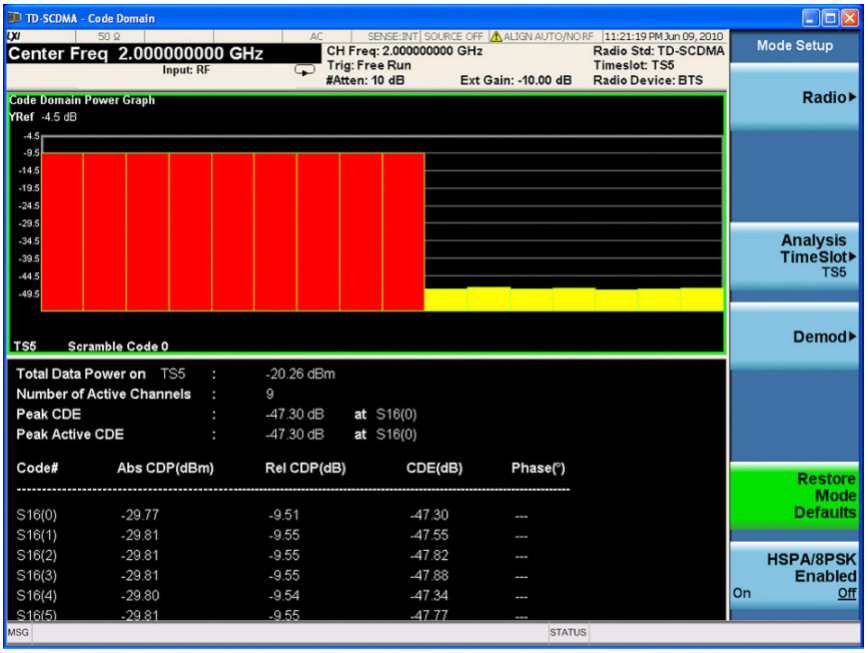
Keysight TD-SCDMA
X-Series Measurement App, Traditional UI
N9079EM0D

Technical Overview



- TD-SCDMA RF transmitter measurements
- HSDPA/HSUPA/8PSK modulation and code domain analysis support
- Demodulation availability of code channel with phase shift or rotation for multi-carrier TD-SCDMA signals
- One-button tests with pass/fail limits per 3GPP standard
- Hardkey/softkey manual user interface and SCPI remote user interface
- Built-in, context sensitive help
- Flexible licensing provides the option of using perpetual or time based licenses with one or multiple signal analyzers

KEYSIGHT TECHNOLOGIES

TD-SCDMA Measurement Application

The TD-SCDMA measurement application transforms the X-Series signal analyzers into standard-based TD-SCDMA transmitter testers by adding fast, one-button RF conformance measurements to help you design, evaluate, and manufacture your TD-SCDMA devices. Software capability is further enhanced by adding support to phase shift or rotation for multi-carrier TD-SCDMA signals, allowing you to stay on the leading edge of design and
manufacturing challenges.

X-Series measurement applications can help you:

- Gain more insight into device performance with intuitive display and graphs for your application. Select from our library of over 25 different measurement applications.
- Ensure that your design meets the latest standard. Updates are made to the X-Series measurement applications as standards evolve.
- Apply the same measurement science across multiple hardware platforms for consistent measurement results over your design cycle from R&D to production.
- Choose the license structure that meets your business needs. We provide a range of license types (node-locked, transportable, floating or USB portable) and license terms (perpetual or time-based).

TD-SCDMA Technology Overview

Time Division-Synchronous Code Division Multiple Access (TD-SCDMA) combines FDMA, CDMA and TDMA technologies. Unlike W-CDMA and cdma2000® technologies, this TDD standard transmits and receives on the same frequency, which greatly increases spectrum efficiency. Because TD-SCDMA effectively handles symmetrical and asymmetrical traffic, it is ideal for data-intensive applications, such as mobile Internet access and multimedia applications.

