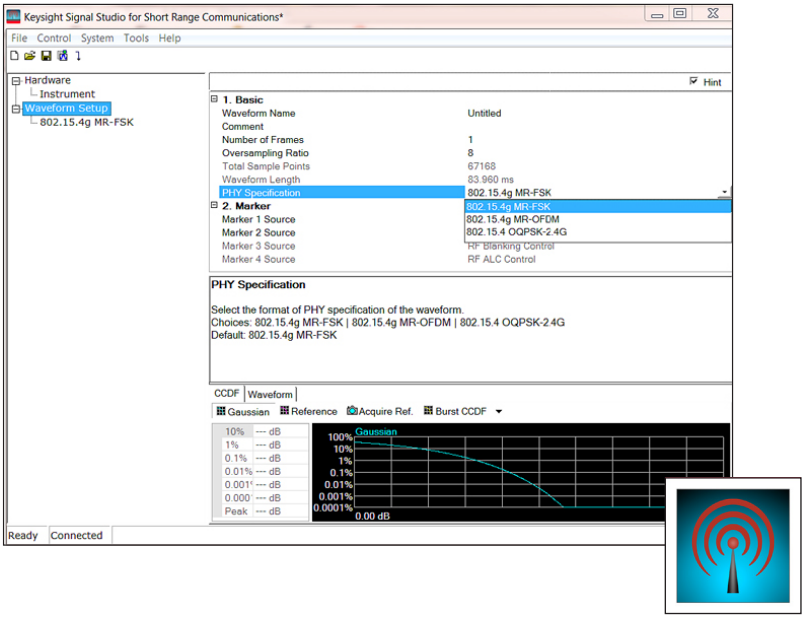
Keysight Technologies
Signal Studio for Short Range Communications
N7610B

Technical Overview



- Create Keysight validated and performance-optimized reference signals compliant to IEEE 802.15.4 (for ZigBee), 802.15.4g (for Wi-SUN) and ITU-T G.9959 (for Z-Wave) PHY standards
- Support ZigBee 2.4 GHz O-QPSK and BPSK modulation and spreading as defined in IEEE 802.15.4
- Support Wi-SUN mandatory profiles for MR-FSK and MR-OFDM PHY mode, respectively
- Support Z-Wave R1/R2/R3 data rate modes as defined in ITU-T G.9959
- Provide signals with full-channel coding, flexible configuration of MAC headers and data types for receiver testing
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Simplify Short Range Communications 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. For short range communications such as IoT and M2M, 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 filter
- 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 inte¬gration 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 non-repeating and dynamically changing signals needed for receiver testing. A graphical user 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 and software platforms. 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
  - M9381A PXIe VSG
- Wireless test sets
- PXB baseband generator and channel emulator
- M8190A arbitrary waveform generator
- M9420A PXIe vector transceiver
- Waveform Creator software
- SystemVue simulation software

Typical measurements

Test components the following capabilities:

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

Verify receivers with the following capabilities:

- Fully-coded 802.15.4 O-QPSK/BPSK
- 802.15.4g PHY MR-FSK, MR-OFDM
- ITU-T G.9959 Z-Wave FSK/GFSK
- Sensitivity
- Maximum input level
- Selectivity
- Blocking
- Intermodulation
- Power control

Component and Transmitter Test

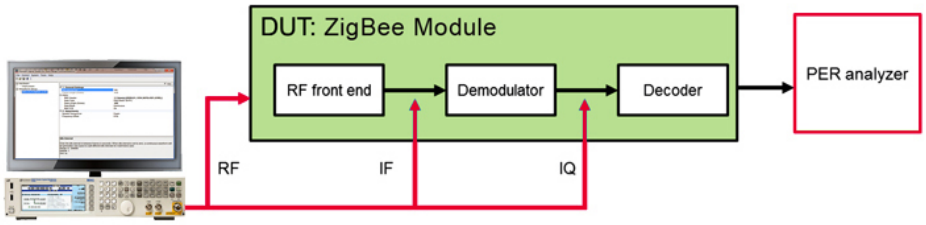


Figure 1. Generate fully channel-coded signals to evaluate ZigBee receiver PER with a Keysight MXG vector signal generator and the N7610B-SFP option for ZigBee advanced capabilities.

