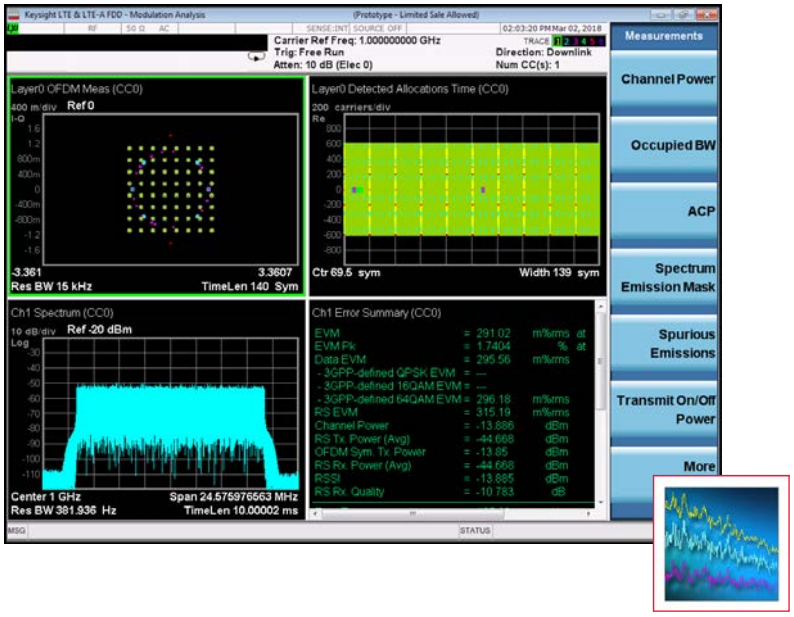
Keysight Technologies
LTE & LTE-Advanced FDD/TDD
X-Series Measurement App, Traditional UI

Technical Overview

LTE/LTE-Advanced FDD: N9080EM0D
LTE/LTE-Advanced TDD: N9082EM0D



- Perform LTE, 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/noncontiguous component carriers
- Use hardkey/softkey manual user interface and SCPI remote user interface
- Leverage built-in, context-sensitive help
- Flexible licensing provides the option of using perpetual or time based licenses with one or multiple signal analyzers

KEYSIGHT TECHNOLOGIES

LTE and LTE-Advanced FDD/TDD Measurement Applications

The LTE/LTE-Advanced FDD and TDD measurement applications transform the X-Series signal analyzers 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.

X-Series measurement applications

X-Series measurement applications increase the capability and functionality of Keysight signal analyzers to speed time to insight. They provide essential measurements for specific tasks in general-purpose, cellular communications, wireless connectivity and digital video applications, covering more than 40 standards or modulation types. Applications are supported on both benchtop and modular, with the only difference being the level of performance achieved by the hardware you select.

X-Series measurement applications can help you:

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

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Top Features

With the LTE/LTE-Advanced FDD and TDD measurement application, 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 specifications.

Downlink eNB measurements

LTE downlink modulation analysis

Figure 1 is an 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.

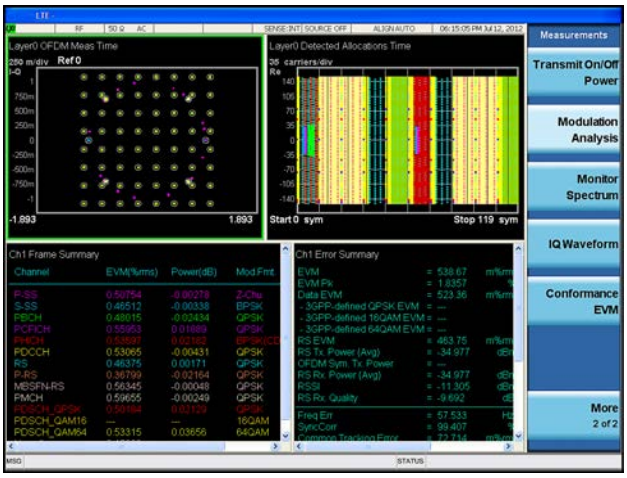

Figure 1

LTE-Advanced downlink analysis

An LTE-Advanced downlink modulation analysis showing constellation of five component carriers side-by-side is displayed in Figure 2.

