	300 kHz to 6, 13.5 or 20 GHz 10 MHz to 20, 40 or 50 GHz	10 MHz to 20, 40, 50 or 67 GHz	10 MHz to 26.5 GHz
Number of ports	2-port: Options 2xx 4-port: Options 4xx	2-port: Options x2x 4-port: Options x4x	2	2-port: Options 2xx 4-port: Options 4xx
Built-in 2nd source	n/a	Option 146, 300 kHz to 13.5 GHz Option 246, 300 kHz to 20 GHz	n/a	2-port: Option 224 4-port: Option 400, 419 or 423
Maximum output power (Specifications/Typicals)	9 kHz to 8.5 GHz 5 GHz: +10 dBm 6 GHz: +9 dBm 7 GHz: +8 dBm 8.5 GHz: +7 dBm	300 kHz to 20 GHz (4-port, single or dual sources) 2 GHz: +8/+11 dBm 10 GHz: +1/+6 dBm 20 GHz: –8/–1 dBm	10 MHz to 20 GHz (2-port, single source with Option 014) 2 GHz: +5 dBm 10 GHz: +5 dBm 20 GHz: +2 dBm	10 MHz to 26.5 GHz (2- or 4-port, single or dual sources) 2 GHz: +10/+13 dBm 10 GHz: +13/+17 dBm 20 GHz: +12/+15 dBm
Source harmonics	9 kHz to 2 GHz –25 dBc at +5 dBm 2 to 8.5 GHz –20 dBc at +5 dBm	300 kHz to 20 GHz –20 dBc at max output power	10 MHz to 20 GHz –23 dBc at max output power	10 MHz to 26.5 GHz –60 dBc at max specified power
Calibrations:				
Source/receiver calibration (mag, relative phase)	Option 008	Option 080	Option 080	Option 080
Scalar-mixer calibration (mag only)	Option 008	Option 082	Option 082	Option 082
Vector-mixer calibration (mag & phase)	Option 008	n/a	Option 083	Option 083
Measurements:				
Basic frequency-offset	Option 008	Option 080	Option 080	Option 080
LO match	Possible[1]	Option 146 or 246	Possible[1]	Option 400, 419 or 423
Highest accuracy conversion gain/loss	Option 008	Option 082	Option 082	Option 082
Absolute group delay	Option 008	n/a	Option 083	Option 083
Swept-LO, fixed-IF	yes	yes	yes	yes
Dual-stage converters	n/a	yes	yes	yes
Embedded LO measurements	n/a	n/a	Option 084	Option 084

1. For instruments with one internal source (2- or 4-port), performing LO match measurements is possible but the user needs to reconfigure the test setup. Reconfiguration includes disconnnect, re-orient, and re-connect the mixer-under-test before such measurement can be made.

PNA Series Network Analyzers



E8364B PNA network analyzer

N4693A ECal module

All mixer or converter measurements require Option 080, and most would benefit from either Option 082 or 083. If you want to create and automate custom frequency-offset measurements (for example, intermodulation distortion), you may only need Options 014 and 080. For converters that require input power below –27 dBm, or for devices that have a large amount of LO feedthrough (like an unfiltered mixer), we highly recommend Option UNL, which adds source attenuators. Besides allowing lower input power levels, these attenuators improve the isolation between the PNA's internal source and LO leakage signals, helping to prevent source-unleveled errors. For devices that put out signals near or above the receiver's compression levels (which varies between –3 and +5 dBm, depending on the model and frequency), we recommend ordering Option 016, which adds receiver attenuators. Finally, Option 010, which adds time-domain analysis, is very useful for gating out unwanted, time-delayed responses which often occur when measuring mixers.

