cdma2000
X-Series Measurement Application
N9072A & W9072A
Technical Overview

- Perform IS-95 or cdmaOne and cdma2000® forward link and reverse link RF transmitter measurements per 3GPP2 specifications

- Perform one-button tests with pass/fail limit per 3GPP2 standard

- Use hardkey/softkey manual user interface or SCPI remote user interface

- Use hardkey/softkey manual user interface or SCPI remote user interface

- Leverage built-in context sensitive help

- Move application between X-Series signal analyzers with transportable licensing

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Agilent Technologies

cdma2000 Measurement Application

The cdma2000 measurement application transforms the X-Series signal analyzers into CDMA standard-based transmitter testers. The application provides fast one-button RF conformance measurements to help you design, evaluate, and manufacture your IS-95 or cdmaOne and cdma2000 devices.

The cdma2000 measurement application is just one in a common library of more than 25 measurement applications in the Agilent X-Series, an evolutionary approach to signal analysis that spans instrumentation, measurements and software. The X-Series analyzers, with upgradable 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 Agilent hardware platforms to pinpoint the answers to signal problems in R&D.

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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 revi-

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

cdma2000 Transmitter Tests

With the X-Series signal analyzers and the cdma2000 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 89600 VSA software cdma2000 applications.

Table 2. Required base station (BTS) RF transmitter measurements and the corresponding measurements in N/W9072A and 89600 VSA software

3GPP2 C.S0010 Paragraph #	Transmitter test	N/W9072A cdma2000 X-Series measurement application	89601B 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 N/W9072A 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 N/W9072A 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 N/W9072A 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 N/W9072A 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 89601B-B7T is used with an Agilent 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 (Table 3). These measurements are fully-remote controllable via the IEC/IEEE bus, GPIB or LAN, using SCPI commands.

Analog baseband measurements are available on the PXA or MXA signal analyzer with BBIQ hardware. Supported baseband measurements include all of the modulation quality pus I/Q waveform measurements.

Table 3. List of one-button measurements provided by N/W9072A measurement application

| Technology	IS-95/cdmaOne		cdma2000	
X-Series measurement application	N9072A	W9072A	N9072A	W9072A
X-Series signal analyzer	PXA, MXA, EXA	CXA	PXA, MXA, EXA	CXA
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	●	●	●	●
Pilot Offset	●	●	●	●
Power Stat CCDF	●	●	●	●
QPSK EVM	●	●	●	●
Monitor spectrum	●	●	●	●
I/Q waveform	●	●	●	●
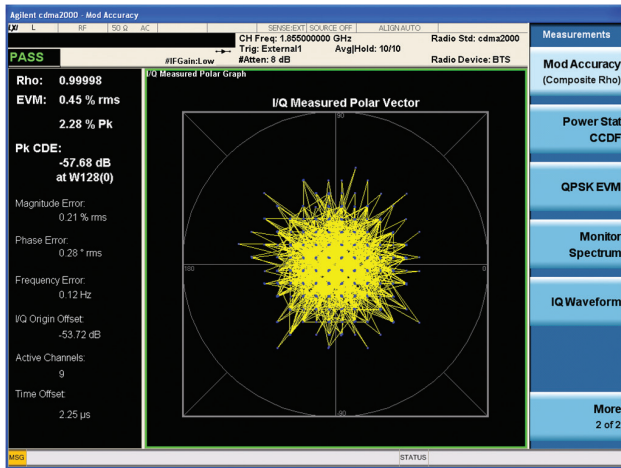
Figure 1. Modulation accuracy with cdma2000 forward 9 channels signal

Figure 2. Code Domain Power quad view

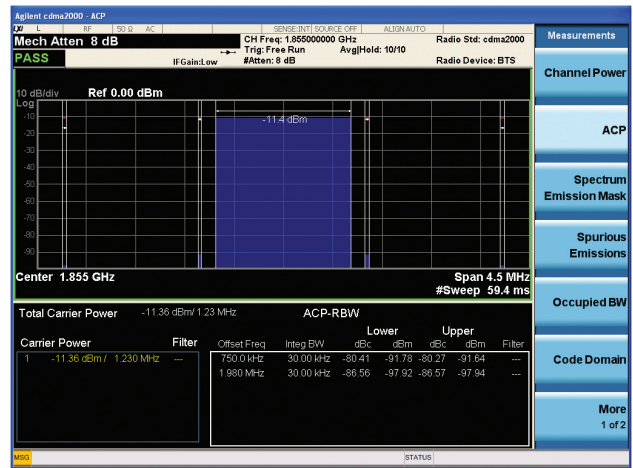Figure 3. Power, Timing, Phase and CDE by each Walsh code

Figure 4. 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.
- PXA specifications apply to analyzers with frequency options of 526 and lower. For analyzers with higher frequency options, specifications are not warranted but performance 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.