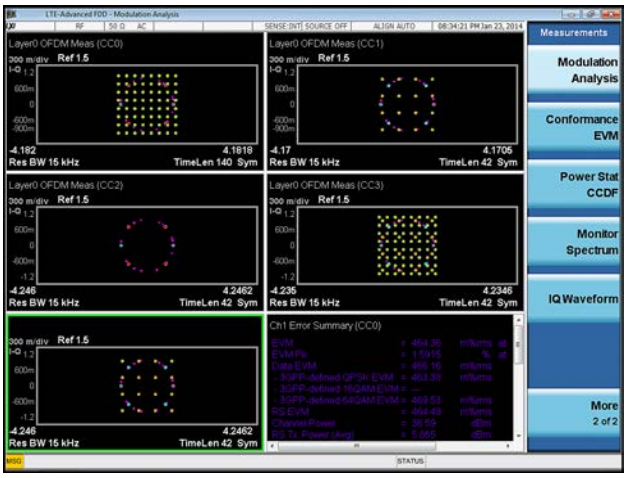

Figure 2

Downlink transport layer channel decoding

Figure 3 shows a downlink transport layer channel decoding measurement with decoded information for PBCH, PDCCH, PCFICH, and PHICH channels. Similar capability is also available for uplink.

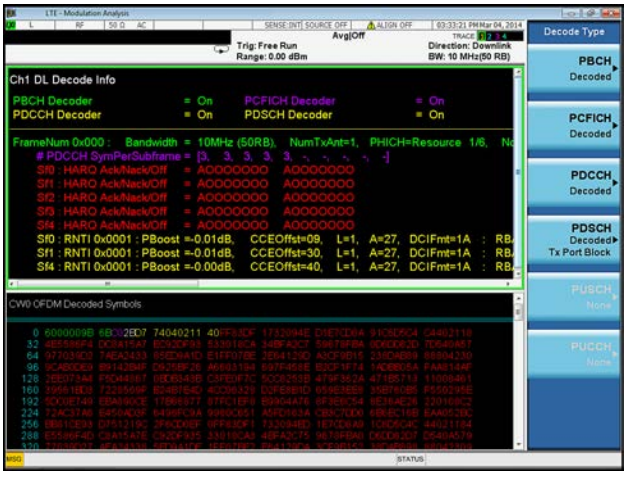

Figure 3

Top Features (continued)

Downlink eNB measurements (continued)

LTE-Advanced cross-carrier summary

LTE-Advanced cross-carrier summary trace showing time alignment error (TAE) and channel power of each CC relative to CC0 is displayed in Figure 4.

Figure 4

LTE-Advanced ACLR measurement

Figure 5 shows an LTE-Advanced ACLR measurement with five contiguous component carriers.

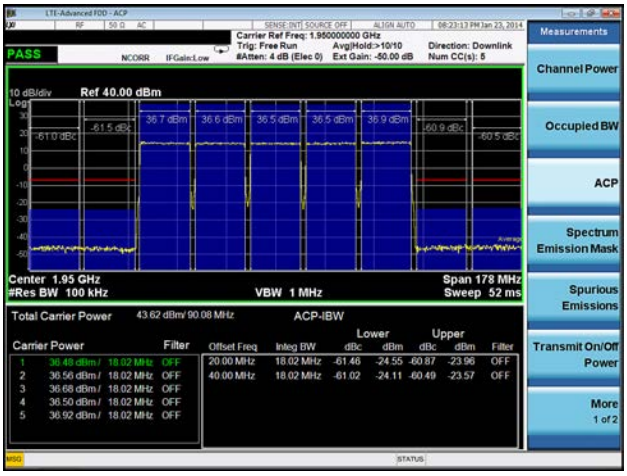

Figure 5

LTE-Advanced cumulative ACLR

LTE-Advanced cumulative ACLR (CACLR) for non-contiguous carrier aggregation is shown in Figure 6.

