Keysight Technologies
1xEV-DO
X–Series Measurement Application
N9076A & W9076A

Technical Overview

KEYSIGHT
TECHNOLOGIES
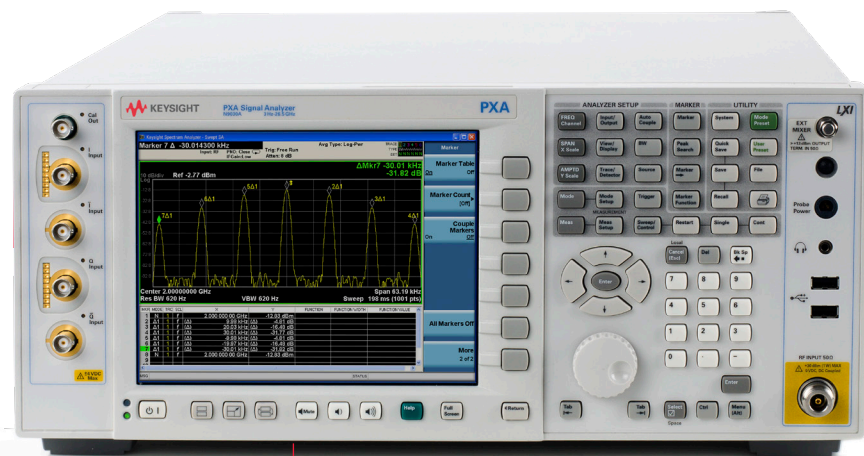
1xEV-DO Measurement Application

– Perform 1xEV-DO forward and reverse link transmitter tests per 3GPP2 standards
– Support 1xEV-DO Rel. 0, Rev. A and Rev. B for single and multi carriers
– Full power and spectrum suite measurements with Pass/Fail indicator
– Use hardkey/softkey manual user interface and SCPI remote user interface
– Leverage built-in context sensitive help
– Move application between X-Series signal analyzers with transportable licensing

The 1xEV-DO measurement application transforms the X-Series signal analyzers into 3GPP2 standard-based transmitter testers. The application provides fast one-button RF conformance measurements to help you design, evaluate, and manufacture your cdma2000® 1xEV-DO base station (Access Network) and mobile station (Access Terminal) devices. The measurement application is fully standard compliant to the 3GPP2 (Rel. 0, Rev. A and Rev. B) helping you to check your 1xEV-DO design with confidence and support manufacturing with a single application covering 1xEV-DO technologies for production.

The 1xEV-DO measurement application is one in a common library of more than 25 measurement applications in the Keysight Technologies, Inc. X-Series, an evolutionary approach to signal analysis that spans instrumentation, measurements and software. The X-Series analyzers, with upgradeable CPU, memory, disk drives, and I/O ports, enable you to keep your test assets current and extend instrument longevity. 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. In addition to fixed, perpetual licenses for our X-Series measurement applications, we also offer transportable licenses which can increase the value of your investment by allowing to you transport the application to multiple X-Series analyzers.

Choosing Between X-Series Applications and 89600 VSA Software

X-Series measurement applications provide embedded format-specific, one button measurements for X-Series analyzers. With fast measurement speed, SCPI programmability, pass/fail testing and simplicity of operation, these applications are ideally suited for design verification and manufacturing. 89600 VSA software is a comprehensive set of tools for demodulation and vector signal analysis. These tools enable you to explore virtually every facet of a signal and optimize your most advanced designs. Use the 89600 VSA software with a variety of Keysight hardware platforms to pinpoint the answers to signal problems in R&D.

www.keysight.com/find/89600vsa

Try Before You Buy!

Free 30-day trials of X-Series measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license online today:

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1xEV-DO Overview

1xEV-DO is standardized by 3rd Generation Partnership Project 2 (3GPP2) as an evolution of cdma2000 technologies that would support high data rates. The 1xEV-DO name means 1x Evolution-Data Optimized or 1x Evolution-Data Only. It uses multiplexing techniques, including code division multiple access (CDMA) as well as time division multiple access (TDMA), to maximize both individual users throughput and the overall system throughput. 1xEV-DO is spectrally compatible with cdma2000, thus the same amplifier, combiners, and antennas can be used on both 1xEV-DO and cdma2000 systems to reduce the installation cost of 1xEV-DO.

