Keysight
LTE FDD/TDD X-Series Measurement Application N9080A and W9080A N9082A and W9082A

Technical Overview

– Perform LTE FDD and TDD base station (eNB) and user equipment (UE) transmitter test
– Perform one-button RF conformance tests for all LTE bandwidths
– Measure beyond physical layer using the transport layer channel decoding capability
– 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

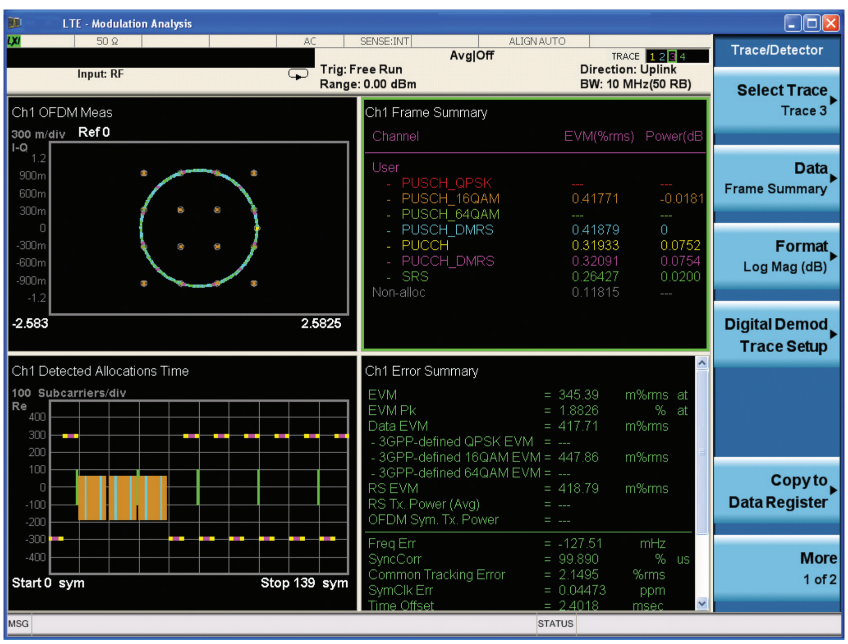
Note:
N9080A and N9082A have been replaced by N9080B and N9082B, respectively. Please refer to the N9080B/N9082B technical overview, literature number 5991-4368EN.

KEYSIGHT TECHNOLOGIES

LTE FDD and TDD Measurement Applications

The LTE FDD and LTE TDD measurement applications transform the X-Series signal analyzers into 3GPP LTE standard-based RF transmitter testers. The applications provide fast, one-button RF conformance measurements to help you design, evaluate, and manufacture your LTE base station (eNB) and user equipment (UE) devices. The measurement applications closely follow the 3GPP standard allowing you to stay on the leading edge of your design and manufacturing challenges.

The LTE FDD and LTE TDD measurement applications are two in a common library of more than 25 measurement applications in the Keysight X-Series, 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 you to transport the application to multiple X-Series analyzers.



Real-time spectrum analysis for LTE

Adding real-time spectrum analysis to a PXA or MXA signal analyzer addresses the measurement challenges associated with dynamic RF signals such as bursted transmissions of LTE-TDD, and enables identification of interference caused by signals in adjacent bands.

- Accurately observe power changes for an LTE signal within a 160 MHz real-time bandwidth
- Capture random interfering signals with durations as short as 3.57 µs
- Perform fast, wideband measurements without compromising EVM, ACPR or other RF measurements

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 X-Series analyzer. Redeem a trial license online today:

www.keysight.com/find/X-Series_trial

Technology Overview

Developed by the Third Generation Partnership Project (3GPP), LTE is the evolution of the Universal Mobile Telecommunication System (UMTS) towards an all-IP broadband network. LTE's evolved radio access technology—the E-UTRA— provides a framework for increasing data rates and overall system capacity, reducing latency, and improving spectral efficiency and cell-edge performance. It is documented in the 3GPP Release 8 and Release 9 specifications.

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. From a specification perspective, the few significant differences between FDD and TDD mode are on the physical layer, in particular, the frame structure. The differences in higher layers are very few.