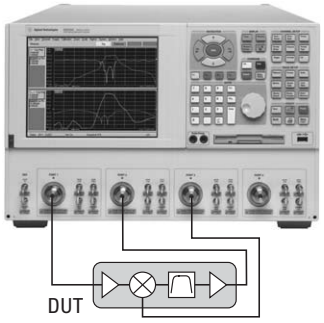
E8362B	**E8363B**	**E8364B**	**E8361A**
10 MHz to 20 GHz –24 to +3 dBm 3.5 mm connectors	10 MHz to 40 GHz –25 to –6 dBm 2.4 mm connectors	10 MHz to 50 GHz –27 to –12 dBm 2.4 mm connectors	10 MHz to 67 GHz –27 to –10 dBm 1.85 mm connectors
Option E8362B-014[1] Configurable test set	Option E8363B-014[1] Configurable test set	Option E8364B-014[1] Configurable test set	Option E8361A-014[1] Configurable test set
Option E8362A-080[1] Frequency-offset mode	Option E8364A-080[1] Frequency-offset mode	Option E8364A-080[1] Frequency-offset mode	Option E8361A-080[1] Frequency-offset mode
Option E8362A-081[1] Reference-receiver switch	Option E8364A-081[1] Reference-receiver switch	Option E8364A-081[1] Reference-receiver switch	Option E8361A-081[1] Reference-receiver switch
Option E8362B-082[1,3] Scalar-calibrated converter measurements	Option E8363B-082[1,3] Scalar-calibrated converter measurements	Option E8364B-082[1,3] Scalar-calibrated converter measurements	Option E8361A-082[1,3] Scalar-calibrated converter measurements
Option E8362A-083[1,3] Vector- and scalar-calibrated converter measurements	Option E8364A-083[1,3] Vector- and scalar-calibrated converter measurements	Option E8364A-083[1,3] Vector- and scalar-calibrated converter measurements	Option E8361A-083[1,3] Vector- and scalar-calibrated converter measurements
Option E8362B-084[4] Embedded LO measurements	Option E8363B-084[4] Embedded LO measurements	Option E8364B-084[4] Embedded LO measurements	Option E8361A-084[4] Embedded LO measurements
Option E8362B-UNL[2] Source attenuators and bias-tees	Option E8364B-UNL[2] Source attenuators and bias-tees	Option E8364B-UNL[2] Source attenuators and bias-tees	Opt E8361A-UNL[2] Source attenuators and bias-tees
Option E8362A-016[2] Receiver attenuators	Option E8364A-016[2] Receiver attenuators	Option E8364A-016[2] Receiver attenuators	Option E8361A-016[2] Receiver attenuators
Option E8362A-010[2] Time-domain capability	Option E8363A-010[2] Time-domain capability	Option E8364A-010[2] Time-domain capability	Option E8361A-010[2] Time-domain capability

ECal (Electronic Calibration) modules for PNA network analyzers

N4691B	**N4692A**	**N4693A**	**N4694A**
300 kHz to 26.5 GHz 3.5 mm connectors	10 MHz to 40 GHz 2.92 mm connectors	10 MHz to 50 GHz 2.4 mm connectors	10 MHz to 67 GHz 1.85 mm connectors

1. Required PNA option for calibrated frequency-offset measurements.
2. Recommended PNA option for frequency-offset converter measurements.
3. Option 082 is a subset of Option 083, and they can not be ordered together.
4. Requires Option 083.

PNA-L Series Network Analyzers



4-port PNA-L network analyzer

N4433A 4-port ECal module

All mixer or converter measurements require Option 080, and most would benefit from Option 082. For the 4-port models, 13.5 and 20 GHz, an option for a built-in 2nd source is available. This option simplifies test setups and improves sweep speed by at least 20 times compared to using an external source. Plus, with the configurable test set, Option 025/125/145/225/245/425/525, an external booster amplifier can be added to increase the output power.

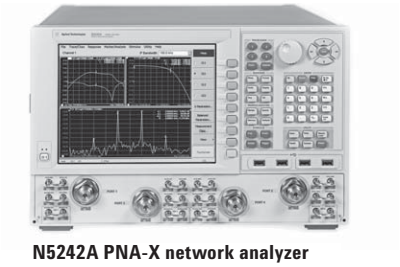
Finally, Option 010, which adds time-domain analysis, is also very useful for gating out unwanted, time-delayed responses which often occur when measuring mixers.

