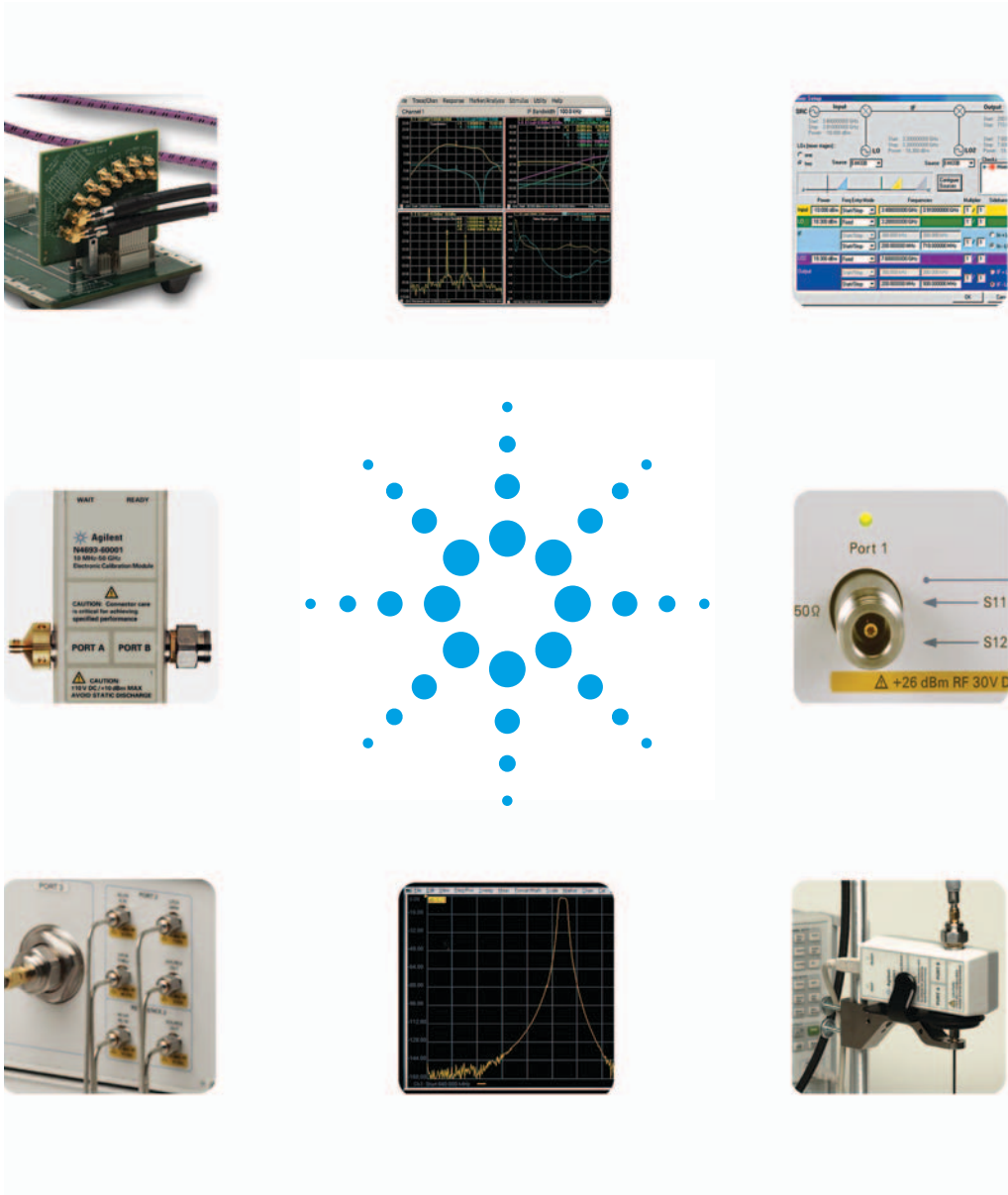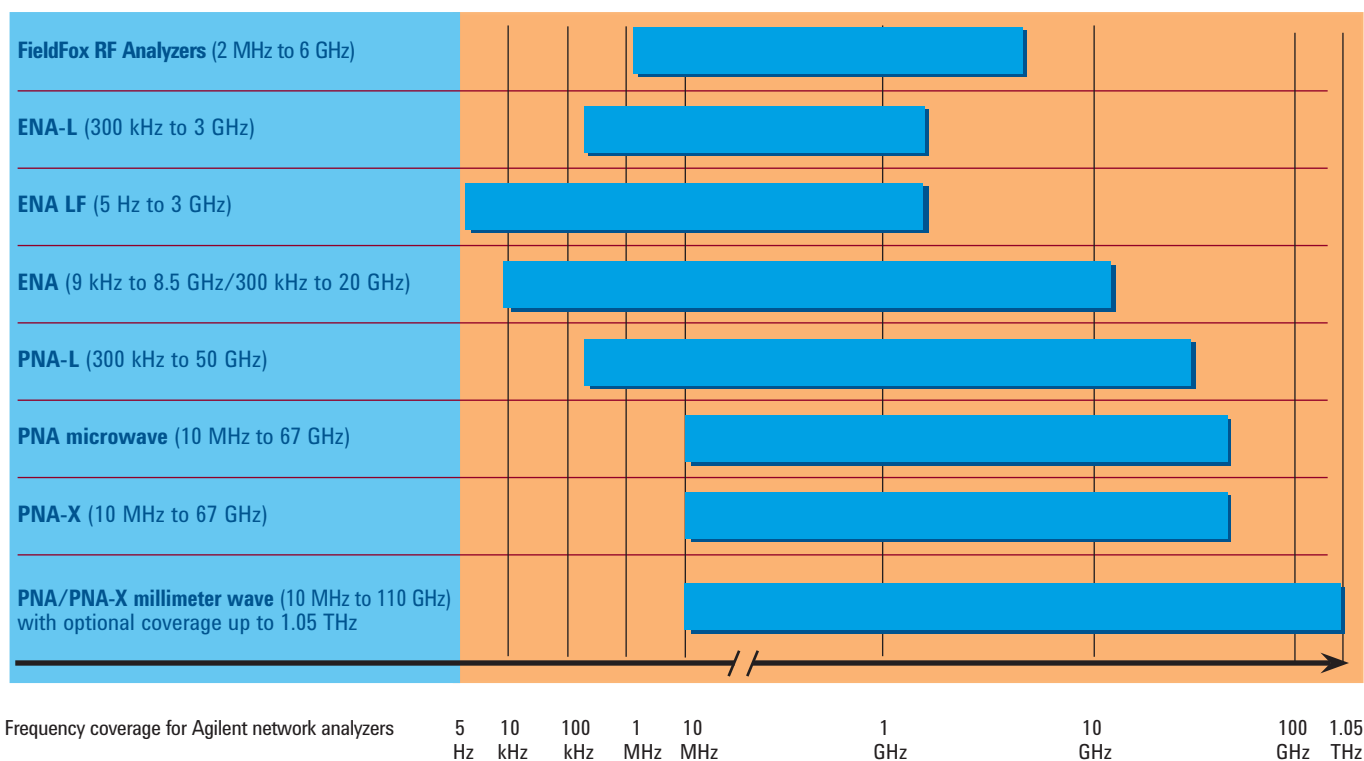# Agilent
Network Analyzer
Selection Guide

Agilent Technologies

Network Analyzers to Meet Your Needs

Agilent offers a variety of network analyzers with the frequency, performance, and versatility to meet your measurement needs. To help you determine which network analyzer is right for you, this selection guide provides an overview and side-by-side comparison of all our network analyzers. In addition, you will find a discussion of the typical network analyzer applications, the measurement needs of each, and how Agilent network analyzers meet those needs.

FieldFox RF Analyzers (2 MHz to 6 GHz)

ENA-L (300 kHz to 3 GHz)

ENA LF (5 Hz to 3 GHz)

ENA (9 kHz to 8.5 GHz/300 kHz to 20 GHz)

PNA-L (300 kHz to 50 GHz)

PNA microwave (10 MHz to 67 GHz)

PNA-X (10 MHz to 67 GHz)

PNA/PNA-X millimeter wave (10 MHz to 110 GHz) with optional coverage up to 1.05 THz

Frequency coverage for Agilent network analyzers

| 5 Hz | 10 kHz | 100 kHz | 1 MHz | 10 MHz | 1 GHz | 10 GHz | 100 GHz | 1.05 THz |

NOTE: The 8510, 871x, 8753, 8757, and 872x network analyzers have been discontinued.
Visit **www.agilent.com/find/na** for more information about the latest network analyzer products and **www.agilent.com/find/nadisco** for discontinued models and migration guides.

Table of Contents

World's Most Integrated Handheld RF Analyzers

FieldFox RF analyzer
N9912A

FieldFox RF vector network analyzer
N9923A

FieldFox RF Analyzers are integrated handheld instruments for wireless network installation and maintenance, and aerospace and defense applications in the field.

Key measurements

- Cable and antenna test (distance to fault, return loss, etc.)
- Insertion loss and transmission measurement
- Power meter with USB power sensor
- S21 and S11, Smith and polar chart displays
- Vector voltmeter

Unique to N9912A

- Spectrum analyzer, interference analyzer
- Spectrogram and waterfall displays
- Channel power, adjacent channel power, and occupied bandwidth
- AM/FM tune and listen

Unique to N9923A

- All four S-parameters, magnitude and phase
- Full 2-port cal
- 2-channel vector voltmeter, A/B and B/A

N9912A FieldFox RF Analyzer   **N9923A FieldFox RF VNA**

Features

- Lightweight, 6.2 lbs or 2.8 kg, battery operated
- No fans, no vents, display viewable indoors and outdoors, MIL class 2 compliance with no exceptions
- Built-in QuickCal technology enables calibration without a cal kit
- Calibrated at test port with CalReady
- LAN, USB, and SD card slot for data transfer and storage, SCPI programmable

www.agilent.com/find/fieldfox

# New Standard for Low-Cost Basic RF Network Analysis

ENA-L RF network analyzers

E5061A, E5062A

Providing the latest in modern technology and flexibility, the Agilent ENA-L network analyzers provide basic vector network analysis in a wide range of industries and applications such as wireless communication, cable TV, automotive, education, and more. Designed to reduce tune and test times, these analyzers provide increased throughput to improve your measurement productivity.

The ENA-L offers all of the critical performance and features needed in R&D, manufacturing, and service to test RF components such as: filters, amplifiers, antennas, cables, CATV taps, and distribution amplifiers.

The affordably priced ENA-L, equipped with the core functions of the industry-standard ENA, includes many easy-to-use features and is optimized for efficient measurements and high reliability.
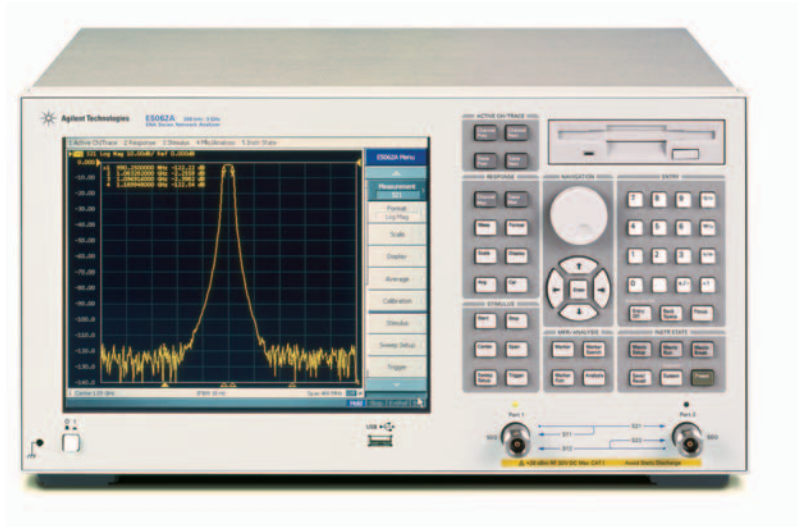
Features

- 120 dB dynamic range and 0.005 dB rms trace noise
- S-parameter or T/R test set models
- 50 ohm or 75 ohm system impedance available
- optional fault location and structural return loss measurement
- built-in Visual Basic for Applications (VBA)
- optional electronic calibration (ECal) module simplifies and speeds your calibration process

www.agilent.com/find/ena

Ultimate General-Purpose Network Analyzer

LF-RF network analyzer
E5061B

The Agilent E5061B is the latest addition to the industry-standard ENA Series network analyzers. The option E5061B-3L5 expands the frequency range down to 5 Hz for network analysis, while covering the most frequently-used RF ranges up to 3 GHz.

With its basic and useful S-parameter measurement ability in a wide frequency range, the E5061B can help you in a variety of measurement areas. Meanwhile, the uncompromised performance in a low frequency (LF) range along with the gain-phase test port strongly supports you in designing LF components and circuits.

The broad coverage for low-frequency devices such as DC-DC converters and sensor circuits to RF devices used in the radio systems and wireless interfaces enables you to improve the performance and quality of your end products. The E5061B works as a strong and convenient network analyzer in every lab that needs network analysis.
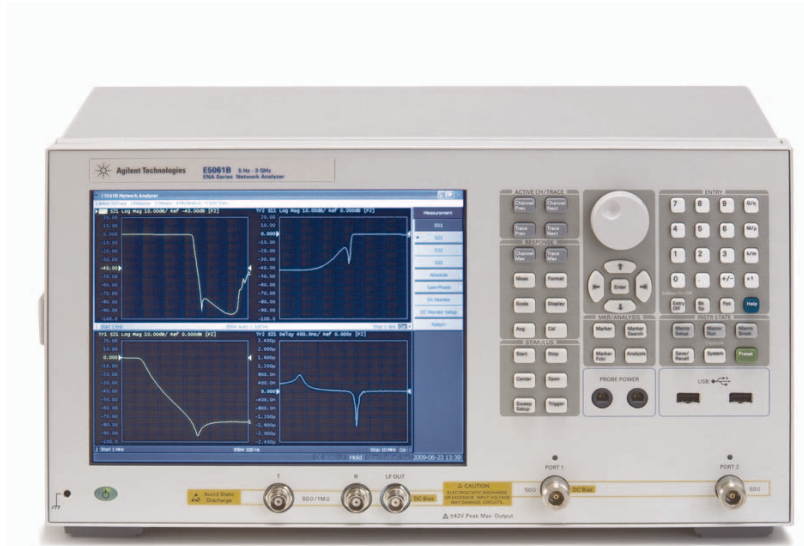
Features

- 5 Hz to 3 GHz frequency
- S-parameter test port (5 Hz to 3 GHz, 50 Ω)
- gain-phase test port (5 Hz to 30 MHz, 1 MΩ/50 Ω)
- excellent dynamic range down to LF
- built-in DC bias source (up to ±40 Vdc)
- compact form factor (254 mm depth)
- built-in Visual Basic for Applications (VBA)

www.agilent.com/find/ena

1. E5061B-3L5 is the only one test set option available as of October 2009.

# Industry Standard for RF Network Analysis

ENA network analyzers
E5071C

The Agilent ENA offers fast, accurate measurements for multiport components such as duplexers and couplers. Up to four built-in test ports are available in the E5071C (4.5, 6.5, 8.5, 14, and 20 GHz).

The ENA offers a built-in balanced measurement capability, which enables you to test advanced handset components such as balanced SAW filters. It provides mixed-mode S-parameter measurements with a fixture simulator function that includes matching circuit embedding, fixture de-embedding and impedance conversion capabilities.

In addition, the ENA provides frequency-offset mode to characterize your mixers and converters accurately.

Efficient measurements can be easily made in manufacturing. Using the built-in Microsoft® Visual Basic for Application (VBA) you can quickly develop test routines or automation programs. In addition, the parts-handler interface makes it easy to integrate the ENA into an automation system and enables fast communication.

