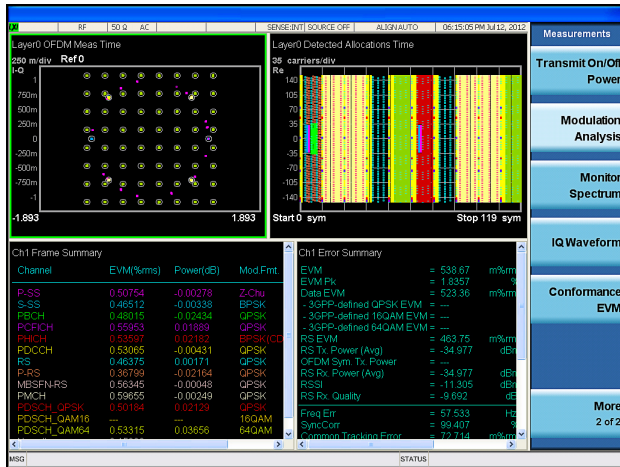
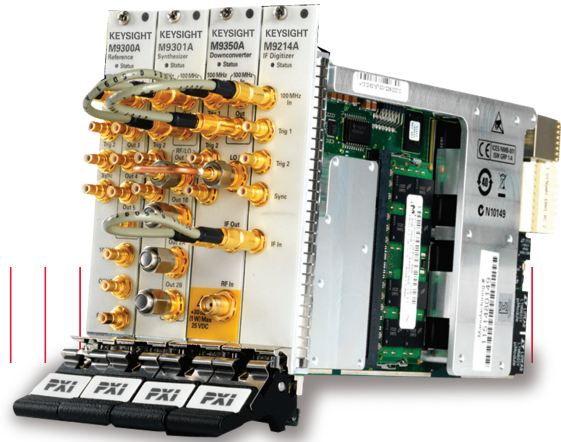


Keysight Technologies

M9080B & M9082B LTE & LTE-Advanced FDD/TDD

X-Series Measurement Applications for PXIe Vector Signal Analyzers

Technical Overview



- Perform LTE plus LTE-Advanced FDD and TDD base station (eNB) and user equipment (UE) transmitter tests
- Accelerate measurements with one-button RF conformance tests as defined by 3GPP TS 36.141 and 36.521 specification
- Analyze carrier-aggregated signal of up to 5 contiguous/non-contiguous component carriers
- 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

LTE/LTE-Advanced FDD and TDD Measurement Applications

Expand the capabilities of your M9391A and M9393A PXIe vector signal analyzers (PXI VSAs) with Keysight Technologies' 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 PXIe 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 LTE/LTE-Advanced FDD and TDD measurement applications transform the PXI VSAs into 3GPP LTE/LTE-Advanced standard-based RF transmitter testers. The applications provide fast, one-button RF conformance measurements to help you design, evaluate, and manufacture your LTE and LTE-Advanced base stations (eNB) and user equipment (UE). The measurement applications closely follow the 3GPP standard, allowing you to stay on the leading edge of your design and manufacturing challenges.

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. The LTE/LTE-Advanced measurement applications are two in a common library of several measurement applications. 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 software for fast spectrum measurements.

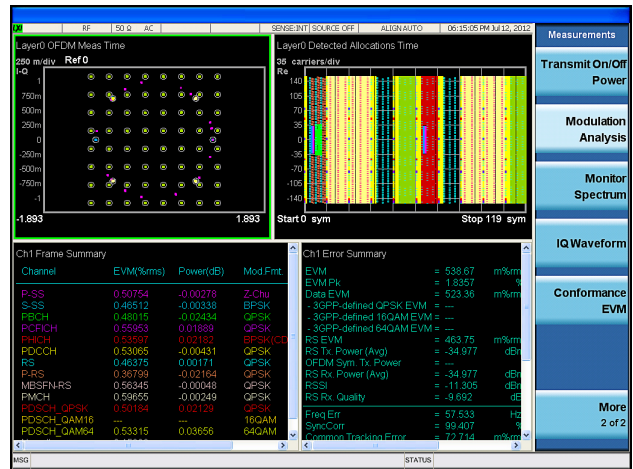


Figure 1. LTE downlink modulation analysis measurement showing constellation, detected allocation, frame summary, and error summary information. Measurements are color-coded based on channel type for ease of troubleshooting.

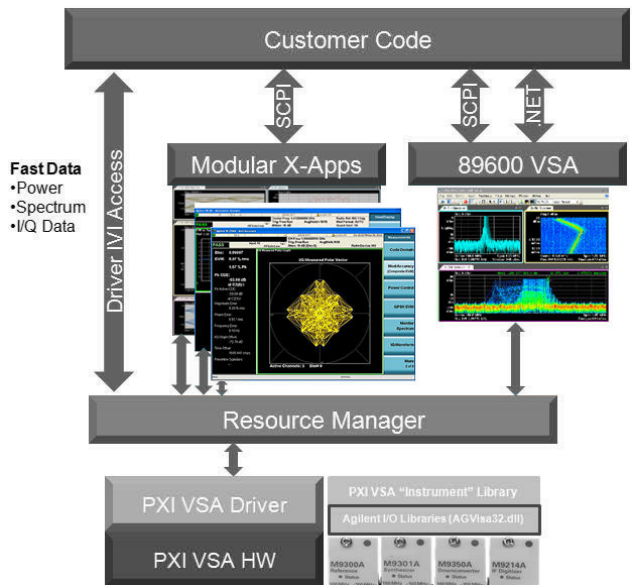


Figure 2. Resource manager included with all X-Series measurement applications for modular instruments.

