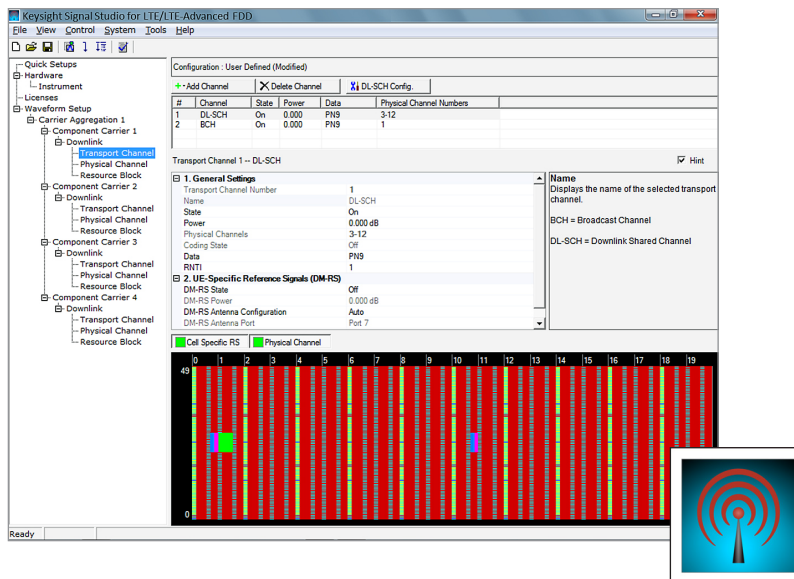# Keysight Technologies
Signal Studio for LTE/LTE-Advanced/ LTE-Advanced Pro FDD/TDD
N7624B/N7625B

Technical Overview

- 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)
- 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
TECHNOLOGIES

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.

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.

– Vector signal generators
  – MXG X-Series
  – EXG X-Series
  – ESG
  – First-generation MXG
  – M9381A PXIe VSG
– EXT wireless communication test set
– PXB baseband generator and channel emulator
– M9420A/M9421A VXT PXIe vector transceiver
– M8190A Wideband AWG
– SystemVue simulation software

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

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) 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.

The new waveform library manager, which requires Option JFP, can help you manage imported waveforms. Multiple sample rate waveforms can be stored to help shorten the time it takes to combine multi-carrier waveforms with different sample rates.
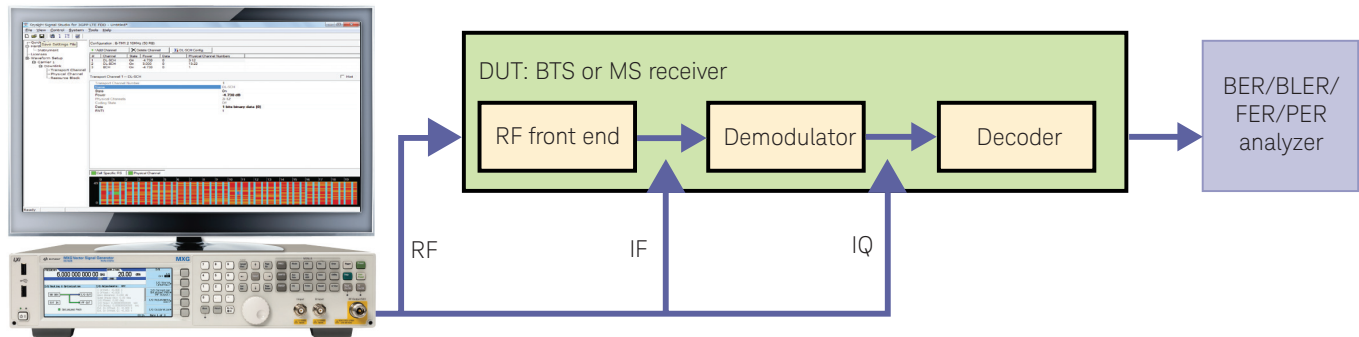
Receiver Test

Figure 3. 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 4. 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.

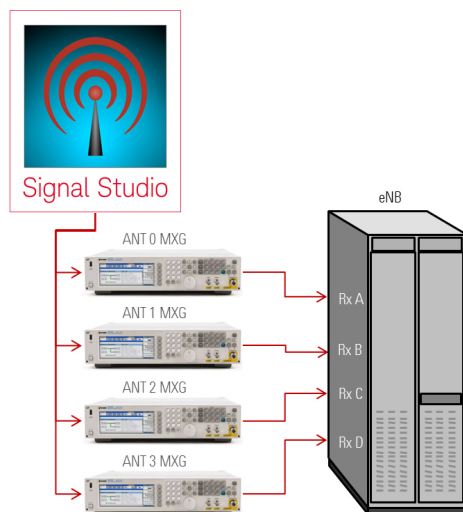For more information, please visit
www.keysight.com/find/N7649b