TD-SCDMA was proposed by China Wireless Telecommunication Standards group (CWTS) and approved as a 3G technology by ITU in 1999. The TD-SCDMA standard now is fully supported by 3GPP and China Communication Standards Association (CCSA). The 3GPP TD-SCDMA standard is also known as the low chip rate (LCR) option of TDD, which is included in the 3GPP Universal Terrestrial Radio Access (UTRA) as the UTRA-TDD option.

In combination of Time Division Multiple Access (TDMA) and Time Division Duplex (TDD), the TD-SCDMA technology is based on the backbone of TDMA-TDD operation which significantly improves network performance by allowing radio resources to process network traffic in both directions, per uplink and downlink. There are 7 time slots (numbered 0 through 6) in a single 5 ms long frame, and within each time slot there are up to 16 code channels that are available to allocate to a single user or to distribute among multiple users.

Time division duplexing is used to separate uplink and downlink periods in a given time frame. Therefore, a resource unit (RU) is defined by a frequency, time slot, and code channel with spreading factor. The basic resource unit uses a spreading factor of 16. In TD-SCDMA, the chip rate is 1.28 Mcps and each carrier signal occupies 1.6 MHz bandwidth.

Since the adoption of TD-SCDMA by the 3GPP body, the standard has continued to evolve. As with W-CDMA, the high-speed downlink packed access (HSDPA) and the high-speed uplink packed access (HSUPA) specifications for TD-SCDMA were added into 3GPP Release 5 and, respectively, HSPA+ features for TDD are part of 3GPP Release 8. Meanwhile, the 3GPP has specified UMTS Long Term Evolution (LTE) TDD mode as the evolution patch for TD-SCDMA, which is also referred to as TD-LTE.

Key specifications and differences of TD-SCDMA, TD-HSPA and TD-HSPA+ are summarized in Table 1.

Table 1. Differences in TD-SCDMA, TD-HSPA, and HSPA+ standards

	TD-SCDMA	TD-HSPA (HSDPA, HSUPA)	TD-HSPA+
Multiple access	TDMA/CDMA	TDMA/CDMA	TDMA/CDMA
Modulation	QPSK 8-PSK	QPSK, 16QAM	QPSK, 16QAM, 64QAM
Symbol rate/chip rate	1.28 Mcps	1.28 Mcps	1.28 Mcps
Channel spacing	1.6 MHz/carrier	1.6 MHz/carrier	1.6 MHz/carrier
Date rate/user	Up to 2 Mbps	HSDPA: 2.8 Mbps[1]	DL: 8.4 Mbps[1]

1. These are peak data rates from 3GPP specifications. 2.8 Mbps is at 1.6 MHz bandwidth, 8.4 Mbps is using N-point carriers (here N = 3) technologies.

RF Transmitter Tests

With the TD-SCDMA measurement application, perform RF transmitter measurements on BTS and mobile devices in time, frequency and modulation domains. The TD-SCDMA and HSPA signals as well as HSPA+ signals with all modulation formats, as shown in Table 2, can be measured.

Standard-based RF transmitter tests

The RF transmitter test requirements for TD-SCDMA are defined in TS 25 and 34 series of 3GPP standard. Table 2 shows the required base station RF transmitter tests along with the corresponding measurement applications.

Table 2. Required BTS RF transmitter measurements and the corresponding measurements in N9079EM0D and 89600B VSA.

3GPP TS.25.142 paragraph number	Transmitter test	N9079EM0D TD-SCDMA measurement application	89601B-B7N 3G modulation analysis (includes cdma2000, W-CDMA, 1x-EVDO and TD-SCDMA)
6.2	Maximum output power	Transmit power	Can be performed using band power marker
6.3	Frequency stability	OBW or modulation accuracy (Tx frequency error)	EVM
6.4	Output power dynamics	Transmit power	89600B based solutions offer modulation quality measurements. For one button, non-demodulation, measurements such as spectrum emission mask and PvT, the embedded application must be used.
6.5.1	Transmit OFF power	Power vs. time	
6.5.2	Transmit ON/OFF time mask	Power vs. time	
6.6.1	Occupied bandwidth	Occupied BW	
6.6.2.1	Spectrum emission mask	Spectrum emission mask	
6.6.2.2	Adjacent channel leakage power ratio (ACLR)	Adjacent channel power	
6.6.3	Spurious emissions	Spurious emissions	
6.7	Transmit intermodulation	Spectrum analyzer mode	
6.8.1	Modulation accuracy	Modulation accuracy	EVM
6.8.2	Peak code domain error	Modulation analysis	EVM

Measurement details

All of the RF transmitter measurements as defined by the 3GPP 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.

