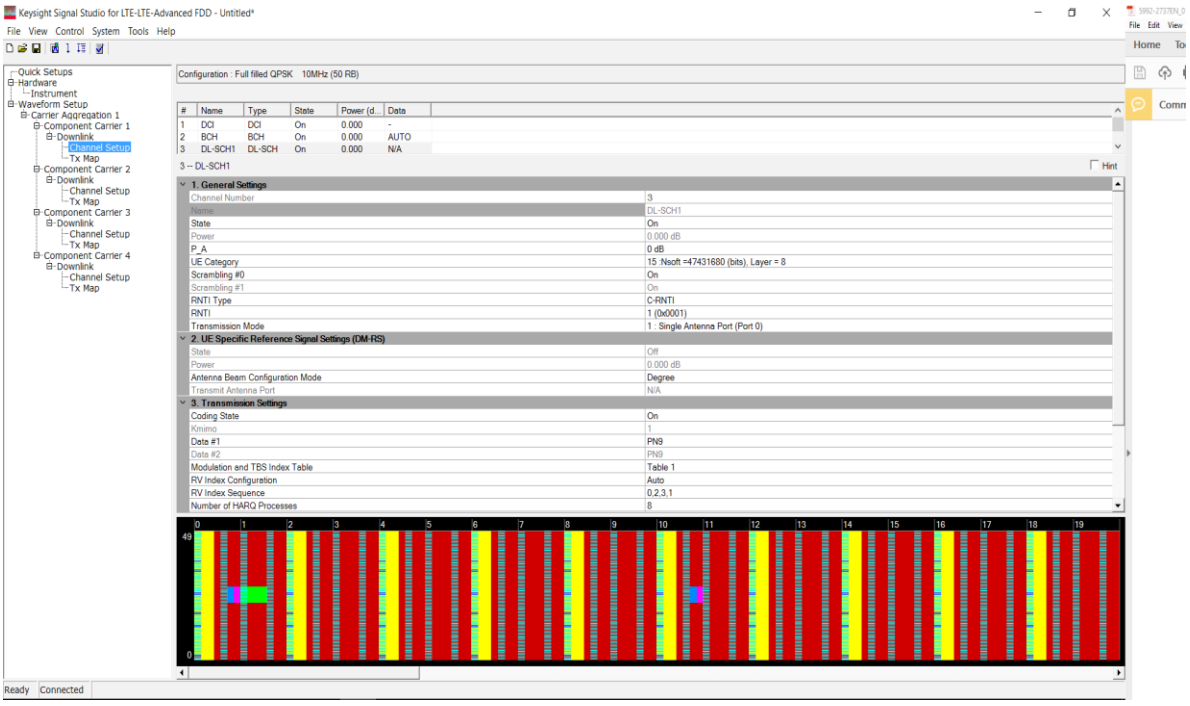
N7624C / N7625C Signal Studio Pro for LTE / LTE-Advanced / LTE-Advanced Pro FDD / TDD

- Create Keysight validated and performance optimized reference signals in compliance with 3GPP LTE, LTE-Advanced, and LTE-Advanced Pro (with NB-IoT / eMTC) specifications
- Use predefined setups for E-UTRA test models (E-TM) and fixed reference channels (FRC)
- Create LTE co-existence signals which can combine with 5G NR signals for Dynamic Spectrum Sharing (DSS)
- Perform closed loop HARQ and timing adjustment testing with real-time signal generation
- ARB based multi-UE simulation for eNB capacity testing
- Perform multi-carrier, multi-format tests with multi-standard radio (MSR) signal generation
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation



KEYSIGHT

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Simplify LTE, LTE-Advanced, and LTE-Advanced Pro Signal Creation

Keysight Technologies, Inc. Signal Studio software is a flexible suite of signal-creation tools that will reduce the time you spend on signal simulation. Signal Studio's performance-optimized reference signals — validated by Keysight — enhance the characterization and verification of your devices. Through its application-specific user-interface you'll create standards-based and custom test signals for component, transmitter, and receiver test.

Typical measurements

Test components with basic capabilities:

- ACLR
- CCDF
- EVM
- Modulation accuracy
- Channel power
- Occupied bandwidth

Verify receivers with advanced capabilities:

- Sensitivity
- Selectivity
- Blocking
- Intermodulation

Component and transmitter test

Signal Studio's basic capabilities use waveform playback mode to create and customize waveform files needed to test components and transmitters. Its user-friendly interface lets you configure signal parameters, calculate the resulting waveforms and download files for playback. The applications for these partially-coded, statistically correct signals include:

- Parametric test of components, such as amplifiers and filters
- Performance characterization and verification of RF sub-systems

Receiver test

Signal Studio's advanced capabilities enable you to create fully channel-coded signals for receiver bit-error-rate (BER), block-error-rate (BLER), packet-error-rate (PER), or frame error rate (FER) analysis. Applications include:

- Performance verification and functional test of receivers, during RF / baseband integration and system verification
- Coding verification of baseband subsystems, including FPGAs, ASICs, and DSPs

More advanced capabilities operate in real-time mode, which is used to define the parameters of nonrepeating and dynamically changing signals needed for receiver testing. Its graphical interface provides a direct instrument connection for parameter transfer and closed-loop or interactive control during signal generation.

Apply your signals in real-world testing

Once you have setup your signals in Signal Studio, you can download them to a variety of Keysight instruments. Signal Studio software complements these platforms by providing a cost-effective way to tailor them to your test needs in design, development and production test.