There have been several revisions of the 1xEV-DO standard, starting with Release 0 (Rel. 0), which provides air interface data rates of up to 2.4 Mbps on forward links and 153.2 kbps on reverse links. 1xEV-DO Rev. A is a successor to 1xEV-DO Rev. 0. It offers improved peak data rates on both the forward and reverse links. On forward links, peak data rates increase to 3.072 Mbps, while reverse link peak data rates have increased to 1.8 Mbps. Rev. A also offers higher sector capacity within the same 1.25 MHz channel, allowing operators to support more users and richer applications.

1xEV-DO Rev. B is a multi-carrier evolution of the Rev. A. It delivers dramatically improved data rates by aggregation of multiple carriers and high order modulation (64QAM). Typical deployments are expected to include three carriers for a peak rate of 14.7 Mbps on forward links and 5.4 Mbps on reverse links, making it possible to enable new services such as high-definition video streaming. 1xEV-DO Rev. B has backward compatibility with both 1xEV-DO Rel. 0 and Rev. A, allowing Rev. B carriers to continue to support older Rel. 0 and Rev. A devices.

Table 1. Differences in 1x EV-DO Rel. 0, Rev. A and Rev. B standards

	1xEV-DO Rel. 0		1xEV-DO Rev. A		1xEV-DO Rev. B	
	Forward link	Reverse link	Forward link	Reverse link	Forward link	Reverse link
Modulation	QPSK, 8-PSK, 16QAM	BPSK	QPSK, 8-PSK, 16QAM	BPSK, QPSK, 8-PSK	QPSK, 8-PSK, 16QAM, 64QAM	BPSK, QPSK, 8-PSK
Carrier bandwidth	1.25 MHz	1.25 MHz	1.25 MHz	1.25 MHz	20 MHz (15 carriers)[1]	20 MHz (15 carriers)[1]
Peak data rate	2.5 Mbps	153.6 kbps	3.1 Mbps	1.8 Mbps	14.7 Mbps[2]	5.4 Mpbs[2]

1. Rev. B standard supports up to 15 aggregated Rev. A carriers technically.
2. This peak rate for three EV-DO carriers with 64QAM on forward links.

RF Transmitter Tests

With the X-Series signal analyzers and the 1xEV-DO measurement application, you can perform RF transmitter measurements on base stations and mobile stations in time, frequency, code and modulation domains. The measurement application is fully-standard compliant to the 3GPP2 (Rel. 0, Rev. A and Rev. B), helping you to check your 1xEV-DO design with confidence and support manufacturing with a single application covering 1xEV-DO technologies from product development to production.

Standard-based RF transmitter tests

The RF transmitter test requirements for 1xEV-DO are defined in 3GPP2 C.S0032 (base station) and 3GPP2 C.S0033 (mobile station) standards. Table 2 shows the required base station RF transmitter tests along with the corresponding measurements. According to the standard recommendation that is required to use the test equipment with signaling supportable for the mobile devices tests, please refer to the Keysight E1966A for more details.

Table 2. Required base station RF transmitter measurements and the corresponding measurements in N/W9076A and 89600 VSA software

3GPP2 C.S0032 Paragraph #	Transmitter test	X-Series N/W9076A 1xEV-DO measurement application	89601B-B7W 1xEV-DO modulation analysis[1]
4.1.2	Frequency tolerance	Freq error[2]	Freq error[2]
4.2.1	Synchronization and timing	Pilot Offset[3]	Composite error summary (meas chan=Pilot)[3]
4.2.2	Waveform quality	Forward link mod accuracy (waveform quality)	Composite error summary (meas chan=Pilot, MAC or data)
4.3.1	Total power	Power vs. Time	Not available
4.3.2	Pilot/MAC channel power	Power vs. Time	Not available
4.3.3	Code domain power	Forward link code domain	CDP composite
4.4.1	Conducted spurious emissions	ACP and spectrum emission mask	ACP can be performed using marker function; SEM is not available[4]
4.4.2	Radiated spurious emission	Spurious emission	Not available[4]
4.4.3	Inter-sector transmitter intermodulation	Channel power, ACP, SEM, spur emissions or spectrum analyzer mode	Not available[4]
4.4.4	Occupied bandwidth	Occupied BW	Can be performed using marker function[5]

1. 89601B-B7W only supports 1xEV-DO demodulation analysis for Rel. 0.
2. For the N/W9076A application, these values are found in "IQ Measured Polar Graph" view under Forward Link Mod Accuracy (Waveform Quality) measurement. For 89601B-B7W, these values are found under "Composite Error Summary" trace.
3. For the N/W9076A application, these values are found in "Result Metrics" view under Forward Link Mod Accuracy (Waveform Quality) measurement. For 89601B-B7W, these values are found under "Composite Error Summary" trace.
4. If 89601B-B7W is used with a Keysight spectrum or signal analyzer, these measurements are available as part of the spectrum analyzer mode under PowerSuite measurements.
5. Measurement parameters must be set up manually. If 89601B-B7W is used with a Keysight spectrum or signal analyzer, these measurements are available as part of the spectrum analyzer mode under PowerSuite measurements.