These integrated measurement capabilities provide the lowest test cost per component and dramatically improve test throughput of multiport and balanced components.
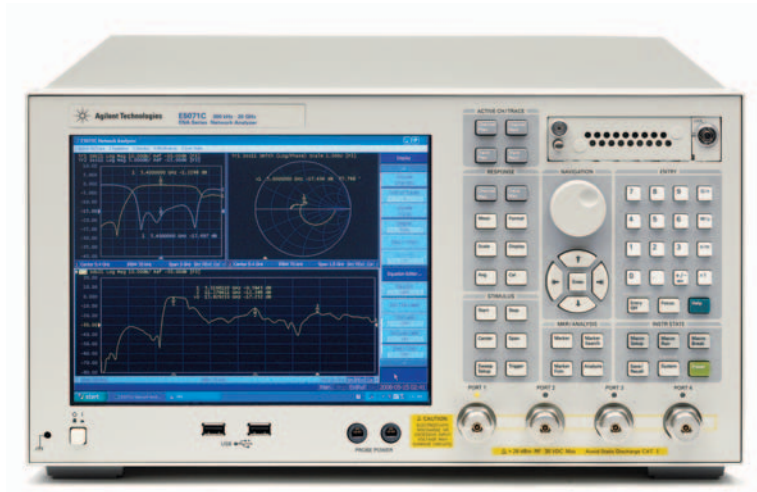
Features

- 123 dB dynamic range and 0.004 dB rms trace noise (70 kHz IFBW)
- 8753x successor for general purpose use
- 2- or 4-port measurements with full port calibration
- built-in balanced measurement capability
- expandable with multiport test sets (E5092A)
- built-in Visual Basic for Applications (VBA)
- optional time-domain and frequency-offset capabilities
- optional removable hard disk drive
- optional electronic calibration (ECal) module simplifies and speeds your calibration process
- hardware and software upgrade paths available

www.agilent.com/find/ena

New Standard for General Purpose Network Analysis
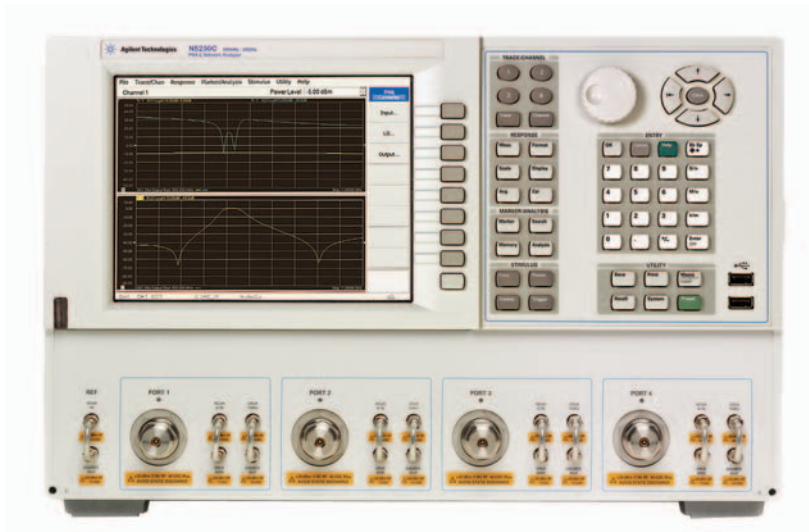
PNA-L network analyzers
N5230C

The PNA-L is designed for your general-purpose network analysis needs and priced for your budget. Advanced features help you work quickly, easily, and accurately. With the same firmware as the PNA, the PNA-L offers the perfect balance of value and performance.

The PNA-L is available with frequency coverage from 300 kHz to 6 and 13.5 GHz, 10 MHz to 20, 40, or 50 GHz and offers capabilities that can dramatically increase your design and test efficiency. 4-port models are also available from 300 kHz to 13.5 or 20 GHz. The Windows® operating system provides the ability to expand the instrument's connectivity and provides tools for maximum flexibility. From the Windows desktop you can install measurement tools, which reduce the need for a dedicated PC. Use embedded Help to quickly refer to programming and user documentation from within the instrument. Furthermore, COM/DCOM programming provides a powerful automation environment.

The enhanced user interface, crisp display with touch screen, and flexible remote interfaces maximize productivity in design and production environments.

PNA-L provides efficiency and flexibility in both manufacturing and R&D applications for industries ranging from Wireless LAN components to Aerospace & Defense.

Features

- measurement speeds as fast as 4 to 9 µs per point
- superior performance and advanced connectivity compared to our 872x network analyzers
- optional built-in second source (4-port models only)
- optional time-domain and frequency-offset capabilities
- optional electronic calibration (ECal) modules allow you to calibrate 10 times faster than mechanical calibration
- up to 32 independent measurements channels

www.agilent.com/find/pnal

High-Performance Microwave Measurements

PNA microwave network analyzer
E8361/2/3/4C

The Agilent E8361/2/3/4C are the microwave frequency models from the PNA series of network analyzers. These models offer an unsurpassed combination of high performance, speed, and outstanding interconnectivity capabilities to meet the challenges of component testing.

The microwave PNA network analyzers cover 10 MHz to 20, 40, 50 and 67 GHz frequency ranges with excellent accuracy. These analyzers are suitable for high-performance microwave devices, such as satellite communication components. They offer 123 dB dynamic range at the test ports and 136 dB with direct receiver access. They also provide TRL/LRM calibration capability for in-fixture and on-wafer devices. In addition, the receiver architecture enables frequency-offset mode to characterize your mixers and converters. The configurable test set allows you to connect external test sets easily and make accurate multiport measurements.

The enhanced user interface, crisp display with touch screen, and flexible remote interfaces maximize productivity in design and production environments.

The Windows operating system provides the ability to expand the instrument's connectivity and provides tools for maximum flexibility. In addition, from the Windows desktop you can install measurement tools, which reduce the need for a dedicated PC, and use on-line Help to quickly refer to programming and user documentation. Furthermore, COM/DCOM provides a powerful automation function. These functions can increase your design and test efficiency dramatically.
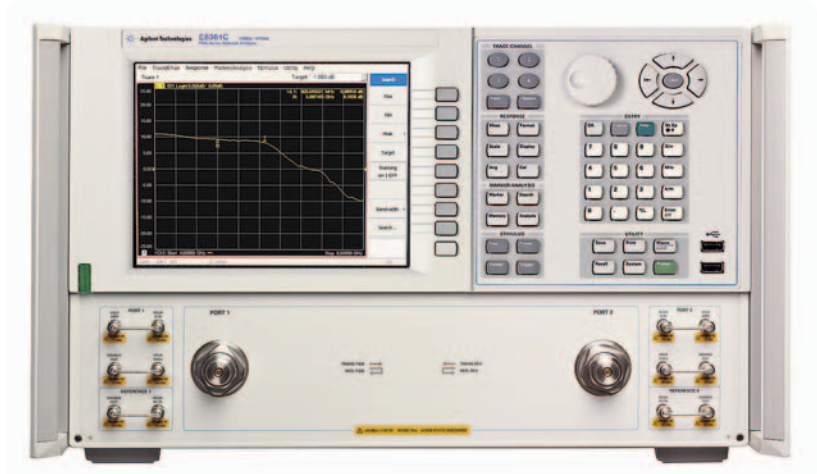
Features

- 136 dB dynamic range with direct receiver access
- expandability with configurable test set
- optional advanced mixer and converter test
- optional electronic calibration (ECal) modules allow you to calibrate 10 times faster than mechanical calibration
- optional antenna and pulsed-RF measurements

www.agilent.com/find/pna

Premier-Performance and Versatility for Active Device Tests

PNA-X microwave network analyzer

N5241A

N5242A

N5244A

N5245A

N5247A

The Agilent PNA-X premier-performance network analyzers are designed for high performance active device tests that help you minimize design iterations, test system integration, and significantly simplifies test processes. The industry-leading performance and highly integrated, configurable nature of the PNA-X makes it the ideal solution for comprehensive network analysis and tests.

The PNA-X is available with frequency range of 10 MHz to 13.5, 26.5, 43.5, and 50 and 67 GHz, and offers 2- or 4-port models. The PNA-X's very low harmonics internal source is ideal for active device characterization, and delivers the highest accuracy. The optional second internal source (standard for 4-port model) together with internal combining network allows fast swept intermodulation distortion measurements for amplifiers. Internal path switches and rear access loops provide maximum flexibility for integrating signal conditioning components or external instruments, and turn the PNA-X into a test hub for a single-connection multiple-measurement (SCMM) solution.

The noise figure measurement option employs an innovative error-correction technique and delivers the most accurate noise figure measurements in the market.

The enhanced user interface, large and crisp display with touch screen, and flexible remote interfaces maximize productivity in design and production environments.

The award winning nonlinear vector network analyzer application provides a critical leap in technology to go beyond S-parameters, allowing you to efficiently and accurately analyze and design active devices under real world operating conditions.
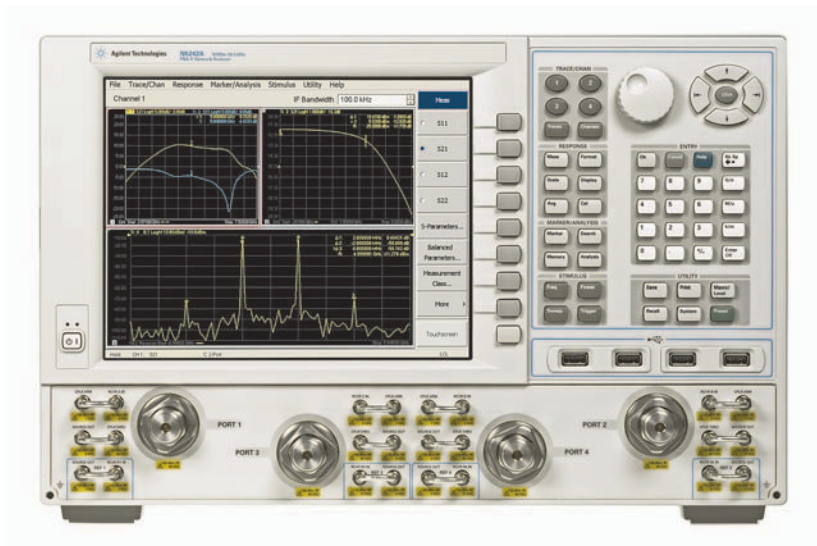
Features

- integrated 2- or 4-port with balanced measurements
- 130 dB dynamic range, 32 channels, 32,001 points
- second internal source (optional for 2-port model)
- optional combining network for two-tone measurements
- optional path switches for SCMM
- optional rear access loops for signal conditioning or external instruments

Application options

- Nonlinear vector network analyzer (NVNA) application including:
  - nonlinear component characterization
  - X-parameters[1]
  - nonlinear pulse envelope domain
- Noise figure
- Gain compression
- Intermodulation and harmonic distortion
- Pulsed RF- wide and narrow pulse width

www.agilent.com/find/pnax

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1. X-parameters is a trademark of Agilent Technologies

N5247A PNA-X Based Single Sweep Solution (10 MHz to 110 GHz)

PNA-X millimeter wave network analyzers

This configuration of the millimeter-wave network analyzer is based on the N5247A PNA-X network analyzer. It allows both a single sweep measurement solution that starts at 10 MHz, up to 110 GHz. This solution is a direct replacement for the 8510XF with improved performance. In particular, an added capability to control and use receiver leveling allows you to set the power accurately at the 1.0 mm test port. Architecturally very similar to the existing N5250C system but is configurable as separate components that include the N5247A PNA-X, either a 2 or 4 port test set controller, and the appropriate frequency extenders as needed.

Features

- Frequency Range: 10 MHz to 110 GHz
- Dynamic Range > 110 dB, without the need for external RF and LO sources
- Built-in Kelvin bias tee on combiners which brings the bias signal close to the device being measured
- Industry leading stability, less the 1% drift over a 24 hour period
- Mechanical attenuation of 25 to 30 dB available for above 67 GHz on either port 1 or 2 for high power device measurements
- Removing the combiners converts the system to extend W-band waveguide system for the measurements from 67 GHz to 110 GHz
- Modules fully supported by Cascade® probe stations and Agilent accessories to easily connect to probes
- Utilizes Agilent's patented weight least squares calibration method in 1.0 mm for industry leading accuracy
- Provides two and four port S-parameter measurements from 10 MHz to 110 GHz in a single sweep
- Full power control over the entire frequency range down to as low as 50 dBm
- Receiver leveling to maintain accurate power across the entire frequency range
- Broad power sweeps across the entire frequency range
- Supports true differential measurements across the frequency range
- Supports scalar mixer measurements
- Integrated pulse measurement capability

www.agilent.com/find/mmwave
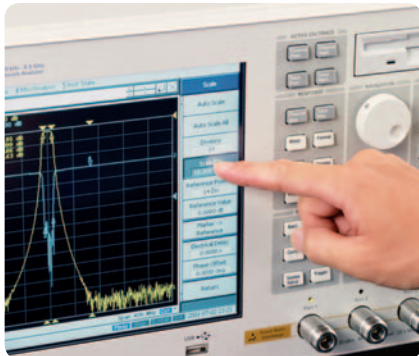
Network analysis and more

S-parameter measurements are the most common measurement parameters for network analysis. However, if you only need to measure transmission or reflection characteristics, you might consider a network analyzer with a T/R test set to help manage costs. In some cases, you might want to make additional types of measurements like absolute power, spectrum, impedance, time-domain and pulsed-RF. Time-domain and pulsed-RF measurements are often used for R&D activities to evaluate filters or high-power devices, respectively. Agilent's network analyzers offer a wide range of capabilities – providing you with convenient and cost-effective solutions tailored to your measurement needs. Nonlinear component analysis and X-parameters, in conjunction with ADS design and simulation tools, minimize design iterations, speed simulation and deterministically model the nonlinear behavior of active components.

Connector types and calibration accuracy

In an actual measurement environment, your devices might not have coaxial connectors, such as when you perform on-wafer measurements, or your devices might not have insertable connector types. In either case, it is difficult to perform an accurate calibration, which will affect measurement accuracy. Agilent network analyzers have various calibration functions, such as TRL, adapter-removal calibration, unknown thru, and embedding/de-embedding to ensure measurement accuracy in these types of situations. TRL enables our network analyzers to perform accurate on-wafer or in-fixture measurements. Adapter-removal calibration, unknown thru, or our electronic calibration (ECal) modules make it possible to perform calibration for non-insertable coaxial connectors. Embedding/de-embedding allows for the mathematical removal of fixtures. These functions will help you produce accurate measurements.

Expanding your system or using measurement data to write reports

Automation capabilities are critical for making complex component measurements. Internal and external programming capabilities like Visual Basic and Agilent VEE make it easier to develop automation programs and even control other instruments as a system.

Another common, time-consuming task for R&D engineers is incorporating analysis data into simulations and reports. Agilent network analyzers provide linkages to design tools such as Advanced Design System (ADS), that let you simulate and analyze a system without hardware — saving you valuable time and money. In addition, many of our network analyzers are compatible with IntuiLink Connectivity Software, which enables you to easily incorporate measurement results into Microsoft applications.