- N5186A MXG vector signal generator
- N5182B MXG X-Series RF vector signal generator
- N5172B EXG X-Series RF vector signal generator
- N5166B CXG RF vector signal generator
- E4438C ESG vector signal generator [1]
- N5182A MXG vector signal generator [1]
- E8267D PSG vector signal generator
- M9381A PXIe vector signal generator
- M9383B VXG-m microwave signal generator
- M9384B VXG microwave signal generator
- M9484C VXG Signal Generator
- M9420A / M9421A PXIe VXT vector transceiver
- M8190A arbitrary waveform generator
- E6640A EXM wireless test set

1. Signal Studio 2019 update 1.0 or above release doesn't support this hardware with N7624EMBC or N7625EMBC licenses. Signal Studio Pro 2020 or above release N7624C with N7624APPC or N7625C with N7625APPC as PC license can still support this hardware.

Component and Transmitter Test

Figure 1. Typical component test configuration using Signal Studio's basic capabilities with a Keysight X-Series signal generator and an X-Series signal analyzer

Signal Studio's basic capabilities enable you to create and customize LTE, LTE-Advanced and LTE-Advanced Pro waveforms to characterize the power and modulation performance of your components and transmitters. Easy manipulation of a variety of signal parameters, including transmission bandwidth, cyclic prefix, and modulation type, simplifies signal creation.

- Create spectrally-correct signals for ACLR, channel power, spectral mask, and spurious testing
- Set parameters such as channel power and data channel modulation type (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024 QAM) for modulation verification and analysis, such as EVM tests
- Create NB-IoT (Cat-NB1) or eMTC (Cat-M1) uplink / downlink signals
- Use pre-defined E-UTRA test models (E-TM) for downlink, reference measurement channels (RMC) for uplink
- Configure multi-carrier waveforms to simulate multi-user, multi-cell signals
- View CCDF, spectrum, time domain, and power envelope graphs to investigate the effects of power ramps, modulation formats, power changes, clipping, and other effects on device performance
- Generate slot length-based waveforms to help make a fast PA tests with a waveform sequence
- Dynamic TDD (eIMTA) for uplink and downlink
- TDD-FDD carrier aggregation for downlink
- VoLTE: TTI bundling with enhanced HARQ (ARB / Real-time) for uplink
- Multi-UE simulation update (Excel import / export) for uplink

Multi-Standard Radio (MSR) testing

Today's modern base stations support multiple radio access technologies. The 3GPP TS37.141 Rel-9 specification defines how to test these multi-standard base station transmitters and receivers.

To address the challenges of testing multi-standard components and receivers, Signal Studio for LTE and LTE-Advanced FDD / TDD enables you to import W-CDMA / HSPA, GSM / EDGE, cdma2000 / 1xEV-DO, TD-SCDMA, LTE TDD / FDD, and WLAN waveforms from other Signal Studio products.

Receiver test

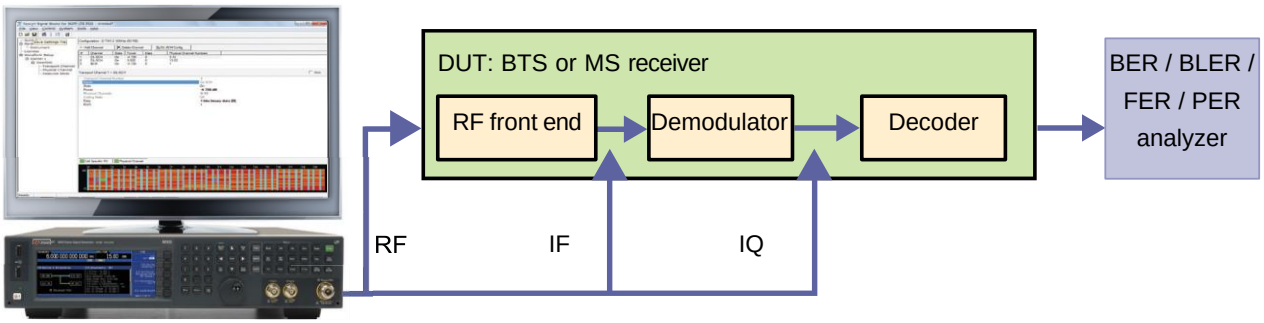


Figure 2. Generate fully channel-coded signals to evaluate the throughput of your receiver with Keysight X-Series signal generators and Signal Studio's advanced capabilities.

Signal Studio's advanced capabilities address applications in LTE receiver test, including the verification of baseband designs and the integration of the baseband and RF modules. Using waveform playback mode with the capability to generate up to 1024 frames enables transport-channel coding to validate eNB and UE receiver characteristics and performance.

The real-time mode enables you to define the parameters of nonrepeating signals and provides a direct instrument connection to dynamically change signal parameters and respond to closed-loop feedback.

eNB receiver testing

- Choose from a variety of pre-defined fixed reference channel (FRC) configurations
- Create PUSCH sounding reference signals (SRS), including frequency hopping and UL control information (UCI) multiplexing
- Use the PUCCH wizard to create multi-user configurations
- Customize RV index sequence for HARQ retransmission
- Dynamically configure uplink 2x2 MIMO signals based on HARQ and Timing Advanced feedback with real-time signal generation
- UL 4x4 MIMO
- NB-IoT and eMTC uplink with channel coding

