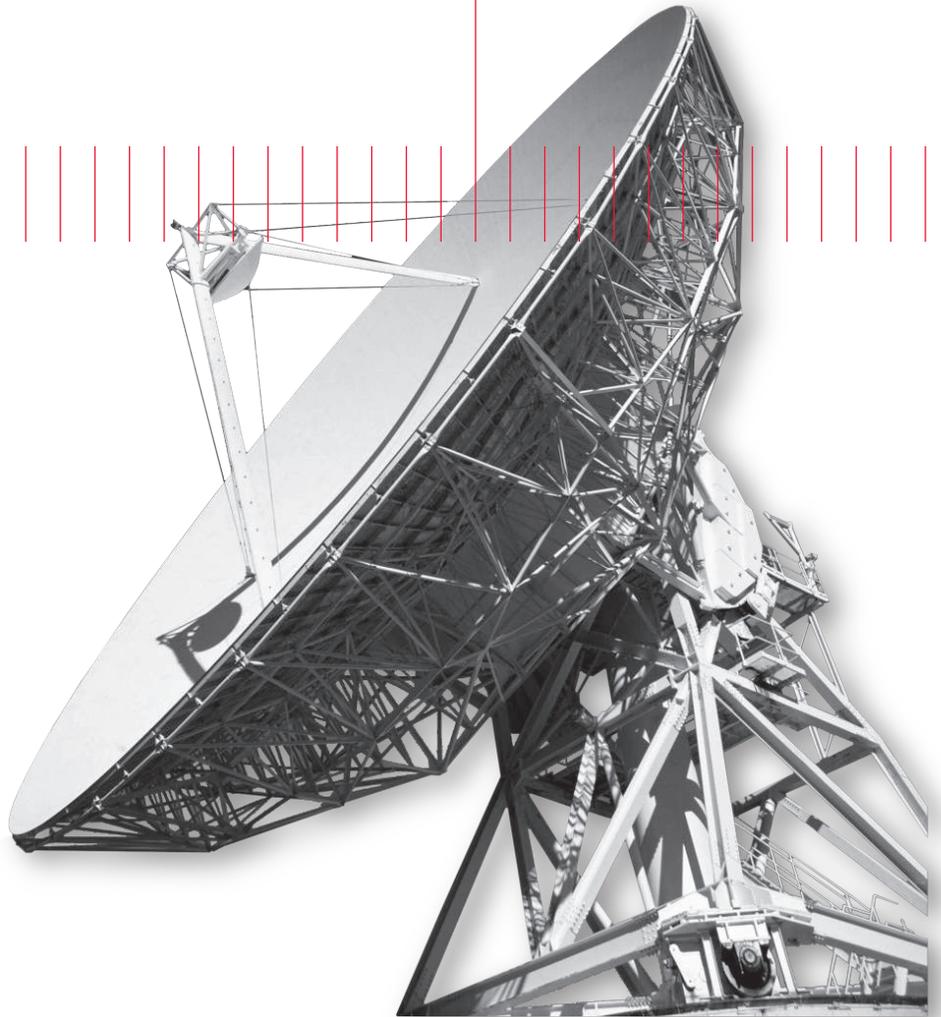


# Keysight Technologies Solutions for Antenna Characterization

Fully evaluate  
the performance  
of your antennas  
in significantly  
less time

