Keysight Technologies
M9072A cdma2000/cdmaOne
X-Series Measurement Application for PXI Vector Signal Analyzers

Technical Overview

KEYSIGHT TECHNOLOGIES

cdma2000/cdmaOne 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 cdma2000/cdmaOne X-Series measurement application for modular instruments transforms the PXI VSAs into CDMA standard-based transmitter testers. The application provides fast RF conformance measurements to help you speed up manufacturing of your IS-95 or cdmaOne and cdma2000 devices.

The cdma2000/cdmaOne measurement application is just 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.

Key features

- Perform IS-95 or cdmaOne and cdma2000® forward link and reverse link RF transmitter measurements per 3GPP2 specifications
- Perform transmitter tests with pass/fail limit per 3GPP2 standard
- 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

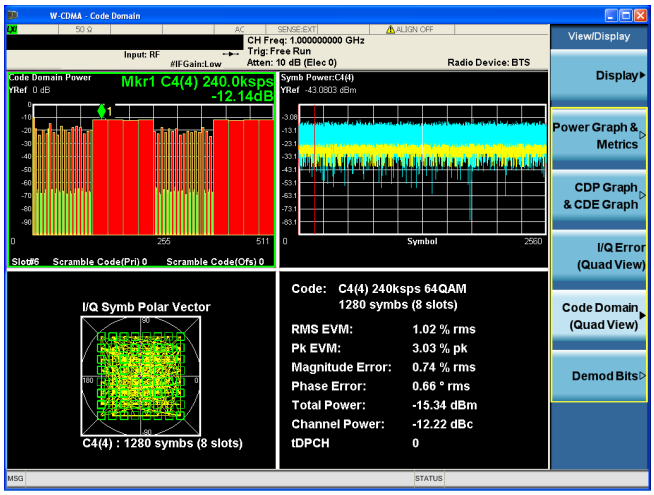

Figure 1. Multi-slot power vs. time on mixed modulation types of GSM and EDGE burst.

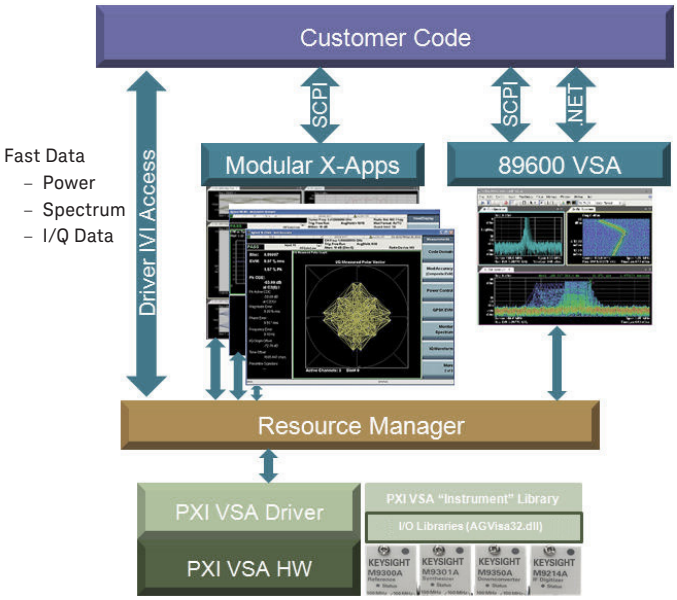

Figure 2. Resource manager included with all X-Series measurement applications for modular instruments.

cdma2000 Technology Overview

cdma2000 is one of the wireless transmission format technologies that meets the IMT-2000 requirements for a Third Generation (3G) global wireless communications system. It uses direct sequence modulation with digital codes to spread its spectrum. cdma2000, also known as IMT–CDMA Multi-Carrier or 1xRTT (Single-Carrier Radio Transmission Technology), is derived from IS-95. The IS-95A revision was first published in May 1993 as a solution for voice communication. The IS-95B revision standard can support a data rate of up to 115 kbps by bundling up to eight channels. The IS-95A and IS-95B are combined into the cdmaOne family.

cdma2000 1x (IS-2000) incorporates a number of improvements that result in roughly twice the spectral efficiency of IS-95. It supports circuit-switched voice communications as well as a packet data rate up to 307 kbps in a single 1.25 MHz channel for low-speed mobility, and up to 2 Mbps for fixed installations.

Key differences of IS-95 or cdmaOne and cdma2000 are summarized in Table 1.