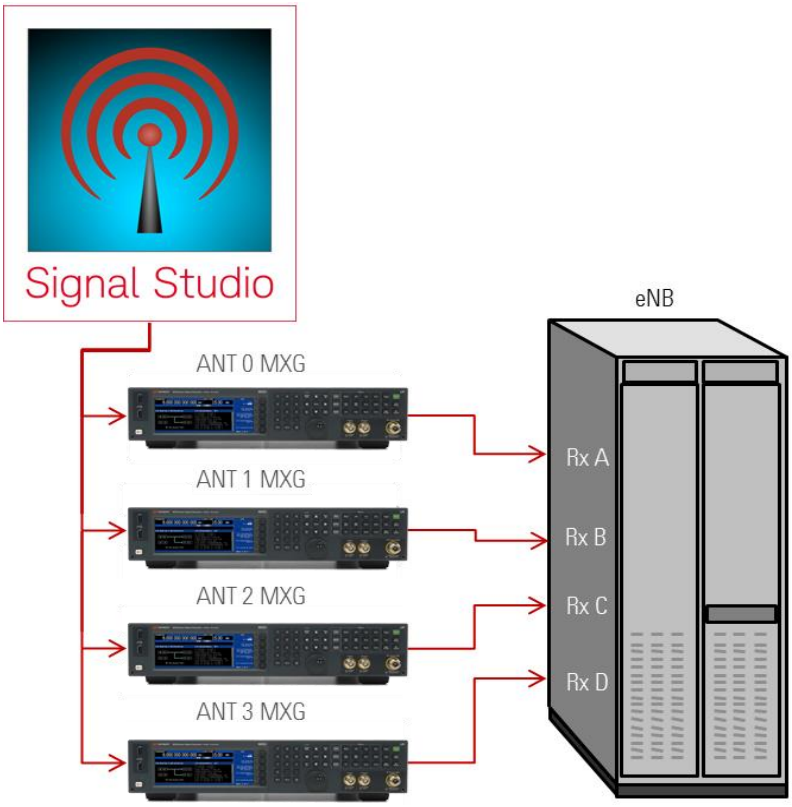


Figure 3. UL 4x4 MIMO for eNB receiver testing

Conformance test made easy with N7649B Test Case Manager

Test Case Manager (TCM) provides a simplified user interface for quick and easy set-up of standard-compliant conformance test configurations for eNB receiver tests. With TCM, simply choose one of the test cases from TS36.141 clause 7 and clause 8 from the tree menu and specify a few parameters such as eNB type, carrier frequency, etc. TCM then automatically generates standard-compliant wanted and interference waveforms and sets up the signal generators according to the standard requirement.

For more information, please visit www.keysight.com/find/N7649b

Multi-UE Simulation for eNB receiver capacity testing

Base station R&D engineers request to allow simulating large number of UE to test LTE eNB capacity. Usually, the requirement is to test with hundreds of UE which shares same frequency bandwidth. The eNB under capacity test shall be able to distinguish different UE and recognize their RNTI and other physical layer characteristics. Traditional eNB capacity test solution is to use hundreds of real UE, or a UE simulator to generate multiple UE's environment.

Signal Studio's Multi-UE Simulation option adds "ARB based multi-UE simulation" capability which allows for a single waveform generation to simulate up to 100 UEs with each UE's modulation type, RNTI, resource block allocation etc. Download only one waveform into one X-Series signal genera- tor, you can get multiple UE's simulation without using expensive and complicated UE simulator solution. An easy-to-use Multi-UE Wizard is provided for quick access to 100 UE's configuration.

UE receiver testing

- Choose a pre-defined fixed reference channel (FRC) configuration for early verification of baseband
- Create downlink control information (DCI) coding, automatically, based on PDSCH allocation, UE scheduling and random access, and UL power control
- Define your own system information block (SIB) and automatically configure master information block (MIB)
- Select transmission modes 1 through 10, including transmitter diversity and spatial multiplexing, with up to 8x8 MIMO configuration
- Generate Inter-band carrier aggregation signals with cross-carrier scheduling applied, in conjunction with up to 8x8 MIMO in each inter-band
- Perform HARQ testing with up to 15 simulated retransmission and user-definable RV index sequence
- Test E-MBMS with MCH / PMCH and MBSFN RS
- NB-IoT and eMTC downlink with channel coding