Analog baseband measurements are available on the PXA or MXA signal analyzer with BBIQ option. Supported baseband measurements include EVM and power versus time.

Table 3. List of one-button measurements provided by N9079EM0D measurement application

TD-SCDMA/HSPA/8PSK
Modulation analysis[1] (Composite EVM)
Rho
RMS EVM
Peak EVM
Peak code domain error
Frequency error
Phase error
Magnitude error
I/Q offset
Time offset
Transmit power
Power vs. time
Adjacent channel power (ACP)
Spectrum emission mask (SEM)
Occupied BW (OBW)
CCDF
Code domain
IQ waveform
Monitor spectrum

1. For 16QAM, 64QAM and 8PSK modulation analysis, need to install Option 2FP of N9079EM0D.

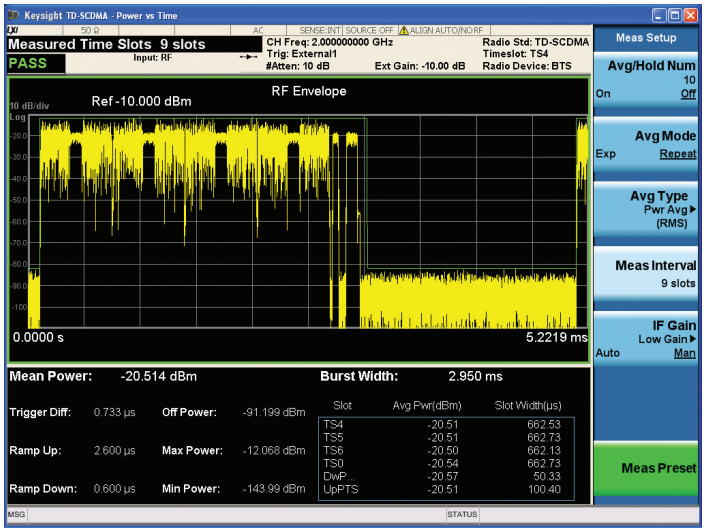


Figure 1. TD-SCDMA PvT measurement of nine time slots on one 5 ms sub-frame

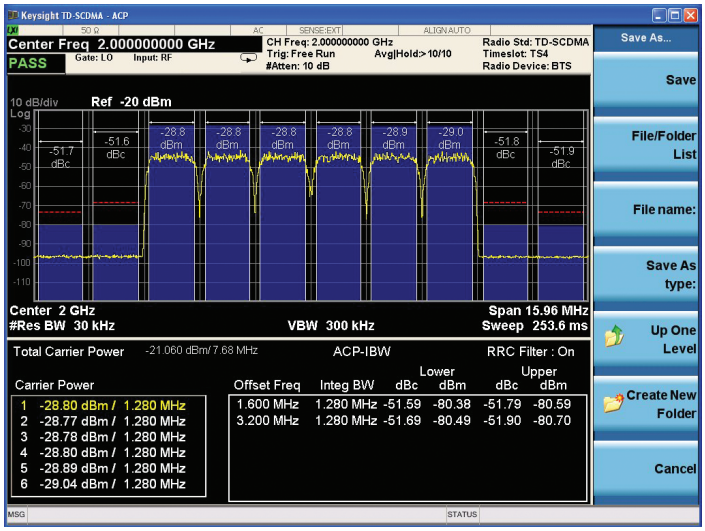


Figure 2. TD-SCDMA six carriers ACP

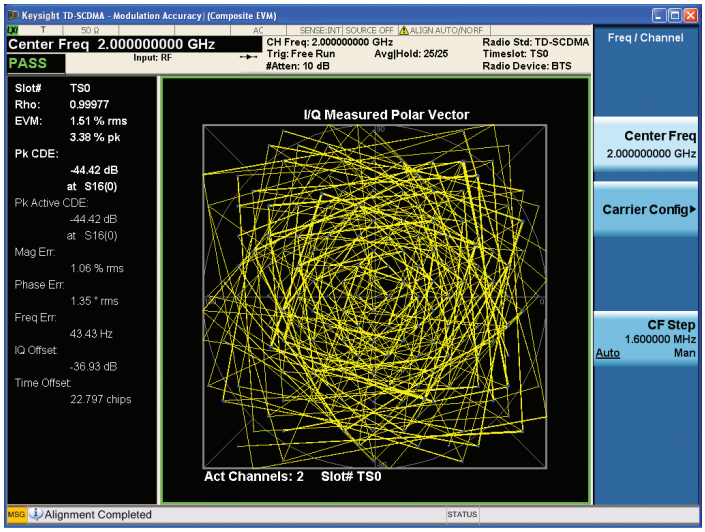


Figure 3. Composite EVM for time slot 0 with 40 degree phase rotation

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

Supported devices and standard version

Device type	BTS, MS
Standard version	Mobile station: 3GPP TS34.122 Base Station: 3GPP TS25.142
BTS type	1.28 Mcps 3GPP TDD
Radio band[1]	1900 to 1920 MHz 2010 to 2025 MHz 1850 to 1910 MHz 1930 to 1990 MHz 1910 to 1930 MHz 2570 to 2620 MHz 2300 to 2400 MHz 1880 to 1920 MHz

1. 3GPP has designed frequency bands for UTRA/TDD for uplink and downlink transmission. Refer to TS24.142 paragraph 4.2 for details.

Performance Specifications

Description	PXA	MXA	EXA	CXA
Transmit power				
Burst type		Traffic, UpPTS and DwPTS		
Measurement time		Up to 18 slots		
Power accuracy	±0.20 dB (95%)	±0.25 dB (95%)	±0.29 dB (95%)	± 0.86 dB (95%)
Measurement floor	–90.4 dBm (nom)	–88.3 dBm (nom)	–84.3 dBm (nom)	–83.3 dBm (nom)
Power vs. time				
Burst type		Traffic, UpPTS and DwPTS		
Measurement time		Up to 9 slots		
Dynamic range	130.4 dB (nom)	130.3 dB (nom)	128.3 dB (nom)	125.3 dB (nom)
