

# Keysight Technologies

X-Series Signal Analyzers (MXA/EXA)

Single Acquisition Combined Fixed WiMAX™

Measurement Application (N9074A-XFP)

## Technical Overview

The screenshot displays the measurement results for a Combined Fixed WiMAX signal. The interface includes a top status bar with the title 'Combined Fixed WiMAX - Combined Fixed WiMAX', a date/time stamp '11:58:32 PM Nov 24, 2009', and various control buttons like 'ALIGN AUTO', 'SENSE INT', and 'Radio Std: 802.16d'. Below this, a table lists various measurement items and their results. The table is organized into sections: 'TX Power', 'TX Output Spectrum', and 'Reference Channel'. The 'TX Power' section shows measurements for three bursts (Burst1, Burst2, Burst3) with Total Power and Peak PSD values. The 'TX Output Spectrum' section shows measurements for Burst1 with Total Power and Peak PSD values. The 'Reference Channel' section shows measurements for Min Margin Level, Min Margin from Limit Line, and Minimum margin offset frequency, with Pass/Fail status. The 'STATUS' bar at the bottom indicates 'MSG'.

| Measurement                  | Measurement Item                | Result          |
|------------------------------|---------------------------------|-----------------|
| -----TX Power-----           |                                 |                 |
| Burst1                       | Total Power                     | -7.258 dBm      |
|                              | Peak PSD                        | -15.709 dBm/MHz |
| Burst2                       | Total Power                     | -7.257 dBm      |
|                              | Peak PSD                        | -15.708 dBm/MHz |
| Burst3                       | Total Power                     | -7.266 dBm      |
|                              | Peak PSD                        | -15.709 dBm/MHz |
| -----TX Output Spectrum----- |                                 |                 |
| Burst1                       | -----Reference Channel-----     |                 |
|                              | Total Power                     | -7.258 dBm      |
|                              | Peak PSD                        | -15.709 dBm/MHz |
|                              | -----Negative Offset A-----     |                 |
|                              | Min Margin Level                | -86.760 dBm     |
|                              | Min Margin from Limit Line      | -39.846 dB      |
|                              | Minimum margin offset frequency | -3.776 MHz      |
|                              | Pass/Fail                       | Pass            |
|                              | -----Positive Offset A-----     |                 |
|                              | Min Margin Level                | -87.429 dBm     |
|                              | Min Margin from Limit Line      | -38.262 dB      |
|                              | Minimum margin offset frequency | 3.800 MHz       |
|                              | Pass/Fail                       | Pass            |
|                              | -----Negative Offset B-----     |                 |
|                              | Min Margin Level                | -81.807 dBm     |
|                              | Min Margin from Limit Line      | -39.294 dB      |
|                              | Minimum margin offset frequency | 3.800 MHz       |
|                              | Pass/Fail                       | Pass            |



## Introduction

The Keysight Technologies, Inc. N9074A-XFP single acquisition combined Fixed WiMAX measurement application is a breakthrough, high-speed manufacturing test solution available as an option on Keysight's highest speed mid-range, general-purpose X-Series signal analyzers—the MXA (N9020A) and EXA (N9010A).

## Features and Benefits

- Supports IEEE standard 802.16d (802.16-2004)
- Supports demodulation of uplink and downlink signals using IEEE 802.16-2004 modulation formats including BPSK, QPSK, 16QAM and 64QAM
- SCPI<sup>1</sup>-based measurement application allows production familiar remote programming commands for ease-of-test software development
- Flexible selections of predefined parameters allow easy and customizable set-up of the measurements to suit various production test requirements
- Varied measurement methods to meet different needs for best speed or best accuracy
- Supports frequency hopping for broadband and multi-frequency points measurements
- Tabular user interface showing the parameter, measurement, and result lists for easy viewing
- Parameter list view displays SCPI commands, related parameter name and value in one table and is easier to understand than only showing a list of SCPI commands
- Additional RF envelope view provides troubleshooting tool for the time alignment between target signal and the instrument

---

1. SCPI is the abbreviation for Standard Commands for Programmable Instruments.

# Introduction

The increasing complexity of today's mobile devices, driven by the need for multi-frequency/band coverage, support of multiple formats (2G/3G and emerging communication technologies) and multiple applications (phone, multimedia and PDA) combined with ever-increasing pressure to achieve lower cost factors are driving manufacturers to look for ways to reduce test times and test costs for these complex devices. By using general-purpose RF test equipment without any call-processing for production testing, it is possible to apply new measurement processing techniques to drastically reduce the test time required and keep test costs well under control.