UP GRADE

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

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)
Adjacent channel power				
Minimum power at RF input	−36 dBm (nom)			
Dynamic range (reference to average power of carrier in 1.23 MHz bandwidth)				
Offset frequency/integrated bandwidth				
750 kHz/30 kHz	−85.9 dBc −89.5 dBc (typ)	−78.6 dBc −85.1 dBc (typ)	−73.6 dBc −81.0 dBc (typ)	−67.4 dBc −72.7 dBc (typ)
1980 kHz/30 kHz	−87.6 dBc −90.6 dBc (typ)	−83.1 dBc −87.9 dBc (typ)	−78.3 dBc −83.9 dBc (typ)	−75.6 dBc −79.6 dBc (typ)
ACPR relative accuracy				
Offsets < 750 kHz	± 0.04 dB	± 0.09 dB	± 0.09 dB	± 0.09 dB
Offsets > 1.98 MHz	± 0.04 dB	± 0.10 dB	± 0.10 dB	± 0.10 dB
Spectrum emission mask				
Dynamic range (relative)				
750 kHz (30 kHz RBW)	85.9 dBc 89.5 dBc (typ)	78.6 dBc 85.1 dBc (typ)	73.6 dBc 81.0 dBc (typ)	67.4 dBc 72.7 dBc (typ)
Sensitivity, absolute				
750 kHz (30 kHz RBW)	−103.7 dBc −106.7 dBc (typ)	−99.7 dBc −104.7 dBc (typ)	−94.7 dBc −100.7 dBc (typ)	−93.7 dBc −99.7 dBc (typ)
Accuracy, relative				
750 kHz (30 kHz RBW)	± 0.04 dB	± 0.09 dB	± 0.09 dB	± 0.09 dB
Spurious emission				
Dynamic range, relative	104.1 dB 107.4 dB (typ)	96.7 dB 101.7 dB (typ)	93.1 dB 98.4 dB (typ)	84.7 dB 86.8 dB (typ)
Sensitivity, absolute	−88.4 dBm −91.4 dBm(typ)	−84.4 dBm −89.4 dBm (typ)	−79.4 dBm −85.4 dBm (typ)	−78.4 dBm −84.4 dBm (typ)
Accuracy (attenuation = 10 dB)				
20 Hz to 3.6 GHz (100 kHz to 3.0 GHz for CXA)	± 0.19 dB (95th percentile)	± 0.29 dB (95th percentile)	± 0.38 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
Occupied bandwidth				
Minimum power at RF input	−30 dBm (nom)			
Frequency accuracy	± 2 kHz (nom) (RBW = 30 kHz, Number of points = 1001, Span = 2 MHz)			

Description	PXA	MXA	EXA	CXA
Code domain (−25 dBm ≤ ML ≤ −15 dBm, 20 to 30 °C)				
Code domain power				
Relative accuracy				
Code domain power range				
0 to −10 dBc	± 0.015 dB			
−10 to −30 dBc	± 0.06 dB			
−30 to −40 dBc	± 0.07 dB			
Symbol power vs. time				
Relative accuracy				
Code domain power range				
0 to −10 dBc	± 0.015 dB			
−10 to −30 dBc	± 0.06 dB			
−30 to −40 dBc	± 0.07 dB			
Symbol error vector magnitude				
Accuracy				
0 to −25 dBc	± 1.0% (nom)			
Modulation accuracy (Composite EVM) (−25 dBm ≤ ML ≤ −15 dBm, 20 to 30 °C)				
Accuracy				
Composite EVM (for 12.5% < EVM < 22.5%)	± 0.5%	± 0.5%	± 0.5%	± 0.5%
Composite Rho (at Rho 0.99751 (EVM 5%))	± 0.0010	± 0.0010	± 0.0010	± 0.0010
Pilot time offset	± 300 ns	±300 ns	± 300 ns	± 300 ns
Code domain timing	± 1.25 ns	± 1.25 ns	± 1.25 ns	± 1.25 ns
Code domain phase	± 10 mrad	± 10 mrad	± 10 mrad	± 10 mrad
Peak code domain error	± 1.0 dB (nom)	± 1.0 dB (nom)	± 1.0 dB (nom)	± 1.0 dB (nom)
Frequency error	± 10 Hz + tfa	± 10 Hz + tfa	± 10 Hz + tfa	± 10 Hz + tfa
Power statistics CCDF				
Histogram resolution	0.01 dB			
QPSK EVM (−25 dBm ≤ ML ≤ −15 dBm, 20 to 30 °C)				
EVM range	0 to 25%	0 to 25%	0 to 25%	0 to 25%
EVM accuracy	± 1.0%	± 1.0%	± 1.0%	± 1.0%
Frequency error accuracy	± 5 Hz + tfa	± 5 Hz + tfa	± 5 Hz + tfa	± 5 Hz + tfa

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

PXA: www.agilent.com/find/pxa_specifications

MXA: www.agilent.com/find/mxa_specifications

EXA: www.agilent.com/find/exa_specifications

CXA: www.agilent.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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  This allows you to run the application in the X-Series analyzer in which it is initially installed, plus it may be transferred from one X-Series analyzer to another.

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

N9072A & W9072A cdma2000 X-Series measurement application

Description	Model-Option		Additional information
	PXA, MXA, EXA	**CXA**	
cdma2000	N9072A-2FP	W9072A-2FP	

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	One Recommended

N9000A CXA signal analyzer

Description	Model-Option	Additional information
3.0, 7.5, 13.6, or 26.5 GHz frequency range	N9000A-503, -507, -513, or -526	One required
Precision frequency reference	N9000A-PFR	Recommended
Fine step attenuator	N9000A-FSA	Recommended
Preamplifier, 3.0, 7.5, 13.6, or 26.5 GHz	N9000A-P03, -P07, -P13, or -P26	One recommended

Related 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

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

Web

Product page:
www.agilent.com/find/N9072A and **www.agilent.com/find/W9072A**

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