Figure 6

Top Features (continued)

Downlink eNB measurements (continued)

Transmit ON/OFF power measurement

Figure 7 shows a transmit ON/OFF power measurement of an LTE-Advanced TDD downlink signal with two component carriers.

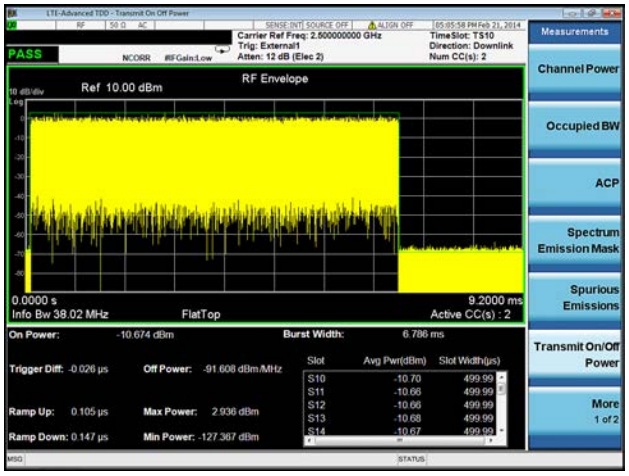

Figure 7

SEM measurement

Figure 8 shows how an SEM measurement can be made on a single carrier LTE or up to five component carrier LTE-Advanced signals simultaneously.

Figure 8

LTE-Advanced non-contiguous carrier aggregation SEM measurement

An LTE-Advanced non-contiguous carrier aggregation SEM measurement with a special cumulative mask inside the sub-block gap is shown in Figure 9.

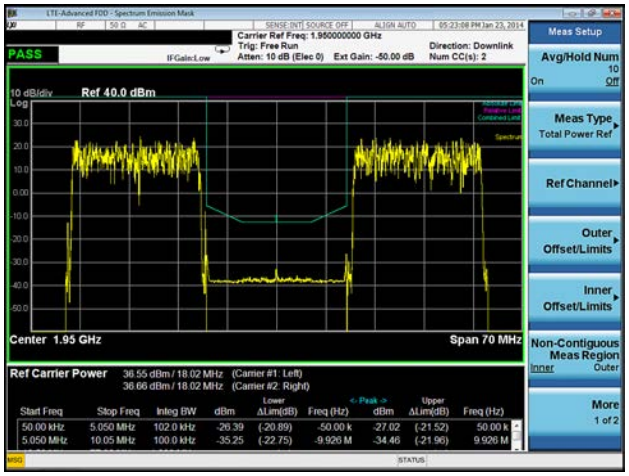

Figure 9

Top Features (continued)

Uplink UE measurements

Uplink modulation analysis

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 10)

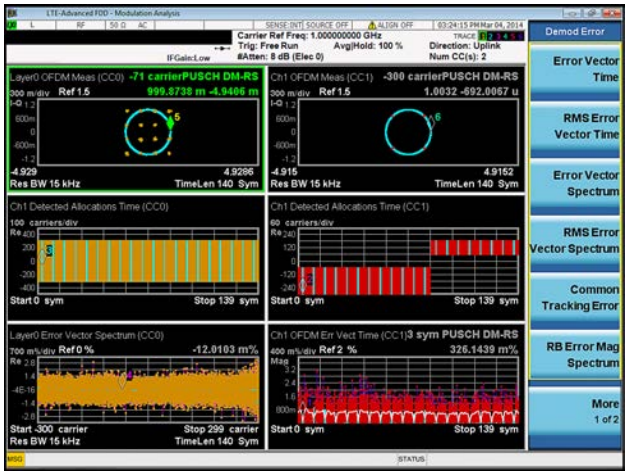

Figure 10

Conformance EVM measurement

Conformance EVM measurement showing all required modulation quality metrics. This measurement is optimized for manufacturing because of its fast measurement speed. (Figure 11)