Table 1. Physical layer comparisons of LTE FDD and LTE TDD

<table>
<tr><th></th><th>LTE FDD</th><th>LTE TDD</th></tr>
<tr><td>Radio access mode</td><td>FDD</td><td>TDD</td></tr>
<tr><td>Radio frame length</td><td>10 ms (20 slots, 10 sub-frames)</td><td>10 ms (20 slots, 10 sub-frames)</td></tr>
<tr><td rowspan="2">Transmission scheme</td><td>Downlink: OFDMA</td><td>Downlink: OFDMA</td></tr>
<tr><td>Uplink: SC-FDMA</td><td>Uplink: SC-FDMA</td></tr>
<tr><td>Channel bandwidth, 1 Resource Block (RB) = 180 kHz</td><td colspan="2">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)</td></tr>
<tr><td>Data type</td><td colspan="2">Packet switched for both voice and data. No circuit switched.</td></tr>
<tr><td rowspan="2">Data modulation</td><td colspan="2">Downlink: QPSK, 16QAM, 64QAM</td></tr>
<tr><td colspan="2">Uplink: QPSK, 16QAM, 64QAM (UE category 5 only)</td></tr>
<tr><td rowspan="3">Peak data rate (Mbps)</td><td colspan="2">Downlink (using 64QAM): 100 (SISO); 172.8 (2x2 MIMO); 326.4 (4x4 MIMO)</td></tr>
<tr><td colspan="2">Uplink (single transmit antenna): 50 (QPSK); 57.6 (16QAM); 86.4 (64QAM)</td></tr>
<tr><td colspan="2">Note: TDD rates are a function of up/downlink asymmetry</td></tr>
<tr><td rowspan="2">MIMO technology</td><td colspan="2">Downlink (up to 4 transmit antennas): Single user (SU)-MIMO spatial multiplexing (open loop and close loop), transmit diversity, cyclic delay diversity, dedicated beamforming (beamforming is particularly interesting for LTE TDD)</td></tr>
<tr><td colspan="2">Uplink (single transmit antenna per UE): Multi-user MIMO (MU-MIMO) – more than one UE transmit in the same time-frequency resource.</td></tr>
</table>

RF Transmitter Tests

With the X-Series signal analyzers and the LTE FDD and TDD measurement applications, you can perform RF transmitter measurements on BTS 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 the 3GPP TS 36.141 conformance document. The measured results can be viewed by resource block, sub-carrier, slot, or symbol. Graphical displays with color coding and marker coupling allow you to search for problems faster and troubleshoot the found problems quicker. For manufacturing, “conformance EVM” measurement provides up to 2x speed improvement over the traditional EVM measurement.

In addition, the measurement applications allow you to test beyond the physical layer by using the transport layer decoding functionality. Troubleshoot transport layer problems and verify the channel encoding is correct by getting access to data at different points in the encoding chain such as: de-mapped, de-interleaved, de-scrambled, de-ratematched, and decoded data.

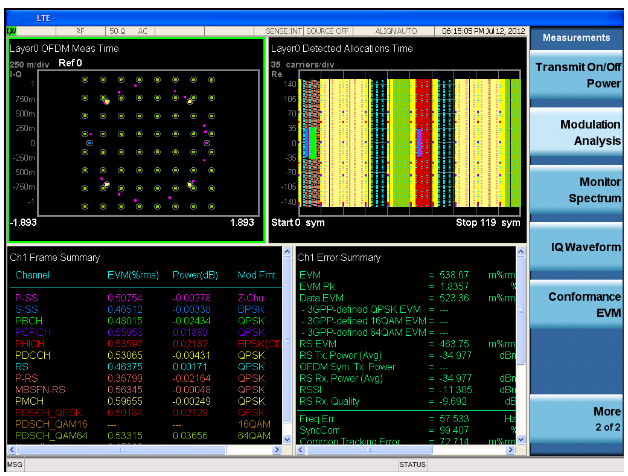


Figure 1. Downlink modulation analysis measurement showing constellation, detected allocation, frame summary, and error summary information. Measurements are color-coded based on channel type for ease of troubleshooting.

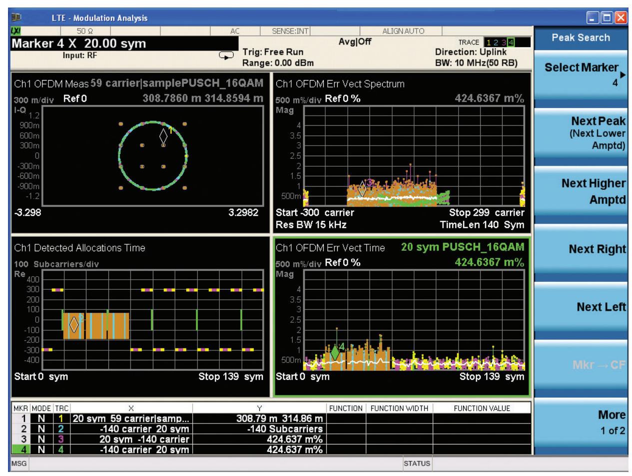


Figure 2. Uplink modulation analysis measurement showing constellation, EVM vs. subcarrier, detected allocation, and EVM vs. symbol information. Measurements are color-coded based on channel type and up to 12 markers with marker coupling between measurements are used for ease of troubleshooting.

