Keysight Technologies
M9079A TD-SCDMA

X-Series Measurement Application for PXI Vector Signal Analyzers

Technical Overview

KEYSIGHT TECHNOLOGIES

– 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
– Transmitter tests with pass/fail limits per 3GPP standard
– PC-based SCPI remote interface and manual user interface
– Built-in context sensitive help with SCPI command reference
– Transportable license supports up to four PXI VSA channels in one mainframe

TD-SCDMA 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 TD-SCDMA measurement application transforms PXI VSAs into standard-based TD-SCDMA transmitter testers by adding fast, RF conformance measurements to help you speed up manufacturing of 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 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 89600 VSA for fast spectrum measurements.

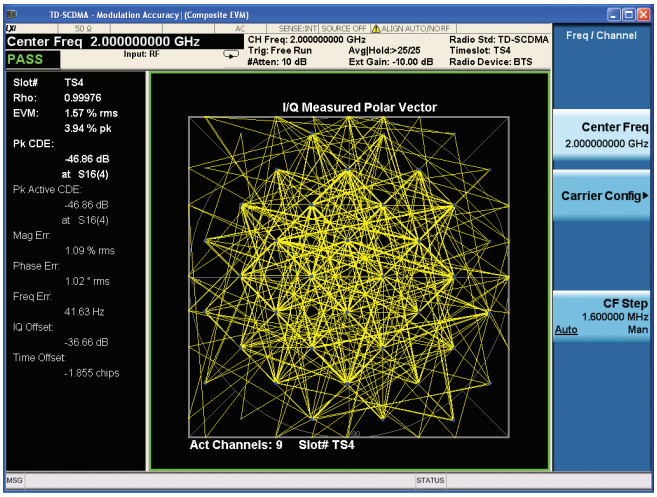

Figure 1. M9073A W-CDMA/HSPA+ X-Series measurement application for modular instruments.

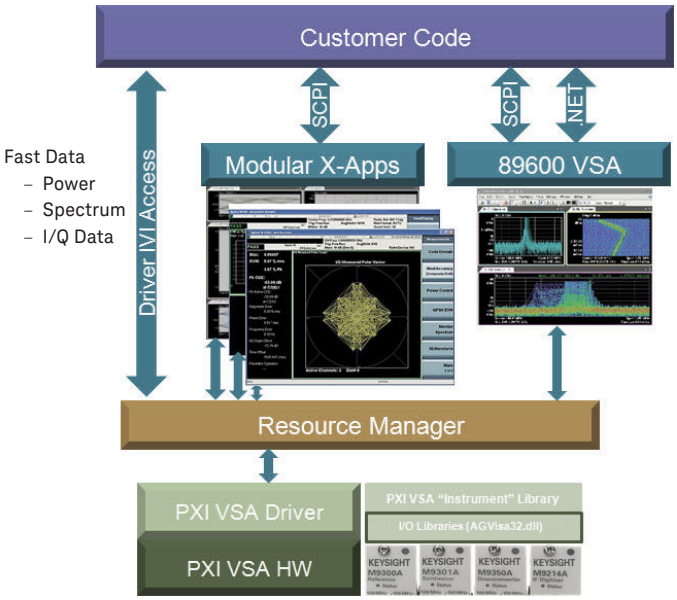

Figure 2. Resource manager included with all X-Series measurement applications for modular instruments.

TD-SCDMA Technical 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

The modular PXI VSAs, along 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 allmodulation 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 M9079A and 89600 VSA.

3GPP TS.25.142 paragraph number	Transmitter test	M9079A 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

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

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.

Table 3. List of one-button measurements provided by M9079A 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, M9079A option 2TP is required.