The single acquisition combined Fixed WiMAX measurement application allows manufacturers to make measurements much faster than traditional measurements. In the combined measurement applications a single acquisition of data is used for multiple measurements, saving valuable time in comparison to traditional measurements that recapture data for each individual measurement. The N9074A-XFP option is a SCPI-based measurement application with varied parameter setups and a simple user interface. It supports multiple measurements for different signals including frequency hopping signal. The N9074A-XFP option is designed for time-critical tests on the production line, and the high dynamic range of the Keysight signal analyzers ensures that the measurements remain as accurate as possible.

**Single acquisition:** contains one continuous block of captured data using predefined capture settings. The capture period can be defined by test engineers to suit the requirements for specific device tests, for example, how many bursts are required to provide enough data to ensure a good measurement on the DUT.

**Combined measurements:** imply that the measurement sequences performed by the analyzer can accommodate transmitter power measurements and any mix of transmitter output spectrum modulation accuracy measurements performed on the data collected within the capture period.

## Advantages of the combined Fixed WiMAX application measurements

*Acceleration of test speed without required measurement switching and using fewer acquisitions*

Compared with traditional one-button measurements, which limit the "speed" of tests due to measurement switching time (such as from SEM to EVM), the combined Fixed WiMAX measurement application uses SCPI-based programming to configure the X-Series signal analyzer to conduct the specified measurements ahead of time, without measurement switching, and with fewer acquisitions that normally would require processing of the data after each capture is completed.

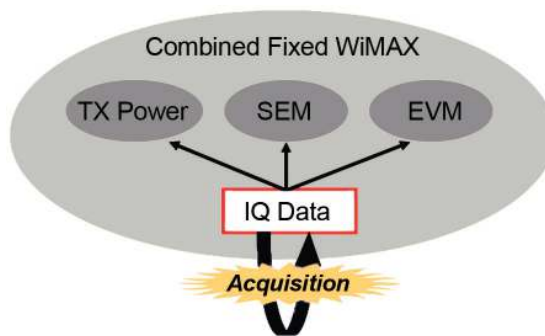


Figure 1. Combined Fixed WiMAX measurement

In order to perform the single acquisition combined measurements, the N9074A-XFP measurement application option requires option B25 to be installed on either the N9020A MXA or N9010A EXA signal analyzer.

## Available measurements:

- Transmit Power
- Transmit Output Spectrum
- Modulation Accuracy

## Measurement overview

The N9074A–XFP combined Fixed WiMAX measurement application is ideal for characterizing the overall PHY layer performance of a Fixed WiMAX signal. Take advantage of standardized tests to evaluate a transmitter against the IEEE standard for manufacturing test.

The N9074A–XFP combined Fixed WiMAX measurement application provides all of the IEEE 802.16d Fixed WiMAX transmitter tests. Through SCPI commands, turn Transmit Output Spectrum measurement and Modulation Accuracy measurement On or Off to assure complete assessment or perform only a few tests to reduce overall test time and speed device evaluation.

The Transmit Power measurement specifies the total power of the transmitted signal, and the power spectral density is also provided.