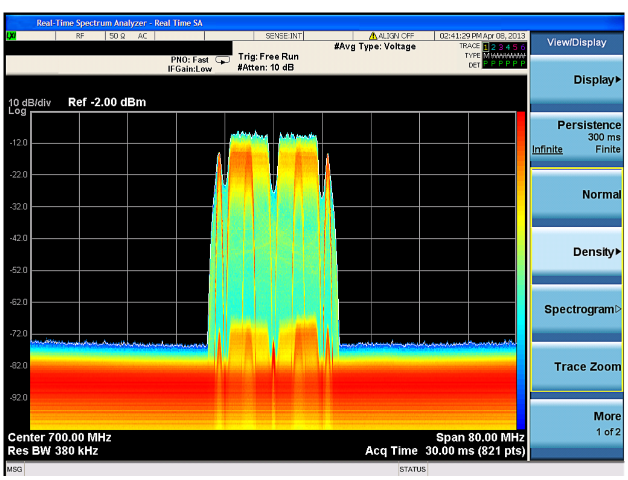


Figure 3. Real-time view of LTE-TDD uplink with PUCCH and frequency hopped PUSCH signal configuration using the RTSA option on a PXA or MXA signal analyzer.

Standards-Based RF Transmitter Test

Table 2. Required base station (eNB) RF transmitter measurements and the corresponding measurements in N/W9080A and N/W9082A and 89600 VSA

3GPP TS36.141 subclause	Transmitter test	E-TM required	N/W9080A (FDD) and N/W9082A (TDD) measurement applications	89600 VSA Options BHD (FDD) and BHE (TDD)
6.2	Base station output power	E-TM1.1	Channel power	Channel power using band power marker
6.3.1	RE power control dynamics	E-TM 2; E-TM 3.1; E-TM 3.2; E-TM 3.3	Modulation analysis [1]	Error summary trace [1]
6.3.2	Total power dynamic range	E-TM 2; E-TM 3.1	OFDM Symbol Tx. Power (OSTP) [2]	OFDM Sym.Tx Power [3]
6.4	Transmit ON/OFF power (TDD only)	E-TM1.1	Transmit ON/OFF Power (N9082A only)	Not available
6.5.1	Frequency error	E-TM 2; E-TM 3.1; E-TM 3.2; E-TM3.3	Freq error [2]	Freq error [3]
6.5.2	Error vector magnitude	E-TM 2; E-TM 3.1; E-TM 3.2; E-TM3.3	EVM [2]	EVM[3]
6.5.3	Time alignment between transmitter branches	E-TM 1.1	MIMO summary	MIMO info table
6.5.4	DL RS power	E-TM 1.1	RS Tx Power (RSTP) [2]	RS Tx Power [3]
6.6.1	Occupied bandwidth	E-TM 1.1	OBW	OBW [4]
6.6.2	Adjacent channel leakage power ratio	E-TM 1.1, E- TM 1.2	ACP	ACP [4]
6.6.3	Operating band unwanted emissions	E-TM 1.1, E-TM 1.2	Spectrum emission mask	Not available [5]
6.6.4	Transmitter spurious emission	E-TM 1.1	Spurious emissions	Not available [5]
6.7	Transmitter intermodulation	E-TM 1.1	ACP	ACP [4]

1. RE power control dynamic range is the difference between the power of an RE and the average RE power for a BS. No specific test for RE power control dynamic range. The EVM test provides enough test coverage for this requirement.
2. These values are found in “Error Summary” table under Mod Analysis measurement or under Conformance EVM measurement for N/W9080A and N/W9082A.
3. These values are found in “Error Summary” trace.
4. Measurement parameters must be set up manually within the 89600 VSA software or if 89600 VSA is used with an Keysight spectrum or signal analyzer, these measurements can be set up manually using the spectrum analyzer mode.
5. If 89600 VSA used with an Keysight spectrum or signal analyzer, these measurements can be set up manually using the spectrum analyzer mode.

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 Keysight hardware platforms to pinpoint the answers to signal problems in R&D.

www.keysight.com/find/89600vsa

Standards-Based RF Transmitter Test (continued)

Table 3. Required user equipment (UE) RF transmitter measurements and the corresponding measurements in N/W9080A and N/W9082A and 89600 VSA

3GPP TS 36.521-1 subclause	Transmitter test	N/W9080A (FDD) and N/W9082A (TDD) measurement applications	89600 VSA Options BHD (FDD) and BHE (TDD)
6.2.2	UE maximum output power (MOP)	Channel power	Channel power using band power marker
6.2.3	Maximum power reduction (MPR)	Channel power	Channel power using band power marker
6.2.4	Additional maximum power reduction (A-MPR)	Channel power	Channel power using band power marker
6.2.5	Configured UE transmitted output power	Channel power	Channel power using band power marker
6.3.2	Minimum output power	Channel power	Channel power using band power marker
6.3.3	Transmit off power	Channel power	Channel power using band power marker
6.3.4	On/off time mask	Transmit on/off power	Not available
6.3.5	Power control	Not available	Not available
6.5.1	Frequency error	Frequency error [1] and frequency error per slot [2]	Frequency error and frequency error per slot trace
6.5.2.1	EVM	EVM [1]	EVM
6.5.2.2	IQ-component	IQ offset [1] and IQ offset per slot [2]	IQ offset and IQ offset per slot
6.5.2.3	In-band emissions for non-allocated RB	In-band emissions [2]	In-band emissions
6.5.2.4	Spectrum flatness	Equalizer channel freq response per slot [3]	Per slot equalizer channel frequency response
6.6.1	Occupied bandwidth	Occupied BW	OBW [4]
6.6.2.1	Spectrum emission mask	Spectrum emission mask	Not available [5]
6.6.2.2	Additional spectrum emission mask	Spectrum emission mask	Not available [5]
6.6.2.3	Adjacent channel leakage power ratio (ACLR)	ACP	ACP [4]
6.6.2.4	Additional ACLR requirements	ACP	ACP [4]
6.6.3.1	Transmitter spurious emission	Spurious emissions	Not available [5]
6.6.3.2	Spurious emission band UE co-existence	Spurious emissions	Not available [5]
6.6.3.3	Additional spurious emissions	Spurious emissions	Not available [5]
6.7	Transmit intermodualtion	ACP	ACP [4]