Measurement details

All of the RF transmitter measurements as defined by the 3GPP2 standard, as well as a wide range of additional measurements and analysis tools, are available with a press of a button. These measurements are fully-remote controllable via the IEC/IEEE bus or LAN, using SCPI commands. A detailed list of supported measurements is shown in Table 3.

Table 3. One-button measurements for base station provided by the N/W9076A measurement application

Technology	1xEV-DO Rel. 0	1xEV-DO Rev. A	1xEV-DO Rev. B
X-Series measurement application	**N9076A, W9076A**	**N9076A, W9076A**	**N9076A, W9076A**
X-Series signal analyzer	**PXA, MXA, EXA, CXA**	**PXA, MXA, EXA, CXA**	**PXA, MXA, EXA, CXA**
Modulation Accuracy			
Rho	▪	▪	▪
EVM	▪	▪	▪
Peak CDE	▪	▪	▪
Magnitude Error	▪	▪	▪
Phase Error	▪	▪	▪
Frequency Error	▪	▪	▪
I/Q Origin Offset	▪	▪	▪
Active Channels	▪	▪	▪
Pilot Offset	▪	▪	▪
QPSK EVM	▪	▪	▪
Forward Link Code Domain	▪	▪	▪
Channel power	▪	▪	▪
ACP	▪	▪	▪
Power vs Time	▪	▪	▪
Spectrum emission mask	▪	▪	▪
Spurious emissions	▪	▪	▪
Occupied bandwidth	▪	▪	▪
Power Stat CCDF	▪	▪	▪
Monitor spectrum	▪	▪	▪
I/Q waveform	▪	▪	▪

Table 4. One-button measurements for mobile station provided by the N/W9076A measurement application

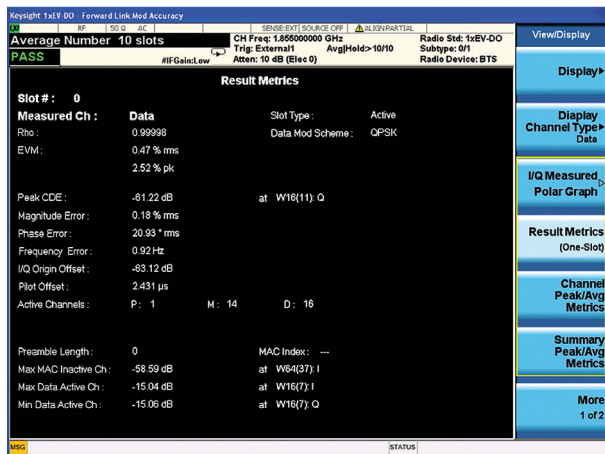| Technology	1xEV-DO Rel. 0	1xEV-DO Rev. A	1xEV-DO Rev. B
X-Series measurement application	N9076A, W9076A	N9076A, W9076A	N9076A, W9076A
X-Series signal analyzer	PXA, MXA, EXA, CXA	PXA, MXA, EXA, CXA	PXA, MXA, EXA, CXA
Modulation accuracy			
Rho	▪	▪	▪
EVM	▪	▪	▪
Peak CDE	▪	▪	▪
Magnitude error	▪	▪	▪
Phase error	▪	▪	▪
Frequency error	▪	▪	▪
I/Q origin offset	▪	▪	▪
Active channels	▪	▪	▪
Pilot offset	▪	▪	▪
QPSK EVM	▪	▪	▪
Reverse link code domain	▪	▪	▪
Channel power	▪	▪	▪
ACP	▪	▪	▪
Spectrum emission mask	▪	▪	▪
Spurious emissions	▪	▪	▪
Occupied bandwidth	▪	▪	▪
Power stat CCDF	▪	▪	▪
Monitor spectrum	▪	▪	▪
I/Q waveform	▪	▪	▪