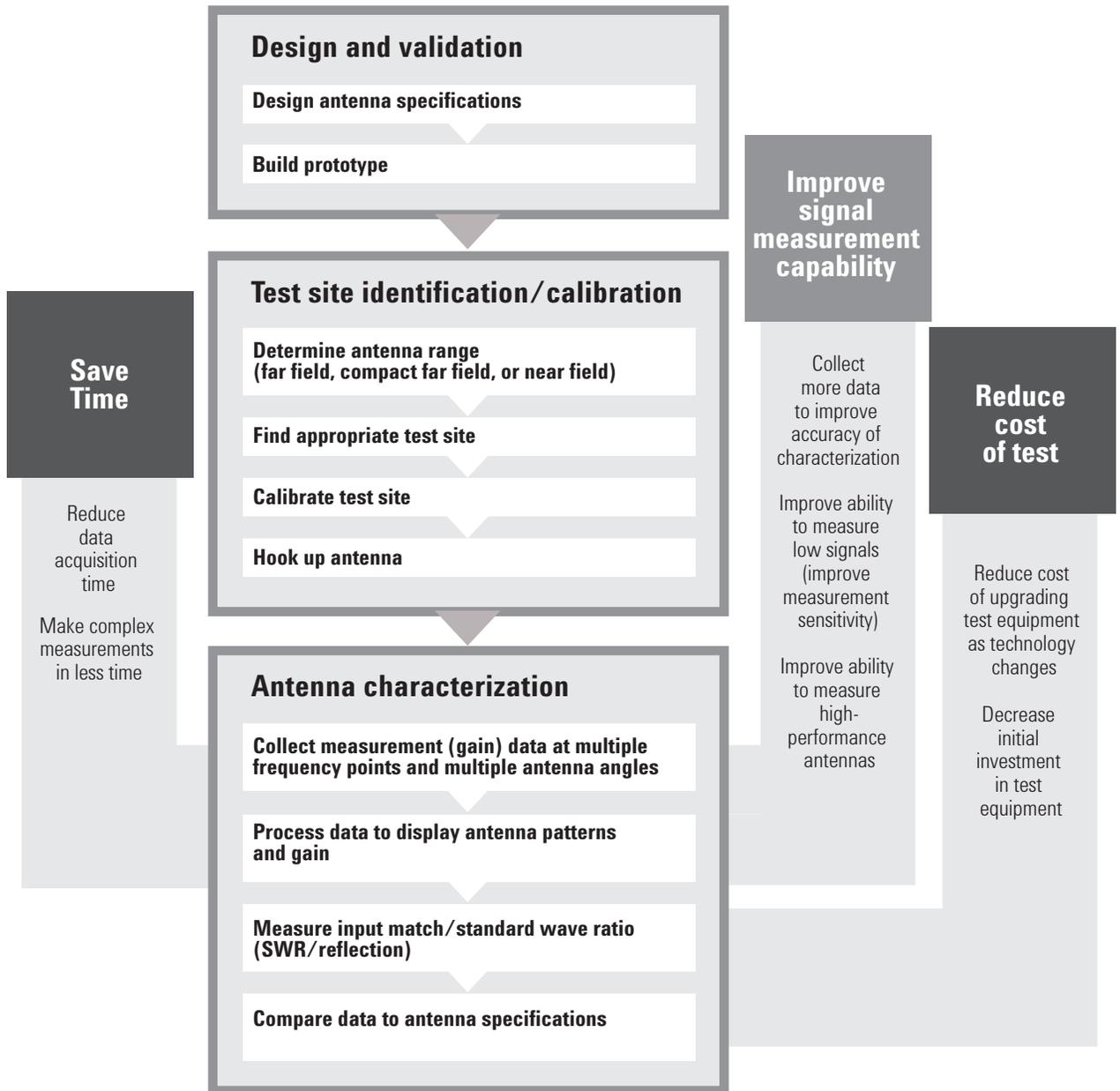
Case Study



Your mission: Fully test your complex antennas to verify performance—now and as technology evolves

Common problems

- **You need more test data to accurately evaluate the performance of your latest antennas, and you need to collect it quickly**  
The more data you collect, the more accurately you can characterize your antenna’s performance—but you can’t afford to spend weeks making measurements at multiple frequency points and multiple antenna angles.
- **You need better measurement sensitivity to characterize today’s high-performance antennas**  
Today’s antennas can pick up increasingly low-level signals. But as antenna performance increases, you need better measurement sensitivity.
- **You need to keep your cost of test in check to stay competitive**  
The cost of test directly affects the cost of manufacturing and producing antennas, so cost-effective testing is critical.



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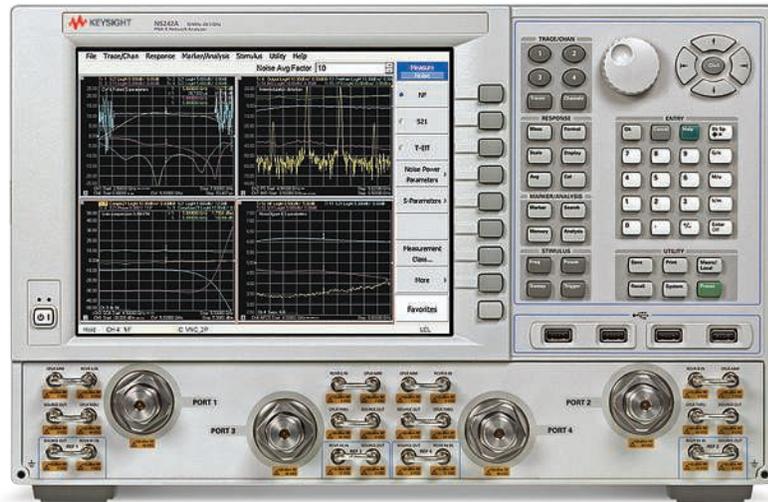
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# 1 Problem

You need more test data to accurately evaluate the performance of your latest antennas, and you need to collect it quickly

The increasing performance levels and technical complexity of today's antennas make it challenging to fully characterize them. You need significantly more test data to characterize them completely and accurately. At the same time, time-to-market pressures are intense, and the longer you spend testing, the more it costs.