Measurement floor	–100.4 dBm (nom)	–100.3 dBm (nom)	–98.3 dBm (nom)	–95.3 dBm (nom)
Adjacent channel power				
Single carrier				
Minimum power at RF input		–36 dBm (nom)		
ACPR accuracy[1]				
Radio / Offset freq				
BTS 1.6 MHz	±0.07 dB	±0.17 dB	±0.34 dB	±0.47 dB
		(ACPR –37 to –43 dBc with optimum mixer level)		
BTS 3.2 MHz	±0.11 dB	±0.13 dB	±0.18 dB	±0.26 dBm
		(ACPR –42 to -48 dBc with optimum mixer level)		
BTS 1.6 MHz	±0.04 dB	±0.11 dB	±0.14 dB	±0.47 dB
		(ACPR –43 dBc non-coherent ACPR)		
Four carriers				
ACPR accuracy, BTS, Incoherent TOI				
Noise correction (NC) off	±0.08 dB	±0.15 dB	N/A	N/A
		(UUT ACPR –37 to –43 dB, optimum ML –14 dBm)		
Noise correction (NC) on	±0.06 dB	±0.10 dB	N/A	N/A
		(UUT ACPR –37 to –43 dB, optimum ML –18 dBm)		
Spectrum emission mask				
Dynamic range, relative				
815 kHz offset	90.5 dB (typ)	85.3 dB (typ)	81.3 dB (typ)	71.7 dB (typ)
Sensitivity, absolute				
815 kHz offset	–106.7 dBm (typ)	–104.7 dBm (typ)	–100.7 dBm (typ)	–92.7 dBm (typ)
Accuracy				
815 kHz offset, relative	±0.05 dB	±0.12 dB	±0.11 dB	±0.11 dBm
815 kHz offset, absolute	±0.29 dB (95%)	±0.27 dB (95%)	±0.31 dB (95%)	±0.65 dBm (95%)
Spurious emissions				
Dynamic range, relative (RBW = 1 MHz)	92.1 dB (typ)	92.1 dB (typ)	77.4 dB (typ)	75.0 dB (typ)
Sensitivity, absolute (RBW = 1 MHz)	-91.5 dB (typ)	-89.5 dB (typ)	-86.5 dB (typ)	–84.4 dBm (typ)
Accuracy (attenuation = 10 dB)	±0.19 dB (95%) (Frequency range 20 Hz to 3.6 GHz)	±0.29 dB (95%) (Frequency range 20 Hz to 3.6 GHz)	±0.38 dB (95%) (Frequency range 9 kHz to 3.6 GHz)	±0.81 dB (95%) (Frequency range 100 kHz to 3.0 GHz)
	±1.08 dB (95%) (Frequency range 3.5 to 8.4 GHz)	±1.17 dB (95%) (Frequency range 3.5 to 8.4 GHz)	±1.22 dB (95%) (Frequency range 3.5 to 7.0 GHz)	±1.80 dB (95%) (Frequency range 3.0 to 7.5 GHz)
	±1.48 dB (95%) (Frequency range 8.3 to 13.6 GHz)	±1.54 dB (95%) (Frequency range 8.3 to 13.6 GHz)	±1.59 dB (95%) (Frequency range 6.9 to 13.6 GHz)	–

