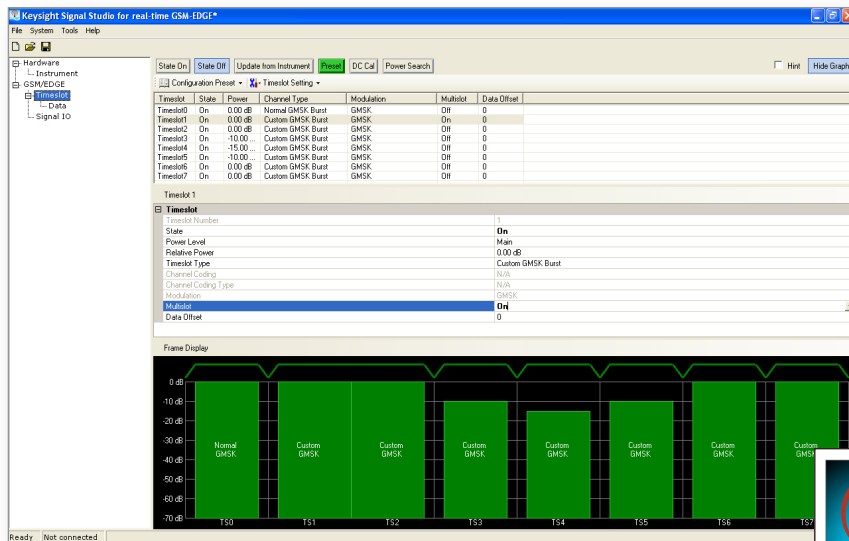# Signal Studio for GSM/EDGE/Evo
N7602B

Technical Overview

- Create Keysight validated and performance optimized GSM, EDGE and EDGE Evolution reference signals compliant to 3GPP Release 7
- Perform UE and BTS component testing with mixed-frame configuration containing GSM, EDGE and EDGE Evolution timeslots
- Perform UE and BTS receiver testing with transport-channel coding
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation

KEYSIGHT
TECHNOLOGIES

Simplify GSM EDGE and EDGE Evolution Signal Creation

Keysight Signal Studio software is a flexible suite of signal-creation tools that will reduce the time you spend on signal simulation. For GSM, EDGE and EDGE Evolution, 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 userfriendly interface lets you configure signal parameters, calculate the resulting waveforms and download files for playback. The applications for these partiallycoded, 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

In addition to waveform playback mode, some 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
  – X-Series: MXG and EXG
  – PSG
  – ESG
  – First-generation MXG
  – PXIe M9381A
– EXT wireless communication test set
– PXB baseband generator and channel emulator
– M9252A DigRF host adaptor
– SystemVue simulation software

Typical Measurements

Test components with basic capabilities

– IMD/NPR
– ACLR
– CCDF
– EVM
– Modulation accuracy
– Code domain power
– Channel power
– Occupied bandwidth

Verify receivers with advanced capabilities

– Sensitivity
– Maximum input level
– Selectivity
– Blocking
– Intermodulation
– Power control

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 for GSM/EDGE/Evo simplifies and accelerates the testing of standards-based scenarios with included pre-defined signal configurations including single slot, all slots, uniform, and mixed-burst waveforms for GSM, EDGE, and EDGE Evolution, including all modulation formats and symbol rates.

Basic N7602B Signal Studio functionality enables the creation of physical layer GSM, EDGE and EDGE Evolution signals, respectively, allowing engineers working on BTS and MS components to analyze and understand the power and modulation quality of their device under test. Option R81 working with a 16800/16900/N5343A logic analyzer enables the creation of symbol bits specifically needed for GSM/EDGE DigRF communication.

Easily create and modify sophisticated waveforms for your specific test applications with the confidence that they will conform to the 3GPP standards. Use the flexibility of the software to quickly configure waveforms for fast deterministic testing of power amplifiers, filters, antennas, front-end modules, and other GSM/EDGE/Evo system components for mobile devices and base stations. Export encrypted waveform files that you can easily share with test engineers to ensure consistency in application.