1. These values are found in “Error Summary” table under Mod Analysis measurement or under Conformance EVM measurement for N/W9080A and N/W9082A.
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}.
4. Measurement parameters must be set up manually within the 89600 VSA software or if 89600 VSA is used with an Keysight spectrum or signal analyzer, these measurements can be set up manually using the spectrum analyzer mode.
5. If 89600 VSA is used with an Keysight spectrum or signal analyzer, these measurements can be set up manually using the spectrum analyzer mode.

Standards-Based RF Transmitter Test (continued)

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

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

Uplink/Downlink support

Supported downlink (eNB) channels/signals: P-SS; S-SS; C-RS; UE-RS; PBCH; PCFICH; PHICH; PDCCH; PDSCH; PMCH; MBSFN-RS; P-RS

Supported uplink (UE) channels/signals: PRACH; SRS; PUCCH; PUCCH-DMRS; PUSCH; PUSCH-DMRS

Table 4. List of eNB measurements provided by N/W9080A and N/W9082A measurement applications

Technology	**LTE FDD**	**LTE TDD**
X-Series measurement application	**N/W9080A**	**N/W9082A**
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)	•	•
– RS Rx. quality (RSRQ)	•	•
– RSSI	•	•
– 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, number of allocated RB and RNTI for all active channels and signals	•	•

Standards-Based RF Transmitter Test (continued)

Table 4. List of eNB measurements provided by N/W9080A and N/W9082A measurement applications (continued)

Technology	LTE FDD	LTE TDD
X-Series measurement application	N/W9080A	N/W9082A
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	•	•
Transmit on/off power		•
Spectrum emission mask (SEM)	•	•
Spurious emissions	•	•
Occupied bandwidth	•	•
CCDF	•	•
Monitor spectrum	•	•
I/Q waveform	•	•

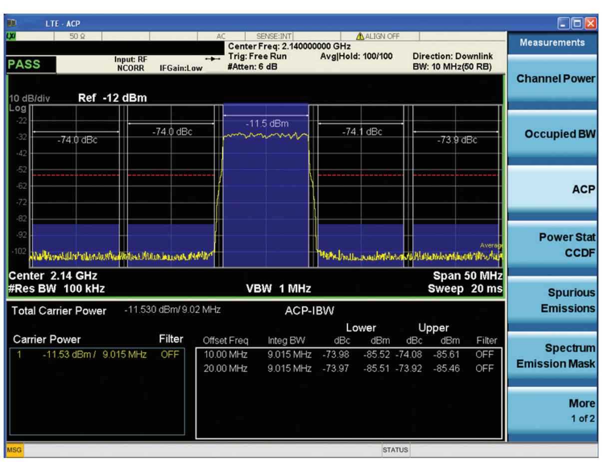


Figure 4. ACLR measurement with LTE main and adjacent carriers.

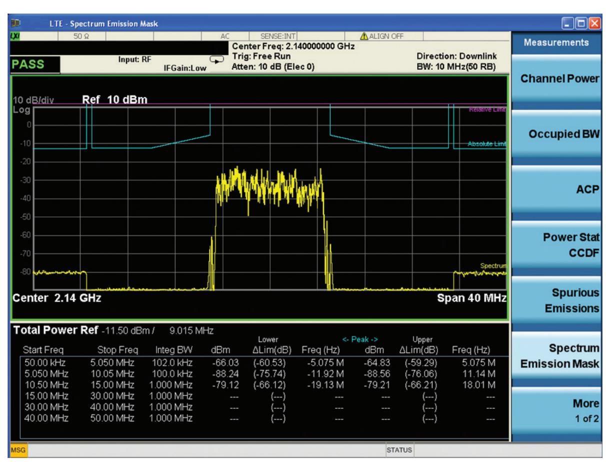


Figure 5. SEM measurement.