LTE/LTE-Advanced FDD and TDD Overview

LTE is the long term evolution of 3GPP's universal mobile telephone system (UMTS). The aim of LTE is to provide a new radio access technology focused on packet-switched data only. Multiple requirements are set to achieve increased downlink and uplink peak data rates, scalable channel bandwidths, spectral efficiency improvements, control/user-plane latency, and co-existence with legacy standards while evolving towards an all-IP network. LTE accommodates both paired spectrum for frequency division duplex (FDD) and unpaired spectrum for time division duplex (TDD) operation. There is a high degree of commonality between FDD and TDD modes. These two modes are coordinated in the sense that they both share the same underlying framework including radio access schemes orthogonal frequency division multiple access (OFDMA) for the downlink, and single-carrier frequency division multiple access (SC-FDMA) for the uplink. Both modes share a single radio-access specification, equally applicable to paired and unpaired spectrum. There are some significant differences in specifications between FDD and TDD, most notably on the physical layer in the frame structure. There are few differences on the higher layers.

LTE-Advanced is not a new technology, instead it is an evolution step in the continuing development of LTE. It was initially specified as part of Release 10 of the 3GPP standard with continued evolution with additional features in Release 11 and more upcoming features in Release 12 and beyond. The three key LTE-Advanced technologies that are essential for meeting the ITU 4G requirements are: carrier aggregation, enhanced uplink multiple access, and enhanced multiple antenna transmission. Carrier aggregation is one of the key features of LTE-Advanced and the earliest deployed technologies of LTE-Advanced. It allows two or more (up to 5) component carriers to be aggregated in both contiguous and non-contiguous configurations in order to support up to 100 MHz transmission bandwidth.

Table 1. Physical layer comparisons of LTE and LTE-Advanced FDD/TDD

	LTE FDD (3GPP Rel 8/9)	LTE TDD (3GPP Rel 8/9)	LTE-Advanced FDD (3GPP Rel 10/11)	LTE-Advanced TDD (3GPP Rel 10/11)
Radio access mode	FDD	TDD	FDD	TDD
Radio frame length	10 ms (20 slots, 10 sub-frames)			
Transmission scheme	Downlink: OFDMA Uplink: SC-FDMA		Downlink: OFDMA Uplink: SC-FDMA, clustered SC-FDMA	
Channel bandwidth (BW)	Maximum: 20 MHz 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz		Maximum: 100 MHz with carrier aggregation; BW per component carrier (CC): 1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz	
Data type	Packet switched for both voice and data, no circuit switched			
Data modulation	Downlink: QPSK, 16QAM, 64 QAM Uplink: QPSK, 16 QAM; 64 QAM for UE category 5 only		Downlink: QPSK, 16QAM, 64 QAM Uplink: QPSK, 16 QAM; 64 QAM for UE categories 5, 7, and 8 only	
Peak data rate	Downlink – 300 Mbps Uplink – 75 Mbps		Downlink – 1 Gbps Uplink – 500 Mbps	
MIMO technology	Downlink: Up to 4x4 spatial multiplexing; transmit diversity; multi-user (MU) MIMO; beamforming Uplink: MU-MIMO - more than one UE transmit in the same time-frequency resource		Downlink: Up to 8x8 spatial multiplexing; transmit diversity; MU-MIMO; beamforming Uplink: Up to 4x4 spatial multiplexing for data (PUSCH); transmit diversity for control (PUCCH); MU-MIMO	

RF Transmitter Tests

With the LTE/LTE-Advanced FDD and TDD measurement applications, you can perform RF transmitter measurements on eNB and UE devices in time, frequency, and modulation domains. Measurement setups are simplified with automatic detection of downlink channels and signals. For eNB conformance testing, measurement is simplified by recalling E-TM presets according to 3GPP TS 36.141 specification.

For LTE-Advanced demodulation measurements, such as EVM and frequency error, the measurement application uses an automatic sequencing function, instead of a single wideband capture of the multi-carrier signal, eliminating the need for the wide analysis bandwidth option on the signal analyzer and thereby reducing the overall test equipment cost. The measured results of up to 5 CCs for LTE-Advanced can be viewed side-by-side and represented in multiple domains such as resource block, sub-carrier, slot, or symbol. Graphical displays with color coding and marker coupling allows you to search for problems faster and troubleshoot the found problems quicker. For manufacturing, “conformance EVM” measurement provides significant speed improvement over the traditional EVM measurement.

