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Communication networks are moving from voice and data communications to full-blown connected application ecosystems. Technological innovations will support the consolidation of communication systems under one 5G roof to meet end-user application needs. This includes data, voice, video, Internet of Things (IoT), and crucial communications. The 5G connected application ecosystem will provide much higher throughput, ultra-low latency, dramatically increased network capacity, reliability, and secure services.

The aerospace and defense (A / D) industry triggered many of these commercial communications technologies. The industry continues to push the boundaries of what is possible in threat detection, sophisticated military communications, and Low-Earth Orbit (LEO) satellites.

You are inventing technologies to support paradigm shifts. Your innovations will make communication networks more efficient, support broader frequency ranges, and much wider bandwidth requirements. 5G, IoT, and WLAN-enabled devices will give users widespread availability of high-speed coverage and support for data-intensive applications. Satellites and other devices will provide multiple-input and multiple-output (MIMO) functionality and greater spectral efficiency.

Your technological advances are bigger than ever and moving faster than ever — all of which pose complex test challenges.
The technology shift in communications presents unchartered territory for many RF engineers. Some of the challenges you may experience are:

- characterizing a millimeter-wave air interface
- identifying potential interference issues
- ensuring compliance with evolving standards
- learning about RF design
- capturing out-of-band emissions
- field-testing an expanding wireless ecosystem

Keysight offers signal analysis solutions to address your toughest test challenges.

New to RF Design?  
We’ll help you get up to speed on RF test.

Stay in sync with evolving wireless standards

Achieve high-speed, multi-channel test

Acquire the performance edge in wideband, millimeter-wave measurement

Demodulate and analyze your most complex signals

Ensure EMI compliance and pre-compliance

Field test wireless networks

N9041B UXA Signal Analyzer, Multi-touch
New to RF Design?  
We’ll Help You Get Up to Speed on RF Test.

RF design and test does not have to break your budget. Our entry-level signal analyzer and signal generator provide an easy-to-use, solid foundation for accurate, cost-effective testing in general-purpose applications.

**TODAY’S LEADING ENTRY-LEVEL RF INSTRUMENTS FOR ESSENTIAL SIGNAL CHARACTERIZATION**

- Make essential frequency and power measurements with superior level accuracy.
- Do more with PowerSuite such as adjacent channel power (ACP), complementary cumulative distribution function (CCDF), and EMC emission measurement.
- Dig deeper into your wireless devices with PathWave X-Series measurement applications on the CXA for further digital demodulation analysis.
- Pair the N9000B CXA X-Series signal analyzer with the N5166B CXG RF vector signal generator for industrial IoT/consumer electronics characterization.

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**View Keysight’s X-Series signal analyzers**

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>Maximum analysis bandwidth</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>DANL at 1 GHz</th>
<th>Third-order intermodulation distortion (TOI) at 3 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>N9000B CXA signal analyzer</td>
<td>26.5 GHz</td>
<td>25 MHz</td>
<td>-110 dBc / Hz</td>
<td>-150 dBm</td>
<td>+13 dBm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>Maximum RF bandwidth (internal / external)</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Frequency switching</th>
<th>Maximum output power at 1 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>N5166B CXG signal generator</td>
<td>6 GHz</td>
<td>120 MHz / 200 MHz</td>
<td>-119 dBc / Hz</td>
<td>5 ms</td>
<td>+18 dBm</td>
</tr>
</tbody>
</table>
RESOURCES TO HELP YOU GET STARTED TODAY

KEYSIGHT’S ENGINEERING EDUCATION WEBINAR SERIES

Learn what you need to know about RF measurements. Our webinars cover concepts from RF basics to advanced methods for RF testing. Our popular webinars, Spectrum Analysis Fundamentals, and RF Back to Basics take you through the theory behind signal analysis, the many measurements you can make with a signal analyzer, and how to evaluate instrument specifications.

Keysight also offers more advanced courses such as signal analysis for 5G and automotive applications.

Browse and register for Keysight’s Engineering Education Webinars.