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 generator, 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
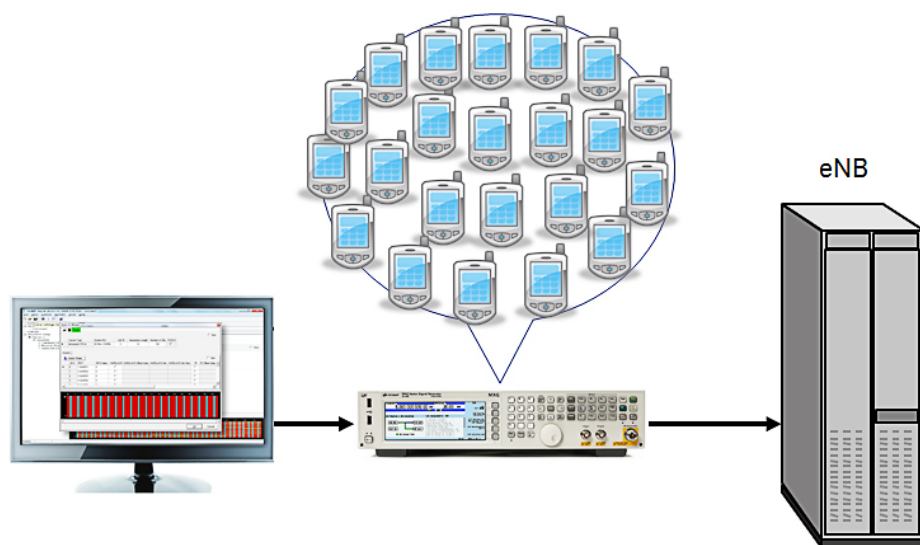– NB-IoT and eMTC downlink with channel coding

Figure 5. Multi-UE Simulation with single waveform and single MXG

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					●	●	
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		●			●	●	
E-TM wizard: 1.1/1.2/2/3.1/3.2/3.3	●	●	●				
E-TM wizard: 2a/3.1a (256QAM)		●	●				
E-TM wizard: BC3 CS3 test models (TS37.141 Annex.A) (TDD only)	●	●	●				
MCH with MBSFN RS					●	●	
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						●	
eMTC downlink: PDSCH, MPDCCH						●	

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					●	●	
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			●				
eMTC (Cat-M1): PUSCH, PUCCH, PRACH						●[1]	
NB-IoT uplink: NPUSCH (format 1, 2), NPRACH						●[1]	
NB-IoT FRC wizard						●[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 -13	
	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	14.1.0	2016-09
36.211	9.1.0	2010-03	10.7.0	2013-02	11.5.0	2013-12	12.4.0	2014-12	13.3.0	2016-09
36.212	9.4.0	2011-09	10.8.0	2013-06	11.5.1	2014-09	12.3.0	2014-12	13.3.0	2016-09
36.213	9.3.0	2010-09	10.12.0	2014-03	11.7.0	2014-06	12.4.0	2014-12	13.3.0	2016-09
36.306	9.9.0	2013-12	10.11.0	2013-12	11.9.0	2014-12	12.3.0	2014-12	13.3.0	2016-09
36.321	9.6.0	2012-03	10.9.0	2013-06	11.5.0	2014-03	12.4.0	2014-12	13.3.0	2016-09
36.331	9.11.0	2012-06	10.10.0	2013-06	11.10.0	2014-12	12.4.1	2014-12	13.3.0	2016-09
36.521-1	9.8.0	2012-03	10.6.0	2013-06	11.4.0	2014-03	12.4.0	2014-12	13.3.0	2016-09
36.423	N.A.	N.A.	N.A.	N.A.	11.8.0	2014-03	12.4.2	2014-12	13.5.0	2016-09

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	Total power dynamic range
	   EVM of single 256QAM 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	Output power dynamics
	   Total power dynamic range
	Transmitted signal quality
	   Frequency error
	   EVM for 256QAM 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[1,2]	Interfering signal	Hardware[3,4]
8.2.1 PUSCH in multipath fading propagation condition transmission on single antenna port	Real-time (with HARQ feedback)	N/A	MXG/EXG or PXB
8.2.1A PUSCH in multipath fading propagation conditions transmission on two antenna ports	Real-time MIMO (with HARQ feedback)	N/A	MXG/EXG or PXB
8.2.2 UL timing adjustment	Real-time (with HARQ and TA feedback)	Waveform playback or real-time	2 MXG/EXG or PXB
8.2.3 HARQ-ACK multiplexed on PUSCH	Waveform playback	N/A	MXG/EXG or PXB
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 or PXB
8.3.4 ACK missed detection for PUCCH format 1b with Channel Selection[5]		N/A	MXG/EXG or PXB
8.3.5 ACK missed detection for PUCCH format 3[5]			
8.3.6 NAK to ACK detection for PUCCH format 3[5]			
8.3.7 ACK missed detection for PUCCH format 1a transmission on two antenna ports[5]			2 MXG/EXG or PXB
8.3.8 CQI performance requirements for PUCCH format 2 transmission on two antenna ports[5]			
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 or PXB