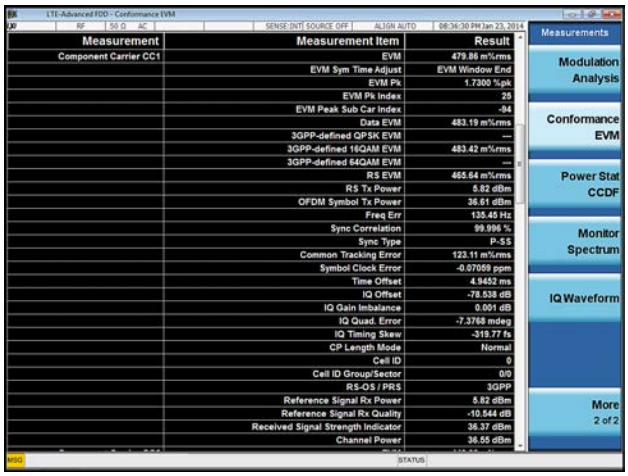

Figure 11

Real-time view of LTE-Advanced FDD uplink

Figure 12 shows a real-time view of LTE-Advanced FDD uplink with simultaneous PUCCH and frequency hopped PUSCH signal configuration using the RTSA option on a PXA or MXA signal analyzer.

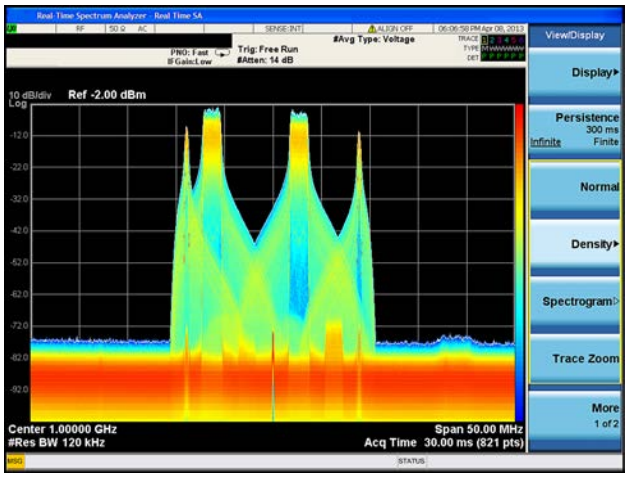

Figure 12

Measurement Summary

One-button standards-based measurements

Required base station (eNB) RF transmitter measurements

3GPP TS36.141 paragraph #	Transmitter test	E-TM required	FDD: N9080EM0D TDD: N9082EM0D measurement applications [1]
6.2	Base station output power	E-TM 1.1	Channel power [2]
6.3.2	Total power dynamic range	E-TM 2 E-TM 3.1	OFDM symbol Tx. power (OSTP) [3]
6.4	Transmit ON/OFF power (TDD only)	E-TM1.1	Transmit ON/OFF power (N9082B only) [4]
6.5.1	Frequency error	E-TM 2 E-TM 3.1	Frequency error [3]
6.5.2	Error vector magnitude	E-TM 3.2 E-TM 3.3	EVM [3]
6.5.3	Time alignment error (TAE)	E-TM 1.1	MIMO summary or cross-carrier summary [5]
6.5.4	DL RS power	E-TM 1.1	RS Tx power (RSTP) [3]
6.6.1	Occupied bandwidth	E-TM 1.1	Occupied BW
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. 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. These measurements are available under “Error Summary” trace in Mod Analysis as well as under “Conformance EVM” measurement.
4. For LTE-Advanced, this measurement is supported for contiguous carrier aggregation and requires analysis bandwidth on X-Series signal analyzer 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, “Cross-carrier Summary” trace is used to measure TAE.