ADS: **www.agilent.com/eesof-eda**
VEE: **www.agilent.com/find/vee**
IntuiLink: **www.agilent.com/find/intuilink**
ECal: **www.agilent.com/find/ecal**
NVNA: **www.agilent.com/find/NVNA**

Measurement Solutions for Your Application
Research and development

Research and development	FieldFox		ENA-L	ENA LF	ENA	PNA-L	PNA-X	PNA MW	PNA/PNA-X millimeter wave
	N9912A	N9923A							
Basic measurements									
S-parameters	●[12]	●	●	●	●	●	●	●	●
Transmission and reflection with T/R test set	●[12]	●	●						
Gain-phase test port with 1 Mohm input				●					
X-parameters							●		
Absolute power	●	●		●[14]	●	●	●	●	●[1]
Spectrum analyzer function	●						●[2]		
Non-coaxial devices [3]									
TRL calibration (on-wafer measurement)					●	●	●	●	●
Waveguide measurements					●	●	●	●	●
Non-insertable devices [4]									
Adapter-removal calibration using mechanical calibration				●	●	●	●		
SOLR (unknown thru) using mechanical calibration or ECal		●			●	●	●		
Different connector types supported by ECal			●	●[6]	●	●	●	●	●[1]
Applications									
Gain compression							●		
Intermodulation and harmonic distortion							●		
True mode differential							●		
Nonlinear component characterization							●		
Nonlinear pulse envelope domain							●		
Time-domain mode/gating			●[5]	●	●	●	●	●	●
Frequency-offset mode					●	●	●	●	●
TOI and harmonics	●				●	●	●	●	
Noise figure measurements							●		
Pulsed-RF: wide and narrow pulse width				●	●	●	●	●	●
Frequency conversion application					●		●	●	●[1]
Scalar-calibrated converter measurements					●	●	●	●	●[1]
Antenna	●	●	●	●	●	●	●	●	
Materials measurement [7]	●[13]	●[13]	●	●	●	●	●	●	
Signal integrity					●[7]		●		●
Automated gain compression							●		
True differential measurements							●		
Programming and connectivity									
Windows-OS	●[9]	●[9]	●[9]	●[10]	●[10]	●[10]	●[10]	●[10]	●[10]
LAN interface	●	●	●	●	●	●	●	●	●
Internal programming capability [11]			●	●	●	●	●	●	●
ADS linkage					●	●	●	●	●
VEE linkage						●	●	●	●
IntuiLink			●		●	●		●	●
LXI compliance			●	●	●				
Display touch screen			opt	●	●	●	●	●	●
USB for mass storage	●	●	●	●	●	●	●	●	●

1. Functions up to 67 GHz.
2. Option 087 intermodulation distortion measurements provides spectrum-analyzer-like display for use with IMD measurements.
3. For example, on-wafer, in-fixture, or waveguide applications.
4. A non-insertable device is a device that cannot be inserted in place of a zero-length through. For example, a device that has the same connectors on both ports (type and sex) or different types of connectors on each port (for example, waveguide on one port and coaxial on the another).
5. Time domain gating is not supported.
6. ECal modules do not cover the whole frequency range of the E5061B. Check whether the frequency range of each ECal module meets your measurement needs.
7. For more information, see page 25.
8. Physical Layer Test System (PLTS) 4.5 only supports E5071C-x4x, x8x.
9. Closed environment, which does not allow access to a Windows desktop operating system.
10. Open environment, which allows access to a Windows desktop operating system and enables you to install software and manage data for easy post-measurement analysis.
11. Includes integrated programming language such as Visual Basic for Applications®, and ability of open Windows environments to install programming languages into analyzers.
12. S11 vector and S21 scalar.
13. 85070E Dielectric Probe Kit only.
14. The source and receiver calibrations are not available. For trace normalization, use Data/Memory math function since the response calibration is not applicable to absolute traces.

Optional electronic calibration (ECal) modules for easy, accurate calibration

Unlike the traditional mechanical calibration technique, Agilent's ECal modules only require one set of connections to perform full 2-, 3-, or 4-port calibration. Controlled through the front panel USB port, and requiring only one set of connections, ECal drastically simplifies the calibration process for non-technical operators.

An ENA or PNA controls the ECal module to perform the entire calibration, providing:
- faster calibration and reduced complexity
- reduced chance of operator error
- reduced wear on connectors

Sweep and data analysis

Total measurement speed can be divided into several different components such as sweep speed, display processing, data analysis, and data transfer. In low-volume manufacturing, the data analysis and display speeds are unimportant. After the measurement, a limit test or a marker function is typically used. Conversely, in high-volume manufacturing the sweep speed and data analysis speed are important. In many cases, analysis needs to be done quickly using internal programming capability or waveform analysis commands, and the analyzer must send pass/fail results to an automated system. In both cases, the sweep speed can be maximized using segment sweep. For automation, you can choose from a variety of Windows-compatible programming environments like VBA, VB or Agilent VEE. In case you want to transfer all data to an external computer quickly, COM/DCOM provides a seamless environment between your instruments and external computers.

Communication interfaces

It is becoming more common to have a LAN interface in test and measurement instruments. A LAN is convenient to send data from your manufacturing line to your office, or to monitor measurement status, or have a central data server, or use network printers.

For high-volume automation applications, fast communication with an automated handler system is important. A parts handler interface is commonly used for this purpose. It has a dedicated pin assignment in the I/O interface so that triggers measurement-end status, and limit-test results are communicated quickly between the instrument and the automated handler system.
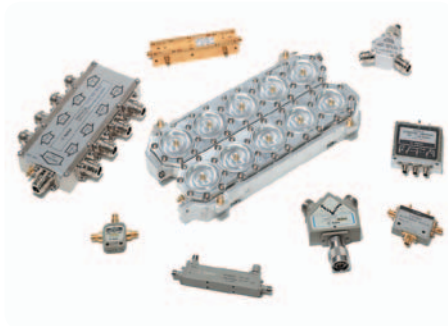
Measurement Solutions for Your Application

Manufacturing test

Manufacturing test	FieldFox N9912A	FieldFox N9923A	ENA L	ENA LF	ENA	PNA-L	PNA-X	PNA MW	PNA/PNA-X millimeter wave
Programming									
Internal programming capability [1]			●	●	●	●	●	●	●
Fast data transfer [2]				●	●	●	●	●	●
Calibration									
Adapter-removal calibration [3]			●	●	●	●	●	●	●
SOLR (Unknown thru) using mechanical calibration or ECal		●			●	●	●	●	●
ECal support			●	●[4]	●	●	●	●	●[5]
Measurement and analysis									
Segment sweep [6]			●	●	●	●	●	●	●
Pass/fail testing	●	●	●	●	●	●	●	●	●
Embedding and de-embedding [7]					●	●	●	●	●
Waveform analysis command [8]			●	●	●				
Interface									
LAN	●	●	●	●	●	●	●	●	●
I/O port			●	●	●	●	●	●	●
Parts handler interface [9]			●	●	●	●	●	●	●
VGA output			●	●	●	●	●	●	●

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1. Includes integrated programming language such as Visual Basic for Applications, and ability of open Windows environments to install programming languages into analyzers.
2. COM/DCOM provides faster data transfer than GPIB.
3. The calibration technique used for non-insertable devices such as those with the same connectors on input and output ports.
4. Usable at the frequency range of >300 kHz (2-port ECal modules) or >9 kHz (N4431B 4-port ECal module). ECal user characterization function is not usable for the 4-port ECal module with the ENA LF and other 2-port ENA Series network analyzers.
5. Functions up to 67 GHz.
6. Segment sweep includes sweep types that are known as list and fast-swept list.
7. Functions to embed or de-embed a fixture's characteristics.
8. Programming commands to quickly retrieve parameters of filters and resonators.
9. The parts handler interface is an I/O-port specialized for communication with an automatic parts handler system.

Filter and duplexer measurements

Dynamic range, IF bandwidth and sweep time

Dynamic range requirements vary among applications. Agilent offers a variety of network analyzers with different dynamic ranges in different frequency ranges. For wide dynamic range, Agilent's PNA series offers a configurable test set that bypasses the couplers and improves dynamic range by approximately 15 dB. The PNA series offers 122 dB dynamic range at test port. In addition, many analyzers offer segment sweep — a convenient function that manages dynamic range and sweep speed. This function enables you to set different IFBWs for the passband or rejection band, and the sweep speed can be optimized for your measurement needs.

Calibration for filter testing

Agilent network analyzers provide various functions that help you perform efficient, accurate filter evaluations, which can help shorten your design cycles. For instance, the adapter removal calibration functions make it possible to accurately calibrate non-insertable devices. Interpolated calibration is convenient if the measurement frequency is unknown.

Time domain, multiport, and balanced measurement capabilities for advanced devices

Today's wireless devices require test instruments that have advanced measurement functionality. For example, a time-domain function is needed to easily tune coupled-cavity-resonator bandpass filters. Duplexer or front-end modules for handsets often require multiport and balanced measurement capabilities. For more details on multiport and balanced testing, see page 19.

Measurement Solutions for Your Application

Filter and duplexer measurements

| Filter and duplexer measurements	FieldFox		ENA-L	ENA LF	ENA	PNA-L	PNA	PNA-X	PNA/PNA-X millimeter wave
	N9912A	N9923A							
Dynamic range									
Wide dynamic range [1]			●	●	●	●	●	●	●
Direct receiver access to obtain widest possible dynamic range						●	●	●	●
Calibration									
Adapter-removal calibration [3]				●	●	●	●	●	●
SOLR (Unknown thru) using mechanical calibration or ECal		●			●	●	●	●	●
Interpolated calibration	●	●	●	●	●	●	●	●	
Measurement and analysis									
Segment sweep [2]			●	●	●	●	●	●	●
Four-parameter display		●	●	●	●	●	●	●	●
Marker statistics function [3]			●	●	●	●	●	●	●
Other functions									
Time domain mode/gating			●[4]	●	●	●	●	●	●
Balanced measurement capability [5]					●	●	●	●	●
Multiport measurement capability [5]					●[7]	●[7]	●[7]	●	
Handheld/portable	●	●							

1. Wide dynamic range is defined as 120 dB or better for RF analyzers and greater than 90 dB for microwave analyzers.
2. Segment sweep includes sweep types that are known as list and fast swept list.
3. Obtains real-time calculations of device characteristics such as maximum/minimum, center frequency, and 3 dB bandwidth.
4. Time gating is not supported.
5. For more details about balanced and multiport tests, see page 19.
6. For 2-port network analyzers, balanced measurement capability requires an external test set and software.
7. An external test set may be required to achieve these functionalities.

E5071C ENA network analyzer with E5092A configurable multiport test set
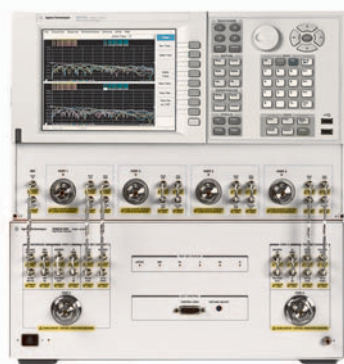
4-port, 20 GHz PNA-L with high-power test set

Multiport testing for communication components

Many modern components have more than two ports. In order to test these devices efficiently, network analyzers with multiple ports are required. Agilent offers numerous multiport instruments for you to choose from. One example is the Agilent ENA series. ENA, PNA-L and PNA-X have optional built-in four-port measurement capability — enabling fast and accurate multiport measurements from 9 kHz to 67 GHz.

Calibration for multiport measurements

When doing multiport measurements, you need to use the proper calibration method to achieve accurate measurements. Agilent offers a three-, four-, or N-port full calibration function together with multiport measurement capability. Four-port ECal modules are available as well, so that calibration can be done easily and quickly. When it is not possible to place coaxial connectors on your design, Agilent provides multiport TRL and LRM calibration techniques, as well as two- and four-port de-embedding to ensure accuracy for balanced or on-wafer measurements.

Balanced measurements for balanced components

Balanced components are commonly used in communications devices to maintain RF signal quality. The ENA has a built-in balanced capability to make fast and easy balanced measurements. It also has a fixture simulation function, including matching circuit embedding/de-embedding and impedance conversion capabilities. These capabilities are also available on the 4-port PNA-L and PNA-X. The 4-port PNA-X provides the most accurate true differential measurements with Option 460.
For more details, visit **www.agilent.com/find/multiport**

www.agilent.com/find/balanced
www.agilent.com/find/multiport
www.agilent.com/find/plts

Measurement Solutions for Your Application
Multiport and balanced testing

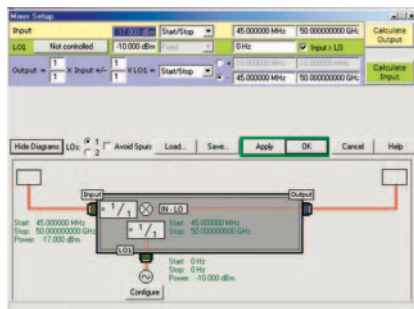| Multiport and balanced devices	FieldFox		ENA-L	ENA LF	ENA	PNA-L	PNA	PNA-X	PNA/PNA-X millimeter wave
	N9912A	N9923A							
Multiport measurements									
Built-in 4-port measurement capability					●	●		●	
Multiport measurement capability with external test set [1]					●	●	●	●	
Multiport calibration									
Full 4-port calibration					●	●	●[2]	●	
Full N-port calibration						●[2]	●[2]	●[2]	
Balanced measurement									
Built-in balanced measurement capability					●	●		●	
Balanced measurement capability with external test set [3]					●	●	●	●	
Fixture simulation/embedding and de-embedding					●	●	●	●	●
True differential measurements								●	

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1. Refer to *Test Solutions for Multiport and Balanced Devices* brochure (literature number 5988-2461EN available on the **www.agilent.com/find/multiport** Web site) for more details.
2. Available only when used with external test sets and Option 550 or 551.
3. The external test set and software are available with either Option 55x or the Physical Layer Test System (PLTS). For more details on PLTS, refer to the Agilent Physical Layer Test Systems Data Sheet (literature number 5988-5288EN) available on the PLTS Web site: **www.agilent.com/find/plts**
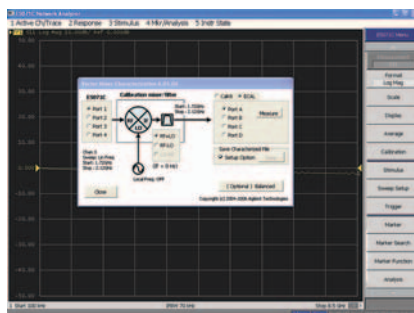
The PNA Frequency Converter Application simplifies set up and calibration for advanced mixer measurements such as absolute phase and group delay.
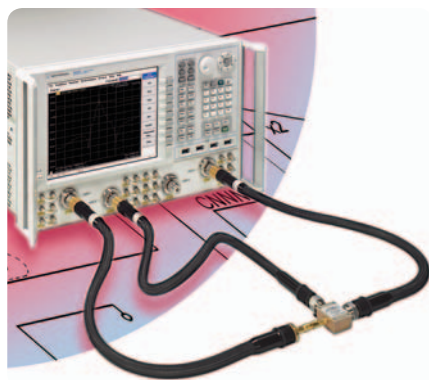
The PNA-X drives mixers with two internal sources, making multiple measurements with a single connection.

The ENA Frequency-Offset Mode offers vector mixer calibration technique that enables you to perform accurate absolute group delay measurements for frequency-translating devices.

Measurement challenges

Frequency-translation devices such as mixers, converters, and tuners are critical components in most RF and microwave communication systems. They present unique measurement challenges because their input and output frequencies are different. Network analyzers used for testing these devices need to have a frequency-offset mode to detect output frequencies different from the input.

Improved accuracy with advanced measurement techniques

Agilent offers the scalar-mixer calibration, which corrects mismatch errors between the analyzer and the device under test, and provides the most accurate conversion loss measurements in the market. This eliminates external pads and minimizes connector ware and tear due to different padding layouts required for different measurements.

The Frequency Converter Application (FCA) is another Agilent unique solution. It includes an easy-to-use graphical user interface and vector-mixer calibration that enables absolute group delay measurements without extensive knowledge. You can accurately measure delay characteristics of your devices and no longer need to rely on a "golden" mixer.

Further more, the Embedded LO Measurements capability works with FCA, and allows the measurement receiver to be tuned at IF frequencies without accessing the LO of the device. With this technique, you can reduce the error significantly from absolute group delay measurements, even though there is no access to the LO or reference clock of your devices.