Standards-Based RF Transmitter Test (continued)

Table 5. List of UE measurements provided by N/W9080A and N/W9082A measurement applications

Technology	**LTE FDD**	**LTE TDD**
X-Series measurement application	**N/W9080A**	**N/W9082A**
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	•	•
– Spectral flatness result	•	•
Conformance EVM	•	•
In-band emissions	•	•
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: Demapped, descrambled, deratematched and decoded data	•	•
Uplink decode table:		
– Decode information from PUSCH and PUCCH	•	•
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)	•	•
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	•	•

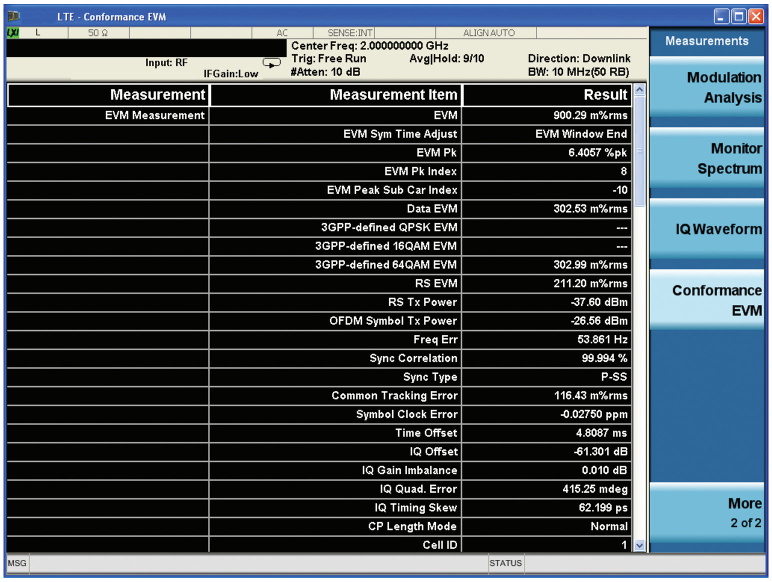


Figure 6. Conformance EVM measurement showing all required modulation quality metrics. This measurement is optimized for manufacturing because of its fast measurement speed.

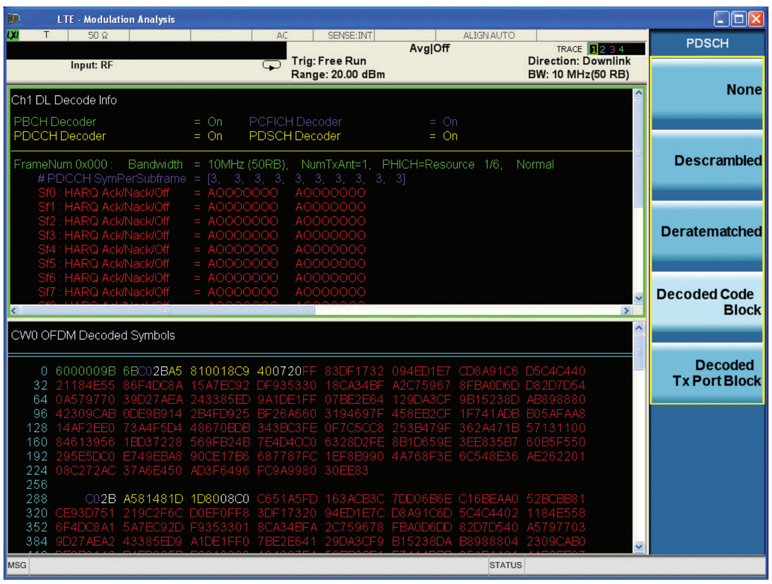


Figure 7. Downlink transport layer channel decoding measurement showing decoded information for PBCH, PDCCH, PCFICH and PHICH channels.

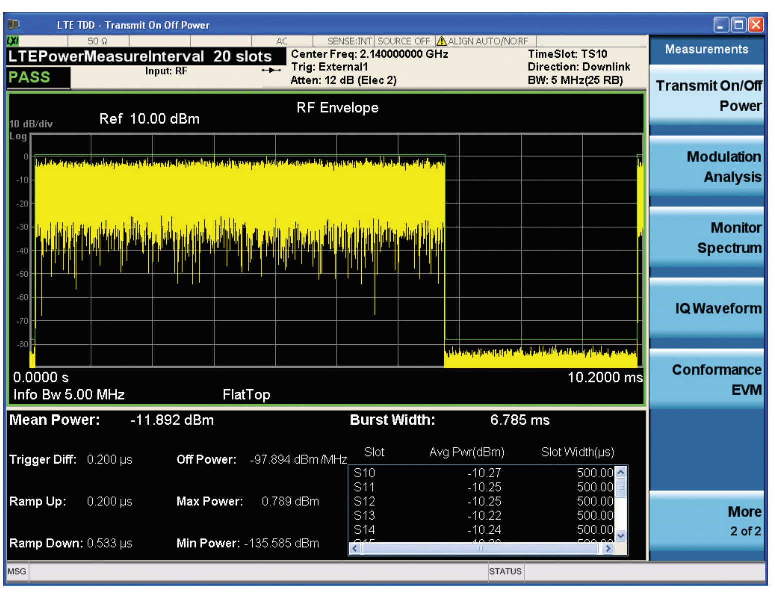


Figure 8. Transmit ON/OFF power measurement of an LTE TDD downlink signal.