300 kHz to 6 GHz **3.5 mm connectors**	**300 kHz to 13.5 GHz** **(2- or 4-port)** **3.5 mm connectors**	**300 kHz to 20 GHz (4-port)** **10 MHz to 20 GHz (2-port)** **3.5 mm connectors**	**10 MHz to 40 GHz** **2.4 mm connectors**	**10 MHz to 50 GHz** **2.4 mm connectors**
N52300-025 2-port Configurable test set	N52300-125 2-port Configurable test set	N52300-225 2-port Configurable test set	N52300-425 2-port Configurable test set	N52300-525 2-port Configurable test set
n/a	N52300-145 4-port Configurable test set	N52300-245 4-port Configurable test set	n/a	n/a
n/a	N52300-146 4-port Internal 2nd source	N52300-246 4-port Internal 2nd source	n/a	n/a
N52300-080 Frequency-offset mode	N52300-080 Frequency-offset mode	N52300-080 Frequency-offset mode	N52300-080 Frequency-offset mode	N52300-080 Frequency-offset mode
N52300-082 Scalar-calibrated converter measurements	N52300-082 Scalar-calibrated converter measurements	N52300-082 Scalar-calibrated converter measurements	N52300-082 Scalar-calibrated converter measurements	N52300-082 Scalar-calibrated converter measurements
N52310-010 Time-domain capability	N52300-010 Time-domain capability	N52300-010 Time-domain capability	N52300-010 Time-domain capability	N52300-010 Time-domain capability

ECal (Electronic Calibration) modules for PNA-L network analyzers

85093C	**N4431B (4-port)**	**N4433A (4-port)**	**N4692A**	**N4693A**
300 kHz to 9 GHz 3.5 mm connectors	300 kHz to 13.5 GHz 3.5 mm connectors	300 kHz to 20 GHz 3.5 mm connectors	10 MHz to 40 GHz 2.92 mm connectors	10 MHz to 50 GHz 2.4 mm connectors

PNA-X Network Analyzers



N5242A PNA-X network analyzer

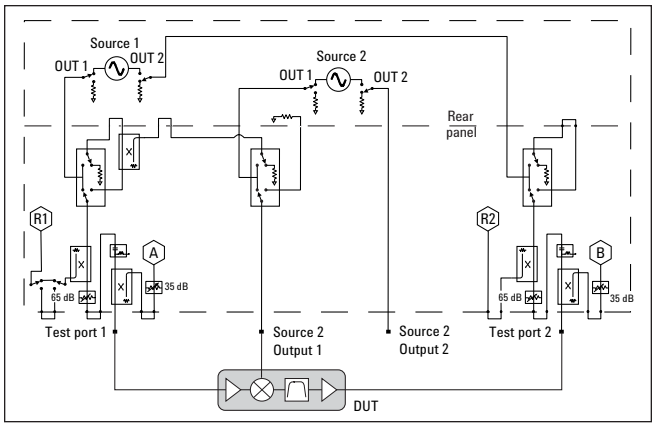
N4433A 4-port ECal module

All mixer or converter measurements require Option 080, and most would benefit from either Option 082 or 083. If you only perform scalar measurements, then you can replace Option 083 with 082. Built-in 2nd source can greatly simplify test setup and is available in both 2- and 4-port models. With the 4-port models, performing LO match measurements is very simple. With internal combiner and mechanical switches, Option 224 for 2-port or Option 423 for 4-port, an external source can easily be connected in to the PNA-X to provide a simple solution for two-tone converter measurements. Option 010, which adds time-domain analysis, is also very useful for gating out unwanted, time-delayed responses which often occur when measuring mixers.

