Keysight Technologies
M9076A 1xEV-DO

X-Series Measurement Application for PXI Vector Signal Analyzers

Technical Overview

KEYSIGHT TECHNOLOGIES

– 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

– PC-based SCPI remote interface and manual user interface

– Leverage built-in context sensitive help with SCPI command reference

– Transportable license supports up to four PXI VSA channels in one mainframe

1xEV-DO X-Series Measurement Application for Modular Instruments

Expand the capabilities of your M9391A and M9393A PXIe vector signal analyzers (PXI VSAs) with the Keysight Technologies, Inc. library of measurement applications – the same applications used to increase the capability and functionality of its X-Series signal analyzers. Eleven of the most popular applications are now available for use with Keysight's new M9393A PXI performance VSA and the M9391A PXI VSA. When you combine the raw hardware speeds of the PXI VSAs and the X-Series measurement applications for modular instruments, you can test more products in less time while ensuring measurement continuity from design to manufacturing.

The 1xEV-DO measurement application transforms PXI VSAs into 3GPP2 standard-based transmitter testers. The application provides fast RF conformance measurements to help you design, evaluate, and manufacture speed up manufacturing of your 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 measurement applications in the Keysight X-Series, an evolutionary approach to signal analysis that spans instrumentation, measurements and software. Proven algorithms, and a common user interface across the X-Series analyzers and modular PXI VSAs 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. You can further extend your test assets by utilizing up to four PXI VSAs with one software license.

Keysight's X-Series applications for modular instruments also include a unique "Resource Manager" that provides direct access to PXI VSA hardware drivers for the fastest power and spectrum-based measurements, while simultaneously using the X-Series applications for fast modulation quality measurements and the 89600 VSA for fast spectrum measurements.

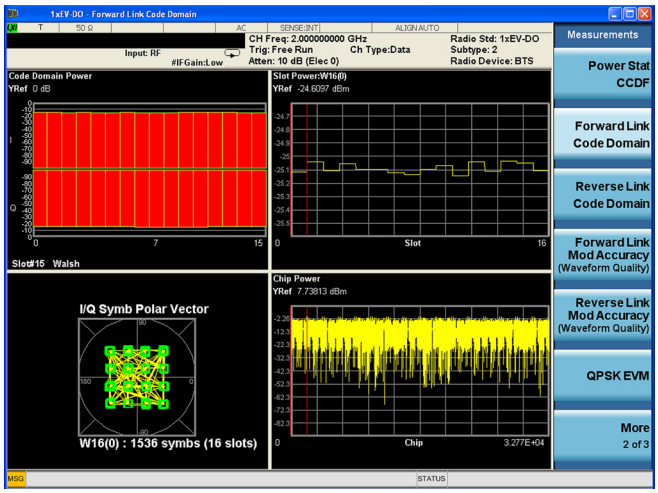

Figure 1. M9076A 1xEV-DO X-Series measurement application for modular instruments.

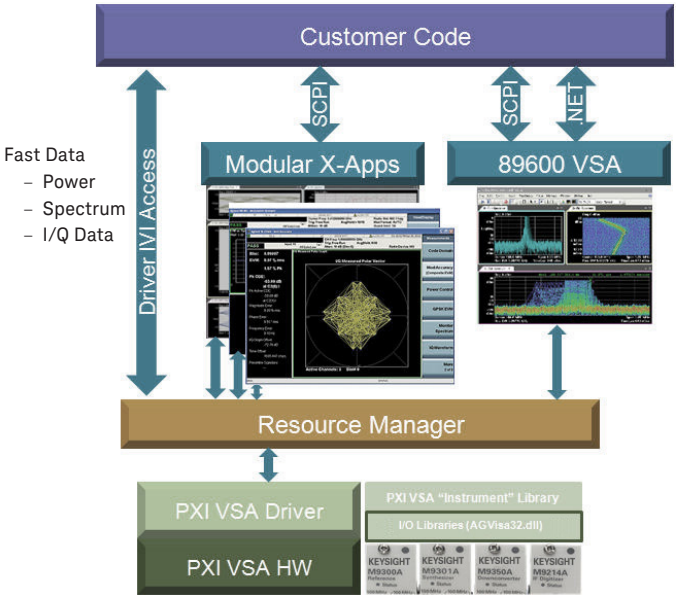

Figure 2. Resource manager included with all X-Series measurement applications for modular instruments.

1xEV-DO Technology 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 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.