For analyzing the power and modulation characteristics under multiple test conditions, N7602B enables:

– Creation of spectrally correct signals for ORFS, power, and spurious testing
– Settable parameters such as channel power and data channel modulation type (GMSK, 8-PSK, QPSK, 16QAM, 32QAM), including normal and high symbol rates for modulation verification and analysis such as EVM testing
– Multi-carrier signal generation for up to 25 carriers, with adjustable data bit offset for low cross-carrier correlation
– View CCDF, spectrum and time domain graphs to gain insight into the effects of power ramps, modulation formats, power changes, clipping, and other effects on device performance
– Timeslot view for rapid verification of varying power-level slots within a frame
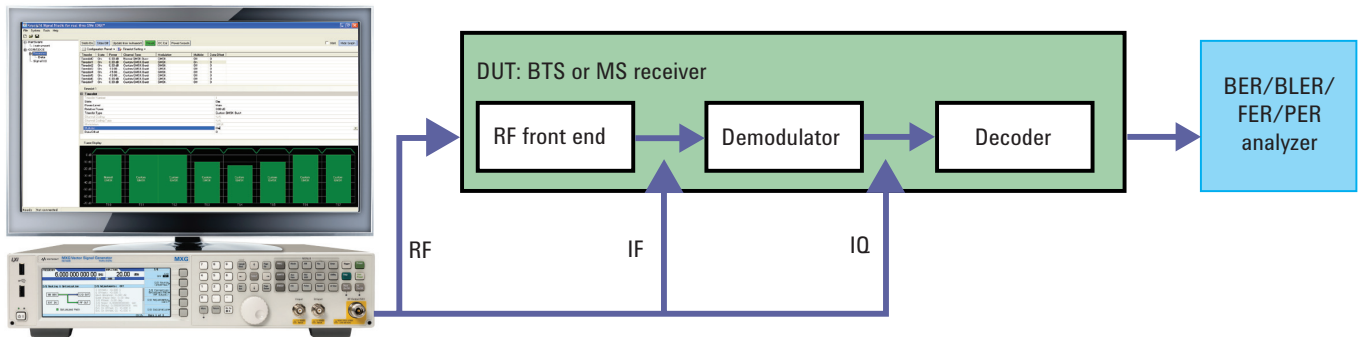
Receiver Test

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

N7602B accelerates and simplifies receiver conformance testing by generating uplink and downlink signals, including transport-channel coding, GSM, EDGE, and EDGE Evolution signals. Long multi-frame waveforms can be configured for receiver BER testing. The software's pre-defined configurations include:

– Advanced GSM/EDGE/EGPRS2-A
– Advanced half rate GSM/EDGE/EGPRS2-A
– Advanced EGPRS2-B
– Control channels

EDGE Evolution (or EGPRS2) introduces new functionality and new features, including higher order modulation and higher symbol rate bursts. New modulation formats include QPSK, 16QAM, and 32QAM. A new symbol rate format, HSR, is added with a symbol rate of 325 ksps.

BTS testing is enabled through easy configuration of coded channel types such as TCH/FS, CS1, CS4, MCS1, 5–9 (uplink), MCS1, 4–9 (downlink), TCH/F (9.6k, 4.8k), TCH/WFS (12.65k, 8.85k, 6.60k), TCH/AFS (12.2k, 10.2k, 7.95k, 7.4k, 6.7k, 5.9k, 5.15k 4.75k), FACCH/F, TCH/HS, and UAS-11, UBS-6, 8, 11.

Multi-frame generation, with configuration of 51 or 52 multiframes, enables receiver BER testing with continuous PN9 sequence data. Testing for MS factory test mode is enabled by creating signals with BCH content. This includes control channels with FCCH, SCH, BCH, CCCH or with FCCH, SCH, BCCH, CCCH, SDCCH, SACCH. Carrier configurations such as control channel bursts with dummy and GSM/EDGE bursts are available as pre-defined configurations and also allow the user the flexibility to configure the signal structure according to test needs.