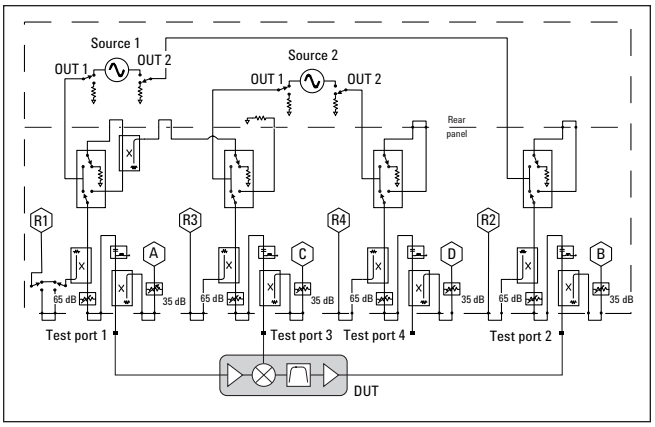
2-port (Option 200)	**4-port (Option 400 and includes 2 sources)**
10 MHz to 26.5 GHz –30 to +15 dBm 3.5 mm connectors	10 MHz to 26.5 GHz –30 to +15 dBm 3.5 mm connectors
Option 219 Extended power range & bias-tees	Option 419 Extended power range & bias-tees
Option 224 Add internal 2nd source, combiner & mechanical switches	Option 423 Add internal combiner & mechanical switches
Option 080 Frequency-offset mode	Option 080 Frequency-offset mode
Option 082[1] Scalar-calibrated converter measurements	Option 082[1] Scalar-calibrated converter measurements
Option 083[1,3] Vector- and scalar-calibrated converter measurements	Option 083[1] Vector- and scalar-calibrated converter measurements
Option 084[2] Embedded LO measurements	Option 084[2] Embedded LO measurements
Option 010 Time-domain capability	Option 010 Time-domain capability

ECal (Electronic Calibration) modules for PNA-X network analyzers

N4691B	**N4433A (4-port)**
300 kHz to 26.5 GHz 3.5 mm connectors	300 kHz to 20 GHz 3.5 mm connectors



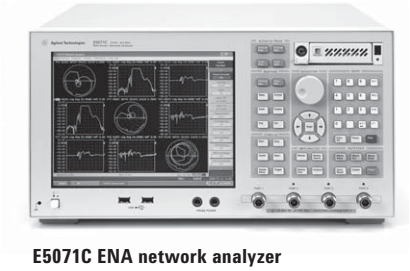
2-port PNA-X with internal second source, combiner and mechanical switches (Option 224) configured for basic mixer/converter measurements. Because there is no coupler behind Source 2 Output 1 and Source 2 Output 2, LO match measurements are not possible with this configuration.



4-port PNA-X with internal second source, combiner and mechanical switches (Option 423) configured for basic mixer/converter measurements. With couplers available behind Test Ports 3 and 4, this configuration allows for fully calibrated LO match measurements.

1. Option 082 is a subset of Option 083, and they cannot be ordered together.
2. Requires Options 080 and 083.
3. Requires Option 080.

ENA Network Analyzers



E5071C ENA network analyzer

N4431B 4-port ECal module

Mixer or converter test applications require Option 008. This option also provides advanced measurements such as intermodulation distortion. Option 010, which adds time-domain analysis, is also very useful for gating out unwanted, time-delayed responses which often occur when measuring mixers.

E5071C

	2-port Test Set	4-port Test Set
Without Bias Tees	Option E5071C-240, 9 kHz to 4.5 GHz Option E5071C-280, 9 kHz to 8.5 GHz	Option E5071C-440, 9 kHz to 4.5 GHz Option E5071C-480, 9 kHz to 8.5 GHz
With Bias Tees	Option E5071C-245, 100 kHz to 4.5 GHz Option E5071C-285, 100 kHz to 8.5 GHz	Option E5071C-445, 100 kHz to 4.5 GHz Option E5071C-485, 100 kHz to 8.5 GHz

–55 to +10 dBm (9 kHz to 5 GHz)
–55 to +9 dBm (5 to 6 GHz)
–55 to +8 dBm (6 to 7 GHz)
–55 to +7 dBm (7 to 8.5 GHz)

Type-N connectors

Option E5071C-008[1] Frequency-offset mode

Option E5071C-010[2] Time-domain analysis capability

ECal (Electronic Calibration) modules for ENA network analyzers

N4431B (4-port)	85091C	85092C	85093C
300 kHz to 13.5 GHz 3.5 mm connectors[3] Type-N connectors[4]	300 kHz to 9 GHz 7 mm connectors	300 kHz to 9 GHz Type-N connectors	300 kHz to 9 GHz 3.5 mm connectors

1. Required ENA option for calibrated frequency-offset measurements.
2. Recommended ENA option for frequency-offset measurements.
3. Option 010 is required.
4. Option 020 is required.