More free classes are available at Keysight University.
Stay in Sync with Evolving Wireless Standards

SIGNAL ANALYZERS WITH PERFORMANCE AND FLEXIBILITY TO EVOLVE AS STANDARDS CHANGE

- Increase throughput and yield while minimizing costs, an essential component of base station manufacturing.
- Develop and deliver new wireless devices using best-in-class phase noise performance.
- Meet your 5G NR requirements with error vector magnitude (EVM) as low as 0.5% and real-time analysis (RTSA) bandwidth of up to 510 MHz.
- Reduce test time with enhanced frequency sweep algorithm without compromising performance.

View Keysight’s X-Series signal analyzers

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>Maximum analysis bandwidth</th>
<th>DANL at 1 GHz</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Maximum real-time bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>N9010B EXA X-Series signal analyzer</td>
<td>44 GHz Mixers to 1.1 THz</td>
<td>40 MHz</td>
<td>-172 dBm</td>
<td>-109 dBc / Hz</td>
<td>N / A</td>
</tr>
<tr>
<td>N9020B MXA X-Series signal analyzer</td>
<td>50 GHz Mixers to 1.1 THz</td>
<td>160 MHz</td>
<td>-172 dBm</td>
<td>-114 dBc / Hz</td>
<td>160 MHz</td>
</tr>
<tr>
<td>N9021B MXA X-Series signal analyzer</td>
<td>50 GHz Mixers to 1.1 THz</td>
<td>510 MHz</td>
<td>-172 dBm</td>
<td>-130 dBc / Hz</td>
<td>510 MHz</td>
</tr>
</tbody>
</table>
KEYSIGHT’S PATHWAVE X-SERIES MEASUREMENT APPLICATIONS SOFTWARE HELPS YOU STAY CURRENT ON WIRELESS STANDARDS

Transform your signal analyzer with X-Series measurement applications. Address ever-changing measurement requirements with over 25 signal analysis applications for cellular communications, wireless connectivity, digital video, and general-purpose measurements. Characterize device performance from phase noise, noise figure, and pulse measurements to the latest wireless standards-compliant signals including 5G, LTE, IoT, and WLAN.

Try out the software free of charge

POPULAR SOFTWARE APPLICATIONS

<table>
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<tr>
<th>Application</th>
<th>Description</th>
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<tr>
<td>Analog demodulation</td>
<td>Perform modulation analysis for AM, FM, PM and FM Stereo signals with information bandwidth.</td>
</tr>
<tr>
<td>Noise figure</td>
<td>Perform noise figure and gain measurements from 10 MHz to 50 GHz.</td>
</tr>
<tr>
<td>Phase noise</td>
<td>Perform measurements for analyzing phase noise in frequency domain (log plot) and time domain (spot frequency).</td>
</tr>
<tr>
<td>5G NR</td>
<td>Perform 5G New Radio (5G NR) transmitter downlink and uplink measurements.</td>
</tr>
<tr>
<td>Short range communications</td>
<td>Perform ZigBee®, Z-Wave, and LoRa CSS RF transmitter tests.</td>
</tr>
<tr>
<td>WLAN 802.11ac/ax</td>
<td>Perform spectrum and power measurements: channel power, SEM, OBW, CCDF, spurious emission, power versus time, and spectral flatness.</td>
</tr>
</tbody>
</table>

View all PathWave X-Series measurement applications
ACHIEVE MAXIMUM VALUE WITH GOOD, BETTER, AND BEST BUNDLES

Save time and money by taking advantage of bundle options for both signal analyzers and signal generators. Choose from signal analyzers bundles including the EXA or MXA with discounts up to 25%. Pair your savings for signal analyzers with a signal generator bundle, also offering discounts of up to 25% on the EXG or MXG.

Learn More
### Achieve High-Speed, Multichannel RF Test

Drive down the size of test with multifunction testers that deliver high performance, with the scalable, high-speed PXI platform.

#### SPEED, SCALABILITY, AND A SMALL FOOTPRINT

- Generate and analyze multiple, synchronized RF signals.
- Accelerate your test capabilities with low latency and high throughput PCI Express® architecture.
- Perform trusted, repeatable measurements with PathWave X-Series measurement applications and PathWave vector signal analysis (VSA) software.
- Deploy a smaller footprint with no trade-off in precision when transitioning between R&D, manufacturing, and maintenance.