Features Summary

GSM/EDGE/Evo	Component & transmitter testing		Receiver testing	
Signal Studio	**Basic waveform playback mode**		**Advanced waveform playback mode**	**Advanced real-time mode**
	GSM/EDGE	**EDGE Evolution**		
GSM/EDGE support	●	●	●	●
EDGE Evo support		●	●	
Transport channel coding for BER and BLER testing			●	●
Calibrated AWGN (requires instrument option)	●	●	●	●
Extended waveform/signal length			●	●
CCDF, spectrum, and time domain graphics	●	●	●	
Timeslot graph	●	●	●	●
Multi-carrier timing, phase offsets, and clipping	●	●	●	
25-carrier support	●	●	●	
Mixed mode GSM/EDGE timeslot support	●	●	●	●
Mixed mode GSM/EDGE/EGPRS2 timeslot support		●	●	
SACCH frame with coded TCH			●	
BCH control channel support			●	●
Choice of pre-defined carriers with BCH, TCH, and/or packet traffic			●	●
51 multiframe support for BCH content synchronization			●	●
Adjustable timing advance command bits			●	●
Adjustable power level control bits			●	●
13, 26, and 52 multiframe structure waveforms for BER testing			●	●
Alternate Amplitude	●	●	●	●
TCH/FS, TCH/HS, CS1, CS4, MCS1/5/9(UL and DL), E-TCH/F43.2k			●	●
MCS 6-8 support (UL and DL), MCS4 DL, TCH/F (9.6k, 4.8k), TCH/WFS (12.65k, 8.85k, 6.60k), TCH/AFS (12.2k, 10.2k, 7.95k, 7.4k, 6.7k, 5.9k, 5.15k 4.75k), FACCH/F			●	
UAS-11 and UBS-6/8/11 support			●	

Supported Standards and Test Configurations

Standard	Version	Date
Control channels		
3GPP TS24.008	V6.15.0	2006-12
3GPP TS44.004	V6.1.0	2005-11
3GPP TS44.018	V6.17.0	2006-05
3GPP TS44.060	V6.18.0	2006-07
3GPP TS45.001	V7.7.0	2008-02
3GPP TS45.002	V9.3.0	2010-04
3GPP TS45.003	V9.0.0	2009-12
3GPP TS45.004	V7.2.0	2008-02
3GPP TS45.010	V8.5.0	2009-12
EDGE Evolution		
3GPP TS 45.001	V7.7.0	2008-02
3GPP TS 45.002	V7.6.0	2007-11
3GPP TS 45.003	V7.4.0	2008-02
3GPP TS 45.004	V7.2.0	2008-02
3GPP TS 45.010	V7.4.0	2008-02

Performance Characteristics

Definitions

Specification (spec):

Represents warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 to 55 °C, unless otherwise stated, and after a 45 minute warm-up period. The specifications include measurement uncertainty. Data represented in this document are specifications unless otherwise noted.

Typical (typ):

Represents characteristic performance, which 80% of the instruments manufactured will meet. This data is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 25 °C).

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 instruments indicated in the respective tables. For performance characteristics of other instruments, refer to the respective product data sheet.