Comprehensive mixer/converter measurements with PNA-X

The PNA-X offers various advanced capabilities that simplify mixer/converter measurements significantly. The two internal sources drive RF and LO ports without an external signal generator. The built-in combining network combines the two tones internally for IMD measurements [1], and internal path switches allow switching between conversion loss and IMD measurements or even external instruments, without disconnecting the device from the PNA-X's test ports. This dramatically reduces measurement complexity and improves test productivity.

Measurement versatility with ENA

The ENA offers the frequency-offset mode (FOM) that provides frequency-offset sweep, external signal source control, and fixed IF/RF measurement capabilities. The ENA FOM option supports both scalar – and vector – mixer calibrations with inherited mixer measurement techniques from the microwave PNA. These measurement techniques are key to making extremely accurate measurements. Also, this option provides harmonics measurement capabilities for non-linear devices such as amplifies, semiconductor switches, and front-end modules.

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1. Mixer/converter IMD measurements require an external signal source.
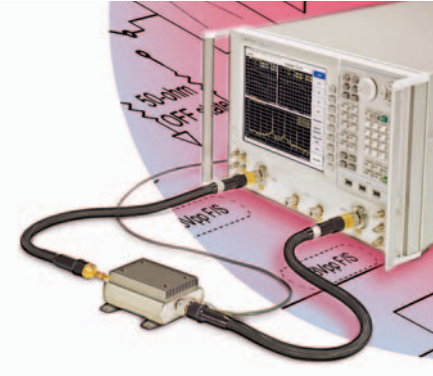
Measurement Solutions for Your Application

Mixer and converter measurements

| Mixer measurements	FieldFox		ENA-L	ENA LF	ENA	PNA-L	PNA	PNA-X	PNA/PNA-X millimeter wave
	N9912A	N9923A							
Measurement and analysis									
Magnitude measurement [1]					●	●	●	●	●[2]
Phase measurement									
Relative phase						●	●	●	●[2]
Absolute phase					●		●	●	●[2]
3-port measurements [3]					●	●	●[4]	●	
Power sweep					●	●	●	●	●[2]
Embedded LO measurements							●	●	●[2]
Internal dual-source						●		●	
External source control					●[5]	●	●	●	●
Calibration									
Power meter calibration					●	●	●	●	●[2]
3-port calibration					●	●	●[4]	●	
Scalar mixer calibration					●	●	●	●	●[2]
Vector mixer calibration							●	●	●[2]

---

1. Frequency-offset modes of the ENA and PNA series let the source and receiver operate at different frequencies. Both magnitude and phase measurements can be made.
2. Funictions available only on a stand-alone PNA, up to 67 GHz. Requires disconnecting mm-wave controller.
3. For LO return loss and LO to RF/IF leak measurements with single connection.
4. Requires an external test set and 4-port measurement option.
5. Supports one external signal source.

The integrated and flexible nature of PNA-X simplifies amplifier measurements.
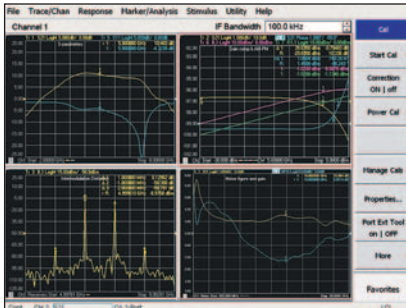
Fully error-corrected amplifier gain (S21), gain and phase compression, IMD, and source-correct noise figure, performed with a single connection between the amplifier and network analyzer.

Measurement challenges

Agilent network analyzers can be used to easily measure commonly specified amplifier parameters such as gain, gain and phase compression, isolation, return loss, and group delay. The power sweep function is often required to make amplifier measurements, and harmonic distortion is commonly used to understand an amplifier's nonlinear behavior. It requires the receiver to be tuned at a different frequency from the source, and the analyzer needs wide frequency coverage. Additional instruments and signal conditioning devices may be required for testing with two-tone, higher input and output power, or for other types of measurements including noise figure, ACP, and EVM. As a result, the test system becomes complicated or requires multiple stations.

Highly integrated, more accurate amplifier measurements with PNA-X

The PNA-X employs very clean signal sources, which minimizes harmonics and IMD measurement errors. The built-in combining network with two internal sources eliminates external components and cable wear, which makes two-tone measurements much faster and simpler. The internal switches and RF access loops maximize the flexibility to add signal conditioning devices and to switch one measurement to another without disconnecting the device from the analyzer.

Agilent's nonlinear vector network analyzer application adds powerful capabilities, X-parameters, nonlinear component characterization, and nonlinear pulse envelope domain.

The integrated pulse generators/modulators with pulse measurement application software increase measurement speed, simplify the test setup, and provide full pulse measurement capabilities such as average pulse, point-in-pulse and pulse-profiling. It can be configured as a uni- or bi-directional pulsed measurement system.

Integrated noise figure measurements with industry-leading accuracy

The PNA-X's unique noise-figure calibration technique uses an ECal module as an impedance tuner to remove the effects of imperfect system source match, providing accurate measurements of 50-ohm noise figure. Measurement accuracy surpasses standalone Y-factor-based noise figure analyzers or spectrum-analyzer-based solutions. With a single connection to the amplifier, the PNA-X network analyzer offers fast, high-accuracy measurements of S-parameters, noise figure, gain and phase compression, IMD, harmonics, and more.

Evolving standard, ENA's enriched versatility

In addition to the highest measurement performance and richest capability in its class, the ENA provides the external test set mode for high power amplifier measurements. Attenuators for high gain amplifiers and other signal conditioning devices can be placed behind the external couplers so that the system is appropriately calibrated. The ENA's DC measurement capability enables power added efficiency (PAE) measurements in parallel with RF measurements.

Power meter calibration

For both mixer and amplifier testing, power meter calibration provides leveled absolute power to devices that are sensitive to absolute input or output levels. This function automatically controls power meters to set the power anywhere in the test setup with power meter accuracy, or to calibrate the network analyzer's receivers for accurate absolute-power measurements.

Measurement Solutions for Your Application
Amplifier measurements

	FieldFox		ENA-L	ENA LF	ENA	PNA-L	PNA	PNA-X	PNA/PNA-X millimeter wave
	N9912A	N9923A							
Basic measurements									
Gain, return loss, isolation	●	●	●	●	●	●	●	●	●
Compression, AM-PM conversion			●	●	●	●	●	●	●
Automated gain compression								●	
High power measurements									
High output power [1]								●	
Source attenuator	●[5]	●[5]	●		●	●	●	●	●
Receiver attenuator							●	●	●
Connection loop before reference path								●	
Configurable test set					●[2]	●	●	●	●[3]
Harmonic measurements									
Frequency-offset mode				●	●	●	●	●	●
Analyzer source harmonics [4]								●	
Receiver attenuator							●	●	●
Intermodulation distortion measurements									
Frequency-offset mode					●	●	●	●	●
Second internal source						●		●	
Internal combining network								●	
Simplified swept-IMD setup								●	
Noise figure								●	
Hot-S22						●			
DC inputs for power added efficiency					●		●	●	
Internal DC bias source				●					
Internal bias-tee					●		●	●	●
Nonlinear vector network analyzer applications									
X-parameters								●	
nonlinear component characterization								●	
nonlinear pulse envelop domain								●	
multi-tone component characterization								●	
two-tone X-parameters								●	
three port devices; mixers, etc.								●	

1. High output power is defined as greater than +13 dBm for leveled power output.
2. Requires Option 44x, 48x or 4K5 to use external test set mode.
3. Available up to 67 GHz.
4. 2nd and 3rd harmonics of the internal source are significantly lower than 20 to 30 dBc.
5. High and low setting only.

Related Network Analyzer Products

Electronic calibration (ECal) modules

ECal is a precision, single-connection calibration technique for Agilent vector network analyzers. Agilent ECal modules are fully traceable and verifiable against electronic impedance standards and can simplify your daily calibration routine. RF ECal modules are available for Type N-50, N-75, 7 mm, 3.5 mm, Type F, and 7-16 (300 kHz to 13.5 GHz) connectors. Modules are available in microwave frequency ranges from 300 kHz to 67 GHz for 7 mm, Type N-50, 3.5 mm, 2.92 mm, 2.4 mm and 1.85 mm. 4-port modules are available in 13.5 and 20 GHz frequency ranges.

www.agilent.com/find/ecal

85070E Dielectric Probe Kit
85071E Materials Measurement Software
85072A Split Cylinder Resonator

Trust Agilent to deliver leading-edge techniques for measuring dielectric and magnetic properties of materials. The new 10 GHz Split Cylinder Resonator measures complex permittivity and loss tangent of thin films, un-clad substrates, and other low loss sheet materials as part of a turn key solution for IPC standard TM 650 2.5.5.13. The Materials Measurement Software automates a variety of techniques across a wide frequency span, including transmission line, free space, NRL arch and resonant cavity. The Dielectric Probe Kit offers hardware and software for measuring complex permittivity of liquids and conformable solids from 200 MHz to 50 GHz.
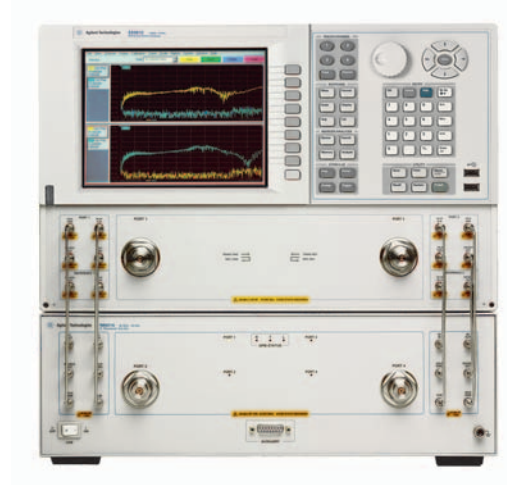
Measuring electromagnetic properties of materials is critical in all stages of a products lifecycle: design, incoming inspection, process monitoring and quality assurance. Agilent sets the measurement standard with 20 years experience and innovative new products.

www.agilent.com/find/materials

N1900B Physical Layer Test Systems (PLTS)

Agilent's PLTS solutions provide the highest accuracy and most comprehensive tool set for model extraction and characterization of single-ended and differential physical-layer interconnects, or balanced RF and microwave components with frequency coverage up to 67 GHz. These test solutions offer single-ended, balanced, and mixed-mode measurements in both frequency and time domain, and eye-diagram analysis with a simple to use graphical user interface.

www.agilent.com/find/plts

Network analyzers

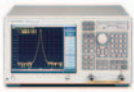|	FieldFox RF Analyzer	FieldFox RF VNA
Model number	N9912A	N9923A
Frequency range	2 MHz to 4 GHz (Option 303, 104) 2 MHz to 6 GHz (Option 303, 106)	2 MHz to 4 GHz (Option 104) 2 MHz to 6 GHz (Option 106)
Number of ports	port 1 vector, port 2 scalar	2
Balanced measurements	no	no
System impedance	50 ohms	50 ohms
System dynamic range	2 MHz to 2 GHz: 72 dB (typical) > 2 GHz to 3 GHz: 67 dB (typical) > 3 GHz to 5 GHz: 58 dB (typical) > 5 GHz to 6 GHz: 49 dB (typical)	90 dB (specified) 100 dB (typical)
Power at test port	high: +5 dBm low: −40 dB	high: +5 dBm low: −40 dBm
Power sweep range	n/a	n/a
Sweep type	linear	linear
Error correction Full 2 port Full 4 port TRL Adapter removal SOLR ECal support	 no no no no no internal Quick Cal	 yes no no no yes internal Quick Cal
Measurement channels	1	1
Maximum number of data traces	4	4
Windows-OS	yes (closed CE)	yes (closed CE)
Automation	SCPI	SCPI
I/O	LAN, USB, SD Flash Card	LAN, USB, SD Flash Card
ADS linkage	no	no
Built-in source attenuator	yes (limited to two settings: low and high)	yes (limited to two settings: low and high)
DC bias input	no	no
Time domain	DTF, x-axis is distance	DTF, x-axis is distance
Corrected specifications[5]	Dir 42 dB SM 36 dB Refl trk 0.06 dB	Dir 42 dB SM 36 dB Refl trk 0.06 dB
Trace noise	n/a	0.008 dB rms < 3 GHz
Measurement speed (1 sweep, 201 points, correction off)	return loss 1.5 ms/point (nominal) 1.75 GHz to 3.85 GHz, 1001 points, Cal ON	return loss 1.5 ms/point (nominal) 1.75 GHz to 3.85 GHz, 1001 points, Cal ON

1. ECal modules don't cover the whole frequency range of the E5061B. Check whether the frequency range of each ECal module meets your measurement needs
2. Only on 4-port models.
3. Segment includes sweep types that are known as list and fast swept list.

4. Option E5071C-xx5 (with bias tees option) is required. Minimum frequency is 100 kHz for Options x45 and x85.
5. Time domain gating is not supported.
6. Dir = directivity; SM = source match; LM = load match; Refl trk = reflection tracking; Trans trk = transmission tracking

Network analyzers

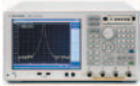|	ENA-L	ENA LF
Model number	E5061A E5062A	E5061B
Frequency range	E5061A: 300 kHz to 1.5 GHz E5062A: 300 kHz to 3 GHz	5 Hz to 3 GHz (S-param. port) 5 Hz to 30 MHz (gain-phase port)
Number of ports	2	2 ports and additional gain-phase port
Balanced measurements	no	no
System impedance	50 ohms or 75 ohms	50 ohms
System dynamic range	120 dB (1 MHz to 3 GHz)	120 dB (1 MHz to 3 GHz)
Power at test port	−5 to +10 dBm −45 to +10 dBm (Option 1E1, 250 or 275)	−45 to +10 dBm
Power sweep range	15 dB	55 dB
Sweep type	linear, log, segment[4], power, CW	linear, log, segment, power, CW, DC bias sweep
Error correction Full 2 port Full 4 port TRL Adapter removal SOLR ECal support	 yes (S-parameter test sets only) no no no no yes	 yes no no yes no yes[1]
Measurement channels	4	4
Maximum number of data traces	16	16
Windows-OS	yes (closed)	yes
Internal automation	VBA, SCPI, COM	VBA, SCPI, COM
I/O	LAN, USB, GPIB, VGA, parallel, handler, mini-DIN	LAN, USB, GPIB, XGA, parallel, handler, mini-DIN
ADS linkage	no	no
Built-in source attenuator	yes (with Option 1E1, 250 or 275)	no
DC bias input	no	yes
Time domain	yes (with Option 100)[5]	yes (with Option 010)
Corrected specifications[5]	(2-port cal, 85032F type-N, 50 ohms) Dir 46 to 49 dB SM 40 to 41 dB LM 46 to 49 dB Refl trk ±0.011 to ±0.021 dB Trans trk ± 0.015 to ±0.018 dB	(2-port cal, 85032F type-N, 50 ohms) Dir 46 to 49 dB SM 40 to 41 dB LM 46 to 49 dB Refl trk ±0.011 to ±0.021 dB[2] Trans trk ± 0.019 to ±0.026 dB[2]
Trace noise	0.005 dB rms (1 MHz to 3 GHz) (3 kHz BW)	0.005 dB rms (1 MHz to 3 GHz) (3 kHz BW)
Measurement speed (1 sweep, 201 points, correction off)	19 ms (1 GHz to 1.2 GHz, 30 kHz BW)	8 ms (1 GHz to 1.2 GHz, 300 kHz BW)

1. ECal modules don't cover the whole frequency range of the E5061B. Check whether the frequency range of each ECal module meets your measurement needs
2. Only on 4-port models.
3. Segment includes sweep types that are known as list and fast swept list.
4. Option E5071C-xx5 (with bias tees option) is required. Minimum frequency is 100 kHz for Options x45 and x85.
5. Time domain gating is not supported.
6. Dir = directivity; SM = source match; LM = load match; Refl trk = reflection tracking; Trans trk = transmission tracking