Choosing between X-Series Measurement Applications and 89600 VSA Software

X-Series measurement applications provide format-specific, one-button measurements for X-Series analyzers and modular PXI VSAs. With fast measurement speed, SCPI programmability, pass/fail testing and simplicity of operation, these applications are ideally suited for design verification and manufacturing. The 89600 VSA is the industry-leading measurement software for evaluating and troubleshooting signals for R&D and design validation. Supporting numerous measurement platforms and multiple measurement channels, the 89600 VSA provides flexibility and sophisticated measurements tools essential to find and fix signal problems. Recent enhancements for the modular PXI VSA platforms (89601B-SSA) provide fast spectrum measurements with benchtop analyzer SCPI programming compatibility.

www.keysight.com/find/89600B

RF Transmitter Tests

With the modular PXI VSAs 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 M9076A and 89600 VSA.

3GPP2 C.S0032 Paragraph #	Transmitter test	1xEV-DO measurement application	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. 89600 only supports 1xEV-DO demodulation analysis for Rel. 0.
2. For the M9076A 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 M9076A 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. Measurements for base station provided by the M9076A measurement application.

Technology	1xEV-DO Rel. 0	1xEV-DO Rev. A	1xEV-DO Rev. B
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. Measurements for mobile station provided by the M9076A measurement application

Technology	1xEV-DO Rel. 0	1xEV-DO Rev. A	1xEV-DO Rev. B
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	●	●	●

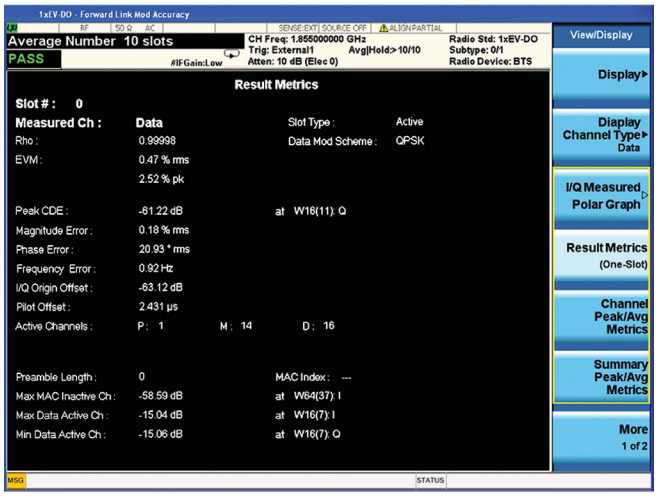

Figure 3. Forward Link Mod Accuracy (waveform quality) with Result Metrics view.

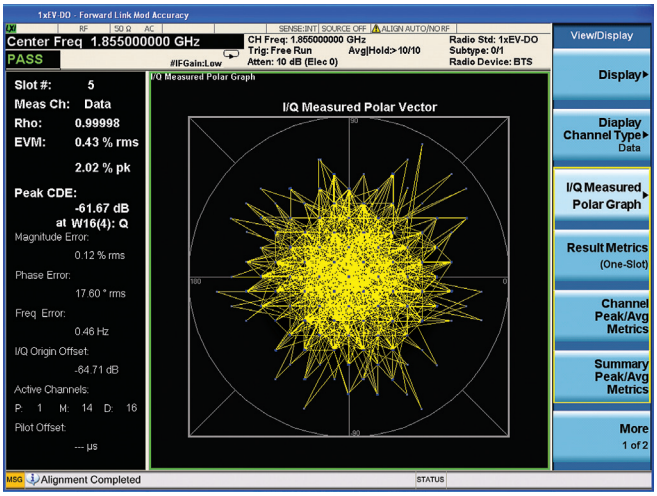

Figure 4. Forward Link Mod Accuracy (waveform quality) with I/Q measured Polar Graph.

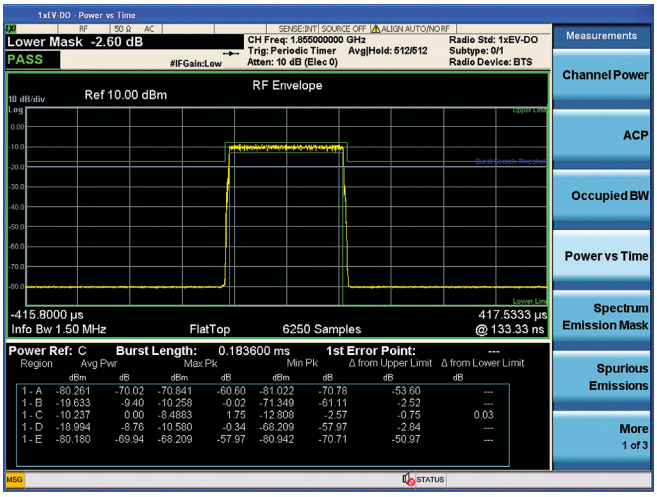

Figure 5. Power vs. Time.