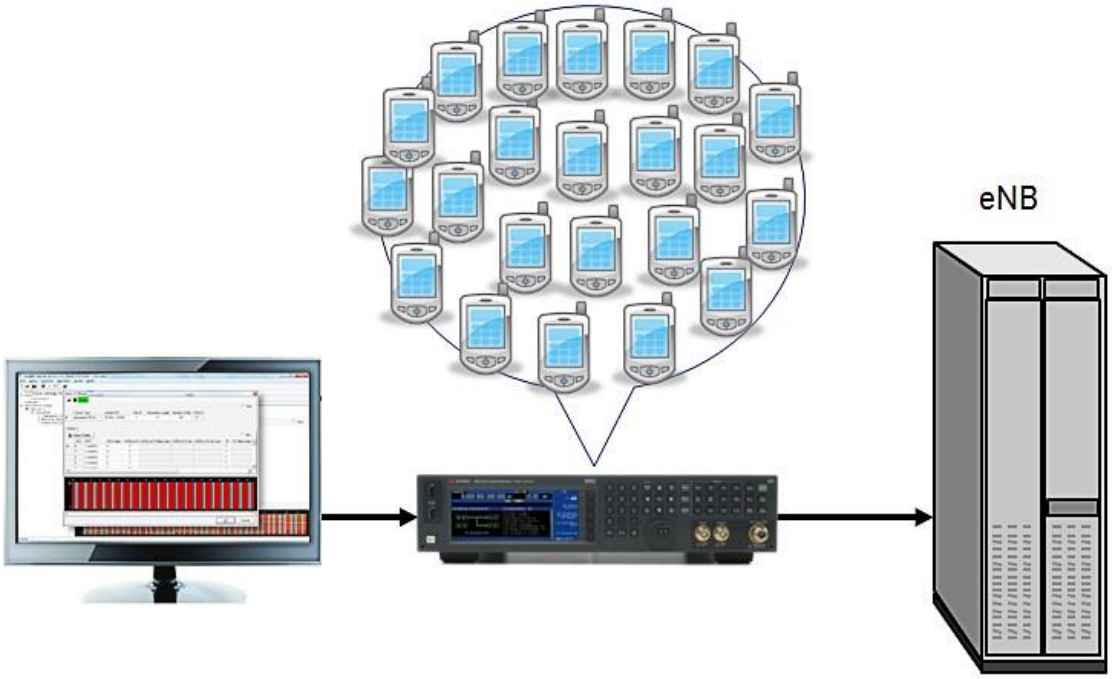
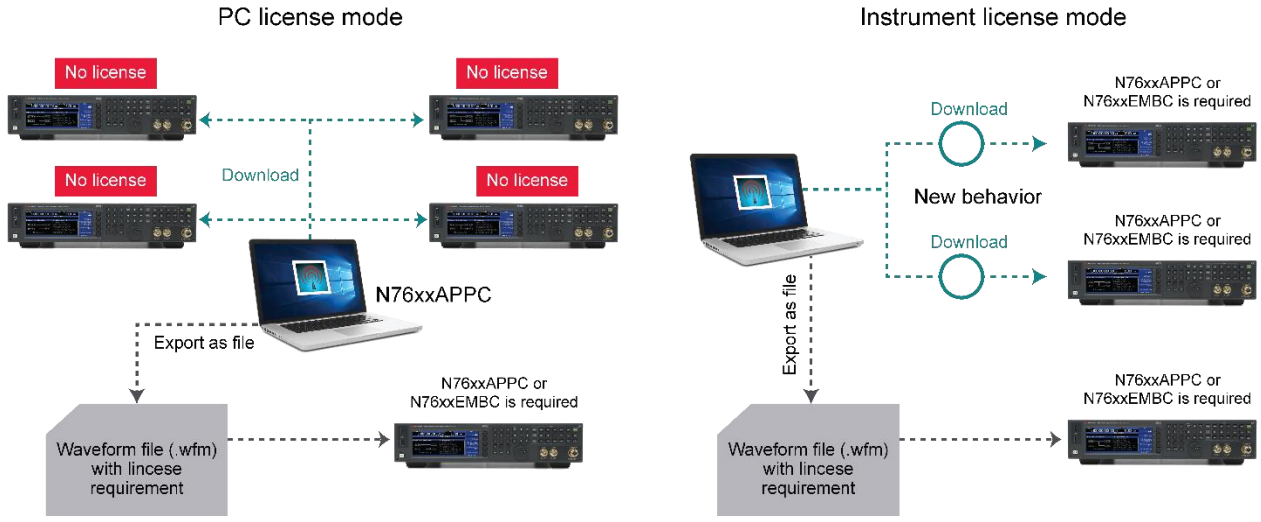


Figure 4. Multi-UE Simulation with single waveform and single MXG

Signal Studio Pro Licensing: Choosing PC License or Waveform Playback License

Signal Studio Pro for LTE / LTE-Advanced / LTE-A Pro FDD or LTE / LTE-Advanced TDD offers two types of license: a PC-based license N7624APPC / N7625APPC and a waveform playback license N7624EMBC / N7625EMBC. And they can make the N7624C or N7625C software working either in a PC license mode or instrument license mode as the description below.

- N7624APPC or N7625APPC is PC based license which enables N7624C or N7625C software operating in PC license mode to generate and make a live connection to download signal waveforms into multiple signal generators, VSGs, VXTs, VXGs or AWGs without license requirement. N7624APPC or N7625APPC is typically recommended for R&D teams. If the N7624APPC / N7625APPC license is installed on an instrument, then it can also work same as N7624EMBC or N7625EMBC license as instrument license mode.
- N7624EMBC or N7625EMBC is an embedded license installed on a signal generator, VSG, VXT, VXG or AWG which enables you to generate, make a live connection to download and offline playback LTE FDD or TDD waveforms. N7624EMBC or N7625EMBC is recommended for design and verification or manufacturing teams.
- PC license mode: when N7624APPC / N7625APPC license is installed in a stand-alone PC, then the N7624C or N7625C software is working as the PC license mode. No license is required inside the instrument if generated waveform is downloaded but the downloaded waveform can't be saved or renamed.
- Instrument license mode: each instrument needs a valid license (N762APPC / N7625APPC or N7624EMBC / N7625EMBC) to playback waveforms. Waveforms can be saved in signal generators for offline playback.