Table 1. Comparison of IS-95/cdmaOne and cdma2000 standards

	IS-95/cdmaOne		**cdma2000**	
	Forward link	**Reverse link**	**Forward link**	**Reverse link**
Modulation	BPSK	BPSK	QPSK	HPSK
Chip rate	1.2288 Mcps	1.2288 Mcps	1.2288 Mcps (SR1) 3.6864 Mcps (SR3)	1.2288 Mcps (SR1) 3.6864 Mcps (SR3)
Data rate	1.2 kbps 2.4 kbps 4.8 kbps 9.6 kbps	1.8 kbps 3.6 kbps 7.2 kbps 14.4 kbps	– RC1: 9.6, 4.8, 2.4, and 1.2 kbps – RC2: 14.4, 7.2, 3.6 and 1.8 kbps – RC3 is based on 9,600 bps and goes up to 153,600 bps – RC4 is based on 9,600 bps and goes up to 307,200 bps Note: RC = Radio Configuration. RC1 to 5 are for SR1 RC6 to 9 are defined for SR3 but not list in this table	– RC1 is based on 9,600 bps traffic – RC2 is based on 14,400 bps traffic – RC3 is based on 9,600 bps and goes up to 307,200 bps – RC4 is based on 14,400 bps and goes up to 230,400 bps Note: RC1 to 4 are for SR1 RC5 to 6 are defined for SR3 but not list in this table
Pilot channel	Yes	No	Yes	Yes

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

cdma2000 Transmitter Tests

With the modular PXI VSAs and the cdma2000/cdmaOne measurement application, you can perform RF transmitter measurements on base station and user equipment devices in time, frequency and modulation domains. Measure basic IS-95 or cdmaOne signals as well as cdma2000 signals with all radio configurations in SR1.

Standard-based RF transmitter tests

The latest RF transmitter test requirements for cdma2000 are defined in 3GPP2 C.S0010-D(BTS) and 3GPP2 C.S0011-C (MS) of the 3GPP2 standard. Table 2 shows the 3GPP2 required BTS RF transmitter tests along with the corresponding measurements available in the X-Series and 89600B VSA cdma2000 applications.

Table 2. Required base station (BTS) RF transmitter measurements and the corresponding measurements in M9072A and 89600B VSA

3GPP2 C.S0010 Paragraph #	Transmitter test	M9072A cdma2000/ cdmaOne measurement application	89600 Option B7T–cdma2000/ 1xEV-DV modulation analysis
4.1.2	Frequency tolerance	Frequency error[1]	Freq error[1]
4.2.1.1	Pilot time tolerance	Time offset[1]	T trigger[1]
4.2.1.2	Pilot channel to code channel time tolerance	Timing[2]	Timing[2]
4.2.1.3	Pilot channel to code channel phase tolerance	Phase[2]	Phase[2]
4.2.2	Waveform quality	EVM/Rho[1]	EVM/Rho[1]
4.3.1	Total power	Total power[3]	Can be performed using band power marker
4.3.2	Pilot power	Pilot Ch[3]	CDP composite
4.3.3	Code domain power	Code domain power[4]	Power[2]
4.3.4	Femto cell transmission authorization	Channel power	Can be performed using band power marker
4.4.1	Conducted spurious emissions	ACP and spectrum emission mask	ACP can be performed using marker function; SEM is not available
4.4.2	Radiated spurious emissions	Spurious emissions	Not available[5]
4.4.3	Inter-base station transmitter intermodulation	Channel power, ACP, SEM, spur emissions or spectrum analyzer mode	Not available[5]
4.4.4	Occupied bandwidth	Occupied BW	Can be performed using marker function

1. For M9072A application, these values are found in "IQ Measured Polar Graph" view under Mod Accuracy (Composite Rho) measurement. For 89601B-B7T, these values are found under "Composite Error Summary" trace.
2. For M9072A application, these values are found in "Power Timing & Phase" view under Mod Accuracy (Composite Rho) measurement. For 89601B-B7T, these values are found under "Code Domain Offsets" trace.
3. For M9072A application, these values are found in "Power Graph & Metrics" view under Code Domain measurement. For 89601B-B7T, these values are found under "Composite Slot Summary" trace.
4. For M9072A application, these values are found in "Code Domain (Quad View)" view under Code Domain measurement. For 89601B-B7T, these values are found under "Composite Slot Summary" trace.
5. If 89600B Option B7T 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 (Table 3). These measurements are fully-remote controllable via the IEC/IEEE bus, GPIB or LAN, using SCPI commands.

Table 3. List of measurements provided by M9072A measurement application

Technology	IS-95/cdmaOne	cdma2000
X-Series measurement application	M9072A	M9072A
Channel power	•	•
ACP	•	•
Spectrum emission mask	•	•
Spurious emissions	•	•
Occupied bandwidth	•	•
Code domain	•	•
Modulation accuracy		
Rho	•	•
EVM	•	•
Peak CDE	•	•
Magnitude error	•	•
Phase error	•	•
Frequency error	•	•
I/Q origin offset	•	•
Active channels	•	•
Power stat CCDF	•	•
QPSK EVM	•	•
Monitor spectrum	•	•
I/Q waveform	•	•