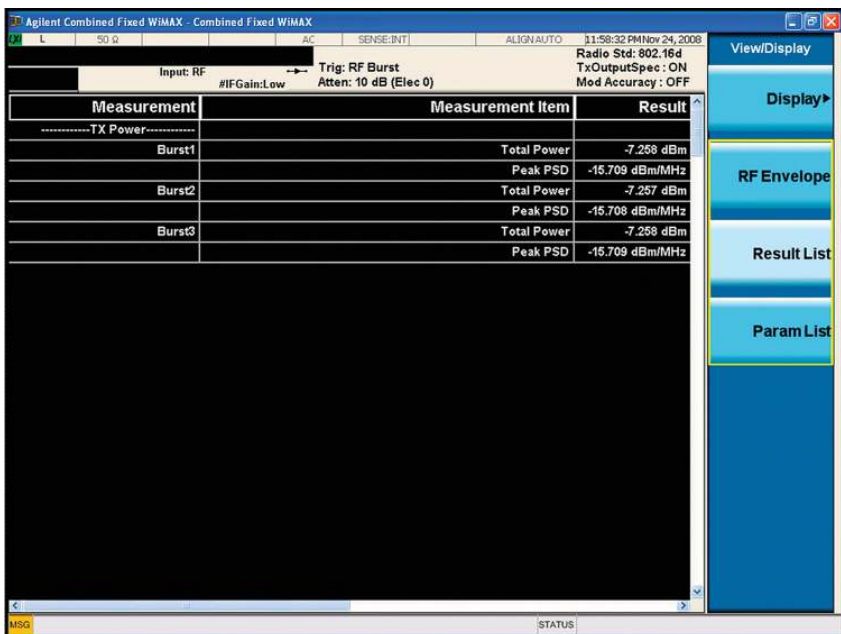


Figure 2. Transmit Power measurement

Transmit Output Spectrum measures spurious signal levels for up to four (A/B/ C/D) pairs of offsets. The specification called out in the standard is used as the default, however, the profile of the test masks can be changed as required by using related SCPI commands. The Pass/Fail sign indicates the result status for each offset.

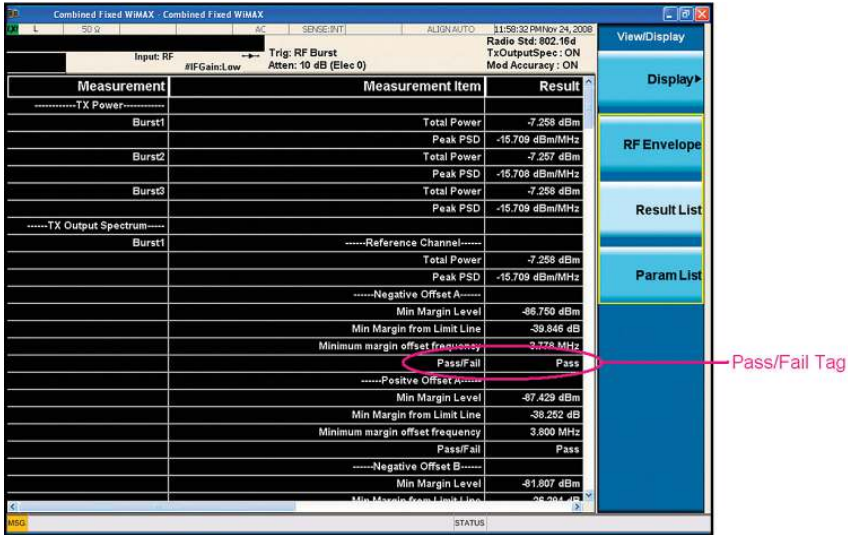


Figure 3. Transmit Output Spectrum measurement

Modulation Accuracy measurement provides the results of Frequency Error, Symbol Error, RMS EVM in dB, RMS EVM in percent, I/Q Offset, Absolute Spectrum Flatness Minimum Margin, Absolute Spectrum Flatness Minimum Margin Pass/Fail flag, Difference Spectrum Flatness Minimum Margin, and Difference Spectrum Flatness Minimum Margin Pass/Fail flag. Figure 4 shows an example of Modulation Accuracy measurement.