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 standards

Device type	Base station (eNB) and user equipment (UE)
Standard version	The LTE demodulator supports signals that are compliant with the following 3GPP technical specifications: – 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)
	EVM calculations and conformance testing are compatible with these specifications: – 36.141 V9.10.0 (July 2012) – 36.521-1 V9.8.0 (March 2012)

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

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

Key Specifications (continued)

Description		PXA	MXA	EXA	CXA
Channel power					
Minimum power at RF input		–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)
Power accuracy		± 0.63 dB	± 0.82 dB	± 1.04 dB	± 1.33 dB
Power accuracy (95% confidence)		± 0.19 dB	± 0.23 dB	± 0.27 dB	± 0.61 dB
Measurement floor (@ 10 MHz BW)		–81.7 dBm (nom)	–79.7 dBm (nom)	–76.7 dBm (nom)	–72.7 dBm (nom)
Transmit On/Off power (only applies to N/W9082A)					
Burst type		Traffic, UpPTS, DwPTS, SRS, PRACH			
Measurement time		Up to 20 slots			
Dynamic range for 5 MHz BW [1]		124.5 dB (nom)	124.5 dB (nom)	122.5 dB (nom)	119.5 dB (nom)
Adjacent channel power					
Minimum power at RF input		–36 dBm (nom)			
Accuracy					
Radio	Offset frequency				
MS (ACPR range –33 to –27 dBc with Opt ML)	Adjacent	± 0.07 dB (5 MHz) ± 0.11 dB (10 MHz) ± 0.21 dB (20 MHz)	± 0.13 dB (5 MHz) ± 0.20 dB (10 MHz) ± 0.38 dB (20 MHz)	± 0.16 dB (5 MHz) ± 0.24 dB (10 MHz) ± 0.41 dB (20 MHz)	± 0.37 dB (5 MHz) ± 0.63 dB (10 MHz) ± 0.92 dB (20 MHz)
BTS (ACPR –48 to –42 dBc with Opt ML)	Adjacent	± 0.23 dB (5 MHz) ± 0.33 dB (10 MHz) ± 0.52 dB (20 MHz)	± 0.57 dB (5 MHz) ± 0.82 dB (10 MHz) ± 1.19 dB (20 MHz)	± 1.03 dB (5 MHz) ± 1.29 dB (10 MHz) ± 2.04 dB (20 MHz)	± 2.16 dB (5 MHz) ± 3.03 dB (10 MHz) ± 4.49 dB (20 MHz)
BTS (ACPR –48 to –42 dBc with Opt ML)	Alternate	± 0.11 dB (5 MHz) ± 0.21 dB (10 MHz) ± 0.40 dB (20 MHz)	± 0.21 dB (5 MHz) ± 0.35 dB (10 MHz) ± 0.65 dB (20 MHz)	± 0.24 dB (5 MHz) ± 0.39 dB (10 MHz) ± 0.74 dB (20 MHz)	± 0.91 dB (5 MHz) ± 1.55 dB (10 MHz) ± 2.48 dB (20 MHz)
Dynamic range E-UTRA					
Offset	Channel BW				
Adjacent	5 MHz	83.5 dB (nom) (Opt ML –8.5 dBm)	74.2 dB (nom) (Opt ML –18.4 dBm)	70.0 dB (nom) (Opt ML –16.5 dBm)	66.8 dB (nom) (Opt ML –20.3 dBm)
Adjacent	10 MHz	82.1dB (nom) (Opt ML –8.3 dBm)	73.8 dB (nom) (Opt ML –18.4 dBm)	69.3 dB (nom) (Opt ML –16.5 dBm)	67.6 dB (nom) (Opt ML –20.3 dBm)
Adjacent	20 MHz	n/a	71.7 dB (nom) (Opt ML –18.2 dBm)	68.4 dB (nom) (Opt ML –16.3 dBm)	65.0 dB (nom) (Opt ML –20.3 dBm)
Alternate	5 MHz	86.7 dB (nom) (Opt ML –8.5 dBm)	77.6 dB (nom) (Opt ML –18.6 dBm)	75.8 dB (nom) (Opt ML –16.6 dBm)	71.1 dB (nom) (Opt ML –20.3 dBm)
Alternate	10 MHz	83.7 dB (nom) (Opt ML –8.3 dBm)	75.1 dB (nom) (Opt ML –18.4 dBm)	73.2 dB (nom) (Opt ML –16.3 dBm)	68.0 dB (nom) (Opt ML –20.3 dBm)
Alternate	20 MHz	N/A	72.1 dB (nom) (Opt ML –18.2 dBm)	70.3 dB (nom) (Opt ML –16.3 dBm)	65.0 dB (nom) (Opt ML –20.3 dBm)
Dynamic range UTRA					
Offset	Channel BW				
2.5 MHz	5 MHz	86.2 dB (nom) (Opt ML –8.5 dBm)	75.9 dB (nom) (Opt ML –18.5 dBm)	70.5 dB (nom) (Opt ML –16.6 dBm)	65.8 dB (nom) (Opt ML –20.3 dBm)
2.5 MHz	10 MHz	84.2 dB (nom) (Opt ML –8.3 dBm)	76.2 dB (nom) (Opt ML –18.4 dBm)	70.5 dB (nom) (Opt ML –16.4 dBm)	70.6 dB (nom) (Opt ML –20.3 dBm)
2.5 MHz	20 MHz	n/a	75.0 dB (nom) (Opt ML –18.2 dBm)	71.4 dB (nom) (Opt ML –16.3 dBm)	71.1 dB (nom) (Opt ML –20.3 dBm)
7.5 MHz	5 MHz	87.3 dB (nom) (Opt ML –8.7 dBm)	78.4 dB (nom) (Opt ML –18.5 dBm)	76.5 dB (nom) (Opt ML –16.6 dBm)	71.1 dB (nom) (Opt ML –20.3 dBm)
7.5 MHz	10 MHz	87.0 dB (nom) (Opt ML –8.4 dBm)	78.6 dB (nom) (Opt ML –18.4 dBm)	76.5 dB (nom) (Opt ML –16.4 dBm)	71.9 dB (nom) (Opt ML –20.3 dBm)
7.5 MHz	20 MHz	N/A	78.1 dB (nom) (Opt ML –18.2 dBm)	75.7 dB (nom) (Opt ML –16.3 dBm)	71.8 dB (nom) (Opt ML –20.3 dBm)