N7624C or N7625C software	With N7624APPC or N7625APPC license	With N7624EMBC or N7625EMBC license
Operation mode	PC license mode [1] or instrument mode [2]	Instrument mode [2]
Live connection	Yes	Yes
Programming API	Yes	Yes
Waveform export	Yes [3]	Yes [3]
Offline playback	No / Yes [4]	Yes [4]
License type	Node-locked, transportable, USB portable, floating (single site, single region, worldwide)	Node-locked, transportable

1. Downloaded waveforms can't be renamed or stored in non-volatile memory. New download is required to play different waveforms.
2. Waveforms can be saved and renamed in signal generators for offline playback.
3. When the waveform is exported as waveform file (*.wfm), then It requires waveform playback license in instrument (N7624APPC / N7625APPC, N7624EMBC / N7625EMBC or 5/50 pack).
4. Offline waveform playback requires embedded waveform playback license (N7624APPC / N7625APPC, N7624EMBC / N7625EMBC or 5/50 pack license) on X-Series signal generators, PXIe VSG, PXIe VXTs or VXG-m/VXG microwave signal generators
5. N7624APPC / N7625APPC are only supported with N7624C / N7625C 2020 release or above.

Features Summary

LTE FDD and TDD	Component & transmitter testing			Receiver testing			
	Basic waveform playback mode			Advanced waveform playback mode			Advanced real-time mode
	LTE	LTE-A	LTE-A Pro	LTE	LTE-A	LTE-A Pro	LTE / LTE-A
Common							
Calibrated AWGN	●	●	●	●	●	●	●
Code domain and CCDF graphs with peak power position	●	●	●	●	●	●	
Power envelope graph	●	●	●	●	●	●	
Multi-carrier timing, and clipping	●	●	●	●	●	●	
Up to 1024 frame waveform length			●	●	●	●	
Short length waveform	●	●	●				
LUT based digital pre-distortion (DPD)	●	●	●	●	●	●	
Static multipath fading				●	●	●	
Time scale factor	●	●	●	●	●	●	
VSA setup file export					●	●	
Import 5G NR waveform file [2]	●	●	●	●	●	●	●
Downlink							
Up to 8x8 MIMO configurations				2x2, 4x4	2x2, 4x4, 8x8	2x2, 4x4, 8x8	
Transmission mode				1 to 6	1 to 10	1 to 10	
CSI-RS and DM-RS		●			●	●	
Carrier aggregation		5CC	32CC		5CC	32CC	
Inter-band carrier aggregation		●	●		●	●	
CA cross-carrier scheduling					●	●	
DCI format: 1/1A/1B/1C/2/2A/2B/2C/3/3A		●			●	●	
DCI format: 2D/4					●	●	
Downlink FRC wizard				●	●	●	
HARQ processing for DL-SCH				●	●	●	
PDSCH 256QAM		●			●	●	
PDSCH 1024QAM	●						
E-TM wizard: 1.1/1.2/2/3.1/3.2/3.3	●	●	●				
E-TM wizard: 2a/3.1a (256QAM)		●	●				
E-TM wizard: 2b/3.1b (1024QAM)	●	●					
E-TM wizard: BC3 CS3 test models (TS37.141 Annex.A) (TDD only)	●	●					
MCH with MBSFN RS					●	●	
Transmit PMCH and MBSFN RS on MBSFN Region: On / Off (For LTE-coexistence with 5G NR DSS)					● [3]		
PMCH 256QAM					●	●	
Positioning RS (PRS)					●	●	
Almost blank subframe (ABS) for eICIC (normal and MBSFN ABS)					●	●	
UE category				1 to 5	0 to 15		
Antenna beam configuration				●	●	●	
TDD special subframe configuration 9 (normal CP) and 7 (extended CP)		●	●		●	●	
Dynamic TDD (eIMTA) (TDD only)					●	●	
FDD-TDD carrier aggregation (requires option VFP)					●	●	

NB-IoT downlink (stand-alone, in-band and guard-band modes)						●	
NB-IoT N-TM wizard						●	
NB-IoT downlink multi-burst						●	
NB-IoT NPRS (Cat-NB2 in Rel 14)						●	
NB-IoT Cat-NB2 TBS						● [1]	
eMTC downlink: PDSCH, MPDCCH						●	
eMTC SIB1 transmission						● [2]	

1. This feature only supports the LTE-A Pro FDD mode.
2. This feature is added in Signal Studio 2019 update 1.0 release (version 1.6.3.0).
3. This feature is added in Signal Studio 2020 release (Version 1.7.6.0)

LTE FDD and TDD	Component & transmitter testing			Receiver testing			
	Basic waveform playback mode			Advanced waveform playback mode			Advanced real-time mode
	LTE	LTE-A	LTE-A Pro	LTE	LTE-A	LTE-A Pro	LTE / LTE-A
Uplink							
Uplink MIMO					2x2, 4x4	2x2, 4x4	2x2
Preconfigured FRC signals with transport channel coding				●	●	●	●
PRACH signal generation	●	●	●			●	
Carrier aggregation		5CC	32CC		5CC	32CC	
Clustered SC-FDMA		●	●		●	●	
Simultaneous PUSCH/PUCCH		●	●		●	●	
PUCCH format: 0/1/1a/1b/2/2a/2b	●	●	●	●	●	●	●
PUCCH format: 3 and format 1b with channel selection					●	●	
PUCCH format: 4/5					●	●	
User-definable HARQ and RV retransmission pattern				●	●	●	
UCI multiplexing on PUSCH				●	●	●	
Sounding RS	●	●		●	●	●	●
Closed loop HARQ and timing adjustment (TA) feedback							●
2x2 uplink MIMO with closed loop HARQ							●
Multi-UE simulation (requires Option LFP)					●		
Virtual cell ID for UL CoMP					●		
TTI bundling with enhanced HARQ (FRC A11-1) (FDD only)					●	●	●
Dynamic TDD (eIMTA) (TDD only)					●	●	
FDD-TDD carrier aggregation (requires option VFP)					●	●	
PUSCH 256QAM			● [1]			● [1]	
PUSCH Resource allocation Type 3						●	
eMTC (Cat-M1): PUSCH, PUCCH, PRACH						● [1]	
NB-IoT uplink: NPUSCH (format 1, 2), NPRACH						● [1]	
NB-IoT FRC wizard						● [1]	
NB-IoT Cat-NB2 TBS						● [1]	