## SOLUTION: Collect more test data faster...

### ...with Keysight antenna test tools

#### N524xA PNA-X vector network analyzer

##### Option 200 and Option 118

##### Key capabilities

- Fast CW mode (Opt. 118) enables
  - 400,000 data points/second on five measurement channels simultaneously
  - 500 million point circular first-in first-out (FIFO) data buffer
- Measure multiple frequency points faster with 120  $\mu$ Sec frequency switching time without band crossing at 600 KHz IFBW and 10-MHz step
- +13 dBm output power lets you increase IF bandwidth of the receiver to acquire data faster

#### N5230C PNA-L vector network analyzer

##### Option xx5

##### Key capabilities

- Measure multiple frequency points faster with 300  $\mu$ Sec frequency switching time without band crossing at 600 KHz IFBW and 10-MHz step

#### E836XC PNA vector network analyzer

##### Option 014

##### Key capabilities

- Measure multiple frequency points faster with 675  $\mu$ Sec frequency switching time without band crossing at 35 KHz IFBW and 10-MHz step

*For more information refer to pages 10 and 11.*

#### TO LEARN MORE

##### VISIT OUR WEB SITE:

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# 1

## CASE STUDY: Antenna manufacturer increases test accuracy, reduces test time by 80%

A European antenna manufacturer tests its antennas thoroughly during design and manufacturing. But collecting adequate measurement data takes time, and the company needed to boost its throughput. The company tests its 100-MHz to 40-GHz antennas in a test range equipped with an Keysight RF subsystem to ensure specification conformance.

### Solving the problem

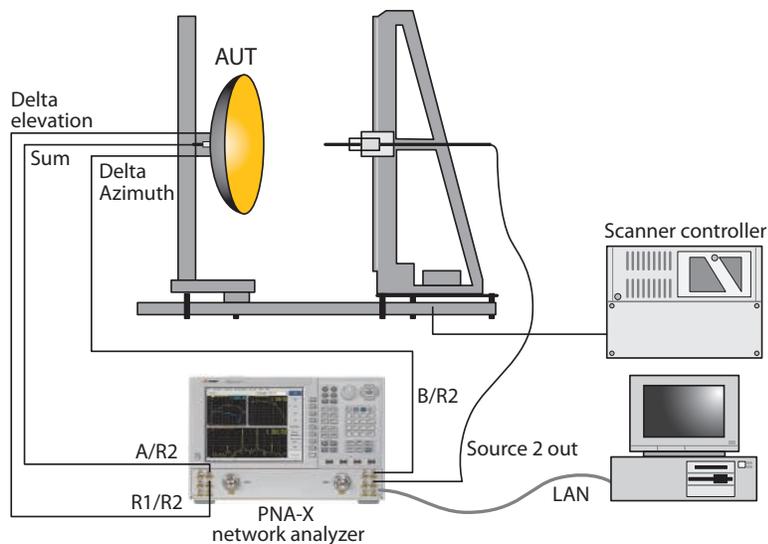
The RF subsystem for the company's spherical near-field antenna test system, installed in 2001, was designed around the Keysight 8722ET vector network analyzer (VNA), which it was ready to replace. A Keysight channel partner developed a high-speed driver for the Keysight PNA-X Series network analyzer that enabled the antenna manufacturer to test multiple frequencies during a single data acquisition. The new setup allowed the company to collect more data in less time and with a much greater dynamic range on the measurements.

"We just finished an order for 96 spiral antennas that needed 100% testing from 2 to 18 GHz in 1-GHz increments," said the company's technical director. "With the PNA-X, this test took 18 minutes per antenna. It would have taken 90 minutes with the old 8722ET. The time savings were amazing. The analyzer is so fast that even with 17 frequencies, we were still at 30 degrees per second measurement speed."