Figure 1. Forward Link Mod Accuracy (waveform quality) with Result Metrics view
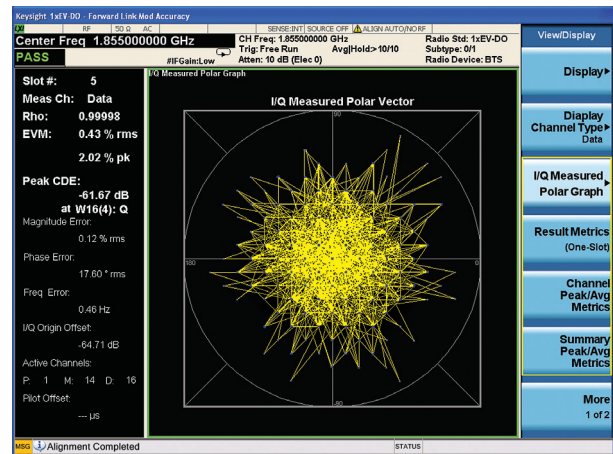

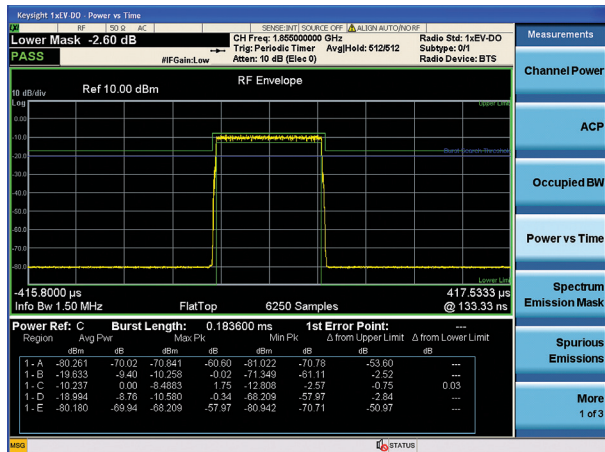Figure 2. Forward Link Mod Accuracy (waveform quality) with I/Q measured Polar Graph
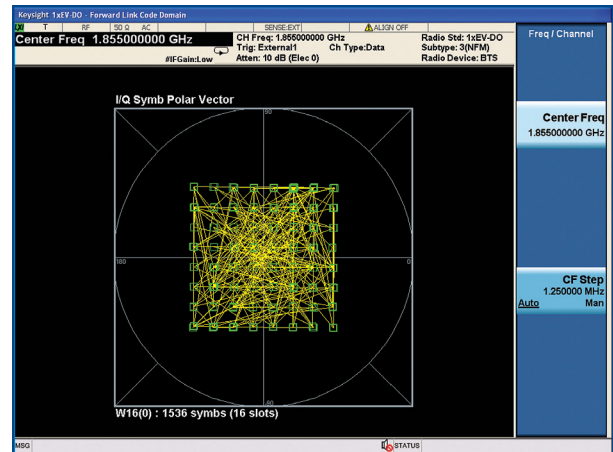

Figure 3. Power vs. Time

Figure 4. Forward Link Code Domain quad view for Rev. B signal with 64QAM

Key Specifications

Definitions

– Specifications describe the performance of parameters.

– 95th percentile values indicate the breadth of the population (≈2σ) of performance tolerances expected to be met in 95% of cases with a 95% confidence.

– Typical values are designated with the abbreviation "typ." These are performance beyond specification that 80% of the units exhibit with a 95% confidence.

– Nominal values are designated with the abbreviation "nom." These values indicate expected performance, or describe product performance that is useful in the application of the product.

– PXA specifications apply to analyzers with frequency options of 526 and lower. For analyzers with higher frequency options, specifications are not warranted but per-formance will nominally be close to that shown in this section.

Note: Data subject to change

You Can Upgrade!

Options can be added after your initial purchase.

All of our X-Series application options are license-key upgradeable.