### Table: Product Specifications

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>Maximum analysis bandwidth</th>
<th>DANL at 1 GHz</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Number of slots</th>
</tr>
</thead>
<tbody>
<tr>
<td>M9290A CXA-m PXle® signal analyzer</td>
<td>26.5 GHz</td>
<td>25 MHz</td>
<td>-163 dBm</td>
<td>-110 dBC / Hz</td>
<td>4</td>
</tr>
<tr>
<td>M9391A PXle vector signal analyzer</td>
<td>6 GHz</td>
<td>160 MHz</td>
<td>-161 dBm</td>
<td>-119 dBC / Hz</td>
<td>4</td>
</tr>
<tr>
<td>M9393A PXle performance vector signal analyzer</td>
<td>27 GHz</td>
<td>160 MHz, 1 GHz IF output</td>
<td>-168 dBm</td>
<td>-110 dBC / Hz</td>
<td>5</td>
</tr>
<tr>
<td>M9410A / M9411A VXT PXle vector transceivers</td>
<td>6 GHz</td>
<td>1.2 GHz</td>
<td>-159 dBm</td>
<td>-130 dBC / Hz</td>
<td>M9410A: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>M9411A: 3</td>
</tr>
<tr>
<td>M9421A VXT PXle vector transceiver</td>
<td>6 GHz</td>
<td>160 MHz</td>
<td>-160 dBm</td>
<td>-111 dBC / Hz</td>
<td>4</td>
</tr>
</tbody>
</table>

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### M9410A VXT PXle vector transceiver

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Signal Analysis Solutions Catalog | I 10
Your applications require the utmost in reliability and performance. Acquire the performance edge with Keysight’s top of the line high frequency, wideband signal analyzers, and specialized software.

GET MAXIMUM PERFORMANCE FOR HIGHER FREQUENCY APPLICATIONS

- Analyze real-world environments and challenging wideband OFDM signals with up to 510 MHz bandwidth with the Keysight N9030B, and 1 GHz on Keysight’s N9040B and N98041B.

- Characterize today’s most challenging signals — fast-hopping, wideband, and transient — while using one-touch measurements for 5G, 802.11ax/ay, satellite, radar, EW, and more.

- Catch impurities early with wide spurious-free dynamic range and improved phase noise.

View Keysight’s X-Series signal analyzers

BUILD A COMPLETE SIGNAL ANALYSIS SOLUTION

Need microwave test accessories to complete your test setup? Keysight offers the most comprehensive selection including preamplifiers, comb generators, connectors, and switches.

View Keysight’s X-Series signal analyzers

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<th>Product</th>
<th>Maximum frequency</th>
<th>Maximum analysis bandwidth (internal / external)</th>
<th>DANL at 1 GHz</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Maximum real-time bandwidth</th>
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</thead>
<tbody>
<tr>
<td>N9030B PXA X-Series signal analyzer</td>
<td>50 GHz Mixers to 1.1 Thz</td>
<td>510 MHz</td>
<td>-174 dBm</td>
<td>-136 dBc / Hz</td>
<td>510 MHz</td>
</tr>
<tr>
<td>N9040B UXA X-Series signal analyzer</td>
<td>50 GHz Mixers to 1.1 Thz</td>
<td>1 GHz</td>
<td>-174 dBm</td>
<td>-135 dBc / Hz</td>
<td>510 MHz</td>
</tr>
<tr>
<td>N9041B UXA X-Series signal analyzer</td>
<td>110 GHz Mixers to 1.1 Thz</td>
<td>1 GHz / 5 GHz</td>
<td>-174 dBm</td>
<td>-135 dBc / Hz</td>
<td>255 MHz</td>
</tr>
</tbody>
</table>
N9041B UXA X-Series signal analyzer
REACH HIGHER FOR MILLIMETER-WAVE APPLICATIONS USING KEYSIGHT SMART MIXERS

Extend your measurement capabilities with the EXA, PXA, MXA, and UXA signal analyzers up to 110 GHz using smart mixers. Using a simple USB connection, the mixers can automatically configure the signal analyzer in use.

DON’T SACRIFICE THE BENEFITS OF MILLIMETER-WAVE EQUIPMENT

Millimeter-wave frequency measurements require precision and care. Download the eBook to get four best practices for making measurements and maintaining your high-performance equipment.