In addition, the measurement applications allow you to test beyond physical layer by using the transport layer decoding functionality. Troubleshoot transport layer problems and verify the channel encoding is correct by accessing data at different points in the receiver chain such as demapped, deinterleaved, descrambled, deratematched, and decoded data.

For unwanted emissions, 3GPP Release 11 adds LTE-Advanced RF conformance requirements for intra-band, non-contiguous carrier aggregation because the spectrum in the sub-block gap can be deployed by another service provider, perhaps using a different technology. These new RF requirements are cumulative adjacent channel leakage power (CACLR), to measure the contributions from carriers on both sides of the sub-block gap, and cumulative spectrum emissions mask (SEM) measurement where a new special limit mask is defined for unwanted emissions within a sub-block gap calculated as the cumulative sum of contribution from each sub-block. The LTE-Advanced embedded measurement application provides limits for both CACLR and SEM in non-contiguous carrier aggregation.

Choosing between X-Series embedded 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/89600_vsa

Standard-Based RF Transmitter Tests

The RF transmitter conformance test requirements for LTE/LTE-Advanced FDD and TDD are defined in 3GPP 36.141 (eNB) and 36.521-1 (UE) of the 3GPP standard. Table 2 shows the required eNB RF transmitter tests along with the corresponding measurements available in the X-Series and 89600 LTE/LTE-Advanced applications. Table 3 shows similar information for UE transmitter tests.

Table 2. Required base station (eNB) RF transmitter measurements and the corresponding measurements in M9080B/M9082B and 89600 VSA

3GPP TS36.141 paragraph #	Transmitter test	E-TM required	M9080B (FDD) M9082B (TDD) measurement applications ¹	89601B Option BHD/BHG (FDD) Option BHE/BHH (TDD) ¹
6.2	Base station output power	E-TM1.1	Channel power ²	Channel power using band power marker ²
6.3.2	Total power dynamic range	E-TM 2 E-TM 3.1	OFDM symbol Tx. power (OSTP) ³	OFDM symbol Tx. power ³
6.4	Transmit ON/OFF power (TDD only)	E-TM1.1	Transmit ON/OFF power (M9082B only) ⁴	Not available
6.5.1	Frequency error	E-TM 2 E-TM 3.1	Frequency error ³	Frequency error ³
6.5.2	Error vector magnitude	E-TM 3.2 E-TM3.3	EVM ³	EVM ³
6.5.3	Time alignment error (TAE)	E-TM 1.1	MIMO summary or time offset ⁵	MIMO info table or cross-carrier summary ⁵
6.5.4	DL RS power	E-TM 1.1	RS Tx power (RSTP) ³	RS Tx power ³
6.6.1	Occupied bandwidth	E-TM 1.1	Occupied BW	89600-based solutions offer modulation-quality measurements; for one-button, non-demodulation measurements such as ACLR and spectrum emission mask, the embedded application should be used
6.6.2	Adjacent channel leakage power ratio (ACLR)	E-TM 1.1 E-TM 1.2	ACP	
6.6.2.6	Cumulative ACLR (LTE-Advanced only)	E-TM 1.1 E-TM 1.2	ACP	
6.6.3	Operating band unwanted emissions (SEM)	E-TM 1.1 E-TM 1.2	Spectrum emission mask	
6.6.3	Cumulative mask for SEM (LTE-Advanced only)	E-TM 1.1 E-TM 1.2	Spectrum emission mask	
6.6.4	Transmitter spurious emission	E-TM 1.1	Spurious emissions	
6.7	Transmitter intermodulation	E-TM 1.1	ACP, SEM, spurious emissions	

1. All of the measurements are available for single carrier (LTE) or multiple-carrier LTE-Advanced with up to 5 component carriers. M9080B/M9082B option 1FP is LTE, option 2FP is LTE-Advanced.
2. These are pre-demodulation channel power measurements. Channel power reading is also available after demodulation under "Error Summary" trace.
3. For M9080B/M9082B, these measurements are available under "Error Summary" trace in Mod Analysis as well as under "Conformance EVM" measurement. For 89600, they are available under "Error Summary" trace.
4. For LTE-Advanced, this measurement is supported for contiguous carrier aggregation and requires analysis bandwidth on PXI VSA wide enough to cover the aggregated bandwidth.
5. "MIMO Summary"/"MIMO Info Table" traces are used to measure TAE for MIMO and Tx diversity signals. For carrier aggregation, time offset reading under "Error Summary" trace is used for M9080B/M9082B and "Cross-carrier Summary" trace is used for 89600 VSA Version 18 or higher.

For uplink, LTE-Advanced added transmitter RF conformance test for carrier aggregation (CA) and uplink MIMO (UL-MIMO) as shown in Table 3. Even though demodulation of UL-MIMO spatial multiplexing is not supported in the M9080B and M9082B embedded applications, the transmitter conformance test for UL-MIMO only requires testing the DUT at each antenna port using UL RMC (same as LTE), so the applications can also be used for UL-MIMO RF conformance test.

