TD-SCDMA
X-Series Measurement Application
N9079A & W9079A

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
- Transportable license between X-Series signal analyzers

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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.

The TD-SCDMA measurement application is just one in a common library of more than 25 measurement applications for the Agilent X-Series signal analyzers, 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.

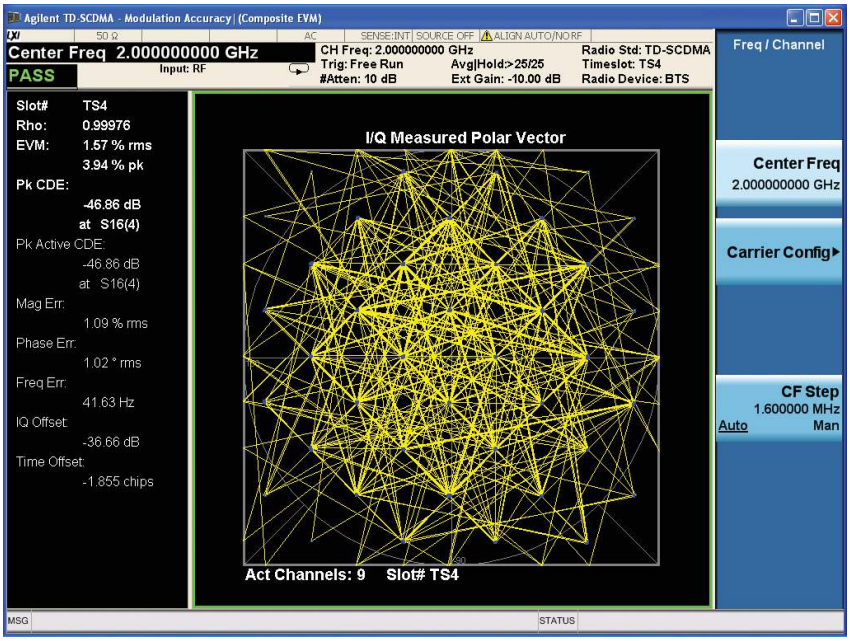

Figure 1. TD-SCDMA composite EVM

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 N/W9079A and 89600B VSA.

3GPP TS.25.142 paragraph number	Transmitter test	N/W9079A TD-SCDMA measurement application	89601B Option B7X – TD-SCDMA modulation analysis
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.

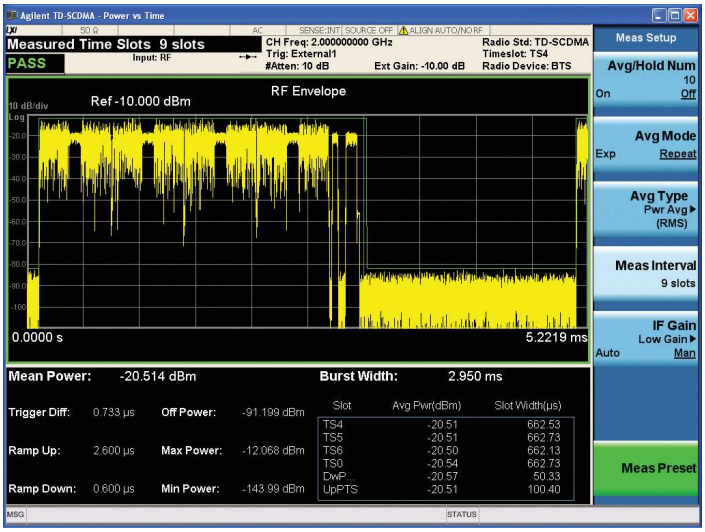

Figure 2. TD-SCDMA PvT measurement of nine time slots on one 5 ms sub-frame

Table 3. List of one-button measurements provided by N/W9079A 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 N9079A or W9079A.*