Learn More

Download eBook
Troubleshoot your most complex signals at any point in your design. When you need to isolate the sources of unexpected interactions or verify signal problems quickly with multiple, simultaneous views, use PathWave vector signal analysis (VSA) software, a comprehensive set of tools for demodulation and vector signal analysis.

EXPLORE VIRTUALLY EVERY FACET OF A SIGNAL AND OPTIMIZE ADVANCED DESIGNS WITH PATHWAVE VSA SOFTWARE

- Make application-specific measurements, such as IoT modulation analysis, pulsed modulated radar signal analysis, multiple linear chirp FM modulated signals, and automotive radar.
- Evaluate and troubleshoot proprietary signals and modulation types to determine the root cause of signal problems with advanced troubleshooting tools.
- Verify signal problems quickly with multiple simultaneous views.
- Apply vector signal analysis across your design process. VSA is compatible with over 45 Keysight hardware platforms, including spectrum and signal analyzers, modular instruments, and oscilloscopes to give you a consistent, repeatable testing platform across teams.
- Choose the best licensing arrangement — perpetual or time-based.
PATHWAVE VSA SOFTWARE GIVES YOU ACCESS TO OVER 75 SIGNAL STANDARDS AND MODULATION TYPES.

- cellular communications
- wireless connectivity
- aerospace, defense, and satellite
- radar pulse
- custom modulation
- plus many others

Learn more

TRY OUT PATHWAVE VECTOR SIGNAL ANALYSIS (VSA) SOFTWARE

Try PathWave 89600 VSA software with a free 30-day trial. Make measurements with your test instrument or see recorded demo signals on your PC free of charge for 30 days.

Download software trial now
Ensure EMI Pre-Compliance and Compliance

Avoid any delays in getting a product to market by testing early for electromagnetic interference (EMI). To ensure successful final EMI compliance testing, make pre-compliance testing a part of your product development cycle.

UNCOVER EMI ISSUES EARLY IN THE DESIGN CYCLE

The Keysight PathWave EMI measurement application enables you to perform pre-compliance radiated and conducted emissions measurements with an X-Series signal analyzer. Use scan tables to set up test specifications, identify suspect signals, and more. Easily identify out-of-band device emissions.

MAKE CONDUCTED AND RADIATED EMISSIONS TESTS IN-HOUSE TO REDUCE TEST CYCLE TIMES

- Real-time scan ensures gapless signal capture while simultaneously showing in the frequency domain, time domain, and spectrogram view.
- Easily perform EMI pre-compliance and compliance tests with built-in limit lines and time domain scan.
- Meet requirements set by both commercial and military regulations — CISPR 16-1-1:2019 and MIL-STD-461G compliant.

<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>DANL at 1 GHz</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Real-time bandwidth options</th>
<th>TDS measurement speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>N9038B MXE EMI receiver</td>
<td>44 GHz Mixers to 1.1 THz</td>
<td>-167 dBm</td>
<td>-114 dBc / Hz</td>
<td>160 MHz</td>
<td>3.1 s*</td>
</tr>
<tr>
<td>N9048B PXE EMI receiver</td>
<td>44 GHz Mixers to 1.1 THz</td>
<td>-174 dBm</td>
<td>-114 dBc / Hz</td>
<td>170, 350 MHz</td>
<td>500 ms 100 ms (Accelerated TDS on)*</td>
</tr>
</tbody>
</table>

*Nominal speed, CISPR band C / D, 30 MHz to 1 GHz. Resolution bandwidth (RBW) = 120 kHz, measurement time = 10 ms, peak detector.
INTRODUCTION TO COMPLIANCE MEASUREMENTS

To learn more about making EMI and EMC measurements, and what requirements your devices must meet, read Keysight’s application note, Making EMI Compliance Measurements. In this application note, you will learn the various international regulations on emissions and EMI receivers, plus what types of tests you need to perform to ensure your device meets these standards.

Download application note
Endure the harshest working conditions with integrated analyzers designed for durability. Easy to view, operate, and carry, Keysight’s FieldFox handheld analyzers enable you to keep a versatile, accurate RF testing solution with you, wherever you are.