1. This feature only supports the LTE-A Pro FDD mode.

Supported Standards and Test Configurations

Carrier	LTE Basic / Advanced / PRACH	LTE-A Basic / Advanced / PRACH	LTE-Advanced Pro (NB-IoT / eMTC)

3GPP technical specifications	Rel-9		Rel-10		Rel-11		Rel-12		Rel -15	
	Version	Date	Version	Date	Version	Date	Version	Date	Version	Date
36.141	9.10.0	2012-06	10.12.0	2013-09	11.11.0	2014-12	12.6.0	2014-12	15.3.0	2018-06
36.211	9.1.0	2010-03	10.7.0	2013-02	11.5.0	2013-12	12.4.0	2014-12	15.2.0	2018-06
36.212	9.4.0	2011-09	10.8.0	2013-06	11.5.1	2014-09	12.3.0	2014-12	15.2.1	2018-06
36.213	9.3.0	2010-09	10.12.0	2014-03	11.7.0	2014-06	12.4.0	2014-12	15.2.0	2018-06
36.306	9.9.0	2013-12	10.11.0	2013-12	11.9.0	2014-12	12.3.0	2014-12	15.1.0	2018-06
36.321	9.6.0	2012-03	10.9.0	2013-06	11.5.0	2014-03	12.4.0	2014-12	15.2.0	2018-06
36.331	9.11.0	2012-06	10.10.0	2013-06	11.10.0	2014-12	12.4.1	2014-12	15.2.2	2018-06
36.521-1	9.8.0	2012-03	10.6.0	2013-06	11.4.0	2014-03	12.4.0	2014-12	15.2.0	2018-06
36.423	N.A.	N.A.	N.A.	N.A.	11.8.0	2014-03	12.4.2	2014-12	15.2.0	2018-06

eNB conformance tests (3GPP TS 36.141)

Transmitter characteristics (Section 6)		Keysight solution	
Test models type	**Test model use case**	**Signal Studio mode [1]**	**Recommended hardware**

E-UTRA test model 1.1	• BS Output power
	• Unwanted emissions
	  ○ Occupied bandwidth
	  ○ ACLR
	  ○ Operating band unwanted emissions
	  ○ Transmitter spurious emissions
	• Transmitter intermodulation
	• RS absolute accuracy
		Waveform playback	MXG / EXG / M9381A

E-UTRA test model 1.2	• ACLR • Operating band unwanted emissions		
E-UTRA test model 2	• Total power dynamic range • EVM of single 64QAM PRB allocation • Frequency error		

E-UTRA test model 2a and 2b	• Total power dynamic range
	  ○ EVM of single 256QAM or 1024 QAM PRB allocation
	  ○ Frequency error		

E-UTRA test model 3.1	• Output power dynamics
	  ○ Total power dynamic range
	• Transmitted signal quality
	  ○ Frequency error
	  ○ EVM for 64QAM		

E-UTRA test model 3.1a and 3.1b	• Output power dynamics
	  ○ Total power dynamic range
	• Transmitted signal quality
	  ○ Frequency error
	  ○ EVM for 256QAM or 1024 QAM modulation		

E-UTRA test model 3.2	• Transmitted signal quality
	  ○ Frequency error
	  ○ EVM for 16QAM		

E-UTRA test model 3.3	• Transmitted signal quality
	  ○ Frequency error
	  ○ EVM for QPSK		

1. Predefined setups for all E-UTRA test models available.

Receiver characteristics (Section 7)	Keysight solution		
	Wanted signal [1] Signal Studio mode	Interfering signal Signal Studio mode	Hardware [2]
7.2 Reference sensitivity level	Waveform playback	N/A	MXG / EXG / M9381A
7.3 Dynamic range		AWGN	
7.4 In-channel selectivity		Waveform playback	2 MXG/EXG/M9381A
7.5 Adjacent channel selectivity			
7.5 Narrowband blocking			
7.6 Blocking (in-band)			
7.6 Blocking (out-of-band)		CW	• MXG / EXG for wanted, mW • MXG / PSG for CW interferer
7.6 Blocking (co-location with other base stations)			2 MXG / EXG / M9381A
7.7 Receiver spurious emissions	N/A		X-Series signal analyzers
7.8 Receiver intermodulation	Waveform playback	CW and waveform playback	3 MXG / EXG / M9381A

1. Predefined setups for all fixed reference channels (FRC) are available.
2. In some tests, wanted and interfering signals can be generated from the same instrument, depending on the dynamic range requirement For best performance, it is recommended to generate the interfering signal with a separate signal generator and combine at RF.