1. This dynamic range is for the case of 5 MHz information bandwidth. For other information bandwidths, the dynamic range can be derived using the following equation: Dynamic Range = Dynamic Range for 5 MHz – 10*log10 (Info BW/5.0e6).

Key Specifications (continued)

Description	PXA	MXA	EXA	CXA
Spectrum emission mask				
Dynamic range				
– 5 MHz	82.9 (86.8 dB typ)	76.2 (82.9 dB typ)	72.6 (79.4 dB typ)	69.0 (75.4 dB typ)
– 10 MHz	86.6 (90.7 dB typ)	77.8 (83.8 dB typ)	73.5 (80.3 dB typ)	69.3 (75.5 dB typ)
– 20 MHz	84.3 (89.7 dB typ)	78.2 (84.9 dB typ)	73.4 (80.6 dB typ)	69.8 (76.0 dB typ)
Sensitivity	–98.5 (–101.5 dBm typ)	–94.5 (–99.5 dBm typ)	–92.5 (–96.5 dBm typ)	–86.5 (–92.5 dBm typ)
Accuracy				
– Relative	± 0.06 dB	± 0.13 dB	± 0.13 dB	± 0.33 dB
– Absolute	± 0.62 (± 0.20 dB 95%)	± 0.88 (± 0.27 dB 95%)	± 1.15 (± 0.31 dB 95%)	± 1.53 (± 0.97 dB 95%)
Spurious emissions				
Dynamic range, relative (RBW=1 MHz)	88.8 (92.1 dB typ)	81.3 (82.2 dB typ)	76.9 (77.4 dB typ)	70.7 (75.9 dB typ)
Sensitivity, absolute (RBW=1 MHz)	–88.5 (–91.5 dBm typ)	–84.5 (–89.5 dBm typ)	–82.5 (–86.5 dBm typ)	–76.5 (–82.5 dBm typ)
Accuracy (attenuation = 10 dB)	± 0.19 dB (95%)	± 0.29 dB (95%)	± 0.38 dB (95%)	± 0.81 dB (95%)
– Frequency range	20 Hz to 3.6 GHz	20 Hz to 3.6 GHz	9 kHz to 3.6 GHz	100 kHz to 3.0 GHz
– Frequency range	± 1.08 dB (95%) 3.5 GHz to 8.4 GHz	± 1.17 dB (95%) 3.5 GHz to 8.4 GHz	± 1.22 dB (95%) 3.5 GHz to 7.0 GHz	± 1.80 dB (95%) 3.0 GHz to 7.5 GHz
– Frequency range	± 1.48 dB (95%) 8.3 GHz to 13.6 GHz	± 1.54 dB (95%) 8.3 GHz to 13.6 GHz	± 1.59 dB (95%) 6.9 GHz to 13.6 GHz	
Occupied bandwidth				
Minimum power at RF input	–30 dBm (nom)			
Frequency accuracy	± 10 kHz (RBW = 30 kHz, Number of points = 1001, Span = 10 MHz)			
Modulation analysis				
Input range	Signal level within one range step of overload			
OSTP/RSTP [1]				
Absolute accuracy	± 0.21 dB (nom)	± 0.27 dB (nom)	± 0.30 dB (nom)	± 0.61 dB
EVM floor for downlink (OFDMA) [2]				
Signal bandwidth				
– 5 MHz	0.34% (–49.3 dB) nom	0.36% (–48.8 dB)	0.68% (–43.3 dB)	0.63% (–44.0 dB) nom
– 10 MHz	0.35% (–49.1 dB) 0.31% (–50.3 dB) nom	0.36% (–48.8 dB)	0.66% (–43.6 dB)	0.64% (–43.8 dB) nom
– 20 MHz	0.39% (–48.1 dB) 0.34% (–49.5 dB) nom	0.40% (–47.9 dB)	0.70% (–43.0 dB)	0.70% (–43.0 dB) nom
EVM floor for downlink (OFDMA) with Option BBA				
Signal bandwidth				
– 5 MHz	0.18% (–54.8 dB) nom	0.18% (–54.8 dB) nom		
– 10 MHz	0.18% (–54.8 dB) nom	0.18% (–54.8 dB) nom		
– 20 MHz	0.18% (–54.8 dB) nom	0.18% (–54.8 dB) nom		
EVM accuracy for Downlink (OFDMA) [3]				
EVM range: 0 to 8%	± 0.3% nom	± 0.3% nom	± 0.3% nom	± 0.3% nom
EVM floor for uplink (SC-FDMA) [2]				
Signal bandwidth				
– 5 MHz	0.31% (–50.1 dB) 0.21% (–53.5 dB) nom	0.35% (–49.1 dB)	0.66% (–43.6 dB)	0.60% (–44.4 dB) nom
– 10 MHz	0.32% (–49.8 dB) 0.21% (–53.5 dB) nom	0.35% (–49.1 dB)	0.66% (–43.6 dB)	0.61% (–44.2 dB) nom
– 20 MHz	0.35% (–49.1 dB) 0.22% (–53.2 dB) nom	0.40% (–47.9 dB)	0.70% (–43.0 dB)	0.63% (–44.0 dB) nom