Network analyzers

	ENA	ENA
Model number	E5071C	E5071C
Frequency range	9 kHz to 4.5 GHz (Option 240, 440) 100 kHz to 4.5 GHz (Option 245, 445) 9 kHz to 6.5 GHz (Option 260, 460) 100 kHz to 6.5 GHz (Option 265, 465) 9 kHz to 8.5 GHz (Option 280, 480) 100 kHz to 8.5 GHz (Option 285, 485)	300 kHz to 14 GHz (Option 2D5, 4D5) 300 kHz to 20 GHz (Option 2K5, 4K5)
Number of ports	2 (Option 2xx) or 4 (Option 4xx)	2 (Option 2D5, 2K5) or 4 (Option 4D5, 4K5)
Balanced measurements	yes	yes (Option 4D5, 4K5)
System impedance	50 ohms	50 ohms
System dynamic range	97 to 123 dB (Option x4x, x8x)	95 dB (300 kHz to 1 MHz) 107 dB (1 to 10 MHz) 136 dB with direct 120 dB (10 to 100 MHz) 123 dB (100 MHz to 6 GHz) 117 dB (6 to 8.5 GHz) 105 dB (8.5 to 10.5 GHz) 100 dB (10.5 to 15 GHz) 96 dB (15 to 20 GHz)
Power at test port	−55 to +10 dBm (Option x4x, x8x at 5 GHz)	−85 to +10 dBm (at 6 GHz) −85 to +3 dBm (at 15 GHz) −85 to 0 dBm (at 20 GHz)
Power sweep range	62 to 65 dB (Option x4x, x8x)	25 to 35 dB
Sweep type	linear, log, CW, power, segment	linear, log, segment[6], power, CW

Error correction
  Full 2 port
  Full 4 port
  Full N-port[2]
  TRL
  Adapter removal
  SOLR
  Ecal support
	
	yes
	yes[1]
	yes
	yes
	yes
	yes
	
		yes
		yes[7]
		no
		yes
		yes
		yes
		yes

Measurement channels	160	160
Maximum number of data traces	1440 (160 channels/9 traces mode)	1440 (160 channels/9 traces mode)
Windows-OS	yes	yes
Internal automation	VBA, SCPI, COM	VBA, SCPI, COM
I/O	LAN, USB, GPIB, XGA, parallel, handler, mini-DIN	LAN, USB, GPIB, XGA, parallel, handler, mini-DIN
ADS linkage	software driver supported	software driver supported
Built-in source attenuator	yes	yes
DC bias input	yes[4]	yes
Time domain	yes (with Option TDR)	yes (with Option 010)
Corrected specifications[5]	(2-port cal, 85033E 3.5 mm, 50 ohms) Dir 38 to 46 dB SM 36 to 43 dB LM 38 to 46 dB Refl trk ±0.006 to 0.010 dB Trans trk ±0.015 to 0.079 dB	(2-port cal, 85052D 3.5 mm, 50 ohms) Dir 36 to 42 dB SM 28 to 37 dB LM 36 to 42 dB Refl trk ±0.003 to 0.008 dB Trans trk ±0.034 to 0.208 dB
Trace noise	0.004 dB rms (10 MHz to 4.38 GHz), (70 kHz BW)	0.004 dB rms (10 MHz to 4.38 GHz), (70 kHz BW)
Measurement speed **(1 sweep, 201 points, correction off)**	4.9 ms (1 GHz to 1.2 GHz, 500 kHz BW)	3.2 ms (11 GHz to 12 GHz, 500 kHz BW)

See back page for footnotes

Network analyzers

	PNA-L	PNA-L	PNA
Model number	N5230C	N5230C	E8361C E8362C E8363C E8364C
Frequency range	300 kHz to 6 GHz (Option 020, 025) 300 kHz to 13.5 GHz (Option 120, 125, 140, 145, 146)	10 MHz to 20 GHz (Option 220, 225, 240, 245, 246) 10 MHz to 40 GHz (Option 420, 425) 10 MHz to 50 GHz (Option 520, 525)	E8362C 10 MHz to 20 GHz E8363C 10 MHz to 40 GHz E8364C 10 MHz to 50 GHz E8361C[1] 10 MHz to 67 GHz
Number of ports	2 (Option x2x) or 4 (Option 14x)	2 (Option x2x), 4 (Option x4x)	2
Balanced measurements	yes (Option 140, 145, 146)	yes (Options 240, 245, 246)	no
System impedance	50 ohms	50 ohms	50 ohms
System dynamic range	122 dB (Option x20, 10 MHz to 6 GHz) 121 dB (Option x25, 10 MHz to 6 GHz) 120 dB (Option 14x, 10 MHz to 4 GHz)	103 dB (Option 240) (at 20 GHz) 98 dB (Option 245, 246) 108 dB (Option x2x) (additional 12 to 16 dB with direct receiver access)	94 to 125 dB 136 dB with direct receiver access (typical)
Power at test port	–30 to +2 dBm (Option x20, 300 kHz to 6 GHz) –90 to +1 dBm (Option x25, 300 kHz to 6 GHz) –27 to +8 dBm (Option 140, 10 MHz to 4 GHz) –87 to +8 dBm (Option 145, 146, 10 MHz to 4 GHz)	–27 to –3 dBm (Option 240) (at 20 GHz) –87 to –8 dBm (Option 245, 246) –27 to +3 dBm (Option 220) –87 to +3 dBm (Option 225) –27 to 0 dBm (Optin 420, 520) –87 to 0 dBm (Option 425, 525)	–25 to +5 dBm at 10 GHz (60 dB source attenuator option expands min. power to –82 dBmat 10 GHz)
Power sweep range	37 dB (Option x20, 300 kHz to 6 GHz) 36 dB (Option x20, 300 kHz to 6 GHz) 33 dB (Option 14x, 10 MHz to 4 GHz)	22 to 33 dB (Option 240) 17 to 33 dB (Option 245, 246) 23 to 25 dB (Option 220, 225) 17 to 25 dB (Option 420, 425) 10 to 25 dB (Option 520, 525)	31 dB
Sweep type	linear, log, CW, power, segment	linear, log, CW, power, segment	linear, log, CW, power, segment
Error correction Full 2 port Full 4 port Full N-port[2] TRL Adapter removal SOLR Ecal support	yes yes (also Full N-port) no yes yes yes yes	yes yes yes yes yes yes yes	yes yes[2] yes yes yes yes yes
Measurement channels	32	32	32
Maximum number of data traces	unlimited	unlimited	unlimited
Windows-OS	yes	yes[3]	yes[3]
Internal automation	SCPI, D/COM	SCPI, D/COM	SCPI, D/COM
I/O	LAN, USB, GPIB, VGA, parallel, RS-232	LAN, USB, GPIB, VGA, parallel, RS-232	LAN, USB[4], GPIB, VGA, parallel, RS-232
ADS linkage	supported	supported	software driver supported
Built-in source attenuator	yes (Option 025, 145, 146)	yes (with Option 225, 245, 246, 425, 525)	yes (with Option UNL)
DC bias input	no	no	yes (with Option UNL)
Time domain	yes (Option 010)	yes (with Option 010)	yes (with Option 010)
Corrected specifications[5]	(2-port cal or 4-port cal, 3.5 mm) Dir 44 to 48 dB SM 31 to 40 dB LM 44 to 48 dB Refl trk ±0.003 to 0.006 dB Trans trk ±0.015 to 0.131 dB	(Option 2xx, 2-or 4-port cal, 3.5 mm) Dir 44 to 48 dB SM 31 to 40 dB LM 44 to 48 dB Refl trk ± 0.003 to .006 dB Trans trk ± 0.01 to .125 dB	(2-port cal, 2.4 mm) Dir 36 to 42 dB SM 31 to 41 dB LM 35 to 42 dB Refl trk ± 0.001 to 0.027 dB Trans trk ± 0.014 to 0.200 dB
Trace noise	10 MHz to 10.5 GHz 0.004 dB rms (Option x2x) 0.006 dB rms (Option 140) 0.008 dB rms (Option 145) 0.016 dB rms (Option 146)	0.01 dB rms (Option 240) 0.014 dB rms (Option 245) 0.038 dB rms (Option 246) 0.006 dB rms (Option 22x) 0.01 dB rms (Option 42x, 52x)	0.006 dB rms (1 kHz BW)
Measurement speed (1 sweep, 201 points, correction off)	6 ms (600 kHz BW)	9 ms (250 kHz BW)	12 ms (35 kHz BW)

See back page for footnotes

	PNA-X	PNA-X	PNA-X
Model number	N5241A N5242A	N5244A N5245A	N5247A
Frequency range	N5241A 10 MHz to 13.5 GHz N5242A 10 MHz to 26.5 GHz	N5244A 10 MHz to 43.5 GHz N5245A 10 MHz to 50 GHz	10 MHz to 67 GHz
Number of ports	2 (Option 200), 4 (Option 400)	2 (Option 200), 4 (Option 400)	2 (Option 200), 4 (Option 400)
Balanced measurements	yes (Option 400)	yes (Option 400)	yes (Option 400)
System impedance	50 ohms	50 ohms	50 ohms
System dynamic range (at 20 GHz)	121 to 130 dB depends on configuration 124 to 141 dB with direct receiver access (typical)	121 to 125 dB depends on configuration 133 to 137 dB with direct receiver access (typical)	125 to 129 dB depends on configuration 136 to 140 dB with direct receiver access (typical)
Power at test port (at 20 GHz)	−25 to +13 dBm (Option 200, 400) −90 to +10 dBm (Option 219, 419) −90 to +15 dBm (Option 224) −90 to +10 dBm (Option 423)	−25 to +13 dBm (Option 200, 400) −90 to +10 dBm (Option 219, 419) −90 to +10 dBm (Option 224, 423)	+11 dBm (Option 200, 400) +8 dBm (Option 219, 419) +7 dBm (Option 224, 423)
Power sweep range	38 dB	38 dB	38 dB
Sweep type	linear, log, CW, power, segment	linear, log, CW, power, segment	linear, log, CW, power, segment
Error correction Full 2 port Full 4 port Full N-port TRL Adapter removal SOLR Ecal support	 yes yes yes yes yes yes yes	 yes yes yes yes yes yes yes	 yes yes yes yes yes yes yes
Measurement channels	32	32	32
Maximum number of data traces	unlimited	unlimited	unlimited
Windows-OS	yes[3]	yes[3]	yes[3]
Internal automation	SCPI, D/COM	SCPI, D/COM	SCPI, D/COM
I/O	LAN, USB[4], GPIB, VGA, parallel, RS-232	LAN, USB, GPIB, VGA, parallel, RS-232	LAN, USB, GPIB, VGA, parallel, RS-232
ADS linkage	supported	supported	supported
Built-in source attenuator	yes (with Option 219, 419)	yes (with Option 219, 419)	yes (with Option 219, 419)
DC bias input	yes	yes	yes
Time domain	yes (with Option 100)[4]	yes (with Option 010)	yes (with Option 010)
Corrected specifications[5]	(2-port cal, 3.5 mm) Dir 44 to 48 dB SM 31 to 40 dB LM 44 to 48 dB Refl trk ±0.003 to 0.006 dB Trans trk ±0.015 to 0.104 dB	(2-port cal, 2.4 mm) Dir 36 to 42 dB SM 31 to 41 dB LM 35 to 42 dB Refl trk ±0.001 to 0.027 dB Trans trk ±0.020 to 0.182 dB	(2-port, 1.85 mm) Dir 34 to 41 dB SM 34 to 44 dB LM 34 to 41 dB Refl trk 0.01 to 0.33 dB Trans trk 0.036 to 0.164 dB
Trace noise	0.002 dB rms (1 kHz BW)	0.002 dB rms (1 kHz BW)	0.002 dB rms (1 kHz BW)
Measurement speed (1 sweep, 201 points, correction off)	6 ms (600 kHz BW)	6 ms (600 kHz BW)	6 ms (600 kHz BW)

See back page for footnotes

Network analyzers

	PNA millimeter wave	PNA-X millimeter wave
Model number	N5250C	N5247A
Frequency range	10 MHz to 110 GHz, and extendable to 1.05 THz	10 MHz to 110 GHz
Number of ports	2	2 or 4
Balanced measurements	no	yes
System impedance	50 ohms	Normalized to 1 Ohm
System dynamic range (at 20 GHz)	111 dB	Typically 115 dB
Power at test port (at 20 GHz)	–5 dBm	Typically –8 at 110 GHz
Power sweep range	20 dB[4]	60 dB
Sweep type	linear, log, CW, power, segment	Linear, Log, CW, power segment
Error correction		
Full 2 port	yes	yes
Full 4 port	no	yes
Full N-port	no	n/a
TRL	yes	yes up to 67 GHz with, 1.0 mm characterized standards to 110 GHz
Adapter removal	yes	yes
SOLR	yes	yes
Ecal support	yes[4]	yes up to 67 GHz with, 1.0 mm characterized standards to 110 GHz
Measurement channels	32	32
Maximum number of data traces	64	64
Windows-OS	yes[3]	yes
Internal automation	SCPI, COM,/DCOM	SCPI, COM, D/COM
I/O	LAN, USB, GPIB, VGA, parallel, RS-232	LAN, USB,GPIB, VGA, parallel, RS-232
ADS linkage	software driver supported	software driver supported
Built-in source attenuator	yes	yes with source power calibration
DC bias input	yes	Kelvin bias built into combiner assembly
Time domain	yes (with Option 010)	yes with Option 010
Corrected specifications[5]	SM source dependent LM 20 dB	(75 to 110 GHz performance using a 1.0 mm calibration kit) Dir –36.8 dB SM –33 dB LM –36 dB Refl trk : ±.08 Trans trk: ±.1
Trace noise	—	—
Measurement speed (1 sweep, 201 points, correction off)	—	6 ms (35 kHz BW)

See back page for footnotes

Web Resources

Visit our Web sites for additional product information and literature.

Microwave and RF network analyzers:
www.agilent.com/find/na

ENA series network analyzers:
www.agilent.com/find/ena

PNA Microwave series network analyzers:
www.agilent.com/find/pna

Combination analyzer:
www.agilent.com/find/combo

Electronic calibration (ECal):
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and signal integrity:
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Multiport measurements:
www.agilent.com/find/multiport

Nonlinear Vector Network analyzer
www.agilent.com/find/NVNA

FieldFox RF Analzyer
www.agilent.com/find/fieldfox

Antenna measurements:
www.agilent.com/find/antenna

RF & MW network analyzer and
impedance probing:
www.agilent.com/find/probingrf

Pulsed-RF measurements:
www.agilent.com/find/pulsedrf
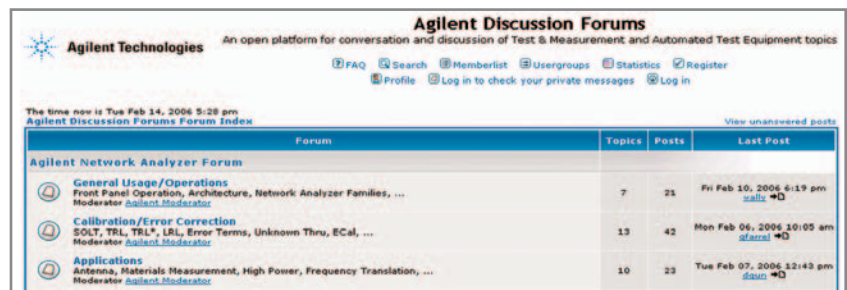
Aerospace defense:
www.agilent.com/find/ad

Network Analyzer Discussion Forum:
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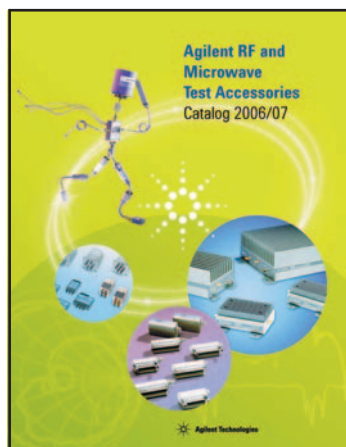
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Comprehensive RF and Microwave Switch Selection Guide (2008)

Packed with information, this guide provides you with the technical information you need to select the right switch for your application. The guide includes overviews of EM and solid state switches and drivers, important switch parameters and typical applications. Easy-to-use selection and option tables provide product specifications.