Table 3. Required user equipment (UE) RF transmitter measurements and the corresponding measurements in M9080B/M9082B and 89600 VSA

3GPP TS 36.521-1 paragraph #			Transmitter test	M9080B(FDD) M9082B(TDD) measurement applications	89601B Option BHD/ BHG(FDD) Option BHE/BHH (TDD)
LTE Rel 8 & up	LTE-Advanced CA	LTE-Advanced UL-MIMO			
6.2.2	6.2.2A	6.2.2B	UE maximum output power (MOP)	Channel power	Channel power using band power marker
6.2.3	6.2.3A	6.2.3B	Maximum power reduction (MPR)		
6.2.4	6.2.4A	6.2.4B	Additional maximum power reduction (A-MPR)		
6.2.5	6.2.5A	6.2.5B	Configured UE transmitted output power		
6.3.2	6.3.2A	6.3.2B	Minimum output power		
6.3.3	6.3.3A	6.3.3B	Transmit off power	Channel power or transmit on/off power	
6.3.4	6.3.4A	6.3.4B	On/off time mask	Transmit on/off power	Not available
6.3.5	6.3.5A	6.3.5B	Power control	Not available	Not available
6.5.1	6.5.1A	6.5.1B	Frequency error	Frequency error ¹ and frequency error per slot ²	Frequency error & frequency error per slot trace
6.5.2.1	6.5.2A.1	6.5.2B.1	Error vector magnitude (EVM)	EVM ¹	EVM
6.5.2.1A	N/A	N/A	PUSCH-EVM with exclusion period	EVM ¹	EVM
6.5.2.2	6.5.2A.2	6.5.2B.2	Carrier leakage	IQ offset ¹ & IQ offset per slot ²	IQ offset & IQ offset per slot
6.5.2.3	6.5.2A.3	6.5.2B.3	In-band emissions for non-allocated RB	In-band emissions ² (not available for CA)	In-band emissions (not available for CA)
6.5.2.4	N/A	6.5.2B.4	EVM equalizer spectrum flatness	Equalizer channel frequency response per slot ³	Per slot equalizer channel frequency response
6.6.1	6.6.1A	6.6.1B	Occupied bandwidth	Occupied BW	89600-based solutions offer modulation-quality measurements. For one-button, non-demodulation, measurements such as ACLR and spectrum emission mask, the embedded application should be used.
6.6.2.1	6.6.2.1A	6.6.2.1B	Spectrum emission mask (SEM)	SEM	
6.6.2.2	6.6.2.2A	6.6.2.2B	Additional SEM	SEM	
6.6.2.3	6.6.2.3A	6.6.2.3B	Adjacent channel leakage power ratio (ACLR)	ACP	
6.6.3.1	6.6.3.1A	6.6.3B.1	Transmitter spurious emission	Spurious emissions	
6.6.3.2	6.6.3.2A	6.6.3B.2	Spurious emission band UE co-existence	Spurious emissions	
6.6.3.3	6.6.3.3A	6.6.3B.3	Additional spurious emissions	Spurious emissions	
6.7	6.7A	6.7B	Transmit intermodulation	ACP	
N/A	N/A	6.8B	Time alignment	Time offset ¹	Time offset

1. These values are found in "Error Summary" table under Mod Analysis measurement or under Conformance EVM measurement for M9080B and M9082B.

2. These measurements are part of the Mod Analysis measurement. Once in Mod Analysis, they are found under [Trace/Detector] -> [Data] > {Demod Error}.

3. This measurement is part of the Mod Analysis measurement. Once in Mod Analysis, it is found under [Trace/Detector] -> [Data] > {Response}.

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 (Table 4 and 5). These measurements are fully remote controllable via the IEC/IEEE bus or LAN, using SCPI commands.

It is important to note that the measurements shown in Tables 4-5 for LTE FDD and TDD are available for a single carrier, while the measurements for LTE-Advanced FDD and TDD columns are available for multiple carriers with up to 5 component carriers.

eNB Transmitter Test

Table 4. List of eNB measurements provided by M9080B and M9082B measurement applications

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
X-Series measurement application	M9080B-1FP	M9080B-2FP	M9082B-1FP	M9082B-2FP
PXI VSA	M9391A, M9393A			
Modulation quality (error summary table):				
EVM (RMS, peak, data, RS)	--	--	--	--
Channel power	--	--	--	--
RS Tx. power (RSTP)	--	--	--	--
OFDM symbol Tx. power (OSTP)	--	--	--	--
RS Rx. power (RSRP)	--	--	--	--
RSSI	--	--	--	--
RS Rx. quality (RSRQ)	--	--	--	--
Frequency error	--	--	--	--
Common tracking error	--	--	--	--
Symbol clock error	--	--	--	--
Time offset	--	--	--	--
IQ (Offset, gain imbalance, quad error, timing skew)	--	--	--	--
Conformance EVM	--	--	--	--
Demodulated error traces:				
EVM vs. frequency (sub-carrier)	--	--	--	--
EVM vs. time (symbol)	--	--	--	--
EVM vs. resource block	--	--	--	--
EVM vs. slot	--	--	--	--
Frequency error per slot	--	--	--	--
Power vs. resource block	--	--	--	--
Power vs. slot	--	--	--	--
Symbols table:				
Numerical values of demodulated symbols (encoded)	--	--	--	--
Decoded symbol table:				
Numerical values of demodulated data include demapped, deinterleaved, descrambled, deratematched, and decoded data	--	--	--	--
Downlink decode table:				
Decode information from PBCH, PDCCH, PHICH, and PCFICH	--	--	--	--
Frame summary table:				
EVM, power, modulation format, and number of allocated RB and RNTI for all active channels and signals	--	--	--	--