Measurement Summary (continued)

One-button standards-based measurements

Required user equipment (UE) RF transmitter measurements

3GPP TS 36.521-1 paragraph #			Transmitter test	FDD: N9080EM0D | N9080EM3D TDD: N9082EM0D measurement applications
LTE Rel 8 and up	**LTE-Advanced CA**	**LTE-Advanced UL-MIMO**		
6.2.2	6.2.2A	6.2.2B	UE maximum output power (MOP)	Channel power
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
6.3.5	6.3.5A	6.3.5B	Power control	Not available
6.5.1	6.5.1A	6.5.1B	Frequency error	Frequency error [1] and frequency error per slot [2]
6.5.2.1	6.5.2A.1	6.5.2B.1	Error vector magnitude (EVM)	EVM [1]
6.5.2.1A	N/A	N/A	PUSCH-EVM with exclusion period	EVM [1]
6.5.2.2	6.5.2A.2	6.5.2B.2	Carrier leakage	IQ offset [1] and IQ offset per slot [2]
6.5.2.3	6.5.2A.3	6.5.2B.3	In-band emissions for non-allocated RB	In-band emissions [2]
6.5.2.4	N/A	6.5.2B.4	EVM equalizer spectrum flatness	Equalizer channel frequency response per slot [3]
6.6.1	6.6.1A	6.6.1B	Occupied bandwidth	Occupied BW
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]

1. These values are found in “Error Summary” table under Mod Analysis measurement or under Conformance EVM measurements.
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 Summary (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. These measurements are fully remote controllable via the IEC/IEEE bus or LAN, using SCPI commands.

Analog baseband measurements for LTE/LTE-Advanced 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 measurement.

It is important to note that the measurements shown in the LTE FDD and TDD tables 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 measurements

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
Model-Option	**N9080EMOD**	**N9080EMOD**	**N9082EMOD**	**N9082EMOD**
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	•	•	•	•
Cross-carrier summary				
– Time alignment error (TAE) and channel power summary of each CC relative to the selected reference CC		•		•

Measurement Summary (continued)

eNB measurements (continued)

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
Model-Option	**N9080EMOD**	**N9080EMOD**	**N9082EMOD**	**N9082EMOD**
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	•	•	•	•

Measurement Summary (continued)

UE measurements

Technology	LTE FDD	LTE-Advanced FDD	LTE TDD	LTE-Advanced TDD
Model-Option	**N9080EMOD**	**N9080EMOD**	**N9082EMOD**	**N9082EMOD**
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 without carrier aggregation	•	•	•	•
– In-band emissions result with carrier aggregation	•		•	
– Spectral flatness result	•	•	•	•
Conformance EVM	•	•	•	•
In-band emissions without carrier aggregation	•	•	•	•
In-band emissions with carrier aggregation		•		•
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)	•	•	•	•
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	•	•	•	•

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 (≈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.

Note: Data subject to change.

Supported standards

Technology	**LTE FDD/TDD**	**LTE-Advanced FDD/TDD**
Model-Option	**FDD: N9080EM0D** **TDD: N9082EM0D**	**FDD: N9080EM0D** **TDD: N9082EM0D**
Standard versions	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 0-9
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 refer to the appropriate specifications guide.

PXA: http://www.keysight.com/find/pxa_specifications
MXA: http://www.keysight.com/find/mxa_specifications
EXA: http://www.keysight.com/find/exa_specifications
CXA: http://www.keysight.com/find/cxa_specifications

PXIe:
VSA up to 6 GHz: www.keysight.com/find/m9391a
VSA up to 50GHz: www.keysight.com/find/m9393a
VXT: www.keysight.com/find/vxt
CXA-m: www.keysight.com/find/cxa-m

Key Specifications (continued)

Description		PXA	MXA	EXA	CXA
Channel power					
Minimum power at RF input			–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 N9082B/W9082B)					
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	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)
			(ACPR range –33 to –27 dBc with Opt ML)		
BTS	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)
			(ACPR range –48 to –42 dBc with Opt ML)		
BTS	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)
			(ACPR range –48 to –42 dBc with Opt ML)		
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	82.1 dB (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	Not available	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	Not available	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	Not available	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	Not available	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)
Sensitity	–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	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	–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) 0.28% (–51.2 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)	0.68% (–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)	0.72% (–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

Flexible licensing and configuration

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

You Can Upgrade!