Most short range communication technologies are implemented in small, low-cost IC forms or complete drop-in modules. Whether you're using single technology formats, such as ZigBee, or multi-format combination modules with WLAN, *Bluetooth*® and ZigBee, Signal Studio software provides a flexible suite of signal-creation tools to reduce receiver testing time on chip-set design, validation and troubleshooting. Combined with Keysight signal generators, the N7610B provides performance-optimized reference signals to enhance the characterization and verification of Devices Under Test (DUTs). Through its application-specific user interface, engineers can create standards-based and custom test signals for component and receiver tests.

The N7610B consists of different options that provide advanced capabilities to address applications defined in IEEE 802.15.4 for ZigBee O-QPSK/BPSK, 802.15.4g for Wi-SUN MR-FSK and MR-OFDM, and ITU-T G.9959 for Z-Wave FSK/GFSK. Use the baseband signal to perform demodulation and decoding verification on chips. To thoroughly test the demodulation capabilities of a module, a fully-coded test signal is necessary. This level of coding enables engineer to determine if each functional stage of a receiver is operating correctly and enables the use of the test signal to perform Packet Error Rate (PER) measurements.

The N7610B's graphical user interface provides a direct instrument connection for parameter transfer and closed-loop or interactive control during signal generation. After a signal is set up in Signal Studio, it can be downloaded into a variety of Keysight instruments. Signal Studio software complements these platforms by providing a cost-effective way to tailor them to the test needs in design, development and production test.

Top Features

Fully-coded IEEE 802.15.4 O-QPSK and BPSK signals for ZigBee PHY measurements

- Supports 2.4 GHz O-QPSK modulation and spreading
- Supports generation of PPDU with standard defined preamble, SFD and configurable PHY payload
- Supports generation of multi-packet signal with variable packet length and different payload
- Applies impairments to ideal signal, frequency offset and timing error

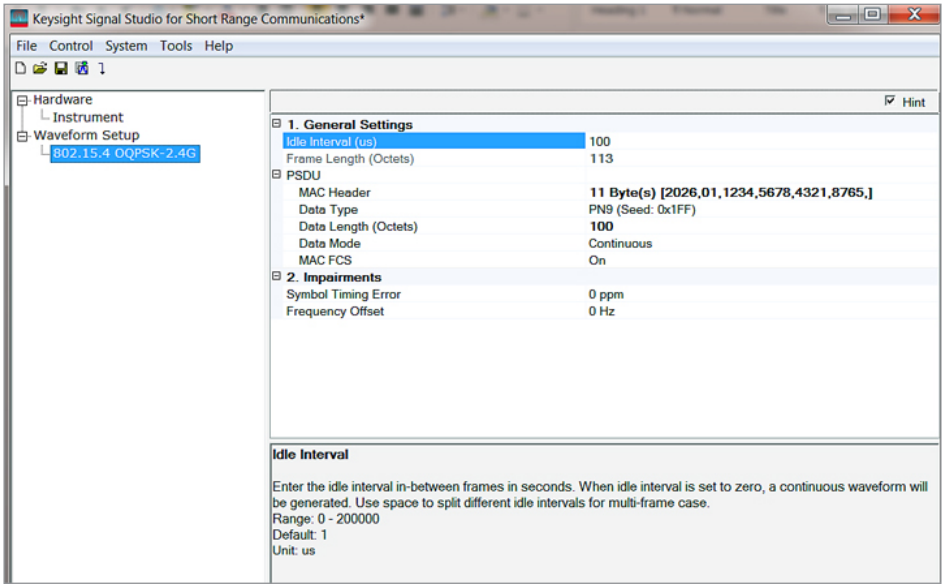


Figure 2. ZigBee O-QPSK configuration user interface

Easy to generate MR-FSK and MR-OFDM signals for Wi-SUN PHY measurements

- Supports multi-rate and multi-regional frequencies and multi-data rate combinations defined in IEEE 802.15.4g specifications
- Supports Wi-SUN MR-FSK and MR-OFDM of SUN PHY formats
- Sets SHR and PHR in relevant tests separately
- Configures MAC header settings, MAC FCS, sequence control, data type, and data length
- Provides impairment tests with Symbol Timing Error, Frequency offset, and Frequency deviation