Table 4. List of eNB measurements provided by M9080B and M9082B measurement applications (continued)

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
X-Series measurement application	M9080B-1FP	M9080B-2FP	M9082B-1FP	M9082B-2FP
PXI VSA	M9391A, M9393A			
TX diversity MIMO (up to 4 Tx antenna) traces: Info table				
RS power	--	--	--	--
RS EVM	--	--	--	--
RS CTE	--	--	--	--
RS timing	--	--	--	--
RS phase	--	--	--	--
RS symbol clock	--	--	--	--
RS frequency	--	--	--	--
IQ gain imbalance	--	--	--	--
IQ quadrature error	--	--	--	--
IQ time skew	--	--	--	--
Channel frequency response	--	--	--	--
Channel frequency response difference	--	--	--	--
Equalizer impulse response	--	--	--	--
Common tracking error	--	--	--	--
Detected allocations trace (resource block vs. symbol)	--	--	--	--
Response:				
Equalizer channel frequency response	--	--	--	--
Instantaneous equalizer channel frequency response	--	--	--	--
Equalizer channel frequency response difference	--	--	--	--
Instantaneous equalizer channel frequency response difference	--	--	--	--
Equalizer impulse response	--	--	--	--
Channel power	--	--	--	--
ACP	--	--	--	--
Cumulative ACLR (CACLR)	--	--	--	--
Transmit on/off power	--	--	--	--
Spectrum emission mask (SEM)	--	--	--	--
Cumulative SEM	--	--	--	--
Spurious emissions	--	--	--	--
Occupied bandwidth	--	--	--	--
CCDF	--	--	--	--
Monitor spectrum	--	--	--	--
I/Q waveform	--	--	--	--

Table 5. List of UE measurements provided by M9080B and M9082B measurement applications

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
X-Series measurement application	M9080B-1FP	M9080B-2FP	M9082B-1FP	M9082B-2FP
PXI VSA	M9391A, M9393A			
Modulation quality (error summary trace):				
EVM (RMS, peak, data, RS)	--	--	--	--
Frequency error	--	--	--	--
Common tracking error	--	--	--	--
Symbol clock error	--	--	--	--
Time offset	--	--	--	--
IQ (offset, gain imbalance, quad error, timing skew)	--	--	--	--
Channel power	--	--	--	--
In-band emissions result	--	--	--	--
		Not available for CA		Not available for CA
Spectral flatness result	--	--	--	--
	--	--	--	--
	--	--	--	--
	--	--	--	--
Conformance EVM	--	--	--	--
In-band emissions	--	--	--	--
		Not available for CA		Not available for CA
Spectrum flatness (eq. ch freq response per slot)	--	--	--	--
Demodulated error traces:				
EVM vs. frequency (sub-carrier)	--	--	--	--
EVM vs. time (symbol)	--	--	--	--
EVM vs. resource block	--	--	--	--
EVM vs. slot	--	--	--	--
IQ offset per slot	--	--	--	--
Frequency error per slot	--	--	--	--
Power vs. resource block	--	--	--	--
Power vs. slot	--	--	--	--
Symbols table:				
Numerical values of demodulated symbols (encoded)	--	--	--	--
Decoded symbol table:				
Numerical values of demodulated data and descrambled data for PUSCH	--	--	--	--
Frame summary table:				
EVM, power, modulation format and number of allocated RB for all active channels and signals	--	--	--	--
Detected allocations trace (resource block vs. symbol)	--	--	--	--

Table continued on next page

Table 5 continued. List of UE measurements provided by M9080B and M9082B measurement applications

Response:				
Equalizer channel frequency response	--	--	--	--
Instantaneous equalizer channel frequency response	--	--	--	--
Equalizer channel frequency response difference	--	--	--	--
Instantaneous equalizer channel frequency response difference	--	--	--	--
Equalizer impulse response	--	--	--	--
Equalizer channel frequency response per slot	--	--	--	--
Channel power	--	--	--	--
ACP	--	--	--	--
Transmit on/off power	--	--	--	--
Spectrum emission mask (SEM)	--	--	--	--
Spurious emissions	--	--	--	--
Occupied bandwidth	--	--	--	--
CCDF	--	--	--	--
Monitor spectrum	--	--	--	--
I/Q waveform	--	--	--	--