### NEVER SACRIFICE
**CAPABILITY OR PORTABILITY**

- Verify 5G and LTE base station coverage, beam performance, and handovers with over-the-air demodulation and phased array antenna measurements.
- Ensure wireless interference does not affect service quality by using 100 MHz of real-time analysis bandwidth and a spectrum density display to capture elusive signals.
- Detect and locate bursty, hidden, multipulse electronic warfare RF threats using real-time spectrum analysis in a variety of harsh environmental conditions.
- Monitor satellite earth station antenna sidelobe gain and optimize transmitter performance using spectrum analysis and channel power measurements.
- Bring the lab home with you by carrying an all-in-one, handheld combination analyzer that performs cable and antenna testing, vector network analysis, spectrum analysis, and more.
<table>
<thead>
<tr>
<th>Product</th>
<th>Maximum frequency</th>
<th>Max real-time analysis bandwidth</th>
<th>DANL at 1 GHz</th>
<th>Total amplitude accuracy</th>
<th>TOI at 2.4 GHz</th>
<th>Phase noise at 1 GHz (10 kHz offset)</th>
<th>Spur-free dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>N9913B FieldFox handheld microwave analyzer</td>
<td>4 GHz</td>
<td>100 MHz</td>
<td>-163 dBm</td>
<td>±0.3 dB</td>
<td>+13 dBm</td>
<td>-117 dBc / Hz</td>
<td>&gt;104 dB</td>
</tr>
<tr>
<td>N9914B FieldFox handheld microwave analyzer</td>
<td>6.5 GHz</td>
<td>100 MHz</td>
<td>-163 dBm</td>
<td>±0.3 dB</td>
<td>+13 dBm</td>
<td>-117 dBc / Hz</td>
<td>&gt;104 dB</td>
</tr>
<tr>
<td>N9918B FieldFox handheld microwave analyzer</td>
<td>26.5 GHz</td>
<td>100 MHz</td>
<td>-163 dBm</td>
<td>±0.3 dB</td>
<td>+13 dBm</td>
<td>-117 dBc / Hz</td>
<td>N/A</td>
</tr>
<tr>
<td>N9950A FieldFox handheld microwave analyzer</td>
<td>32 GHz</td>
<td>10 MHz</td>
<td>-159 dBm</td>
<td>±0.5 dB</td>
<td>+16 dBm</td>
<td>-111 dBc / Hz</td>
<td>&gt;104 dB</td>
</tr>
<tr>
<td>N9951A FieldFox handheld microwave analyzer</td>
<td>44 GHz</td>
<td>10 MHz</td>
<td>-159 dBm</td>
<td>±0.5 dB</td>
<td>+16 dBm</td>
<td>-111 dBc / Hz</td>
<td>&gt;104 dB</td>
</tr>
<tr>
<td>N9952A FieldFox handheld microwave analyzer</td>
<td>50 GHz</td>
<td>10 MHz</td>
<td>-159 dBm</td>
<td>±0.5 dB</td>
<td>+16 dBm</td>
<td>-111 dBc / Hz</td>
<td>&gt;104 dB</td>
</tr>
</tbody>
</table>

View FieldFox handheld analyzers
SOFTWARE-ENABLED, FIELD-UPGRADEABLE MEASUREMENT CAPABILITIES.

• Work with over 20 measurement applications on a single user interface that provides customizable parameters for quick measurements up to 50 GHz.

• Stay current with changing measurement requirements by upgrading your handheld analyzer in the field with convenient, user-installable license keys.

• Analyze the spectrum with unprecedented amplitude accuracy and no required warm-up.

• Capture signals as short as 5.52 µs with a 100% probability of intercept.

• Analyze complex signals with PathWave vector signal analysis software.

INVESTIGATE INTERFERENCE ISSUES IN THE FIELD WITH REAL-TIME SPECTRUM ANALYZERS

Interference is everywhere — and traditional analysis is not reliable. This white paper discusses interference sources, the flaws of traditional analysis, and how real-time spectrum analysis (RTSA) improves interference detection.

Download white paper

SIX ESSENTIAL 5G FIELD TESTS USING FIELDFOX HANDHELD ANALYZERS

This eBook explains six essential 5G field tests that FieldFox handheld analyzers perform. Make your 5G transformation smooth with path loss characterization, base station coverage testing, and more.

Download eBook