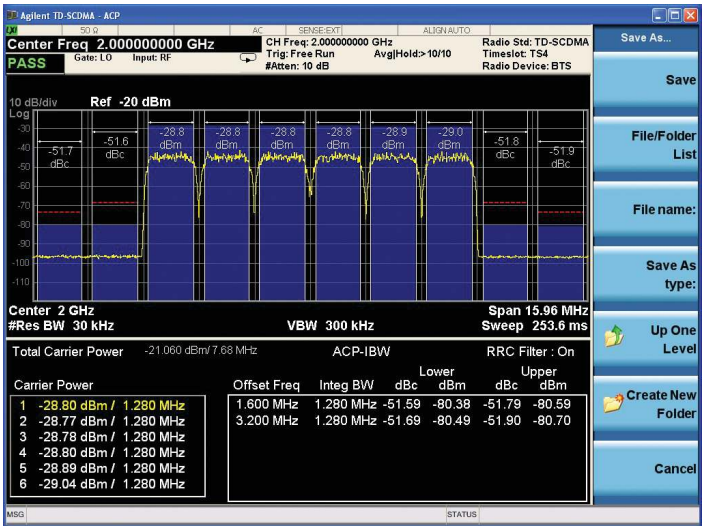

Figure 3. TD-SCDMA six carriers ACP

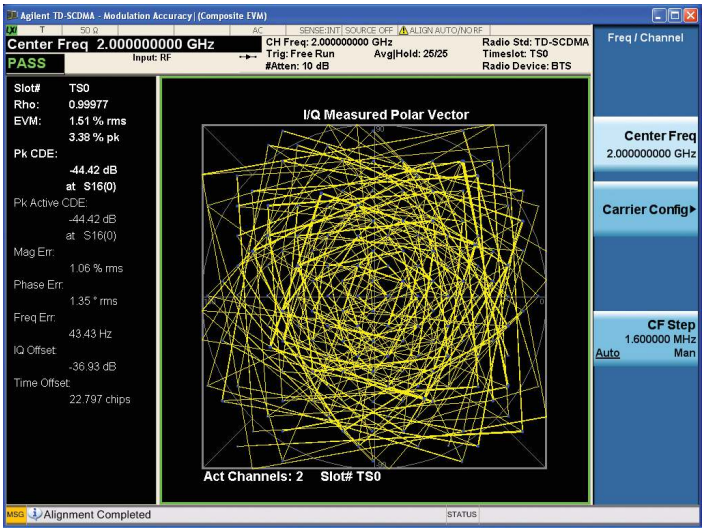

Figure 4. Composite EVM for time slot 0 with 40 degree phase rotation

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

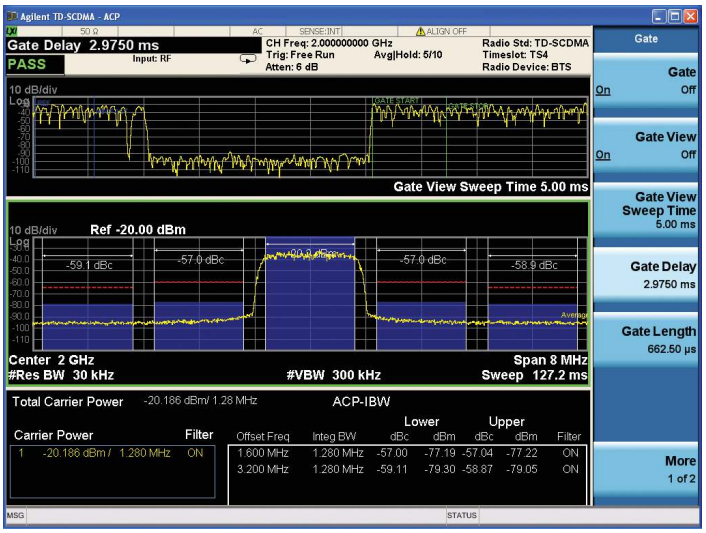

Figure 5. W9079A TD-SCDMA ACP measurement image with gate view on for CXA

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%)	± 0.61 dB (95%)
Measurement floor	± 0.20 dB (95%)	± 0.25 dB (95%)	± 0.29 dB (95%)	± 0.61 dB (95%)
Power vs. time				
Burst type	Traffic, UpPTS and DwPTS			
Measurement time	Up to 9 slots			
Power accuracy	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	± 0.25 dB
	(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	± 0.10 dB
816 kHz offset, absolute	± 0.29 dB (95%)	± 0.27 dB (95%)	± 0.31 dB (95%)	± 0.97 dB (95%)
Spurious emissions				
Dynamic range, relative	107.4 dB (typ)	101.7 dB (typ)	98.4 dB (typ)	86.5 dB (typ)
Sensitivity, absolute	–91.4 dBm (typ)	–89.4 dBm (typ)	–85.4 dBm (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

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

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.

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

N9079A & W9079A TD-SCDMA X-Series measurement application

Description	Model-Option		Additional information
	PXA, MXA, EXA	**CXA**	
TD-SCDMA	N9079A-1FP	W9079A-1FP	
Add HSPA/8PSK	N9079A-2FP	W9079A-2FP	Option 1FP is required

X-Series Measurement Application Updates

To update a previously purchased N9079A/W9079A measurement application to include the latest feature updates, you can purchase the N9079A-MEU or W9079A-MEU minor enhancement update.

For more information, visit:
www.agilent.com/find/N9079A-MEU for PXA, MXA, EXA
www.agilent.com/find/W9079A-MEU for CXA

Hardware configuration

N9030A PXA signal analyzer

Description	Model-Option	Additional information
3.6, 8.4, 13.6, 26.5, 42.98, 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
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, -P26, -P43, -P44 or P50	One required for PvT measurement of BTS Tx Off power of –82 dBm at 1.28 MHz bandwidth

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
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 required for PvT measurement of BTS Tx Off power of –82 dBm at 1.28 MHz bandwidth

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
Electronic attenuator, 3.6 GHz	N9010A-EA3	Recommended
Preamplifier, 3.6, 7.0, 13.6, or 26.5 GHz	N9010A-P03, -P07, -P13, or -P26	One required for PvT measurement of BTS Tx Off power of –82 dBm at 1.28 MHz bandwidth

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
Preamplifier, 3.0, 7.5, 13.6, or 26.5 GHz	N9000A-P03, -P07, -P13, or -P26	One required for PvT measurement of BTS Tx Off power of –82 dBm at 1.28 MHz bandwidth
Fine step attenuator	N9000A-FSA	Recommended

Related Literature

N9079A & W9079A Self-Guided Demonstration, literature number 5990-5928EN

Agilent Signal Generators and Spectrum analyzers TD-SCDMA Solutions (Chinese), Application Note, literature number 5989-6744CHCN

N9079A & W9079A TD-SCDMA with HSPA/8PSK Measurement Application Measurement Guide, Part Number 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.agilent.com/find/N9079A and **www.agilent.com/find/W9079A**

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For other unlisted countries:
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