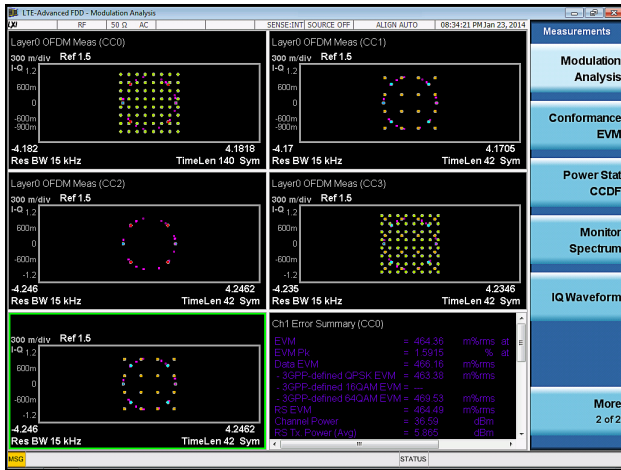


Figure 3. LTE-Advanced downlink modulation analysis showing constellation of five component carriers side-by-side.



Figure 4. Uplink modulation analysis measurement showing constellation, EVM vs. subcarrier, detected allocation, and EVM vs. symbol information for two component carriers. Measurements are color-coded based on channel type and up to 12 markers with marker coupling between measurements are available for easier troubleshooting.

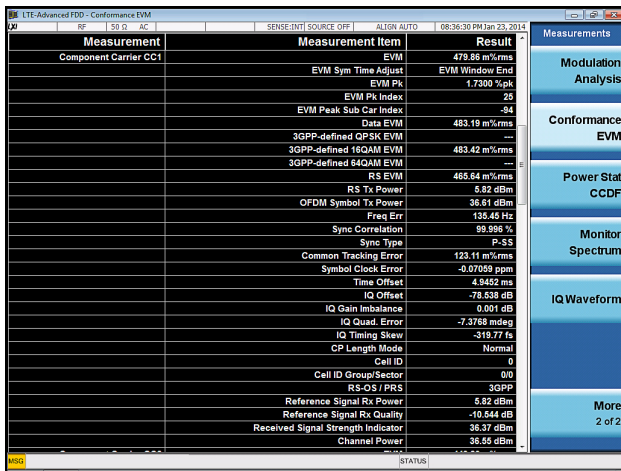


Figure 5. Conformance EVM measurement showing all required modulation quality metrics. This measurement is optimized for manufacturing because of its fast measurement speed.

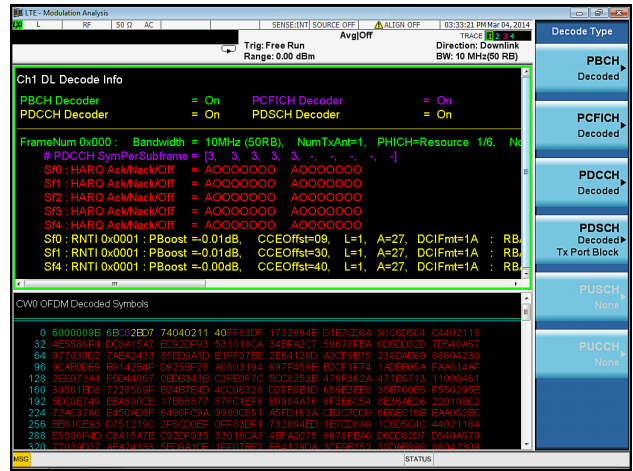


Figure 6. Downlink transport layer channel decoding measurement showing decoded information for PBCH, PDCCH, PCFICH, and PHICH channels. Similar capability is also available for uplink.

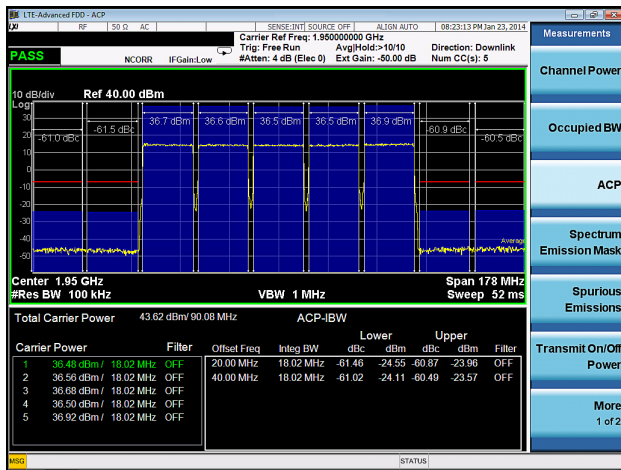


Figure 7. LTE-Advanced ACLR measurement with 5 contiguous component carriers.