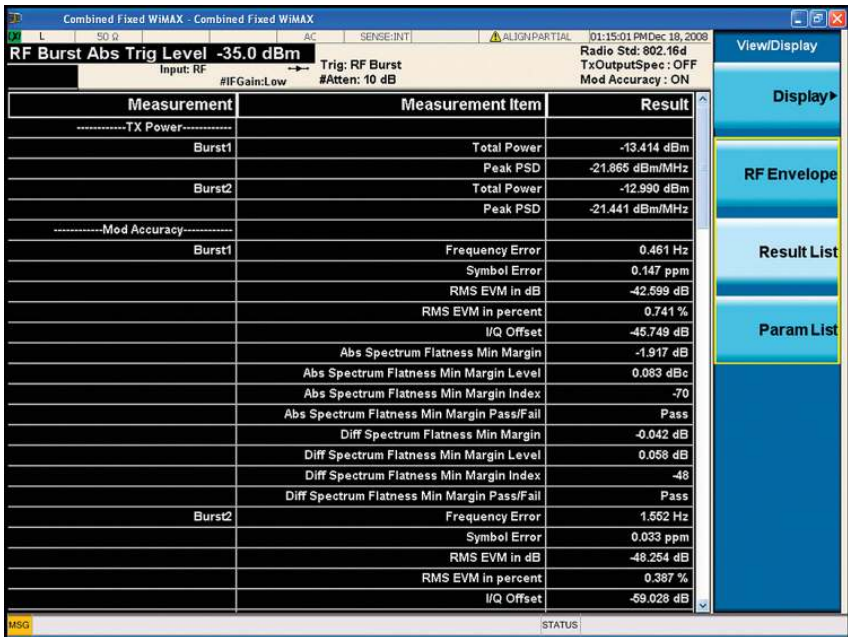


Figure 4. Modulation Accuracy measurement

The N9074A–XFP combined Fixed WiMAX measurement application performs capture according to the capture setup, and after the capture is completed, the acquired data is calculated. The burst setup can be modified for different captures, parameters, and measurements by using SCPI commands. If it is a frequency hopping signal, multiple frequencies in the Center Freq of Burst Setup can be specified and the “Suffix”, which is the time interval for frequency or attenuation change needed by the RF front end, should be designated in the capture setup. There are three types of measurement methods—Best Speed, Balanced, and Best Accuracy to meet specific priorities.

### Greater flexibility of measurement setup

The N9074A-XFP measurement application option provides high flexibility for the setup of combined measurement parameters. Figure 5 shows an example of a parameter list view. Parameter name, with its SCPI command and value, is listed in this view. The list is ordered in SCPI commands and identifying what parameter corresponds to a specific command can be easily found. The value can be verified or modified in three ways—sending SCPI commands, using the menu and front panel keys, or using a mouse and keyboard. This is more convenient than having to access the SCPI programming interface for minor changes.

| Name                               | SCPI   | Value              |
|------------------------------------|--|--------------------|
| EVM Threshold Lower                | :CALCulate:CFWimax:EVM:BURSt:THReshold:LOWer                         | List:Amplitude[36] |
| EVM Threshold Upper                | :CALCulate:CFWimax:EVM:BURSt:THReshold:UPPer                         | List:Amplitude[36] |
| Abs Spectral Flatness Lower Limit  | :CALCulate:CFWimax:EVM:LiMIt:SPECTrum:AMPFlatness:ABSolute:LOWer     | List:Amplitude[2]  |
| Abs Spectral Flatness Upper Limit  | :CALCulate:CFWimax:EVM:LiMIt:SPECTrum:AMPFlatness:ABSolute:UPPer     | List:Amplitude[2]  |
| Diff Spectral Flatness Lower Limit | :CALCulate:CFWimax:EVM:LiMIt:SPECTrum:AMPFlatness:DIFFerential:LOWer | -0.10 dB           |
| Diff Spectral Flatness Upper Limit | :CALCulate:CFWimax:EVM:LiMIt:SPECTrum:AMPFlatness:DIFFerential:UPPer | 0.10 dB            |
| Tx Output Spectrum Limit Level     | :CALCulate:CFWimax:TOSPECTrum:LiMIt:DATA                             | List:Amplitude[4]  |
| View Selection                     | :DISPlay:CFWimax:VIEW:SELEct   | PARAMeter          |
| X Auto Scaling                     | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:X:SCALe:COUPle                 | On                 |
| X Scale Div                        | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:X:SCALe:PDIVision              | 400.0 ps           |
| X Ref Value                        | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:X:SCALe:RLEVel                 | 0.000 s            |
| X Ref Position                     | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:X:SCALe:RPOSiTion              | Left               |
| Y Auto Scaling                     | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:Y:SCALe:COUPle                 | Off                |
| Y Scale Div                        | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:Y:SCALe:PDIVision              | 10.00 dB           |
| Y Ref Level                        | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:Y:SCALe:RLEVel                 | 10.00 dBm          |
| Y Ref Position                     | :DISPlay:CFWimax:VIEW:1SWNDow:1:TRACe:Y:SCALe:RPOSiTion              | Top                |
| Arrival Time Uncertainty           | :SENSe:CFWimax:CAPTure:ATUncertain                                   | 0.000 s            |
| Burst Attenuation                  | :SENSe:CFWimax:CAPTure:BURSt:ATTenuation                             | List:Amplitude[36] |
| Burst Frequency                    | :SENSe:CFWimax:CAPTure:BURSt:FREQuency                               | List:Frequency[36] |
| Gate Source                        | :SENSe:CFWimax:CAPTure:BURSt:GATE:SOURCE                             | List:Enum[36]      |
| Burst Length                       | :SENSe:CFWimax:CAPTure:BURSt:LOAD                                    | List:Time[36]      |
| Burst Number                       | :SENSe:CFWimax:CAPTure:BURSt:NUMBER                                  | 2                  |
| Burst Prefix                       | :SENSe:CFWimax:CAPTure:BURSt:PREFIX                                  | List:Time[36]      |
| Burst Suffix                       | :SENSe:CFWimax:CAPTure:BURSt:SUFFIX                                  | List:Time[36]      |
| Burst Type                         | :SENSe:CFWimax:CAPTure:BURSt:TYPE                                    | DYNAMIC            |
| Capture Offset                     | :SENSe:CFWimax:CAPTure:OFFSet  | 0.000 s            |
| Mod Accuracy Start Burst           | :SENSe:CFWimax:EVM:BURSt:STARt                                       | 1                  |
| Mod Accuracy Stop Burst            | :SENSe:CFWimax:EVM:BURSt:STOP  | 2                  |
| Mod Accuracy Modulation Format     | :SENSe:CFWimax:EVM:DEMod   | AUTO               |
| Mod Accuracy Enable                | :SENSe:CFWimax:EVM:ENABle  | On                 |