1. The accuracy of the Adjacent Channel Power Ratio (ACPR) will depend on the mixer drive level and whether the distortion products from the analyzer are coherent with others in the UUT. These specifications apply even in the worst case condition of coherent analyzer and UUT distortion products. Please refer to the TD-SCDMA Specification Guide for a more detailed explanation.

Performance Specifications (continued)

Description	PXA	MXA	EXA	CXA
Occupied bandwidth				
Minimum power at RF input		–30 dBm (nom)		
Frequency accuracy		±4.8 kHz (RBW = 30 kHz, Number of points = 1001, Span = 4.8 MHz)		
Power statistics CCDF				
Histogram resolution		0.01 dB		
Code domain BTS measurements (–25 dBm ≤ ML ≤ –15 dBm, 20 to 30 °C)				
Code domain power				
Absolute accuracy (–10 dBc DPCH, ATTen = 10 dB)	±0.25 dB (95%)	±0.25 dB (95%)	±0.32 dB (95%)	±0.61 dB (95%)
Absolute accuracy (–10 dBc HS-PDSCH, ATTen = 10 dB)	±0.26 dB (95%)	±0.26 dB (95%)	±0.33 dB (95%)	±0.62 dB (95%)
Relative accuracy				
Code domain power range				
DPCH channel				
0 to –10 dBc		±0.02 dB		
–10 to –20 dBc		±0.02 dB		
–20 to –30 dBc		±0.02 dB		
HS-PDSCH channel				
0 to –10 dBc		±0.03 dB		
–10 to –20 dBc		±0.11 dB		
–20 to –30 dBc		±0.32 dB		
Symbol power vs. time				
Relative accuracy				
Code domain power range				
DPCH channel				
0 to –10 dBc		±0.02 dB		
–10 to –20 dBc		±0.06 dB		
–20 to –30 dBc		±0.19 dB		
HS-PDSCH channel				
0 to –10 dBc		±0.03 dB		
–10 to –20 dBc		±0.11 dB		
–20 to –30 dBc		±0.32 dB		
Symbol error vector magnitude				
Accuracy				
DPCH channel				
0 to –25 dBc		±1.1% (nom)		
HS-PDSCH channel				
0 to –25 dBc		±1.1% (nom)		

Performance Specifications (continued)