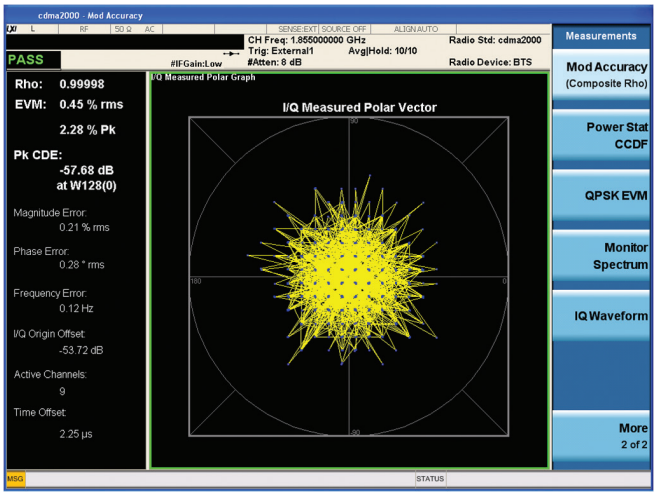

Figure 3. Modulation accuracy with cdma2000 forward 9 channels signal.

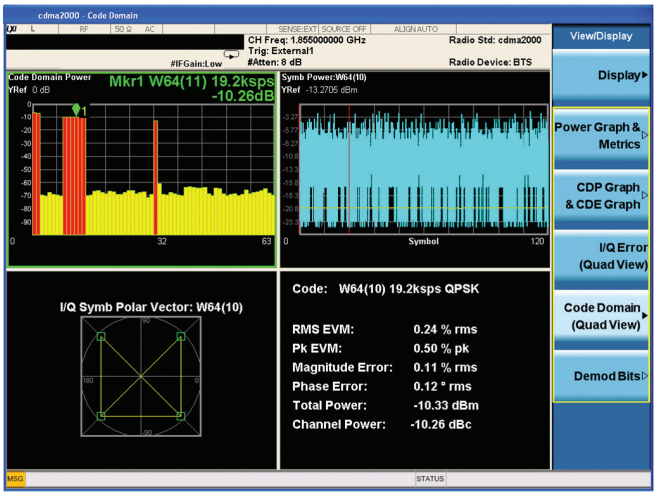

Figure 4. Code Domain Power quad view.

Figure 5. Power, Timing, Phase and CDE by each Walsh code.

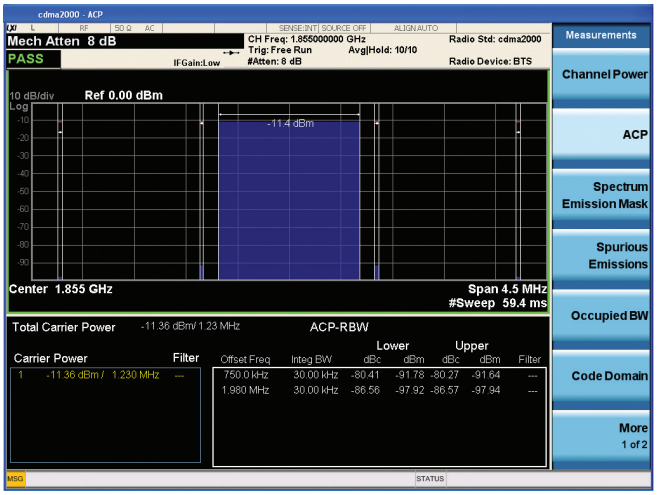

Figure 6. cdma2000 ACP measurement.

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.

Supported devices and radio bands

Device type	BTS, MS
Standard version	Mobile station: 3GPP2 C.S0011-C Base station: 3GPP2 C.S0010-D

Performance specifications

Modulation accuracy Accuracy	Nominal
Composite EVM	*±0.5%*
Composite rho	*1.0*

For a complete list of specifications refer to the M9391A data sheet at literature number **5991-2603EN.**

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	

Ordering Information

Software licensing and configuration

Trasnportable, perpetual license:

This allows you to run the application in the X-Series analyzer 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.

M9071A GSM/EDGE/EVO measurement application

Model-Option	Description
M9072A-2TP	cdma2000/cdmaOne measurement application, transportable perpetual license

Hardware configuration

M9391A PXI VSA

Model-Option	Description	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

Model-Option	Description	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

N9072A & W9072A Self-Guided Demonstration, literature number 5990-8011EN

Understanding CDMA Measurements for Base Stations and Their Components, Application Note 1311, Literature Number 5968-0953E

Testing and Troubleshooting Digital RF Communications Transmitter Designs, Application Note 1313, Literature Number 5968-3578E

M9391A PXIe Vector Signal Analyzer, Data sheet, 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:
www.keysight.com/find/M9072A

X-Series measurement applications for modular instruments:
www.keysight.com/find/M90XA

M9391A PXIe Vector Signal Analyzer:
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M9393A PXIe Performance Vector Signal Analyzer:
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X-Series signal analyzers:
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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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PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

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