To download your FREE copy visit: **www.agilent.com/find/switches**

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Hong Kong	800 938 693
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Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 375 8100

Europe & Middle East

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Denmark	45 70 13 15 15
Finland	358 (0) 10 855 2100
France	0825 010 700*
	*0.125 €/minute
Germany	49 (0) 7031 464 6333
Ireland	1890 924 204
Israel	972-3-9288-504/544
Italy	39 02 92 60 8484
Netherlands	31 (0) 20 547 2111
Spain	34 (91) 631 3300
Sweden	0200-88 22 55
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Revised: October 14, 2010

Product specifications and descriptions
in this document subject to change
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Printed in USA, November 16, 2010
5989-7603EN

1. Specified to 67 GHz, with operation to 70 GHz.
2. Available when used with external test sets and software.
3. Open Windows environment. You can load any software on the instrument,
    such as Visual Basic.
4. Functions up to 67 GHz.
5. Dir = directivity; SM = source match; LM = load match; Refl trk= reflection tracking;
    Trans trk = transmission tracking
6. Only on 4-port models.
7. Segment includes sweep types that are known as list and fast swept list.

Agilent Technologies

Agilent
Spectrum Analyzer and Signal Analyzer
Selection Guide

Over Four Decades
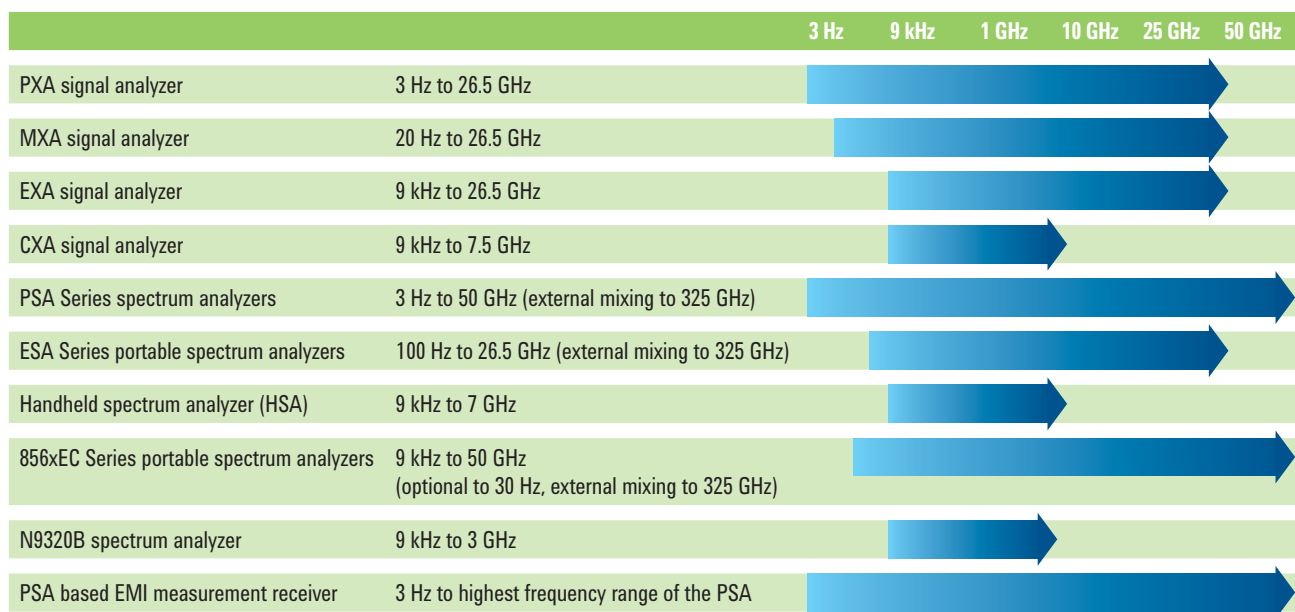of Leadership in Spectrum Analysis

Agilent Technologies

Introduction

Agilent Technologies' spectrum and signal analyzers include an extensive array of products, from DC to 325 GHz, designed to accurately measure frequency, amplitude, and modulation, including distortion, spurious, phase noise, and 2G to 4G wireless communications signals. By combining a spectrum or signal analyzer with 89600B vector signal analysis (VSA) software, flexible modulation analysis software or measurement applications, an instrument's capabilities can be expanded to demodulate a broad range of standard-based and general-purpose digital signals and formats.

Purchasing an instrument for signal and spectrum analysis is an investment. You are buying not only for today's tasks but with foresight into the requirements of tomorrow. Selecting the ideal instrument for your business can be complex and time consuming –every project and user is unique –and time is money. As the premier measurement company, Agilent is able to offer a wide selection of analyzers and applications that fit within a variety of budgets. This selection guide will help you more easily identify the right spectrum or signal analyzer to meet your specific measurement needs.

Frequency coverage for Agilent spectrum and signal analyzers

		3 Hz	9 kHz	1 GHz	10 GHz	25 GHz	50 GHz
PXA signal analyzer	3 Hz to 26.5 GHz						
MXA signal analyzer	20 Hz to 26.5 GHz						
EXA signal analyzer	9 kHz to 26.5 GHz						
CXA signal analyzer	9 kHz to 7.5 GHz						
PSA Series spectrum analyzers	3 Hz to 50 GHz (external mixing to 325 GHz)						
ESA Series portable spectrum analyzers	100 Hz to 26.5 GHz (external mixing to 325 GHz)						
Handheld spectrum analyzer (HSA)	9 kHz to 7 GHz						
856xEC Series portable spectrum analyzers	9 kHz to 50 GHz (optional to 30 Hz, external mixing to 325 GHz)						
N9320B spectrum analyzer	9 kHz to 3 GHz						
PSA based EMI measurement receiver	3 Hz to highest frequency range of the PSA						

Product Definitions

Spectrum analyzers and signal analyzers

Traditionally, spectrum analyzers are referred to as swept-tuned, super-heterodyne receivers that provide a display of amplitude versus frequency. Modern day analyzers offer both swept-tuned and FFT architectures. While the terms spectrum analyzer and signal analyzer are used interchangeably, signal analyzer is a more accurate term for modern day analyzers that provide more comprehensive signal analysis, not only in frequency-domain but also time- and modulation-domains.

Benchtop and handheld analyzers

While benchtop spectrum/signal analyzers offer superior RF specifications and measurement applications, handheld spectrum analyzers (HSA) are favored by RF engineers or technicians who are spending more time in the field to finish their work due to growing congestion in the spectrum space and evolving RF technologies. To address challenges faced by these field technicians and engineers, handheld spectrum analyzers need to be rugged, accurate, fast, and easy-to-use.

Measurement applications and measurement software

Available for a broad range of communication standards and modulation types, Agilent offers PC- and instrument-based applications and software to address measurement needs, from R&D troubleshooting to one-button manufacturing measurements.

EMI and EMC solutions

Electromagnetic interference (EMI) is caused by the radiated or conducted emissions from a device. EMI analyzers and receivers can pinpoint frequency and location of the source, allowing for reduction or elimination of the interfering signal. Electromagnetic compatibility (EMC) is the ability of electrical devices to operate in the same environment. Many regulatory agencies specify both emissions and susceptibility requirements. EMC solutions/devices/instruments allow engineers to identify both product susceptibility and emissions issues that don't meet regulatory agency limits.

Table of Contents

Application and Software Comparison

Measurement applications	PXA	MXA	EXA	CXA	PSA	856xEC	ESA	N9320B	HSA	89600B VSA
General purpose										
AM/FM tune and listen	•	•	•	•		•	•	•	•	
Analog demodulation	•	•	•	•			•[1]	•	•	•
Cable fault location							•			
Cable TV (Analog)							•			
EMI pre-compliance/compliance	•	•	•	•	•					
Enhanced display package (spectrogram plus other display features)	•	•	•	•						•
Stimulus/response measurement		•[2]	•[2]	•[2]	•[2]		•[2]	•[2]	•[2]	
Flexible digital modulation analysis	•	•	•	•	•		•	•[3]	•[3]	•
MATLAB® software package	•	•	•	•	•					
Noise figure	•	•	•	•	•		•			
Phase noise	•	•	•	•	•	•	•			
Pulse measurement	•	•	•	•	•					
Remote language compatibility for 856xE/EC and 8566/68 spectrum analyzers	•	•	•		•					
SCPI language compatibility for R&S FSP/FSU/FSE spectrum analyzers	•	•	•							
Cellular communications										
1xEV-DO		•	•		•					•
cdma2000®		•	•		•					•
GSM/EDGE and EDGE Evolution	•	•	•	•[4]	•[4]		•[4]			•
iDEN/WiDEN/MotoTalk	•	•	•							
LTE FDD and TDD	•	•	•							•
TD-SCDMA with HSDPA/8PSK	•	•	•	•	•					•
W-CDMA/HSPA/HSPA+	•	•	•	•[5]	•[5]					•
Wireless networking										
Bluetooth™	•[6]	•[6]	•[6]	•[6]			•[7]			•[7]
Fixed WiMAX™		•	•							•
Mobile WiMAX	•	•	•	•						•
WLAN	•[8]	•	•	•[8]	•					•
Digital video										
CMMB	•	•	•	•						
Digital cable TV	•	•	•	•						
DTMB (CTTB)	•	•	•	•						
DVB-T/H/T2	•	•	•	•						
ISDB-T/T$_{SB}$	•	•	•	•						

1. FM demodulation only.
2. MXA/EXA/CXA/PSA offer external source control. CXA, ESA, N9320B and HSA offer tracking generator.
3. ASK/FSK demodulation analysis only.
4. GSM/EDGE only, EDGE Evolution not supported.
5. W-CDMA/HSPA only, HSPA+ not supported.
6. Bluetooth Basic 2.1 + EDR + LE.
7. Bluetooth Basic 2.0.
8. With N/W9064A VXA.

Key Specifications Comparison

Specifications	PXA N9030A	MXA N9020A	EXA N9010A	CXA N9000A	PSA E444xA	856xEC 856xEC	ESA E44xxB	N9320B N9320B	HSA N9342C
Performance	★★★★★	★★★★	★★★	★★	★★★★★	★★★★	★★★	★	★
Frequency range	3 Hz - 26.5 GHz	20 Hz - 26.5 GHz	9 kHz - 26.5 GHz	9 kHz - 7.5 GHz	3 Hz - 50 GHz	30 Hz - 50 GHz	100 Hz - 26.5 GHz	9 kHz - 3 GHz	100 kHz - 7 GHz
Warm-up time	30 min	30 min	30 min	30 min	30 min	5 min	5 min	30 min	30 min
Phase noise at 1 GHz (10 kHz offset)	-129 dBc/Hz	-103 dBc/Hz	-99 dBc/Hz	-99 dBc/Hz	-116 dBc/Hz	-113 dBc/Hz	-98 dBc/Hz	-88 dBc/Hz	-89 dBc/Hz[1] (30 kHz offset)
Phase noise at 1 GHz (1 MHz offset)	-145 dBc/Hz	-135 dBc/Hz	-132 dBc/Hz	-120 dBc/Hz	-145 dBc/Hz	NA	-127 dBc/Hz	-112 dBc/Hz[1]	-119 dBc/Hz[1]
Maximum third order dynamic range, 1 GHz	115 dB	110 dB	108 dB	107 dB	113 dB	108 dB	108 dB	93 dB	95 dB
Displayed average noise at 1 GHz	-165 dBm[2] -172 dBm[2,3]	-163 dBm[2]	-161 dBm[2]	-161 dBm[2]	-168 dBm[2]	-151 dBm	-153 dBm[1,2]	-145 dBm[2]	-149 dBm[2]
Displayed average noise at 4 GHz	-164 dBm[2] -172 dBm[2,3]	-162 dBm[2]	-160 dBm[2]	-155 dBm[2]	-165 dBm[2]	-147 dBm	-148 dBm[4]	NA	-148 dBm[2]
Standard attenuator range/step	70 dB/2 dB	70 dB/2 dB	60 dB/10 dB	50 dB/10 dB	70 dB/2 dB	70 dB/10 dB	75 dB/5 dB	70 dB/1 dB	50 dB/1 dB
Overall amplitude accuracy	±0.19 dB[5]	±0.23 dB[5]	±0.27 dB[5]	±0.50 dB[5]	±0.19 dB[5]	±1.9 dB	±0.40 dB[5]	±0.5 dB[1]	±0.6 dB[1]
Resolution bandwidth	1 Hz - 8 MHz	1 Hz - 8 MHz	1 Hz - 8 MHz	1 Hz - 8 MHz	1 Hz - 8 MHz	1 Hz - 2 MHz	1 Hz - 5 MHz	10 Hz - 1 MHz	10 Hz - 3 MHz
Standard analysis bandwidth	10 MHz	10 MHz	10 MHz	10 MHz				1 MHz	2 MHz
Optional RF analysis bandwidth	25, 40, 140 MHz	25, 40 MHz	25, 40 MHz	25 MHz	10, 40, 80 MHz		10 MHz[6]	EMI bandwidth[7]	
Optional baseband analysis bandwidth		25 MHz 40 MHz							
Battery							●		●

1. *Typical.*
2. *With optional built-in preamp on.*
3. *With Noise Floor Extension (NFE) on.*
4. *With Options 1DR and 1D5. No preamplifier above 3 GHz for E44xxB.*
5. *95th percentile.*
6. *With optional B7D/B7E.*
7. *Optional EMI bandwidth (-6 dB): 200 Hz, 9 kHz, 120 kHz, 1 MHz.*

PowerSuite One-Button Measurements

Measurements	PXA	MXA	EXA	CXA	PSA	856xEC	ESA	N9320B	HSA
Channel power	●	●	●	●	●	●	●	●	●
Occupied bandwidth	●	●	●	●	●	●	●	●	●
Multicarrier, multi-offset ACP	●	●	●	●	●		●	●	●
Multicarrier power	●	●	●	●	●		●		
CCDF	●	●	●	●	●		●		
Harmonic distortion	●	●	●	●	●	●[1]	●		
Burst power	●	●	●	●	●		●		
Intermodulation (TOI)	●	●	●	●	●	●[1]	●	●	
Spurious emissions	●	●	●	●	●		●		
Spectrum emission mask	●	●	●	●	●		●	●	●

Connectivity

Measurement applications	PXA	MXA	EXA	CXA	PSA	856xEC	ESA	N9320B	HSA
89600B VSA software link	●	●	●	●	●		●		
Remote interface RS-232							●		
GPIB	●	●	●	●	●	●	●	●[1]	
LAN (BaseT)	1000	1000	1000	1000	10			10	10
USB	2.0	2.0	2.0	2.0	2.0[2]			2.0	2.0
Removable storage	USB	USB	USB	USB	3.5″ floppy	Memory card	3.5″ floppy	USB	USB
			Solid state hard drive						
LXI	C	C	C	C					

1. Optional.
2. Device side (type B) for data transfer only; not for use with USB flash drive.

X-Series Signal Analysis

Stay ready, stay in sync, and arrive ahead – with the Agilent X-Series

Arrive ahead

We can't predict the future, but Agilent can help you shape it with our future-ready test assets. The X-Series is an evolutionary approach to signal analysis that spans instrumentation, measurements and software. It gives you the flexibility to satisfy your business and technical requirements across multiple products and programs – now and in the future. The X-Series creates a consistent framework that enables your teams to move at a faster pace.