Figure 5. Parameter List view

## Simplified user interface for reduced processing overhead allows for highest speed

The user interface of the N9074A-XFP measurement application option is designed for maximum efficiency. All of the results listed in the Result List view can be queried by SCPI commands (see Figures 2, 3, and 4).

## Comprehensive user interface for troubleshooting

For troubleshooting or diagnostic purposes, the N9074A-XFP measurement application option provides a graphical user interface that displays measurement traces. The RF Envelope view is useful for setting time alignment between target signal and the instrument. Figure 6 shows a view of an RF envelope. In this view, the instrument acquires a trace with two bursts for demodulation. The RF Envelope view can be turned off during the measurement for higher speed.

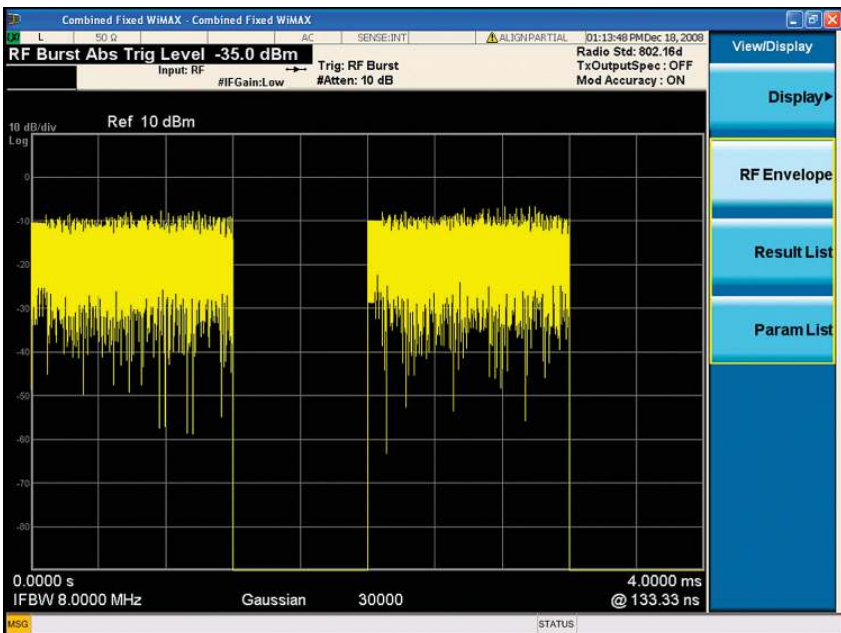


Figure 6. RF Envelope view

## Key Specifications

| N9074A-XFP single acquisition combined Fixed WiMAX measurement application |                |                          |
|--|----------------|--------------------------|
| Description  | N9020A MXA     | N9010A EXA               |
| <b>Transmit power</b>  |                |                          |
| Absolute power accuracy<br>20 to 30 °C                                     | ±1.29 dB       | ±1.46 dB                 |
| <b>Spectrum emission mask</b>  |                |                          |
| 10 MHz Integration BW<br>RBW = 100 kHz<br>5.05 MHz offset<br>Accuracy      |                |                          |
| Relative   | ±0.63 dB       | ±0.63 dB                 |
| Absolute<br>20 to 30 °C  | ±1.37 dB       | ±1.55 dB                 |
| Description  | Specifications | Supplemental information |
| <b>64QAM EVM</b>   |                |                          |
| EVM  |                |                          |
| Operating range  | 0.1 to 8%      | 0.1 to 8%                |
| Floor  | -48 dB (0.37%) | -45 dB (0.57%)           |
| Accuracy   |                |                          |
| from 0.5% to 2%  | ±0.20%         | ±0.30%                   |
| from 2% to 8%  | ±0.10%         | ±0.10%                   |