Performance requirements (Section 8)	Keysight solution		
	Signal Studio mode		
	Wanted signal	Interfering signal	Hardware [1]
8.2.1 PUSCH in multipath fading propagation condition transmission on single antenna port	Real-time (with HARQ feedback)	N/A	MXG / EXG
8.2.1A PUSCH in multipath fading propagation conditions transmission on two antenna ports	Real-time MIMO (with HARQ feedback)	N/A	MXG / EXG
8.2.2 UL timing adjustment	Real-time (with HARQ and TA feedback)	Waveform playback or real-time	2 MXG / EXG
8.2.3 HARQ-ACK multiplexed on PUSCH	Waveform playback	N/A	MXG / EXG
8.2.4 High speed train conditions	Real-time (with HARQ feedback)		
8.3.1 ACK missed detection for single user PUCCH format 1a on single antenna port	Waveform playback		
8.3.2 CQI missed detection for PUCCH format 2 on single antenna port			
8.3.3 ACK missed detection for multi user PUCCH format 1a		Waveform playback	4 MXG / EXG
8.3.4 ACK missed detection for PUCCH format 1b with Channel Selection		N/A	MXG / EXG
8.3.5 ACK missed detection for PUCCH format 3			
8.3.6 NAK to ACK detection for PUCCH format 3			
8.3.7 ACK missed detection for PUCCH format 1a transmission on two antenna ports			2 MXG / EXG
8.3.8 CQI performance requirements for PUCCH format 2 transmission on two antenna ports			
8.3.9 CQI performance requirements for PUCCH format 2 with DTX detection			
8.4.1 PRACH false alarm probability and missed detection			MXG / EXG

1. MXG/EXG requires external fader for channel simulation.

Performance Characteristics

Definitions

Characteristic performance

Non-warranted value based on testing during development phase of this product.

Measured (meas)

An attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is not warranted and is measured at room temperature (approximately 25 °C).

The following performance characteristics apply to the N5172B EXG and the N5182B MXG X-Series vector signal generators with enhanced dynamic range, Option UNV, except as noted. For performance characteristics of other instruments, refer to the respective product data sheet.

Parameters

- **Radio format:** 1-carrier basic LTE FDD downlink and 1-carrier basic LTE TDD downlink
- **Frequencies measured:** 1880, 1900, 1910, 1920, 1960, 2017.5, 2350, and 2595 MHz
  (EVM data for MXG / EXG are measured at 2140 (B1), 1842.5 (B3), 2665 (B7), 942.5 (B8) for FDD, and 1900 (B39), 2350 (B40), 3500 (B42), 753 (B44) for TDD)
- **Power:** –10 dBm (FDD) and +3 dBm (TDD)

Distortion performance (Playback mode)

Carrier bandwidth (MHz)	E-UTRA test model / modulation	E-UTRA adjacent channel						UTRA adjacent channel					
		Offset E-UTRA (MHz)	Measured ACLR (dBc)				Integration bandwidth (MHz)	Offset E-UTRA (MHz)	Measured ACLR (dBc)				Integration bandwidth (MHz)
			N7624C		N7625C				N7624C		N7625C		
			M9381A	N5172B / N5182B	M9381A	N5172B / N5182B			M9381A	N5172B / N5182B	M9381A	N5172B / N5182B	
5	E-TM1.1 / QPSK	Adjacent (5)	–69.8	–71.1	–69.1	–70.4	4.5	Adjacent (5)	–71.1	–73	–70.1	–70.9	3.84 (RRC filtered)
		Alternate (10)	–73.6	–72.2	–72.3	–71.6		Alternate (10)	–74.3	–75.4	–72.9	–71.8	
	E-TM1.2 / QPSK	Adjacent (5)	–69.5	–71.1	–68.6	–70.0		Adjacent (5)	–70.8	–72.6	–69.6	–71.0	
		Alternate (10)	–73.2	–72.9	–70.9	–71.6		Alternate (10)	–73.9	–75.3	–71.6	–72.2	
10	E-TM1.1 / QPSK	Adjacent (10)	–69.1	–69.1	–66.8	–68.6	9	Adjacent (7.5)	–71.7	–73.1	–69.3	–72.0	
		Alternate (20)	–69.6	–69.2	–68.5	–69.3		Alternate (12.5)	–73.6	–75.2	–72.2	–72.6	
	E-TM1.2 / QPSK	Adjacent (10)	–69.2	–69	–66.7	–68.5		Adjacent (7.5)	–71.6	–73.2	–69.0	–71.8	
		Alternate (20)	–69.8	–69.3	–68.5	–69.5		Alternate (12.5)	–73.9	–75.2	–72.1	–72.7	
20	E-TM1.1 / QPSK	Adjacent (20)	–66.8	–66.8	–64.7	–67.0	18	Adjacent (12.5)	–72.4	–73.6	–69.4	–72.3	
		Alternate (40)	–66.7	–66.7	–65.8	–66.5		Alternate (17.5)	–73.1	–74.4	–71.0	–72.9	
	E-TM1.2 / QPSK	Adjacent (20)	–66.9	–66.7	–64.6	–66.1		Adjacent (12.5)	–72.2	–73.5	–69.3	–71.8	
		Alternate (40)	–66.8	–66.4	–65.8	–66.1		Alternate (17.5)	–73.2	–74.6	–71.0	–72.2	

EVM performance (Playback mode)