### Results

The antenna manufacturer reduced test time from 90 to 18 minutes per antenna, an 80% reduction, with increased accuracy and test yield.

**PNA-X configured for near-field measurements**



### *"What new features will I get with the N524xA PNA-X vector network analyzer?"*

- Fast CW mode (Opt. 118) enables 400,000 points/second on five measurement channels and has a 500-million-point data FIFO buffer
- Expand to millimeter-wave frequency (up to 220 GHz) with external modules without using external sources

### TALK TO AN EXPERT

Get answers to your questions about antenna characterization: Call **1 800 829-4444** in the U.S. or visit [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

Get a quote: Contact your Keysight field engineer

# Problem 2

You need a better measurement sensitivity capability to characterize today's high-performance antennas

As antenna performance increases, your test system's measurement sensitivity increasingly affects your ability to measure your antenna's signals. So when you design far-field antenna test sites or large near-field anechoic chambers where you need a distributed RF-subsystem, your system's measurement sensitivity is critical.

## SOLUTION: Improve your measurement sensitivity...

### ...with Keysight test tools

Typical lower-cost test system with a dedicated receiver for making antenna measurements

- N5264A Opt. 108 PNA-X measurement receiver
- N5183A Opt. 5x0 and Opt. UNZ MXG analog microwave signal generator

Key capabilities

- Excellent measurement sensitivity (compared to an 8530A system with the same settings)
- Maximize system sensitivity by placing the N5264A measurement receiver in an optimal location

Typical test system with optimum measurement sensitivity for testing antennas

- N5264A PNA-X measurement receiver (dedicated)
- E8257D Opt. 5xx and Opt. UNX PSG analog signal generators (two)

Key capabilities

- Optimum measurement sensitivity (3 dB more than N5264A/8530A-based system)

Typical system for testing antennas and components

- N524xA Opt. 200, Opt. 020 or E836xC Opt. H11 vector network analyzer
- N5183A Opt. 5x0 and Opt. UNZ MXG analog microwave signal generator

Key capabilities

- Excellent measurement sensitivity (compared to an 8530A system with the same settings)
- Maximize system sensitivity by placing the N524xA or E836xC vector network analyzer in an optimal location

*For more information refer to pages 10 and 11.*

#### TO LEARN MORE

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# 2

## CASE STUDY: Global company replaces obsolete antenna receiver, achieves required measurement sensitivity

A global company with expertise in airborne radar, navigation systems, and electronic countermeasures was building far-field monopulse antennas for one of its clients. The antennas were designed to capture weak signals, so the company needed a receiver with high measurement sensitivity to characterize them accurately. The company had been using an HP 8530A antenna receiver, but the instrument needed repairs and was past the end of its support life.

The company installed a standard network analyzer as the antenna receiver. Measurement signals from the antenna fed into the network analyzer's front test ports. Because each of these ports has its own internal down converter, the instrument's measurement sensitivity was compromised by mixer conversion loss, and the company could not achieve the accuracy it needed.

### Solving the problem

The company solved the problem by installing a Keysight N5264A PNA-X measurement receiver for antenna test to replace the obsolete HP 8530A antenna receiver. The N5264A receiver enables distributed RF-subsystems, so it allowed the test engineers to place the antenna receiver in a strategic location to maximize measurement sensitivity. The N5264A eliminates internal mixer conversion loss, which further enhances measurement sensitivity.

### Results

Company test engineers gained the measurement sensitivity they needed to accurately characterize their monopulse antennas. Using the N5264A kept their costs down because they were able to reuse components of their existing 8530A system.



### *"How can I be sure the N5264A will work for me?"*

- You can try Keysight equipment before you buy to make sure it fits your needs. Contact Keysight for a demo.
- You can have confidence in Keysight solutions because of our strong leadership in RF/microwave network and spectrum analysis for 40-plus years.

### TALK TO AN EXPERT

Get answers to your questions about antenna characterization: Call **1 800 829-4444** in the U.S. or visit [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

Get a quote: Contact your Keysight field engineer

# Problem 3

You need to keep your cost of test in check to stay competitive

Whether you are using near-field or far-field technology, your finished products need to be cost competitive, so you have to keep tight control of your cost of test. Slashing your test time reduces the cost of test, which reduces your manufacturing costs—but you can't jeopardize test coverage in the process. You also need a cost-effective way to update your test system as technology changes.