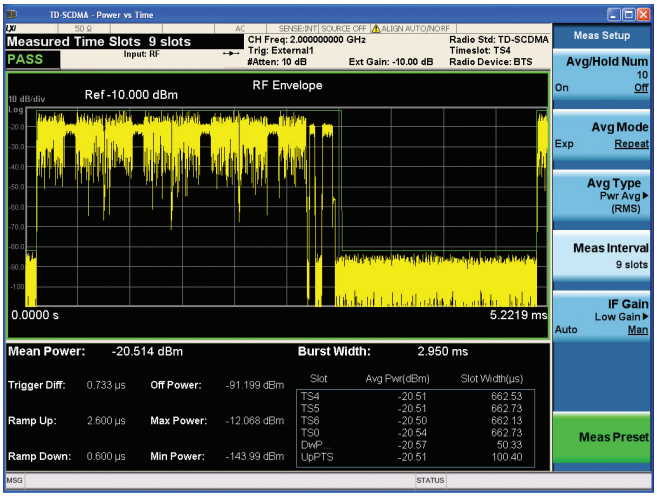

Figure 3. TD-SCDMA PvT measurement of nine time slots on one 5 ms sub-frame

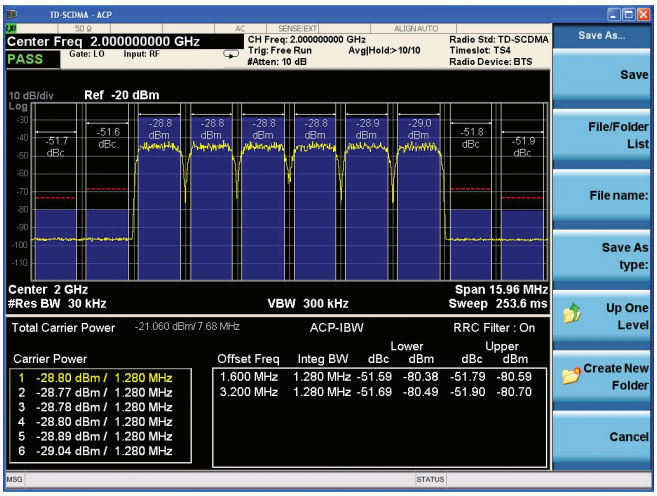

Figure 4. TD-SCDMA six carriers ACP

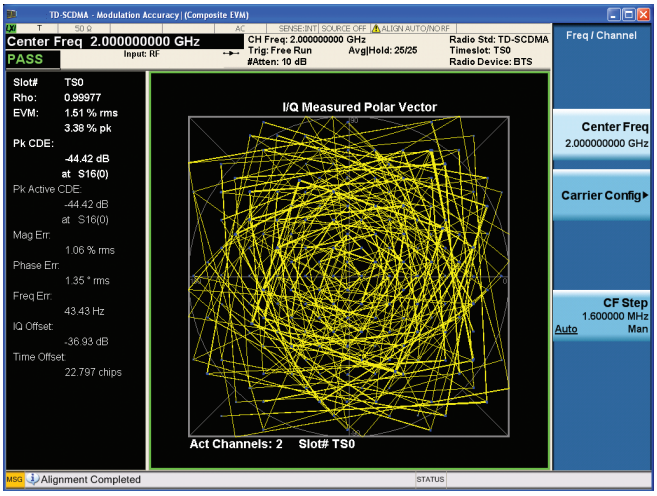

Figure 5. Composite EVM for time slot 0 with 40 degree phase rotation

Measurement Consistency You can Trust

Did you know that X-Series measurement applications for modular instruments use the same measurement algorithms and programming commands as the bench top applications? This means you will get consistent measurement results if you use Keysight bench top and modular equipment across the product development cycle. Learn how this consistency and programming compatibility will increase the efficiency of your product development cycle.

www.keysight.com/find/measurementconsistency

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

Modulation accuracy (Composite EVM) BTS measurements (–25 dBm ≤ ML ≤ –15 dBm, 20 to 30 °C)	**M9391A PXIe Vector Signal Analyzer**
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%

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.

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

N9079A TD-SCDMA measurement application

Model-option	Description	Notes
M9079A - 1TP	TD-SCDMA measurement application, transportable perpetual license	
M9079A - 2TP	Add HSPA/8PSK measurement application, transportable perpetual license	Option 1TP is required
M9079A - MEU	Minor enhancement update, transportable license	Provides latest updates to previous software versions

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

Related Literature

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

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

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:
www.keysight.com/find/M9079A

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

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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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