## Ordering Information

Below you will find information on how to order your X-Series signal analyzer with the single acquisition combined Fixed WiMAX measurement application.

For further information, refer to the *MXA Configuration Guide*, literature number 5989-4943EN or the *EXA Configuration Guide*, literature number 5989-6531EN.

| Instruments   | Model number     | Options  |
|---|------------------|--|
| <b>Required options</b>   |                  |  |
| MXA signal analyzer   | N9020A           | 503 or 508 or 513 or 526 – frequency range up to 26.5 GHz        |
| EXA signal analyzer   | N9010A           | 503 or 507 or 513 or 526 – frequency range up to 26.5 GHz        |
| MXA or EXA signal analyzer                                      | N9020A or N9010A | B25 25 MHz analysis bandwidth                                    |
| Single acquisition combined Fixed WiMAX measurement application | N9074A           | XFP  |
| <b>Recommended options</b>                                      |                  |  |
| MXA signal analyzer   | N9020A           | P03 or P08 or P13 or P26 for MXA – Preamplicifier up to 26.5 GHz |
| EXA signal analyzer   | N9010A           | P03 for EXA—Preamplicifier up to 3.6 GHz                         |
| MXA or EXA signal analyzer                                      | N9020A or N9010A | EA3—Electronic attenuator (3.6 GHz)                              |
| EXA signal analyzer   | N9010A           | PC2 dual core processor (standard on MXA)                        |

# Literature Resources

| Literature title  | Number      |
|---|-------------|
| <b>Keysight MXA Signal Analyzers</b>  |             |
| <i>Brochure</i>   | 5989-5047EN |
| <i>Data Sheet</i>   | 5989-4942EN |
| <i>Configuration Guide</i>  | 5989-4943EN |
| <i>Option BBA: Analog Baseband IQ Inputs Technical Overview</i>   | 5989-6538EN |
| <b>Keysight EXA Signal Analyzers</b>  |             |
| <i>Brochure</i>   | 5989-6527EN |
| <i>Data Sheet</i>   | 5989-6529EN |
| <i>Configuration Guide</i>  | 5989-6531EN |
| <b>Keysight X-Series Signal Analyzers (MXA/EXA)</b>   |             |
| <i>Demonstration Guide</i>  | 5989-6126EN |
| <i>X-Series Signal Analyzer Measurement Application Overview</i>  | 5989-8019EN |
| <i>EMI Precompliance Measurements Using MXA/EXA</i>   | 5990-3690EN |
| <i>Analog Demodulation Measurement Application Technical Overview</i>   | 5989-6535EN |
| <i>Noise Figure Measurement Application Technical Overview</i>  | 5989-6536EN |
| <i>Phase Noise Measurement Application Technical Overview</i>   | 5989-5354EN |
| <i>Pulse Measurement Software Technical Overview</i>  | 5990-3801EN |
| <i>W-CDMA, HSDPA/HSUPA Measurement Application Technical Overview</i>   | 5989-5352EN |
| <i>802.16 OFDMA Measurement Application Technical Overview</i>  | 5989-5353EN |
| <i>GSM/EDGE Measurement Application Technical Overview</i>  | 5989-6532EN |
| <i>EDGE Evolution Measurement Application Flyer</i>   | 5989-9837EN |
| <i>cdma2000®, 1xEV-DO Measurement Application Technical Overview</i>  | 5989-6533EN |
| <i>TD-SCDMA Measurement Application Technical Overview</i>  | 5989-6534EN |
| <i>LTE Measurement Application Technical Overview</i>   | 5989-6537EN |
| <i>Single Acquisition Combined WLAN Measurement Application Technical Overview</i>  | 5990-3519EN |
| <i>Single Acquisition Combined Fixed WiMAX® Measurement Application Technical Overview</i>                                  | 5990-3520EN |
| <i>DVB-T/H Measurement Application Technical Overview</i>   | 5990-3569EN |
| <i>DTMB Measurement Application Technical Overview</i>  | 5990-3570EN |
| <i>Remote Language Compatibility Technical Overview</i>   | 5989-6539EN |
| <i>Speed Enhancement and Removable Hard Drive</i>   | 5989-6541EN |
| <i>Using Keysight X-Series Analyzers (MXA/EXA) for Measuring and Troubleshooting Digitally Modulated Signals</i>            | 5989-4944EN |
| <i>Using Keysight X-Series Analyzers (MXA/EXA) Preselector Tuning for Amplitude Accuracy in Microwave Spectrum Analysis</i> | 5989-4946EN |
| <i>Maximizing Measurement Speed with Keysight X-Series Signal Analyzers (MXA/EXA)</i>                                       | 5989-4947EN |
| <i>Making Precompliance Measurements with Option EMC on X-Series Analyzers (MXA/EXA)</i>                                    | 5990-3133EN |
| <b>Keysight VXA Vector Signal Analyzer Measurement Applications</b>   |             |
| <i>VXA Vector Signal Analyzer Measurement Application, Technical Overview</i>   | 5989-7463EN |
| <i>Option AYA Vector Modulation Analysis, Technical Overview</i>  | 5989-7464EN |
| <i>Option B7R WLAN Modulation Analysis, Technical Overview</i>  | 5989-7465EN |