**SOLUTION:** Reduce the initial cost of your test equipment and the cost of staying up to date as technology evolves...

**...with Keysight antenna test tools**

N5264A Opt. 108 PNA-X measurement receiver

Key capabilities

- Lower initial investment for a dedicated antenna receiver compared to full vector network analyzer (N524xA Opt. 020 or E836xC Opt. H11)
- 8530A code emulation allows you to retain existing measurement software, eliminating the need for expensive and time consuming code modification

*For more information refer to pages 10 and 11.*

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# 3

## CASE STUDY: R&D center conducts “technology refresh” on limited budget

A research and development center that applies advanced technology to problems related to U.S. national security needed to replace the 8530A microwave receiver in its RF subsystem for testing phase array antennas.

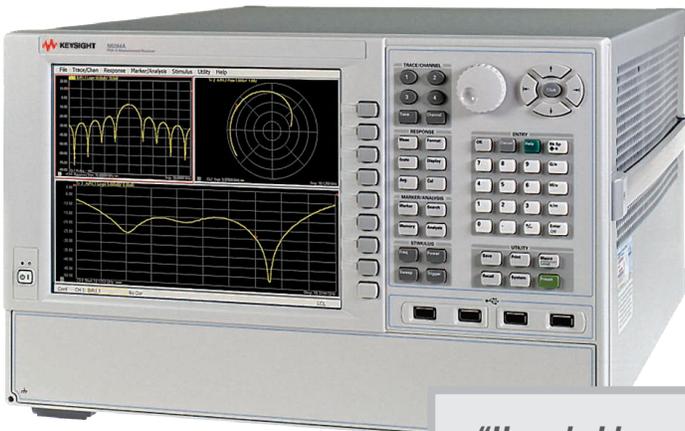
The lab’s 8530A had reached the end of its support life, and lab managers couldn’t risk system downtime. However, they had only a limited budget to use for updating their system.

### Solving the problem

The R&D center couldn’t afford to buy a network analyzer that could be used both as an antenna receiver and as a general-purpose instrument. The center’s Keysight field engineer suggested a lower-cost solution, a dedicated antenna receiver, and showed them how the N5264A PNA-X measurement receiver for antenna test could meet their current needs and allow them to leverage as much as possible of their existing test system’s hardware and software. The field engineer also demonstrated how the N5264A could save them money in the future by allowing them to add components that increase capacity as technology evolves.

### Results

The R&D center got the new technology it needed without exceeding its budget by replacing its 8530A microwave receiver with the N5264A PNA-X receiver. The N5264A’s code emulation capability allowed the center to continue to use the other components of its existing RF-subsystem, such as signal sources and mixers, without having to rewrite code for its test system.



### *“How do I know the N5264A will save me money?”*

- A dedicated antenna receiver keeps you from paying extra for hardware unrelated to antenna characterization.
- Pay less to update your system as technology evolves—for example, upgrade just the CPU board for faster measurements.

### TALK TO AN EXPERT

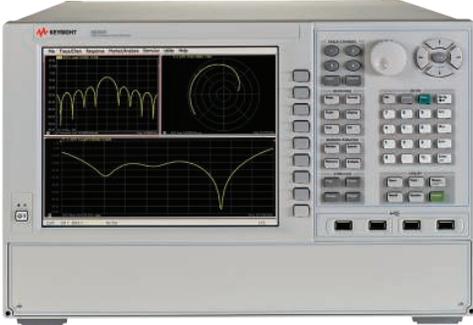
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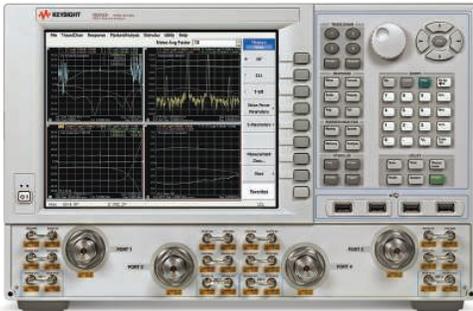
Characterize your antennas more thoroughly in less time with Keysight antenna test tools