Description	PXA	MXA	EXA	CXA
Modulation accuracy (Composite EVM) BTS measurements (–25 dBm ≤ ML ≤ –15 dBm, 20 to 30 °C)				
Composite EVM				
Range				
Test signal with TS0 active and one DPCH in TS0	0 to 18%			
Test signal with TS0 active and one HS-PDCH in TS0	0 to 17% (nom)			
Accuracy				
Test signal with TS0 active and one DPCH in TS0	±0.7% when EVM ≤ 9%			
Peak code domain error				
Accuracy				
Test signal with TS0 active and two DPCH in TS0	±0.3 dB			
Test signal with TS0 active and two HS-DPSCH in TS0	±1.0 dB			
I/Q origin offset				
DUT maximum offset	–20 dBc (nom)			
Analyzer noise floor	–50 dBc (nom)			
Frequency error				
Range	±7 kHz (nom)			
Test signal with TS0 active and one DPCH in TS0	±5.2 Hz + (transmitter frequency x frequency reference accuracy)			
Test signal with TS0 active and one HS-PDCH in TS0	±6 Hz + (transmitter frequency x frequency reference accuracy) (nom)			

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

Benchtop:
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**

PXIe:
VSA up to 6 GHz: **www.keysight.com/find/m9391a**
VSA up to 50GHz: **www.keysight.com/find/m9393a**
VXT: **www.keysight.com/find/m9421a**

Ordering Information

Flexible licensing and configuration

- **Perpetual:** License can be used in perpetuity.
- **Time-based:** License is time limited to a defined period, such as 12-months.
- **Node-locked:** Allows you to use the license on one specified instrument/computer.
- **Transportable:** Allows you to use the license on one instrument/computer at a time. This license may be transferred to another instrument/computer using Keysight's online tool.
- **Floating:** Allows you to access the license on networked instruments/computers from a server, one at a time. For concurrent access, multiple licenses may be purchased.
- **USB portable:** Allows you to move the license from one instrument/computer to another by end-user only with certified USB dongle, purchased separately.
- **Software support subscription:** Allows the license holder access to Keysight technical support and all software upgrades

You Can Upgrade!

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

UP GRADE

TD-SCDMA/HSPA measurement application (N9079EM0D)

Model	Software License Type	Support Contract	Support Subscription (12-month) [2]
N9079EM0D-1FP	Node-locked perpetual	R-Y5C-001-A[2]	R-Y6C-001-L[2]
N9079EM0D-1FL	Node-locked 12-month	R-Y4C-001-L[1]	Included
N9079EM0D-1TP	Transportable perpetual	R-Y5C-004-D[2]	R-Y6C-004-L[2]
N9079EM0D-1TL	Transportable 12-month	R-Y4C-004-L[1]	Included
N9079EM0D-1NP	Floating perpetual	R-Y5C-002-B[2]	R-Y6C-002-L[2]
N9079EM0D-1NL	Floating 12-month	R-Y4C-002-L[1]	Included
N9079EM0D-1UP	USB portable perpetual	R-Y5C-005-E[2]	R-Y6C-005-L[2]
N9079EM0D-1UL	USB portable 12-month	R-Y4C-005-L[1]	Included

One month software support subscription extensions [3]

Model	Description
R-Y6C-501[3]	1-month of software support subscription for node-locked license
R-Y6C-502[3]	1-month of software support subscription for floating license
R-Y6C-504[3]	1-month of software support subscription for transportable license
R-Y6C-505[3]	1-month of software support subscription for USB portable license

1. All time-based X-Series measurement application licenses includes a 12-month support contract which also includes the 12-month software support subscription as same duration.
2. Support contract must bundle software support subscription for all perpetual licenses in the first year. All software upgrades and Keysight support are provided for software licenses with valid support subscription.
3. After the first year, software support subscription may be extended with annual or monthly software support subscription extensions for perpetual licenses.