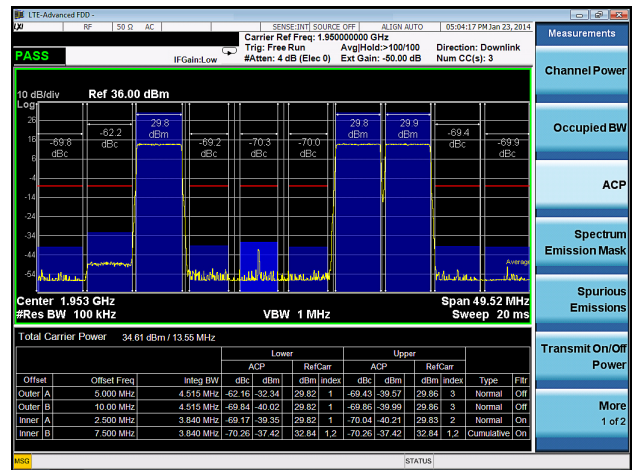


Figure 8. LTE-Advanced cumulative ACLR (CACLR) for non-contiguous carrier aggregation.

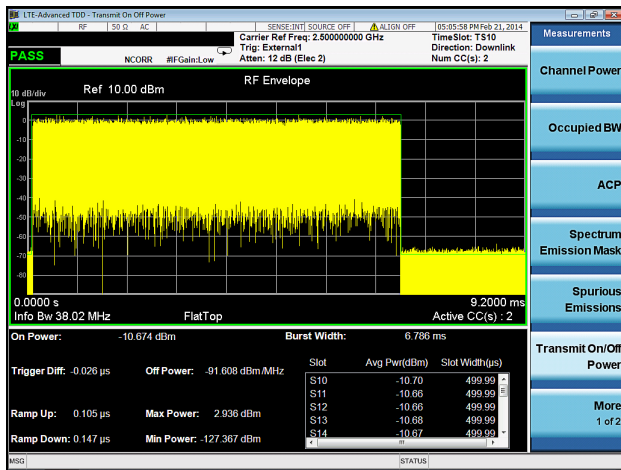


Figure 9. Transmit ON/OFF power measurement of an LTE-Advanced TDD downlink signal with two component carriers.

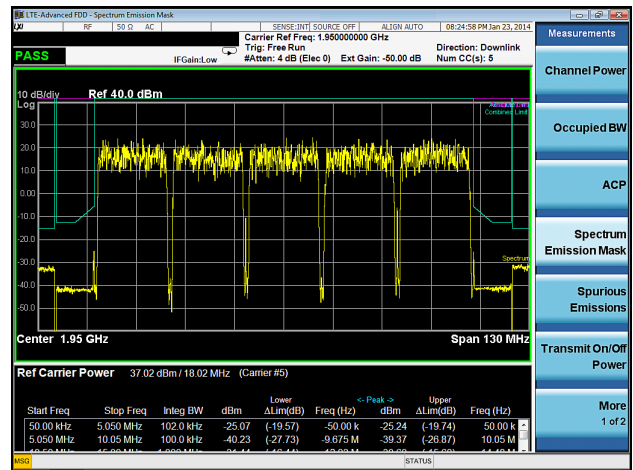


Figure 10. SEM measurement can be made on single carrier LTE or up to 5 component carrier LTE-Advanced signal.

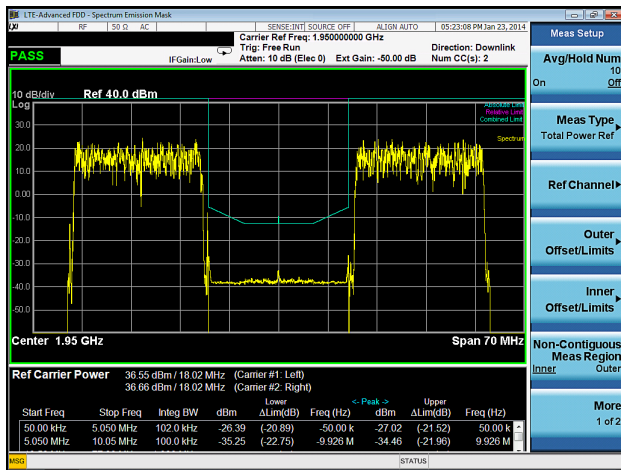


Figure 11. LTE-Advanced non-contiguous carrier aggregation SEM measurement with special cumulative mask inside the sub-block gap.

Key Specifications

Definitions

- Specifications describe the performance of parameters covered by the product warranty.
- The specifications apply to single carrier case only, unless otherwise stated.
- 95th percentile values indicate the breadth of the population ($\approx 2\sigma$) 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.