**Keysight N5183A MXG**  
*microwave analog signal generator*



**Keysight N5264A PNA-X**  
*measurement receiver*



**Keysight N5242A PNA-X**  
*microwave network analyzer*



**Keysight E8257D PSG**  
*analog signal generator*



**Keysight 85309A LO/IF**  
*distribution unit*



**Keysight 85320A/B**  
*test mixer module*

## Selection Guide

Applications	Typical system configuration	Key capabilities	Benefits
<b>Far-field</b>	<ul style="list-style-type: none"> <li> N5264A Opt. 108 PNA-X measurement receiver (dedicated receiver)</li> <li> N5183A Opt. 5x0 and Opt. UNZ MXG analog microwave signal generator</li> <li> 85309A LO/IF distribution unit</li> <li> 85320A test mixer (Opt. H50 for 50 GHz)</li> <li> 85320B reference mixer (Opt. H50 for 50 GHz)</li> </ul>	<p>Faster measurement throughput (120 <math>\mu</math>Sec/freq point)</p> <p>N5264A Opt. 108 RF source can be used as an LO source for remote mixers or frequency down converters</p>	<p>Complete your testing 2-3 times faster than with a 8530A-based system</p> <p>Get MXG measurement speed at a lower cost</p> <p>Reduce the cost of test using a N5264A dedicated antenna receiver</p>
<b>Far-field</b>	<ul style="list-style-type: none"> <li> N5264A PNA-X measurement receiver (dedicated receiver)</li> <li> N5183A Opt. 5x0 and Opt. UNZ MXG analog microwave signal generator (Tx source)</li> <li> E8257D Opt. 5xx and Opt. UNX PSG analog signal generator (LO sources)</li> <li> 85309A LO/IF distribution unit</li> <li> 85320A Test mixer (Opt. H50 for 50 GHz)</li> <li> 85320B Reference mixer (Opt. H50 for 50 GHz)</li> </ul>	<p>Highest measurement sensitivity (3 to 5 dBm more than 8530A-based system)</p> <p>Acceptable measurement throughput (9.50 mSec/freq point)</p>	<p>Characterize complex antennas that require the highest measurement sensitivity, today and in the future</p>
<b>Far-field</b>	<ul style="list-style-type: none"> <li> N524xA Opt. 020 PNA-X or E836xC PNA Opt. H11 vector network analyzer as antenna receiver</li> <li> N5183A Opt. 5x0 and Opt. UNZ MXG analog microwave signal generator (Tx source)</li> <li> 85309A LO/IF distribution unit</li> <li> 85320A test mixer (Opt. H50 for 50 GHz)</li> <li> 85320B reference mixer (Opt. H50 for 50 GHz)</li> </ul> <p>830xxA amplifier with 87421A DC power supply (to be used with PNA-X rear LO output or PNA Opt. H11 rear LO output)</p>	<p>Faster measurement throughput (120 <math>\mu</math>Sec/freq point)</p> <p>Full PNA-X vector network analyzer applications</p>	<p>Complete your testing 2-3 times faster than with a 8530A-based system</p> <p>Get more from your investment in test equipment</p>
<b>Far-field or near-field (large scanner)</b>	<ul style="list-style-type: none"> <li> N524xA Opt. 118 or N5230C Opt. xx5 or E836xC Opt. 014 vector network analyzer as antenna receiver</li> </ul> <p>U3020AY01 remote head controller</p> <p>U3020AY02 test port extension module (Qty. 2)</p>	<p>Forward and reverse transmission</p> <p>N524xA Opt. 118 fast-CW mode (CW mode 2.5 <math>\mu</math>Sec/pt or 120 <math>\mu</math>Sec/pt swept mode)</p> <p>N5230C Opt. xx5 (300 <math>\mu</math>Sec/pt swept mode)</p> <p>E836xC Opt. 014 (675 <math>\mu</math>Sec/pt swept mode)</p> <p>Use full network analyzer applications for general usage</p>	<p>Reduce hardware cost</p> <p>Simplify system configuration (maintain VNA performance—dynamic range, noise floor, and more—while extending test ports)</p> <p>Fast measurement speed (get testing done faster)</p> <p>Get more from your investment in test equipment</p>
<b>Compact range or near-field</b>	<ul style="list-style-type: none"> <li> N524xA Opt. 020 and Opt. 118 PNA-X vector network analyzer as antenna receiver</li> </ul>	<p>Faster measurement throughput (120 <math>\mu</math>Sec/freq point)</p> <p>Use the PNA-X vector network analyzer as a general-purpose instrument</p>	<p>Over 50 times faster than 8530A based system</p> <p>Get more from your investment in test equipment</p>
<b>RF pulsed</b>	<ul style="list-style-type: none"> <li> N524xA Opt. 021 and Opt. 025 PNA-X vector network analyzer as antenna receiver</li> </ul>	<p>Built-in pulse generators and modulator</p>	<p>Simple system configuration</p>

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