Future-ready instruments

X-Series signal analyzers are ready to evolve as technology changes. With X-Series instruments, you can move along the performance curve today and tomorrow without rewriting your test code, while optimizing price and performance for whichever technologies you're pursuing and whichever X-Series analyzer you choose to use. With upgradeable CPU, memory, disk drives, and I/O ports, you can keep your test assets current and extend instrument longevity. Adding functionality or applications to the X-Series' reliable and robust hardware architecture is simply a license-key upgrade that allows for increased instrument functionality and applications with no downtime.

Consistent measurement framework

Proven algorithms, 100% code-compatibility, and a common UI across the X-Series create a consistent measurement framework for signal analysis that ensures repeatable results and measurement integrity so you can leverage your test system software through all phases of product development from R&D to design verification to manufacturing. You can further extend your test assets by transporting applications across multiple X-Series analyzers, from EXA to PXA, across the lab, or around the globe. A common, familiar user-interface means increased efficiency and productivity- when you learn how to use one X-Series analyzer, you know how to use them all.

Applications and software

Save time and money with the X-Series signal analyzers' shared, common library of more than 25 measurement applications which can be easily upgraded as new applications and technologies are introduced. With the open Windows® OS you can create customized demodulation macros and run applications such as MATLAB or 89600B VSA software. The industry-leading VSA software supports over 70 signal standards and modulation types and Agilent's first-to-market track record can help you accelerate the speed with which you get your designs to market.
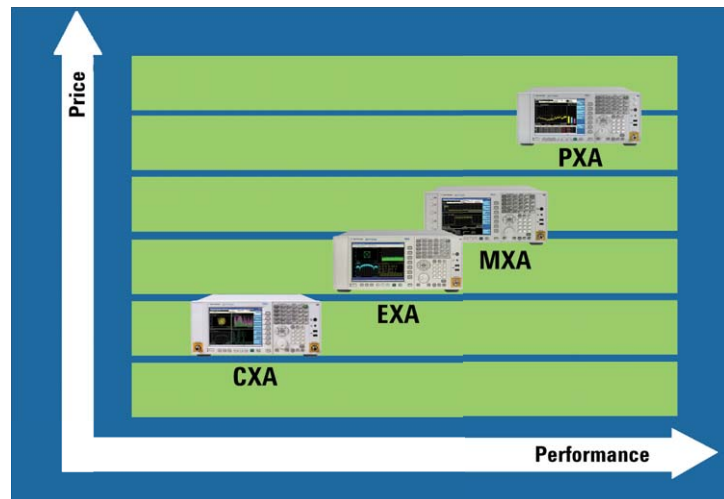
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X-Series Signal Analyzers

N9030A PXA

The PXA signal analyzer, the highest-performance X-Series signal analyzer, is the evolutionary replacement for other performance signal analyzers. Advanced performance, flexibility, capability and expandability enable the user to address demanding applications in aerospace, defense, commercial communications and more. In addition, the PXA includes extensive remote language compatibility features that make it easier to replace your existing performance spectrum analyzers.

- Agilent's exclusive NFE technology delivers -172 dBm or lower analyzer noise floor

- Best phase noise performance (-129 dBc/Hz at 10 kHz offset) and third-order intercept (up to +23 dBm)

- Analyze the most complex signals with 140 MHz analysis bandwidth offering up to 75 dBc SFDR

www.agilent.com/find/PXA

N9020A MXA

The mid-performance MXA is the ultimate accelerator as products move from design to manufacturing to the marketplace. Reuse of test code from development into manufacturing, assures that trusted measurement algorithms are used for the product's entire development cycle and parallel development in manufacturing and R&D facilitates faster time-to-market.

- Up to 300% faster than other signal and spectrum analyzers

- Highest performance and accuracy in a midrange signal or spectrum analyzer

- Up to 40 MHz analysis bandwidth

www.agilent.com/find/MXA

Key specifications	PXA	MXA	EXA	CXA
Frequency range	3 Hz - 26.5 GHz	20 Hz - 26.5 GHz	9 kHz - 26.5 GHz	9 kHz - 7.5 GHz
Phase noise at 1 GHz (10 kHz offset)	-129 dBc/Hz	-103 dBc/Hz	-99 dBc/Hz	-99 dBc/Hz
Maximum third order dynamic range, 1 GHz	115 dB	110 dB	108 dB	107 dB
Displayed average noise at 1 GHz	-165 dBm[1] -172 dBm[1,2]	-163 dBm[1]	-161 dBm[1]	-161 dBm[1]
Standard attenuator range/step	70 dB/2 dB	70 dB/2 dB	60 dB/10 dB	50 dB/10 dB
Overall amplitude accuracy	±0.19 dB[3]	±0.23 dB[3]	±0.27 dB[3]	±0.50 dB[3]

1. *With optional built-in preamp on.*
2. *With Noise Floor Extension (NFE) on.*
3. *95th percentile.*

X-Series Signal Analyzers
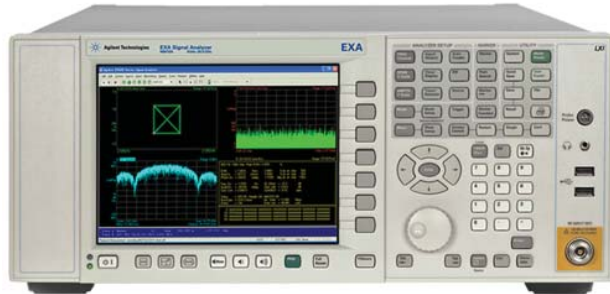
N9010A EXA

The economy-class EXA offers the fastest way to maximize throughput on the production line. From measurement speed to code compatibility, it makes every millisecond count and reduces overall cost of test. Already the fastest analyzer in its class, upgrading from the single core processor to the dual core processor provides further speed advantages. What's more, the accuracy of the EXA accelerates the transition from design into manufacturing.

- Fast remote sweep and rapid trace transfer accelerate throughput and enhance yield

- Front-panel capabilities such as auto-tune, fast mode switching, and 5-ms peak search save time and effort

- Up to 40 MHz analysis bandwidth

www.agilent.com/find/EXA

N9000A CXA

The low-cost CXA, a versatile tool for essential signal characterization, helps accelerate product testing and development on multiple levels: cost reduction, throughput, design enhancement. Get essential capability with X-Series expandability in the CXA - and expect more.

- Reduce costs and improve throughput in manufacturing test

- Up to 25 MHz analysis bandwidth

- Built-in tracking generator for component characterization

www.agilent.com/find/CXA

Free Trial License
Try the X-Series measurement applications FREE for 14 days. Trial license provides unrestricted use of each application's features and functionality. Redeem a trial license for your X-Series signal analyzer online today at **www.agilent.com/find/X-Series_trial.**

X-Series Measurement Applications

A shared library of more than 25 measurement applications for use in the X-Series signal analyzers increase the capability and functionality of the analyzers to speed your time to insight. These software measurement applications provide essential measurements for specific tasks in general purpose, cellular communications, wireless connectivity and digital video applications. The measurement application software is identical across all of the X-Series analyzers. The only difference is the level of performance achieved by the instrument hardware selected. Choose the level of performance necessary for your application and have full assurance that the calculations and algorithms are the same across your X-Series signal analyzers, from development into manufacturing.

Choosing between 89600B VSA software and X-Series measurement applications

X-Series measurement applications provide embedded format-specific, one-button measurements for X-Series analyzers. With fast measurement speed, pass/fail testing and simplicity of operation, these applications are ideally suited for design verification and manufacturing. 89600B VSA is the industry-leading measurement software for evaluating and troubleshooting wireless signals in R&D. PC-based, supporting numerous measurement platforms, the 89600B provides the flexibility and sophisticated measurement tools essential to finding and fixing signal problems in R&D.

Measurement applications

General purpose
Analog demodulation
EMC measurement application
MATLAB software
Noise figure
Phase noise
Pulse Measurement SW
Remote language compatibility 856xE/EC, 8566/68
SCPI language compatibility, R&S FSP/FSU/FSE
VXA vector signal and WLAN modulation analysis

Cellular communication
1xEV-DO
cdma2000
GSM/EDGE/EDGE Evolution
iDEN/WiDEN MotoTalk
LTE FDD
LTE TDD
TD-SCDMA/HSPA
W-CDMA/HSPA/HSPA+

Wireless connectivity
802.16 OFDMA
Bluetooth
Single acquisition combined fixed WiMAX
Single acquisition combined WLAN
Vector signal and WLAN modulation analysis

Digital video
CMMB
Digital cable TV
DTMB (CTTB)
DVB-T/H/T2
ISDB-T/T_{SB}

www.agilent.com/find/X-Series_Apps

Mix and match the X-Series instruments, applications and software to meet the needs of your specific tests and measurements.

Vector Signal Analysis Software

89600B VSA
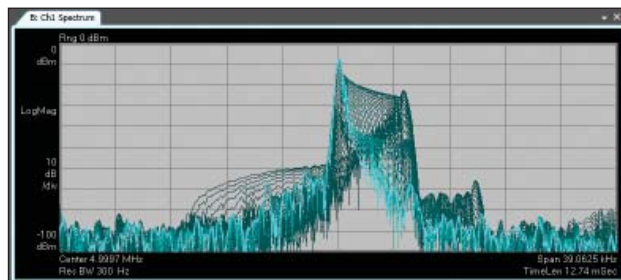
See through the complexity

On the leading edge of wireless design, signal interactions can cause the unexpected. Knowing there's a problem is relatively easy. Achieving the clarity to find the root cause is the real challenge. Look to the Agilent 89600B vector signal analysis (VSA) software: It's your window into what's happening inside complex wireless devices. With views of virtually every facet of a problem, our VSA tools let you find the "why?" behind unexpected interactions. Whether you're working with emerging or established standards, Agilent's industry-leading VSA software helps you see through the complexity.

Measure over 70 modulation and signal types

- 16FSK, QPSK, 1024-QAM, 32 Star QAM, 32APSK, 16VSB, proprietary OFDM

- LTE (FDD/TDD), W-CDMA HSPA+, GSM/EDGE Evolution

- 802.11a/b/g/n, 802.16 OFDMA, WiMAX™, Bluetooth®, Zigbee, UWB

See the "why?" with advanced troubleshooting tools

- Measure in the time, frequency and modulation domains

- Quantify spectral performance with high resolution FFT-based measurements and a rich set of markers

- Analyze time-domain signal quality using signal capture and playback, pulse timing features, CCDF, robust trigger controls and more

- Characterize complex modulation techniques, such as MIMO and LTE, down to raw bits

View virtually every facet of complex signals — simultaneously

- Get greater clarity with 20:20 trace/marker features capabilities

  ◦ Pinpoint problems with arbitrary arrangement, sizing and assignment of up to 20 measurement traces

  ◦ Adjust trace shape to extend event observation time or increase viewable data

  ◦ Optimize trace arrangement to see signal patterns and study interactions

  ◦ Assign any measurement to any trace to analyze sophisticated signals, such as 4x4 MIMO

  ◦ Isolate the sources of unexpected interactions with up to 20 markers per trace and trace-to-trace coupling

- Catch short-lived signal events with multi-domain digital persistence and cumulative history traces

Analyze repeated bursts and transients with digital persistence
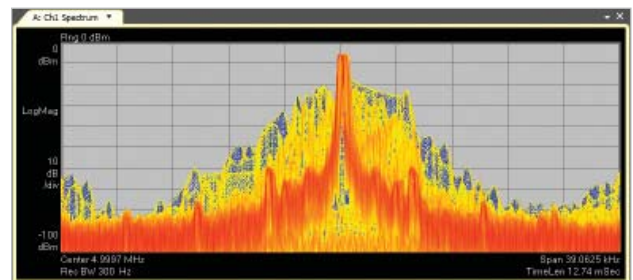
Capture infrequent or random signal events and perform detailed analysis with cumulative history

Apply VSA virtually anywhere in your block diagram

The software runs on a PC or inside PC-based instruments and supports more than 30 Agilent platforms: spectrum analyzers, signal analyzers, oscilloscopes, logic analyzers and modular instrument systems as well as simulation software. You can use this flexibility to evaluate signals throughout your block diagram: analog and digital base-band; IF, RF and microwave; narrowband to UWB; SISO and MIMO; and mixed-signal designs.
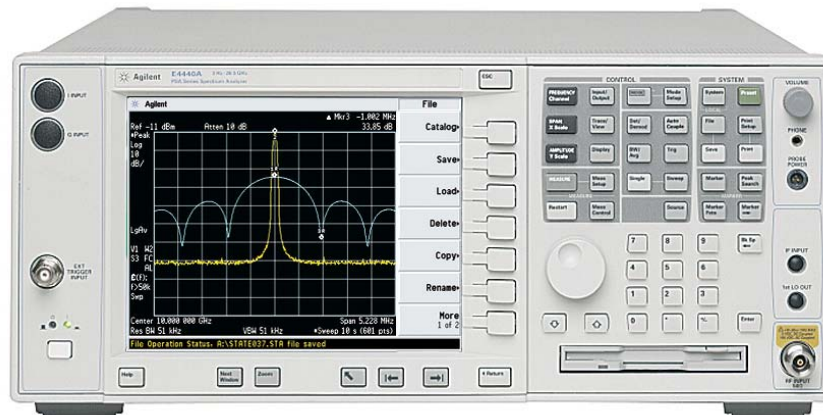
www.agilent.com/find/89600B

89600B VSA software

Digital (SSI)   BB (I-Q)   IF/RF/µW

Logic analyzer   MXA signal analyzer   Signal analyzer
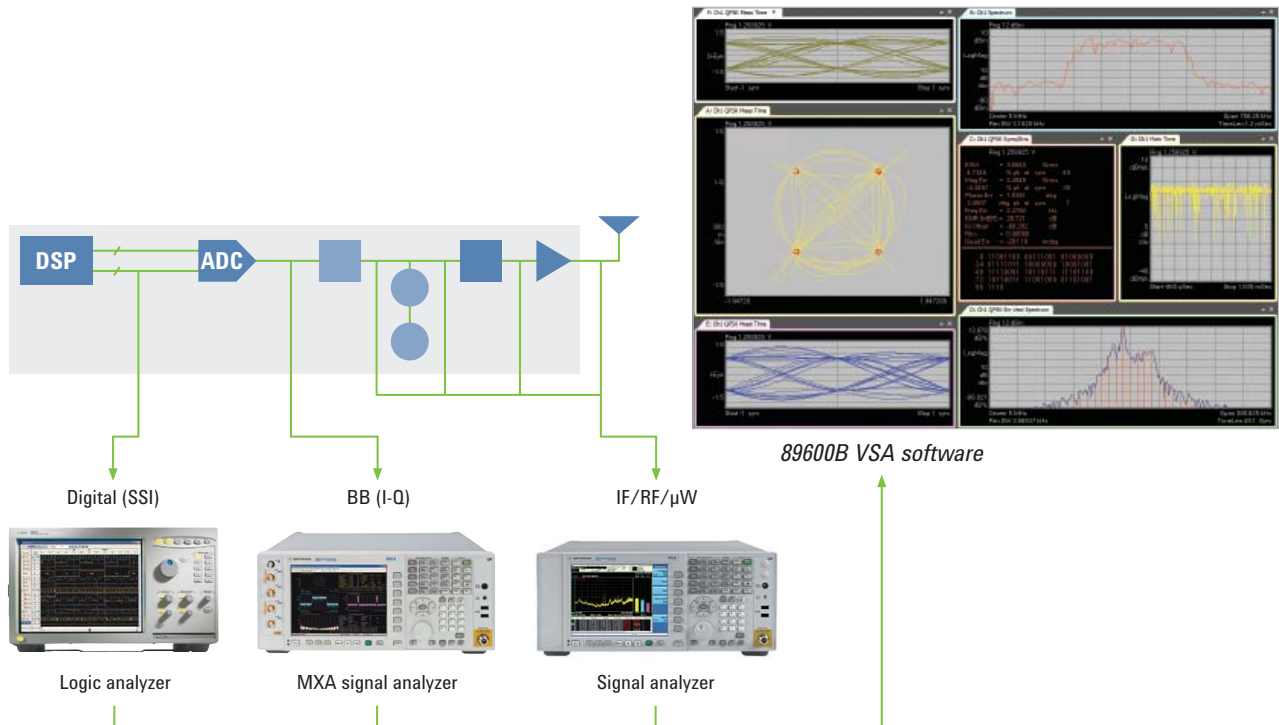
Analyze signals anywhere in the block diagram with 89600B VSA software and one of its > 30 supported measurement platforms

Spectrum Analyzers

PSA Series spectrum analyzers
E4440/43/45/46/47/48A

The Agilent PSA Series offers high-performance spectrum analysis up to 50 GHz and beyond with powerful one-button measurements, a versatile feature set, and a combination of flexibility, accuracy, and dynamic range. Instrument architecture features an all-digital-IF section, a highly accurate internal reference signal, and automatic internal alignment processes to achieve outstanding accuracy.