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

UP GRADE

LTE/LTE-Advanced FDD measurement application (N9080EM0D)

Model	Software License Type	Support Contract	Support Subscription (12-month) [2]
N9080EM0D-1FP	Node-locked perpetual	R-Y5C-001-A[2]	R-Y6C-001-L[2]
N9080EM0D-1FL	Node-locked 12-month	R-Y4C-001-L[1]	Included
N9080EM0D-1TP	Transportable perpetual	R-Y5C-004-D[2]	R-Y6C-004-L[2]
N9080EM0D-1TL	Transportable 12-month	R-Y4C-004-L[1]	Included
N9080EM0D-1NP	Floating perpetual	R-Y5C-002-B[2]	R-Y6C-002-L[2]
N9080EM0D-1NL	Floating 12-month	R-Y4C-002-L[1]	Included
N9080EM0D-1UP	USB portable perpetual	R-Y5C-005-E[2]	R-Y6C-005-L[2]
N9080EM0D-1UL	USB portable 12-month	R-Y4C-005-L[1]	Included

LTE/LTE-Advanced TDD measurement application (N9082EM0D)

Model	Software License Type	Support Contract	Support Subscription (12-month) [2]
N9082EM0D-1FP	Node-locked perpetual	R-Y5C-001-A[2]	R-Y6C-001-L[2]
N9082EM0D-1FL	Node-locked 12-month	R-Y4C-001-L[1]	Included
N9082EM0D-1TP	Transportable perpetual	R-Y5C-004-D[2]	R-Y6C-004-L[2]
N9082EM0D-1TL	Transportable 12-month	R-Y4C-004-L[1]	Included
N9082EM0D-1NP	Floating perpetual	R-Y5C-002-B[2]	R-Y6C-002-L[2]
N9082EM0D-1NL	Floating 12-month	R-Y4C-002-L[1]	Included
N9082EM0D-1UP	USB portable perpetual	R-Y5C-005-E[2]	R-Y6C-005-L[2]
N9082EM0D-1UL	USB portable 12-month	R-Y4C-005-L[1]	Included

One month software support subscription extensions [3]

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

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Hardware Configurations

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

Software Models & Options

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

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

Hardware Configuration

For optimizing the LTE and LTE-Advanced FDD/TDD measurement application, Keysight recommends a minimum level of instrument hardware functionality at each instrument performance point. Supported instruments include:

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

PXIe:
- VSA (6 GHz) M9391A
- VSA (50 GHz) M9393A
- VXT M9420/21A
- CXA-m M9290A

N90x0A X-Series signal analyzer

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

M9391/93A PXIe VSA vector signal analyzer

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

M9420/21A PXIe VXT vector transceiver

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

M9290A CXA-m PXIe signal analyzer

Description	Model-Option	Additional information
Frequency range 3, 7.5, 13.6 or 26.5 GHz	M9290A-F03, F07, F13, or F26	One required
Analysis bandwidth 25 MHz	M9290A-B25	Optional
Preamplifier, 3, 7.5, 13.6 or 26.5 GHz	M9290A-P03, P07, P13 or P26	One required
Fine resolution step attenuator	M9290A-FSA	Optional
Precision frequency reference	-PFR	Optional

Additional Information

Literature

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

Web

Measurement, User's and Programmer guides can be found on the product Web pages of the respective document libraries.

LTE and LTE-Advanced FDD: **www.keysight.com/find/N9080D**
LTE and LTE-Advanced TDD: **www.keysight.com/find/N9082D**

Application pages:
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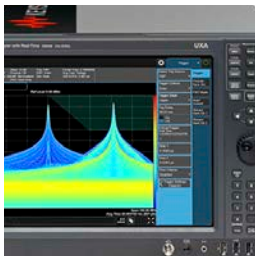


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