Performance specifications

Description	PXA	MXA	EXA	CXA
Channel power				
Minimum power at RF input		–50 dBm (nom)		
Absolute power accuracy	± 0.61 dB ± 0.19 dB (95th percentile)	± 0.82 dB ± 0.23 dB (95th percentile)	± 0.94 dB ± 0.27 dB (95th percentile)	± 1.33 dB ± 0.61 dB (95th percentile)
Measurement floor	–90.8 dBm (nom)	–88.8 dBm (nom)	–84.0 dBm (nom)	–83.8 dBm (nom)
Power vs. time				
Minimum power at RF input	–50 dBm (nom)			
Absolute power accuracy (20 to 30 °C)	± 0.19 dB (nom)	± 0.23 dB (nom)	± 0.3 dB (nom)	± 0.6 dB (nom)
Measurement floor	–90.8 dBm (nom)	–88.8 dBm (nom)	–84.8 dBm (nom)	–83.8 dBm (nom)
Relative power accuracy	± 0.11 dB (nom)	± 0.11 dB (nom)	± 0.16 dB (nom)	± 0.31 dB (nom)
Spectrum emission mask and adjacent channel power				
Minimum power at RF input		–20 dBm (nom)		
Dynamic range (relative)				
Offset frequency/integrated bandwidth				
750 kHz/30 kHz	–89.6 dBc (typ)	–85.1 dBc (typ)	–81.0 dBc (typ)	–73.1 dBc (typ)
1980 kHz/30 kHz	–90.6 dBc (typ)	–87.9 dBc (typ)	–83.9 dBc (typ)	–79.7 dBc (typ)
Sensitivity, absolute				
750 kHz/30 kHz	–106.7 dBm (typ)	–104.7 dBm (typ)	–100.7 dBm (typ)	–99.7 dBm (typ)
1980 kHz/30 kHz	–106.7 dBm (typ)	–104.7 dBm (typ)	–104.7 dBm (typ)	–99.7 dBm (typ)
Accuracy, relative				
750 kHz/30 kHz	± 0.04 dB	± 0.09 dB	± 0.09 dB	± 0.09 dB
1980 kHz/30 kHz	± 0.04 dB	± 0.10 dB	± 0.10 dB	± 0.10 dB
Occupied bandwidth				
Minimum power at RF input		–40 dBm (nom)		
Frequency accuracy		± 2 kHz (nom) (RBW = 30 kHz, Number of points = 1001, Span = 2 MHz)		
Power statistics CCDF				
Minimum power at RF input		–40 dBm (nom)		
Histogram resolution		0.01 dB		
Spurious emission				
Dynamic range, relative	107.4 dB (typ)	100.3 dB (typ)	97.1 dB (typ)	86.8 dB (typ)
Sensitivity, absolute	–91.4 dBm (typ)	–89.4 dBm (typ)	–85.4 dBm (typ)	–84.4 dBm (typ)
Accuracy, absolute				
20 Hz to 3.6 GHz (100 kHz to 3.0 GHz for CXA)	± 0.19 dB (95th percentile)	± 0.29 dB (95th percentile)	± 0.41 dB (95th percentile)	± 0.81 dB (95th percentile)
3.5 GHz to 8.4 GHz (3.0 GHz to 7.5 GHz for CXA)	± 1.08 dB (95th percentile)	± 1.17 dB (95th percentile)	± 1.22 dB (95th percentile)	± 1.80 dB (95th percentile)
8.3 GHz to 13.6 GHz	± 1.48 dB (95th percentile)	± 1.54 dB (95th percentile)	± 1.59 dB (95th percentile)	NA

Description	PXA	MXA	EXA	CXA
Code domain (BTS measurements)				
Code domain power				
For pilot, 2MAC channels and 16 channels of QPSK data				
Absolute power accuracy			± 0.15 dB	
Modulation accuracy (composite rho)				
Composite EVM				
Range			0 to 25% (nom)	
Floor	1.5% (nom)	1.5%	1.5%	1.5% (nom)
Accuracy			1.0%	
Composite Rho				
Range			0.94118 to 1.0 (nom)	
Floor	0.99978 (nom)	0.99978	0.99978	0.99978 (nom)
Accuracy			± 0.0010 dB (at Rho 0.99751, EVM 5%) ± 0.0045 dB (at Rho 0.94118, EVM 25%)	
Frequency error				
Range			± 400 Hz (nom) (pilot, MAC, QPSK Data, 8PSK Data)	
Accuracy			± 10 Hz + tfa	
I/Q origin offset				
DUT maximum offset			−10 dBc (nom)	
Analyzer noise floor			−50 dBc (nom)	
QPSK EVM				
EVM				
Range			0 to 25% (nom)	
Floor	1.5% (nom)	1.5%	1.5%	1.6% (nom)
Accuracy			1%	
I/Q origin offset				
DUT maximum offset			−10 dBc (nom)	
Analyzer noise floor			−50 dBc (nom)	
Frequency error				
Range			± 30 kHz (nom)	
Accuracy			± 5 Hz + tfa	

For a complete list of specifications refer to the appropriate specifications guide.