Recommended Products and Accessories

E8257D PSG signal generator

Signal generators for PNA network analyzers

N5181A MXG	E4428C ESG	E8257D PSG
N5181A-503 250 kHz to 3 GHz –110 to +13 dBm (250 kHz to 2.5 GHz) –110 to +10 dBm (2.5 to 3.0 GHz) Type-N connector	E4428C-503 250 kHz to 3 GHz –136 to +10 dBm (1 to 3 GHz) Type-N connector	E8257D-520 250 kHz to 20 GHz –20 to +13 dBm 3.5 mm connector
N5181A-506 250 kHz to 6 GHz –110 to +13 dBm (250 kHz to 2.5 GHz) –110 to +10 dBm (2.5 to 3.0 GHz) –110 to +13 dBm (3.0 to 4.5 GHz) –110 to +10 dBm (4.5 to 5.8 GHz) –110 to +7 dBm (5.8 to 6 GHz) Type-N connector	E4428C-506[1] 250 kHz to 6 GHz –136 to +13 dBm (1 to 3 GHz) –136 to +10 dBm (3 to 6 GHz) Type-N connector	E8257D-540 250 kHz to 40 GHz –20 to +9 dBm 2.4 mm connector
	E4428C-UNB[1] High output power with mechanical attenuator –136 to +16 dBm (1 to 3 GHz)	E8257D-550 250 kHz to 50 GHz –20 to +5 dBm 2.4 mm connector
		E8257D-567 250 kHz to 67 GHz –20 to +5 dBm 1.85 mm connector
		E8257D-1EA High output power 20 GHz: –20 to +21 dBm 40 GHz: –20 to +14 dBm 50 GHz: –20 to +11 dBm 67 GHz: –20 to +10 dBm
		E8257D-UNX Improved close-in phase stability and phase noise

N5181A MXG signal generator

Signal generators[2] for ENA network analyzers

N5181A MXG	E8663B	E4428C ESG
N5181A-503 250 kHz to 3 GHz –110 to +13 dBm (250 kHz to 2.5 GHz) –110 to +10 dBm (2.5 to 3.0 GHz) Type-N connector	E8663B-503 100 kHz to 3.2 GHz –35 to +15 dBm (250 kHz to 3.2 GHz) Type-N connector	E4428C-503 250 kHz to 3 GHz –136 to +10 dBm (1 to 3 GHz) Type-N connector
N5181A-506 250 kHz to 6 GHz –110 to +13 dBm (250 kHz to 2.5 GHz) –110 to +10 dBm (2.5 to 3.0 GHz) –110 to +13 dBm (3.0 to 4.5 GHz) –110 to +10 dBm (4.5 to 5.8 GHz) –110 to +7 dBm (5.8 to 6 GHz) Type-N connector	E8663B-509 100 kHz to 9 GHz –35 to +15 dBm (250 kHz to 3.2 GHz) –135 to +21 dBm (3.2 GHz to 9 GHz) Type-N connector	E4428C-506[1] 250 kHz to 6 GHz –136 to +13 dBm (1 to 3 GHz) –136 to +10 dBm (3 to 6 GHz) Type-N connector
		E4428C-UNB[1] High output power with mechanical attenuator –136 to +16 dBm (1 to 3 GHz)

1. Options UNB and 506 cannot be ordered together.
2. Agilent 82357B, USB/GPIB interface, is required for the ENA to control the signal generator automatically.

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LXI

www.lxistandard.org
LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

Web Resources

For additional literature and product information visit our Agilent web sites.

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