Carrier bandwidth (MHz)	E-TM	Allocated RB	PDSCH modulation	Measured EVM (%)			
				N7624C		N7625C	
				M9381A	N5172B / N5182B	M9381A	N5172B / N5182B
5	2	1	64QAM	0.21	0.15	0.20	0.15
	2a		256QAM	—	0.18	—	0.17
	3.1	25	64QAM	0.34	0.39	0.51	0.48
	3.1a		256QAM	—	0.51	—	0.52
	3.2		16QAM	0.47	0.46	0.57	0.58
			QPSK	0.26	0.25	0.39	0.40
	3.3		16QAM	0.26	0.34	0.37	0.39
			QPSK	0.61	0.59	0.82	0.89
10	2	1	64QAM	0.18	0.13	0.19	0.13
	2a		256QAM	—	0.13	—	0.14
	3.1	25	64QAM	0.29	0.33	0.37	0.32
	3.1a		256QAM	—	0.39	—	0.36
	3.2		16QAM	0.39	0.31	0.48	0.50
			QPSK	0.23	0.18	0.28	0.28
	3.3		16QAM	0.24	0.19	0.29	0.31
			QPSK	0.53	0.44	0.70	0.78
20	2	1	64QAM	0.14	0.11	0.14	0.13
	2a		256QAM	—	0.16	—	0.15
	3.1	25	64QAM	0.28	0.32	0.33	0.27
	3.1a		256QAM	—	0.31	—	0.31
	3.2		16QAM	0.38	0.31	0.41	0.39
			QPSK	0.22	0.18	0.23	0.22
	3.3		16QAM	0.22	0.23	0.23	0.21
			QPSK	0.53	0.46	0.57	0.51

Distortion performance (Real-time mode)

Fixed reference channel	Modulation	Adjacent channel offset (MHz)	Measured ALCR (dBc) (With Option 660)		Integration bandwidth (MHz)
			N7624C	N7625C	
A3-1	QPSK	1.4	–65.9	–68.2	1.1
A3-4		5	–70.6	–69.7	4.5
A3-5		10	–69	–68.3	9
A3-7		20	–66.6	–65.6	18
A4-1	16QAM	1.4	–66.1		1.1
A4-5		5	–70	–68.6	4.5
A4-6		10	–68.7	–68.4	9
A4-7		20		–65.9	18
A4-8		20	–66.3		18
A5-1	64QAM	1.4	–66.7		1.1
A5-4		5	–69.9	–67.6	4.5
A5-5		10	–68.3	–67.6	9
A5-7		20	–66.2	–65.2	18

EVM performance (Real-time mode)

Fixed reference channel	Modulation	Allocated RB	Measured EVM (%) (With Option 660)	
			N7624C	N7625C
A3-1	QPSK	1	0.46	0.46
A3-4		25		
A3-5		50		
A3-7		100		
A4-1	16QAM	1	0.45	
A4-5		25		
A4-6		50		
A4-8		100		
A5-1	64QAM	1	0.49	
A5-4		25		
A5-5		50		
A5-7		100		

Ordering Information

Software licensing and configuration

Signal Studio offers flexible licensing options, including:

- **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. Floating supports single site, single region and worldwide three different types.
- **USB portable:** Allows you to move the license from one instrument / computer to another by end-user only with certified USB dongle, purchased separately.
- **Time-based:** License is time limited to a defined period, such as 12-months.

LTE / LTE-Advanced / LTE-A Pro FDD, PC license (N7624APPC) LTE / LTE-Advanced Pro TDD, PC license (N7625APPC)

Software license type	Software license	Support subscription
Node-locked perpetual	R-Y5B-001-A	R-Y6B-001-y [2]
Node-locked time-based	R-Y4B-001-z [1]	Included
Transportable perpetual	R-Y5B-004-D	R-Y6B-004-y [2]
Transportable time-based	R-Y4B-004-z 1	Included
Floating perpetual (single site)	R-Y5B-002-B	R-Y6B-002-y [2]
Floating time-based (single site)	R-Y4B-002-z [1]	Included
Floating perpetual (single region)	R-Y5B-006-F	R-Y6B-006-y [2]
Floating time-based (single region)	R-Y4B-006-z [1]	Included
Floating perpetual (worldwide)	R-Y5B-010-J	R-Y6B-010-y [2]
Floating time-based (worldwide)	R-Y4B-010-z [1]	Included
USB portable perpetual	R-Y5B-005-E	R-Y6B-005-y [2]
USB portable time-based	R-Y4B-005- z [1]	Included

LTE / LTE-Advanced / LTE-A Pro FDD, waveform playback license (N7624EMBC [4]) LTE / LTE-Advanced TDD, waveform playback license (N7625EMBC [4])

Software license type	Software license	Support subscription
Node-locked perpetual	R-Y5B-001-A	R-Y6B-001-y [2]
Node-locked time-based	R-Y4B-001- z [1]	Included
Transportable perpetual	R-Y5B-004-D	R-Y6B-004- y [2]
Transportable time-based	R-Y4B-004- z [1]	Included

One-month KeysightCare software support subscription extension [3]

Support subscription	Description
R-Y6B-501	1-month of support subscription for node-locked perpetual licenses
R-Y6B-504	1-month of support subscription for transportable perpetual licenses
R-Y6B-502	1-month of support subscription for floating perpetual licenses (single site)
R-Y6B-506	1-month of support subscription for floating perpetual licenses (single region)
R-Y6B-510	1-month of support subscription for floating perpetual licenses (worldwide)
R-Y6B-505	1-month of support subscription for USB portable perpetual licenses

1. z means different time-based license duration. F for 6 months, L for 12 months, X for 24 months, and Y for 36 months. All time-based licenses have included the support subscription same as the time-base duration.
2. y means different support subscription duration. L for 12 months (as default), X for 24 months, Y for 36 months, and Z for 60-months. Support subscription must be purchased for all perpetual licenses with 12-months as the default. All software upgrades and KeysightCare support are provided for software licenses with valid support subscription.
3. Support subscription for all perpetual licenses can be extended with monthly extensions.
4. N7624APPC / N7625APPC are only supported with N7624C / N7625C 2020 release or above.

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