Move up to the PXA

Agilent's N9030A PXA high-performance signal analyzer is the ideal form, fit, and functional replacement for the PSA. With current models up to 26.5 GHz, analysis bandwidth to 140 MHz, and backward compatibility, the PXA helps to sustain your past success with seamless migration from PSA to PXA. For more information, visit **www.agilent.com/find/psa2pxa.**

Features

- 50 GHz internal preamplifier

- Over 16 optional built-in measurement personalities

- 80 MHz analysis bandwidth available for center frequency up to 50 GHz

Key specifications	
Frequency range	3 Hz - 50 GHz
Phase noise, 1 GHz (10 kHz offset)	–116 dBc/Hz
Maximum third order dynamic range, 1 GHz	113 dB
Displayed average noise, 1 GHz	–168 dBm
Standard attenuator range/step	70 dB/2 dB
Overall amplitude accuracy (95th percentile)	±0.19 dB

www.agilent.com/find/psa

Did you know?

The PSA Series has a 2-year standard calibration cycle based on low fail rates.

The N5531S measuring receiver, the ideal tool for traceable calibration of signal generators and step attenuators, is based on the PSA, P-Series power meter, and the N5532B sensor module.

Spectrum Analyzers

856xEC Series portable spectrum analyzers
8564/65EC[1]

The 856xEC Series spectrum analyzers offer power measurements for both continuous and burst signals that are accurate and easy to make. Measurement capabilities includes adjacent channel power (ACP), carrier power, channel power, and occupied bandwidth. These analyzers provide great measurement flexibility and RF performance, making them powerful spectrum analysis tools for R&D engineers and field technicians working with signals up to 50 GHz and beyond.

These spectrum analyzers combine outstanding phase noise, sensitivity, 1 Hz resolution bandwidths, and wide dynamic range in a Class 3 MIL-rugged package built to withstand harsh environmental conditions.

Migrate to next-generation signal analyzers

Agilent offers the X-Series MXA N9020A signal analyzer for customers looking for a fast midrange RF/MW spectrum analyzer solution. It offers the N9061A remote language compatibility application to ease the migration from 856xE/EC spectrum analyzers.

Features

- Class 3 MIL-rugged, portable

- Resolution bandwidths of 1 Hz to 100 Hz digitally implemented

- Best-in-class performance in phase noise

Key specifications	
Frequency range	30 Hz - 50 GHz
Phase noise, 1 GHz (10 kHz offset)	−113 dBc/Hz
Maximum third order dynamic range, 1 GHz	108 dB
Displayed average noise, 1 GHz	−151 dBm
Standard attenuator range/step	70 dB/10 dB

www.agilent.com/find/8560

1. The RF and microwave models of the 856xEC Series (8560/61/62/63EC) have been discontinued. The recommended replacements are X-Series signal analyzers or the PSA spectrum analyzer. Refer to **www.agilent.com/find/8560** for "856xE/EC migration assistance".

Spectrum Analyzers

ESA Series spectrum analyzers
E4411B, E4402/4/5/7B

Receive faster delivery and a favorable price when you order one of the three ESA Series express analyzers ideal for manufacturing, rugged outdoor use, and general spectrum analysis. The express analyzer options are based on the most frequently ordered ESA configurations and most popular options.

ESA basic analyzer

Basic spectrum analysis with the ESA-L series is perfect for cost conscious bench top, manufacturing, or service environment applications.

ESA standard analyzer

Receive quality spectrum analysis with our most popular express configuration on the ESA-E series. The ESA-E series includes one-button RF power measurements. All standard express analyzers include fast time-domain sweep, AM/FM demodulation, and GPIB connection for your manufacturing needs.

Features

• Five-minute warm up time

• Rubber-encased front and rear frames

• Optional built-in tracking generator and battery options

Key specifications	
Frequency range	100 Hz - 26.5 GHz
Phase noise, 1 GHz (10 kHz offset)	–98 dBc/Hz
Maximum third order dynamic range, 1 GHz	108 dB
Displayed average noise, 1 GHz	–166 dBm
Standard attenuator range/step	75 dB/5 dB
Overall amplitude accuracy	±1.0 dB

www.agilent.com/find/esa

Did you know?

For general-purpose spectrum analysis most ESA customers will benefit by upgrading to the faster EXA and CXA signal analyzers which provide

1. Over 25 measurement applications
2. Increased speed- 50 times faster than the ESA over GPIB
3. USB and 1000Based-T LAN connectivity available
4. Up to 40 MHz analysis bandwidth available

www.agilent.com/find/esa2exa
www.agilent.com/find/esa2cxa

Spectrum Analyzers

N9320B RF spectrum analyzer

The N9320B enables you to reduce manufacturing test overhead without compromising quality.

Whatever type of consumer or general-purpose RF electronic devices or components you are manufacturing, you know that spectrum analysis provides essential information on their performance, characteristics, and interaction. And in today's competitive world, you need this analysis to be fast, accurate, and reliable, but, most importantly, affordable.

The Agilent N9320B is a reliable entry-level spectrum analyzer that allows you to identify and eliminate sources of unwanted interference or check the stability of circuit components or sub-assemblies. It provides fast sweep speed in narrow resolution bandwidth, -145 dBm (@1 GHz, w/preamp) displayed average noise level, and ±1.5 dB overall amplitude accuracy.

Features

- One-button Auto Tune key and PowerSuite

- Optional built-in preamplifier and tracking generator

- Optional AM/FM, ASK/FSK demodulation analysis and EMI filter

Key specifications	
Frequency range	9 kHz - 3 GHz
Phase noise, 1 GHz (10 kHz offset)	−88 dBc/Hz
Maximum third order dynamic range, 1 GHz	93 dB
Displayed average noise, 1 GHz	−145 dBm
Standard attenuator range/step	70 dB, 1 dB
Overall amplitude accuracy	±0.5 dB, typical

www.agilent.com/find/n9320b

Spectrum Analyzers

Handheld spectrum analyzers
N9342C, N9340B

Rely on the Agilent handheld spectrum analyzer (HSA), designed to excel in the field, to provide fast and accurate measurements whether you are installing and maintaining RF systems, doing on-site troubleshooting, monitoring an RF environment, or analyzing interference. The N9342C offers frequency coverage up to 7 GHz and the N9340B offers coverage up to 3 GHz. Both models tune from as low as 9 kHz, or even lower with the low frequency performance enhancement option[1].

Built in a rugged, fanless, and compact chassis, the HSA offers measurement performance that gives assurance that the job's been done right. Gain a complete understanding of the spectrum with best-in-class displayed average noise level (DANL) and accomplish tasks quickly with fastest-in-class sweep and powerful one-button measurement features.

Features

- Built-in tracking generator
- Spectrum monitor and interference analyzer
- Innovative task planner enables routine test automation[2]
- High accuracy power measurement with Agilent U2000 Series USB power sensor
- Built-in GPS receiver and GPS antenna[2]
- AM/FM and ASK/FSK modulation analysis[1]

Key specifications	N9340B	N9342C
Frequency range	100 kHz - 3 GHz	100 kHz - 7 GHz
Phase noise, 30 kHz offset, typical	–87 dBc/Hz	–89 dBc/Hz
Third order intermodulation, 1 GHz	+10 dB	+10 dB
Displayed average noise, 1 GHz, typical	–144 dBm	–152 dBm
Standard attenuator range/step	51 dB, 1 dB	50 dB, 1 dB
Overall amplitude accuracy, typical	±0.5 dB	±0.6 dB

www.agilent.com/find/hsa

Do you need a handheld network analyzer ?

Check out the N9912A FieldFox RF analyzer and the N9923A FieldFox vector network analyzer.

www.agilent.com/find/n9912a
www.agilent.com/find/n9923a

1. *Currently available only on N9340B.*
2. *Currently available only on N9342C.*

EMI/EMC Solutions

N9039A EMI measurement receiver

Combine the world-class performance of the E444xA PSA Series spectrum analyzer and the N9039A RF preselector and the result is an accurate, fast EMI, fully CISPR 16-1-1 compliant measurement receiver to 50 GHz. This receiver gives you the confidence that the measurements you make are precise and repeatable.

Features

- Synchronized zoom trace for easy troubleshooting

- 8192 data points for broad band sweeps

- Mix and match preselectors and PSAs

- Bandwidths for CISPR and MIL-STD measurements

N6141A/W6141A EMC measurement application

The EMC measurement application enables users to perform precompliance conducted and radiated emissions tests to both commercial and MIL-STD requirements. It provides better sensitivity and accuracy and reduces test margins across the X-Series signal analyzers, so you can make more precise measurements.

The wide range of features enables you to use the scan table to set up frequency ranges, gains, bandwidths and dwell time. Scan a frequency range and display the results in log or linear format, search for signals, measure the peak, quasi-peak and average values of the signals and place the results in a table. Use the Signal List feature to mark and delete unwanted signals, leaving only those of interest. Easily identify signals that fail the regulatory agency limit.
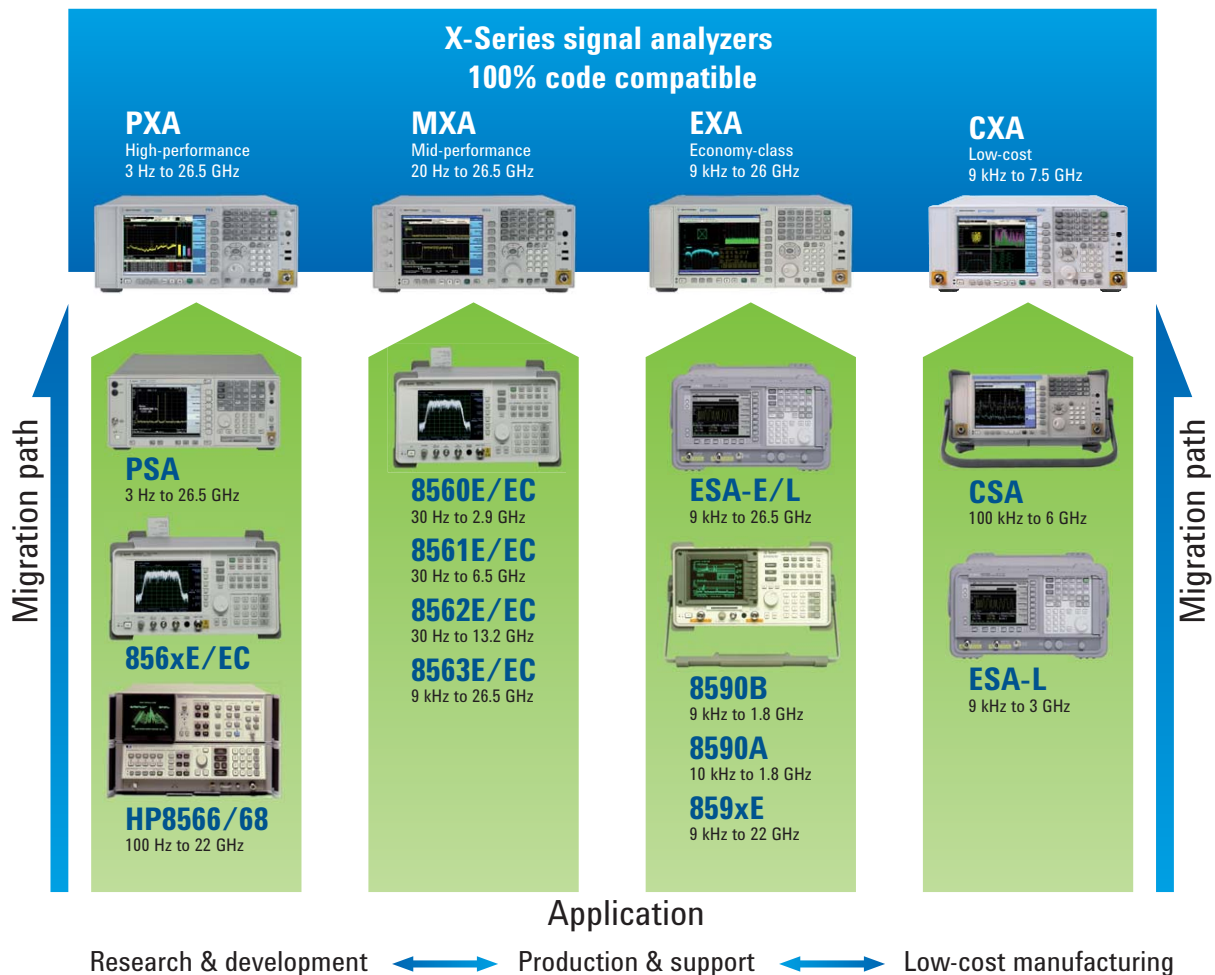
www.agilent.com/find/emc

Migrating from Legacy Spectrum Analyzers

Whether you are working in the aerospace and defense or communications industries, technologies evolve but one thing stays the same: the need to ensure readiness of your test system.

Carefully planned instrument migration and modernization can maximize your test-system efficiency, performance, and readiness, while minimizing risk and potential disrup-

tions, keeping you at the leading edge in the competitive marketplace. The Agilent X-Series signal analyzers were designed as evolutionary replacements to their in-class predecessors. Take advantage of the X-Series' performance, flexibility, speed, modern connectivity, and true form-fit-functional backward compatibility in replacing the legendary HP/Agilent spectrum analyzers to achieve seamless migration and avoid the need to rewrite test software.

X-Series signal analyzers
100% code compatible

PXA
High-performance
3 Hz to 26.5 GHz

MXA
Mid-performance
20 Hz to 26.5 GHz

EXA
Economy-class
9 kHz to 26 GHz

CXA
Low-cost
9 kHz to 7.5 GHz

Migration path

PSA
3 Hz to 26.5 GHz

856xE/EC

HP8566/68
100 Hz to 22 GHz

8560E/EC
30 Hz to 2.9 GHz

8561E/EC
30 Hz to 6.5 GHz

8562E/EC
30 Hz to 13.2 GHz

8563E/EC
9 kHz to 26.5 GHz

ESA-E/L
9 kHz to 26.5 GHz

8590B
9 kHz to 1.8 GHz

8590A
10 kHz to 1.8 GHz

859xE
9 kHz to 22 GHz

CSA
100 kHz to 6 GHz

ESA-L
9 kHz to 3 GHz

Migration path

Application

Research & development ⟷ Production & support ⟷ Low-cost manufacturing

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Revised: October 14, 2010

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Printed in USA, November 4, 2010
5968-3413E

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