**myKeysight**

myKeysight  
[www.keysight.com/find/mykeysight](http://www.keysight.com/find/mykeysight)  
 A personalized view into the information most relevant to you.



[www.lxistandard.org](http://www.lxistandard.org)  
 LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.



Three-Year Warranty  
[www.keysight.com/find/ThreeYearWarranty](http://www.keysight.com/find/ThreeYearWarranty)  
 Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



Keysight Assurance Plans  
[www.keysight.com/find/AssurancePlans](http://www.keysight.com/find/AssurancePlans)  
 Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



[www.keysight.com/quality](http://www.keysight.com/quality)  
 Keysight Electronic Measurement Group  
 DEKRA Certified ISO 9001:2008  
 Quality Management System

Keysight Channel Partners  
[www.keysight.com/find/channelpartners](http://www.keysight.com/find/channelpartners)  
 Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

cdma2000 is a US registered certification mark of the Telecommunications Industry Association.  
 WiMAX, Mobile WiMAX, WiMAX Forum, the WiMAX Forum logo, WiMAX Forum Certified, and the WiMAX Forum Certified logo are US trademarks of the WiMAX Forum.

[www.keysight.com/find/N9074A](http://www.keysight.com/find/N9074A)  
[www.keysight.com/find/N9074A\\_XFP](http://www.keysight.com/find/N9074A_XFP)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

**Americas**

|               |                  |
|---------------|------------------|
| Canada        | (877) 894 4414   |
| Brazil        | 55 11 3351 7010  |
| Mexico        | 001 800 254 2440 |
| United States | (800) 829 4444   |

**Asia Pacific**

|                    |                |
|--------------------|----------------|
| Australia          | 1 800 629 485  |
| China              | 800 810 0189   |
| Hong Kong          | 800 938 693    |
| India              | 1 800 112 929  |
| Japan              | 0120 (421) 345 |
| Korea              | 080 769 0800   |
| Malaysia           | 1 800 888 848  |
| Singapore          | 1 800 375 8100 |
| Taiwan             | 0800 047 866   |
| Other AP Countries | (65) 6375 8100 |

**Europe & Middle East**

|                |               |
|----------------|---------------|
| Austria        | 0800 001122   |
| Belgium        | 0800 58580    |
| Finland        | 0800 523252   |
| France         | 0805 980333   |
| Germany        | 0800 6270999  |
| Ireland        | 1800 832700   |
| Israel         | 1 809 343051  |
| Italy          | 800 599100    |
| Luxembourg     | +32 800 58580 |
| Netherlands    | 0800 0233200  |
| Russia         | 8800 5009286  |
| Spain          | 0800 000154   |
| Sweden         | 0200 882255   |
| Switzerland    | 0800 805353   |
|                | Opt. 1 (DE)   |
|                | Opt. 2 (FR)   |
|                | Opt. 3 (IT)   |
| United Kingdom | 0800 0260637  |

For other unlisted countries:  
[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)  
 (BP-05-19-14)