1. Basic and advanced waveform playback options (N7624B-HFP, SFP/N7625B-EFP,QFP) are required for waveform playback
2. Real-time option (N7624B-WFP for FDD and N7625B-WFP for TDD) is required for real-time signal generation for MXG/EXG and PXB
3. MXG/EXG requires external fader for channel simulation
4. PXB requires same number of upconverter signal generators as eNB receiver antennas for RF output
5. Advanced LTE-Advanced option (N7624B-TFP for FDD and N7625B-TFP for TDD) is required for waveform playback

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)
			N7624B		N7625B				N7624B		N7625B		
			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 (%) | | | |
| | | | | N7624B | | N7625B | |
				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) |
			N7624B	N7625B	
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) | |
			N7624B	N7625B
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:

– **Fixed license:** Allows you to create unlimited I/Q waveforms with a specific Signal Studio product and use them with a single, specific platform.
– **Transportable/floating license:** Allows you to create unlimited I/Q waveforms with a specific Signal Studio product and use them with a single platform (or PC in some cases) at a time. You may transfer the license from one product to another.
– **Waveform license:** Allows you to generate up to 545 user-configured I/Q waveforms with any Signal Studio product and use them with a single, specific platform.

The table below lists fixed, perpetual licenses only; additional license types may be available. For detailed licensing information and configuration assistance, please refer to the Licensing Options web page at **www.keysight.com/find/SignalStudio_licensing**

N7624/25B Signal Studio for LTE/LTE-Advanced FDD/TDD

Model-Option	Description
Connectivity	
N7624/25B-1FP	Connect to E4438C ESG signal generator
N7624/25B-3FP	Connect to N5182/72 MXG/EXG signal generator
N7624/25B-6FP	Connect to N5106A PXB baseband generator and channel emulator
N7624/25B-7FP	Connect to Keysight simulation software
N7624/25B-9FP	Connect to M9381A and M9420A/M9421A
N7624/25B-BFP	Connect to E6610A
N7624B/25B-AFP	Connect to M8190A
FDD Capability	
N7624B-HFP	Basic LTE FDD
N7624B-JFP	Basic LTE-Advanced FDD
N7624B-SFP	Advanced LTE FDD
N7624B-TFP	Advanced LTE-Advanced FDD
N7624B-WFP	Advanced LTE/LTE-Advanced FDD real-time R9/R10 UL
N7624B-NFP	Advanced LTE-A Pro FDD[2]
N7624B-LFP	Multi-UE simulation
N7624B-VFP	FDD-TDD carrier aggregation[1]
TDD Capability	
N7625B-EFP	Basic LTE TDD
N7625B-JFP	Basic LTE-Advanced TDD
N7625B-QFP	Advanced LTE TDD
N7625B-TFP	Advanced LTE-Advanced TDD
N7625B-WFP	Advanced LTE/LTE-Advanced TDD real-time R9/R10 UL
N7625B-LFP	Multi-UE simulation
N7625B-VFP	FDD-TDD carrier aggregation[1]

1. If you have both N7624B and N7625B only one VFP option is needed, either N7624B-VFP or N7625B-VFP.
2. N7624B-NFP for NB-IoT and eMTC requires N7624B-HFP and N7624B-JFP options.

Try Before You Buy!

Free 30-day trials of Signal Studio software provide unrestricted use of the features and functions, including signal generation, with your compatible platform. Redeem a trial license online at

www.keysight.com/find/SignalStudio_trial

Hardware configurations

To learn more about compatible hardware and required configurations, please visit: **www.keysight.com/find/SignalStudio_platforms**

PC requirements

A PC is required to run Signal Studio. **www.keysight.com/find/SignalStudio_pc**

Signal Studio Software Updates

To update previously purchased N7624B or N7625B software to include the latest feature updates, you can purchase the N7624B-MEU or N7625B-MEU minor enhancement update fixed perpetual license.

For more information, visit

www.keysight.com/find/N7624B-MEU or **www.keysight.com/find/N7625B-MEU**

Additional Information

Websites

www.keysight.com/find/SignalStudio

Access the comprehensive online documentation, which includes the complete software HELP

Signal Studio for 3GPP LTE/LTE-Advanced/LTE-Advanced Pro FDD

www.keysight.com/find/n7624b
www.keysight.com/find/ss-lte-fdd

Signal Studio for 3GPP LTE/LTE-Advanced/LTE-Advanced Pro TDD

www.keysight.com/find/N7625b
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Keysight's LTE design and test solutions

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Literature

Move Forward to What's Possible in LTE, Brochure, 5989-7817EN

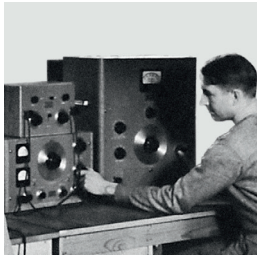*Keysight 3GPP Long Term Evolution*, Application Note, 5989-8139EN
Signal Studio Software, Brochure, 5989-6448EN

Transition from 2G/3G to 3.9G/4G Base Station Receiver Conformance Test, Application Note, 5991-0280EN

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