Note: Data subject to change

Supported devices and standards

Device type	LTE FDD/TDD M9080B-1FP/ M9082B-1FP	LTE-Advanced FDD/TDD M9080B-2FP/ M9082B-2FP
3GPP standards supported	36.211 V9.1.0 (March 2010) 36.212 V9.4.0 (September 2011) 36.213 V9.3.0 (September 2010) 36.214 V9.2.0 (June 2010) 36.141 V9.10.0 (July 2012) 36.521-1 V9.8.0 (March 2012)	36.211 V10.7.0 (March 2013) 36.212 V10.7.0 (December 2012) 36.213 V10.9.0 (March 2013) 36.214 V10.12.0 (March 2013) 36.141 V11.4.0 (March 2013) 36.521-1 V10.5.0 (March 2013)
Signal structure	FDD Frame Structure Type 1 TDD Frame Structure Type 2 Special subframe configurations 0-8	FDD Frame Structure Type 1 TDD Frame Structure Type 2 Special subframe configurations 0-8
Signal direction	Uplink and downlink UL/DL configurations 0-6	Uplink and Downlink UL/DL configurations 0-6
Signal bandwidth	1.4 MHz (6 RB), 3 MHz (15 RB), 5 MHz (25 RB), 10 MHz (50 RB), 15 MHz (75 RB), 20 MHz (100 RB)	Bandwidth per component carrier: 1.4 MHz (6 RB), 3 MHz (15 RB), 5 MHz (25 RB), 10 MHz (50 RB), 15 MHz (75 RB), 20 MHz (100 RB)
Number of component carriers	1	1, 2, 3, 4, or 5
Physical signals		
Downlink	PBCH, PCFICH, PHICH, PDCCH, PDSCH, PMCH	
Uplink	PUCCH, PUSCH, PRACH	
Physical channels		
Downlink	P-SS, S-SS, C-RS, UE-RS, P-PS (positioning), MBSFN-RS	P-SS, S-SS, C-RS, UE-RS, P-PS (positioning), MBSFN-RS, CSI-RS
Uplink	PUCCH-DMRS, PUSCH-DMRS, S-RS (sounding)	PUCCH-DMRS, PUSCH-DMRS, S-RS (sounding)

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

Performance specifications

Description	M9391A PXI VSA, nominal
Demodulation	
LTE FDD E-TM, 10 MHz BW, 2 GHz	-52 dB
LTE FDD E-TM, 10 MHz BW, <1 GHz	-51 dB
LTE TDD E-TM, 10 MHz BW, 2 GHz	-49 dB
LTE TDD E-TM, 10 MHz BW, <1 GHz	-50 dB
Adjacent Channel Power	
Adjacent channel	-64.9 dB
Alternate channel	-66.4 dB

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.

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. See www.keysight.com/find/M90XA for more information.

You can upgrade!

Options can be added after your initial purchase. All of our X-Series application options are license-key upgradeable.

M9080B LTE/LTE-Advanced FDD measurement application

Model-Option	Description	Additional information
M9080B-1TP	LTE FDD measurement application, transportable perpetual license	
M9080B-2TP	LTE-Advanced FDD measurement application, transportable perpetual license	Requires 1TP

Note: M9080B application requires Windows 7 operating system.

M9082B LTE/LTE-Advanced TDD measurement application

Model-Option	Description	Additional information
M9082B-1TP	LTE TDD measurement application, transportable perpetual license	
M9082B-2TP	LTE-Advanced TDD measurement application, transportable perpetual license	Requires 1TP

Note: M9082B application requires Windows 7 operating system.

Hardware Configuration

M9391A PXIe vector signal analyzer configuration

Model-Option	Description	Notes
M9391A-F03, -F06	3 GHz or 6 GHz frequency range	One required
M9391A-B04, -B10, or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. -B16 recommended for fastest 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, -M05, or -M10	Memory options (512 MB, 2 GB, or 4 GB)	Recommend 1 Gsa/4 GB memory

M9393A PXIe performance vector signal analyzer configuration

Model-Option	Description	Notes
M9393A-F08, -F14, -F18, or -F27	8 GHz, 14 GHz, 18 GHz, or 27 GHz frequency range	One required
M9393A-B04, -B10, or -B16	40 MHz, 100 MHz or 160 MHz analysis bandwidth	One required. -B16 recommended for fastest 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, -M05, or -M10	Memory options (512 MB, 2 GB, or 4 GB)	Recommend 1 Gsa/4 GB memory

Related Literature

- *N9080B LTE/LTE-Advanced FDD Measurement Application Measurement Guide*, Part Number N9080-90008
- *N9082B LTE/LTE-Advanced TDD Measurement Application Measurement Guide*, Part Number N9082-90004
- *3GPP Long Term Evolution: System Overview, Product Development, and Test Challenges, Application Note*, Literature Number 5989-8139EN
- *Introducing LTE-Advanced, Application Note*, Literature Number 5990-6706EN
- *Stimulus-Response Testing for LTE Components, Application Note*, Literature Number 5990-5149EN
- *Measuring ACLR Performance in LTE Transmitters, Application Note*, Literature Number 5990-5089EN
- *TD-LTE E-UTRA Base Station Transmit ON/OFF Power Measurement Using a Keysight X-Series Signal Analyzer, Application Note*, Literature Number 5990-5989EN
- User's and Programmer's Reference Guide is available in the library section of the N9080A, W9080A, N9082A and W9082A product pages.
- M9391A Data Sheet, Literature Number 5991-2603EN
- *X-Series Measurement Applications for Modular Instruments Brochure*, Literature Number 5991-2604EN

Web

- Product pages:
www.keysight.com/find/M9080B
www.keysight.com/find/M9082B
- X-Series measurement applications:
www.keysight.com/find/M90XA
- M9391A PXIe vector signal analyzer
www.keysight.com/find/M9391A
- M9393A PXIe performance vector signal analyzer
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