1. The accuracy specification applies when EVM is less than 1% and no power boost is applied on reference signal.
2. For MXA and EXA instruments with serial number prefix ≥ MY/SG/US5233 and ≥ MY/SG/US5340, which ship standard with N9020A-EP2 and N9010A-EP3. Refer to the LTE section in the MXA and EXA specification guides for more information: www.keysight.com/find/mxa_specifications; www.keysight.com/find/exa_specifications.
3. The accuracy specification applies when the EVM to be measured is well above the measurement floor. When the EVM does not greatly exceed the floor, the errors due to the floor add to the accuracy errors. Refer to specification guide for information on calculating the errors due to the floor.

Key Specifications (continued)

Description	PXA	MXA	EXA	CXA
Frequency error				
Lock range	± 2.5 x subcarrier spacing = 37.5 kHz for default 15 kHz subcarrier spacing (nom)			
Accuracy	± 1 Hz + tfa [1] (nom)			
Time offset [2]				
Absolute frame offset accuracy	± 20 ns	± 20 ns	± 20 ns	± 20 ns
Relative frame offset accuracy	± 5 ns (nom)	± 5 ns (nom)	± 5 ns (nom)	± 5 ns (nom)
MIMO RS timing accuracy	± 5 ns (nom)	± 5 ns (nom)	± 5 ns (nom)	± 5 ns (nom)

1. tfa = transmitter frequency x frequency reference accuracy.
2. The accuracy specification applies when EVM is less than 1% and no power boost is applied for resource elements.

Ordering Information

Software licensing and configuration

Choose from two license types:

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  This allows you to run the application in the X-Series analyzer in which it is initially installed.
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N9080A & W9080A LTE FDD, N9082A & W9082A LTE TDD X-Series measurement applications

Description	Model-Option	
	PXA, MXA, EXA	**CXA**
LTE-FDD	N9080A-1FP	W9080A-1FP
LTE-TDD	N9082A-1FP	W9082A-1FP

Note:
N9080A and N9082A have been replaced by N9080B and N9082B, respectively. Please refer to the N9080B/N9082B technical overview, literature number 5991-4368EN.

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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
25, 40, 85, or 160 MHz analysis bandwidth	N9030A-B25, -B40, -B85, -B1X	One required for analysis over 10 MHz bandwidth
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, -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
25, 40, 85, 125, or 160 MHz analysis bandwidth	N9020A-B25, -B40, -B85, -B1A, -B1X	One required for analysis over 10 MHz bandwidth
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
25, 40 MHz analysis bandwidth	N9010A-B25, B40	One required for analysis over 10 MHz bandwidth
Precision frequency reference	N9010A-PFR	Recommended
Fine step attenuator	N9010A-FSA	Recommended
Electronic attenuator, 3.6 GHz	N9010A-EA3	Recommended
Preamplifier, 3.6, 7.0, 13.6, 26.5, 32, or 44 GHz	N9010A-P03, -P07, -P13, -P26 -P32, or -P44	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
25 MHz analysis bandwidth	N9000A-B25	Required for analysis over 10 MHz bandwidth
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

N9080A and N9082A Self-Guided Demonstration, literature number 5990-6385EN

N9080A & W9080A LTE Measurement Application, Measurement Guide,
literature number N9080-90006

N9082A & W9082A LTE TDD Measurement Application, Measurement Guide,
literature number N9082-90002

3GPP Long Term Evolution: System Overview, Product Development, and Test Challenges, Application Note, literature number 5989-8139EN

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 N9075A and W9075A product pages.

Web

Product pages:
www.keysight.com/find/N9080A
www.keysight.com/find/W9080A
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