PXA: www.keysight.com/find/pxa_specifications
MXA: www.keysight.com/find/mxa_specifications
EXA: www.keysight.com/find/exa_specifications
CXA: www.keysight.com/find/cxa_specifications

Ordering Information

Software licensing and configuration

Choose from two license types:

- **Fixed, perpetual license:**
  This allows you to run the application in the X–Series analyzer in which it is initially installed.
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Try Before You Buy!

Free 30-day trials of X-Series measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license online today:

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One Button Transmit Analysis Provides Multiple Results

The measurement sequence performed by the analyzer can accommodate any mix of transmitter power measurements and modulation quality measurements performed on the data collected within the capture period.

The table below contains information on our fixed, perpetual licenses. For more information, please visit the product web pages.

N9076A & W9076A 1xEV-DO X-Series measurement application

Description	Model-Option		Additional information
	PXA, MXA, EXA	CXA	
1xEV-DO	N9076A-1FP	W9076A-1FP	

Hardware configuration

N9030A PXA signal analyzer

Description	Model-Option	Additional information
3.6, 8.4, 13.6, 26.5, 43, 44, or 50 GHz frequency range	N9030A-503, -508, -513, -526, -543, -544, or -550	One required
Analog baseband IQ (BBIQ) inputs	N9030A-BBA	Required for analog baseband measurement
Precision frequency reference	N9030A-PFR	Recommended
Electronic attenuator, 3.6 GHz	N9030A-EA3	Recommended
Preamplifier, 3.6, 8.4, 13.6 26.5, 43, 44 or 50 GHz	N9030A-P03, -P08, -P13 or -P26, -P43, -P44, or -P50	One recommended

N9020A MXA signal analyzer

Description	Model-Option	Additional information
3.6, 8.4, 13.6, or 26.5 GHz frequency range	N9020A-503, -508, -513 or -526	One required
Analog baseband IQ (BBIQ) inputs	N9020A-BBA	Required for analog baseband measurement
Precision frequency reference	N9020A-PFR	Recommended
Electronic attenuator, 3.6 GHz	N9020A-EA3	Recommended
Preamplifier, 3.6, 8.4, 13.6 or 26.5 GHz	N9020A-P03, -P08, -P13 or -P26	One recommended

N9010A EXA signal analyzer

Description	Model-Option	Additional information
3.6, 7.0, 13.6, 26.5, 32, or 44 GHz frequency range	N9010A-503, -507, -513, -526, -532, or -544	One required
Precision frequency reference	N9010A-PFR	Recommended
Fine step attenuator	N9010A-FSA	Recommended
Electronic attenuator, 3.6 GHz	N9010A-EA3	Recommended
Preamplifier, 3.6, 7, 13.6, or 26.5 GHz	N9010A-P03, -P07, -P13, or -P26	Recommended

N9000A CXA signal analyzer

Description	Model-Option	Additional information
3.6, 7.5 GHz frequency range	N9000A-503, -507	One required
Precision frequency reference	N9000A-PFR	Recommended
Fine step attenuator	N9000A-FSA	Recommended
Preamplifier, 3.0 or 7.5 GHz	N9000A-P03, -P07	One recommended

Related Literature

Keysight Forward Link Measurements for 1xEV-DO Access Networks, Literature Number 5988-6125EN

PSA Spectrum Analyzer 1xEV-DO Measurement Personality Technical Overview, Literature Number 5988-4828EN

User's and Programmer's Reference Guide is available in the library section of the N9083A and W9083A product pages.

Web

Product page:
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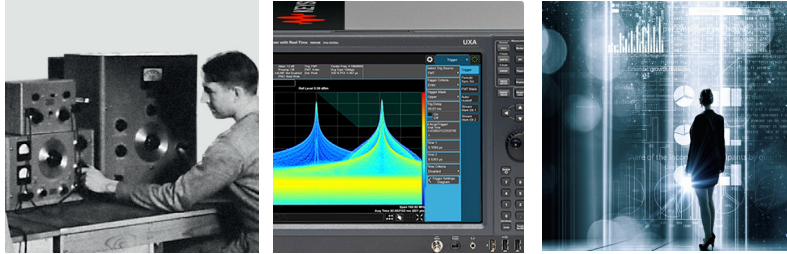www.keysight.com/find/X-Series

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