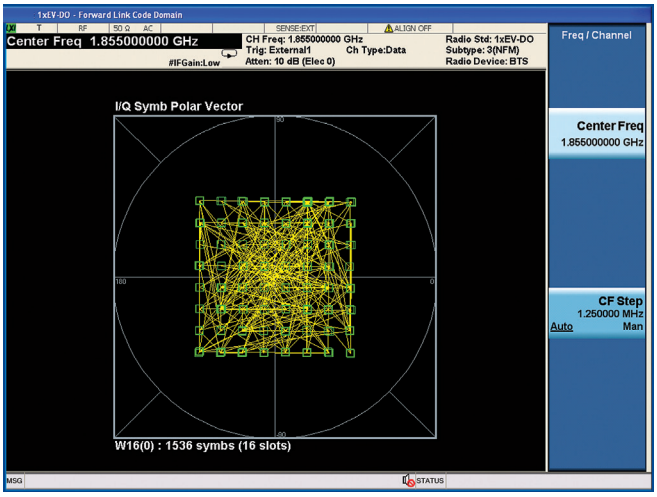

Figure 6. Forward Link Code Domain quad view for Rev. B signal with 64QAM.

Key specifications

Definitions

– Specifications describe the performance of parameters covered by the product warranty.

– 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. These values are not covered by the product warranty.

– Typical values are designated with the abbreviation "typ." These are performance beyond specification that 80% of the units exhibit with a 95% confidence. These values are not covered by the product warranty.

– 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, but is not covered by the product warranty.

Note: Data subject to change

Performance specifications, nominal

Description	M9391A PXIe Vector Signal Analyzer
Modulation accuracy	
Composite EVM	
Range	0 to 25% (nom)
Floor	1.5% (nom)
Accuracy	1.0%
Composite rho	1.0 (nom)

For a more complete list of specifications, please refer to the M9391A datasheet at literature number 5991-2603EN.

Ordering Information

Software licensing and configuration

Transportable, perpetual license: This allows you to run the application using an embedded PXI PC controller or external PC, plus it may be transferred from one controller or PC to another. One software license supports up to four modular PXI VSA channels in one PXI mainframe.

System requirements

Topic	Windows 7 Requirements	Windows XP Requirements
Operating system	Windows 7 Professional, Enterprise or Ultimate (32-bit and 64-bit)	Windows XP Professional, SP3 (32-bit)
Processor speed	2 GHz or faster 32-bit (x86), or 2 GHz or faster 64-bit (x64) processor	
Available memory	1 GB, minimum	
Additional drives	DVD to load software, transfer requires network access, USB flash drive, USB hard drive or USB DVD	

M9076A 1xEV-DO measurement application

Model-option	Description
M9076A-1TP	1xEV-DO measurement application, transportable license

Hardware configuration

M9391A PXI VSA

Description	Model-Option	Additional information
M9391A-F03 or -F06	3 GHz or 6 GHz frequency range	One required
M9391A-B04 or -B10 or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. B16 recommended for fast spectrum measurements with 89600 VSA software – option SSA.
M9391A-300	PXIe frequency reference	Recommended
M9391A-UNZ	Fast tuning	Recommended. Highly recommended for fastest spectrum measurements with 89600 VSA software – option SSA
M9391A-M01 or -M05 or -M10	Memory options (512MB, 2GB, or 4GB)	Recommend 1Gsa/4GB memory

M9393A PXI Performance VSA

Description	Model-Option	Additional information
M9393A-F08, -F14, -F18 or -F27	8 GHz, 14 GHz, 18 GHz or 27 GHz frequency range	One required
M9393A-B04 or -B10 or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. B16 recommended for fast spectrum measurements with 89600 VSA software – option SSA.
M9393A-300	PXIe frequency reference	Recommended
M9393A-UNZ	Fast tuning	Recommended. Highly recommended for fastest spectrum measurements with 89600 VSA software – option SSA
M9393A-M01 or -M05 or -M10	Memory options (512MB, 2GB, or 4GB)	Recommend 1Gsa/4GB memory

Additional Resources

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.

M9391A PXIe Vector Signal Analyzer, Datasheet, literature number 5991-2603EN

M9391A & M9381A PXIe Vector Signal Analyzer & Generator, Configuration Guide, literature number 5991-0897EN

X-Series Measurement Applications for Modular Instruments, Brochure, literature number 5991-2604EN

Web

Product pages:
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X-Series measurement applications for modular instruments:
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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 modular PXI VSA.

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