N5172B EXG and N5182B MXG X–Series vector signal generators

GSM/EDGE Output RF spectrum (ORFS)[1] (Playback mode)			GSM		EDGE	
Offset	Configuration	Frequency[2]	Standard (typ)	Option UNV (typ)	Standard (typ)	Option UNV (typ)
200 kHz	1 normal timeslot, bursted	800 to 900 MHz 1800 to 1900 MHz	–34 dBc	–36 dBc	–37 dBc	–38 dBc
400 kHz			–69 dBc	–70 dBc	–69 dBc	–70 dBc
600 kHz			–81 dBc	–82 dBc	–80 dBc	–81 dBc
800 kHz			–82 dBc	–83 dBc	–82 dBc	–83 dBc
1200 kHz			–84 dBc	–85 dBc	–83 dBc	–84 dBc

1. Amplitude ≤ 7 dBm.
2. Performance evaluated at bottom, middle and top of bands shown.

N5172B EXG and N5182B MXG-X-Series vector signal generators

EVM performance (Playback mode)

Format	GSM		EDGE	
Modulation type	GMSK (bursted)		3pi/8 8PSK (bursted)	
Modulation rate	270.833 ksps		70.833 ksps	
Channel configuration	1 timeslot		1 timeslot	
Frequency	800 to 900 MHz 1800 to1900 MHz		800 to 900 MHz 1800 to 1900 MHz	
EVM power level	≤ 7 dBm		≤ 7 dBm	
EVM power level with Option 1EA	≤ 13 dBm		≤ 13 dBm	
EVM/Global Phase Error	Spec	Type	Spec	Type
	RMS 0.8 °	0.2 °	1.2%	0.75%
	Peak 1.5°	0.6°		

M9381A vector signal generator

GSM/EDGE/Evo Output RF Spectrum (ORFS) with M9381A[1] (Typical)

Offset	RBW	Configuration	Frequency	GSM (dBc)	EDGE (dBc)	EGPRS2 (dBc)
200 kHz	30 kHz	1 normal timeslot bursted or continous	450 to 950 MHz 1700 to 1950 MHz	−36.3	−38.4	−38.4
400 kHz	30 kHz			−64.5	−64.5	−64.6
600 kHz	30 kHz			−82.4	−80.3	−78.0
800 kHz	30 kHz			−83.7	−81.5	−79.1
1200 kHz	30 kHz			−84.8	−84.0	−82.4
1800 kHz	100 kHz			−80.0	−79.7	−78.2

1. Amplitude ≤ 10 dBm.

M9381A vector signal generator

EVM performance (Playback mode)

Format	GSM	EDGE
Modulation type	GMSK (bursted)	3p/8 8PSK (bursted)
Modulation rate	270.833 ksps	270.833 ksps
Channel configuration	1 timeslot	1 timeslot
Frequency	450 to 950 MHz	450 to 950 MHz
	1700 to 1950 MHz	1700 to 1950 MHz
EVM power level	≤ 10 dBm	≤ 10 dBm
Global phase error	0.2° RMS	N/A
	0.6° Peak	N/A
EVM	N/A	0.3% RMS

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

N7602B Signal Studio for GSM/EDGE/Evo

Model-Option	Description
Connectivity	
N7602B-1FP	Connect to E4438C, fixed perpetual license
N7602B-2FP	Connect to E8267D, fixed perpetual license
N7602B-3FP	Connect to N5182/62 MXG, N5172 EXG, fixed perpetual license
N7602B-6FP	Connect to N5106A PXB, fixed perpetual license
N7602B-7FP	Connect to Keysight simulation software
N7602B-8FP	Connect to E6607 EXT, fixed perpetual license
N7602B-9FP	Connect to M9381A or M9252A
Capability	
N7602B-EFP	Basic GSM/EDGE
N7602B-FFP	Basic EDGE Evo
N7602B-QFP	Advanced GSM/EDGE/Evo
N7602B-WFP	Advanced GSM/EDGE real-time

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 N7602B software to include the latest feature updates, you can purchase the N7602B-MEU minor enhancement update fixed perpetual license.

For more information, visit

www.keysight.com/find/N7602B-MEU

Additional Information

Websites

www.keysight.com/find/SignalStudio

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

www.keysight.com/find/n7602b
www.keysight.com/find/signalstudio

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

Literature

Signal Studio Software, Brochure, literature number 5989-6448EN

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

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