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Hardware Configurations

To learn more about compatible platforms and required configurations, please visit: www.keysight.com/find/X-Series_apps_platform

Software Models & Options

To learn more about X-Series measurement application licensing, model numbers and options, please visit: www.keysight.com/find/X-Series_apps_model

Hardware Configuration

For optimizing the TD-SCDMA/HSPA measurement application, Keysight recommends a minimum level of instrument hardware functionality at each instrument performance point. Supported instruments include:

Benchtop:
- PXA N9030A
- EXA N9010A
- MXA N9020A
- CXA N9000A

PXIe:
- VSA (6 GHz) M9391A
- VSA (50 GHz) M9393A
- VXT M9420/21A

N90x0A X-Series signal analyzer

Capability	Instrument Option	Benefit
Analysis bandwidth	10 or 25 MHz as default or higher	**Required**: Wider analysis bandwidth options such as 25/40/85/160 MHz can be selected depending on the specified signal analyzer model
Precision frequency reference	-PFR	**Recommended**: For enhanced frequency accuracy and repeatability for lower measurement uncertainty
Electronic attenuator	-EA3	**Recommended**: Fast and reliable attenuation changes ideal for manufacturing without the wear associated with mechanical attenuators up to 3.6 GHz in 1 dB steps
Pre-amplifier	3.6 GHz (-P03) or higher	**Recommended**: For maximizing the measurement sensitivity
Fine resolution step attenuator	-FSA	**Recommended**: Useful for maximizing useable dynamic range to see signals
Analog baseband I/Q inputs	-BBA on PXA and MXA only	**Optional**: To extend measurements at baseband if required by device under test

M9391/93A PXIe VSA vector signal analyzer

Description	Model-Option	Additional information
Frequency range 3 or 6 GHz	M9391A-F03, or F06	One required for M9391A
Frequency range 8.4, 14, 18, or 27 GHz Frequency extension to 43.5 or 50 GHz	M9393A-F08, F14, F18, or F27 M9393A-FRZ or FRX	One required for M9393A Optional (requires M9393A-F27)
Analysis bandwidth 40, 100 or 160 MHz	M9391A/M9393A-B04, B10 or B16	One required
Memory 128, 512 or 1024 MSa	M9391A/M9393A-M01, M05 or M10	One required
Frequency reference 10 MHz and 100 MHz	M9391A/M9393A-300	One required

M9420/21A PXIe VXT vector transceiver

Description	Model-Option	Additional information
Frequency range 3.8 or 6 GHz	M9420A/M9421A-504, or 506	One required
Analysis bandwidth 40, 80 or 160 MHz	M9420A/M9421A-B40/B80/B1X	One required
Memory 256 or 512 MSa	M9420A/M9421A-M02/M05	One required
Half duplex port	M9420A/M9421A-HDX	Optional
High output power	M9420A/M9421A-1EA	Optional

Related Literature

Description	Publication number
N9079A & W9079A Self-Guided Demonstration	5990-5928EN
Keysight Signal Generators and Spectrum analyzers TD-SCDMA Solutions (Chinese), Application Note	5989-6744CHCN
N9079A & W9079A TD-SCDMA with HSPA/8PSK Measurement Application Measurement Guide	N9079-90005
User's and Programmer's Reference Guide is available in the library section of the N9079A and W9079A product pages.	

Web

Product page:
www.keysight.com/find/N9079D

X-Series measurement applications:
www.keysight.com/find/X-Series_Apps

X-Series signal analyzers:
www.keysight.com/find/X-Series

PXIe VXT vector transceiver:
www.keysight.com/find/VXT

PXIe VSA vector signal analyzer:
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Application pages:
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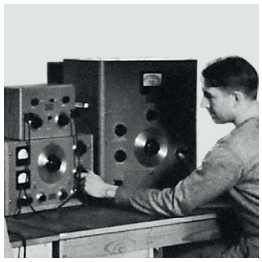

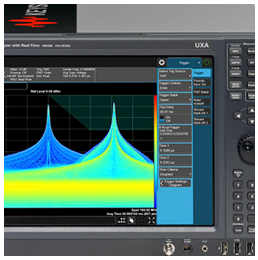

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