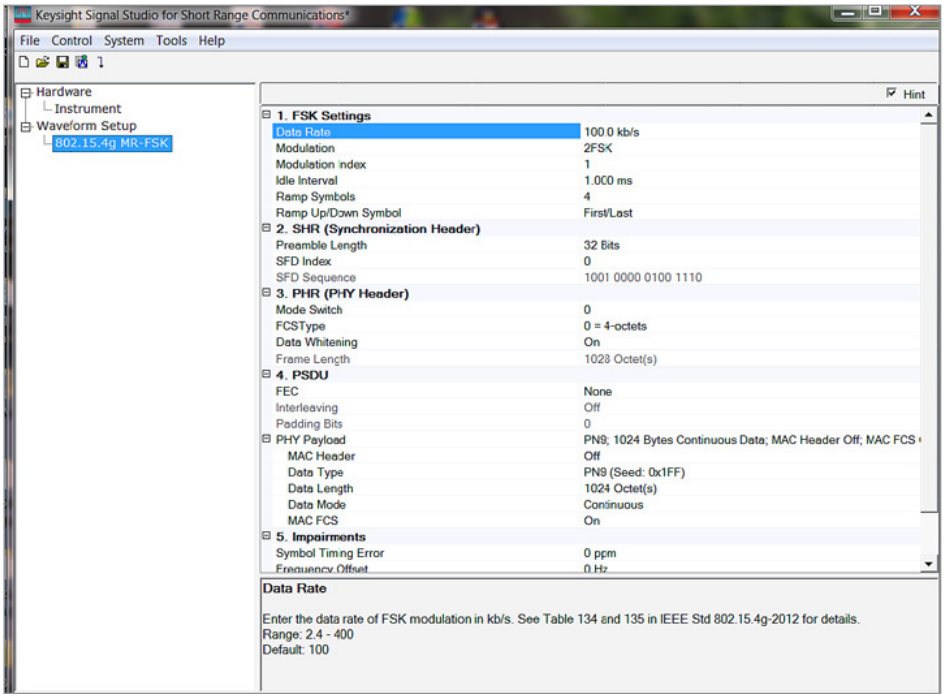


Figure 3. Wi-SUN MR-FSK configuration user interface

Measurement details

IEEE 802.15.4g PHY	Supported option	Component and receiver testing Advanced waveform playback mode
MR-FSK (Wi-SUN)	N7610B-QFP	– FSK setting – Date rate: 2.4 to 400 kb/s – Modulation: 2FSK, 4FSK – Modulation index: 0.33 to 2.0 – Idle interval: 0 to 200 ms – Ramp symbols: 1 to 10 – Synchronization header (SHR) – Preamble length for 2FSK: 32 to 8000 bits; for 4FSK: 64 to 16000 bits – SFD index: 0/1 – SFD sequence: values as defined in Table 131 and 132 in standards – PHY header (PHR) – Mode switch: 0/1 – When mode switch = 0, FCS type: 0/1, Data whitening: on/off, Frame length: 1026 or 1028 octets – When mode switch = 1, Mode switch parameter entry: 0 to 3 , New mode FEC: On/off, New mode, page, modulation scheme and mode, Checksum, Parity check – PSDU – FEC: None/RSC/NRNSC – Interleaving: On/off – PHY payload: -- MAC header: can be configured -- Data length: 0 to 2047 octets -- MAC FCS: On/off – Impairments: symbol timing error, frequency offset, frequency deviation scaling, Gaussian BT.
MR-OFDM (Wi-SUN)	N7610B-RFP	– OFDM settings – Option: 1/2/3/4 – Idle interval: 0 to 200 ms – Windowing length: 0 to 256 – PSDU – MCS, modulation and coding, scramble, OFDM interleaving: varied according to definitions in standard – PHY payload: -- MAC header: can be configured -- Data length: 0 to 2047 octets -- MAC FCS: On/off – PHY header (PHR) information
O-QPSK/BPSK (ZigBee)	N7610B-SFP	– General setting – Idle interval: 0 to 200 ms – PSDU – Mac header: can be configured – Data length: 0 to 127 octets – MAC FCS: On/off – Impairments: symbol timing error, frequency offset
FSK/GFSK (ITU-T G.9959 for Z-Wave)	N7610B-TFP	– General setting – Data rate: R1 (9.6 kbps), R2 (40 kbps), R3 (100 kbps) – Idle interval: 0 to 200 ms – PSDU – MAC header: can be configured – MAC FCS: On/Off – End of Frame Delimiter: On/Off – Impairments: symbol timing error, frequency offset, frequency deviation scaling

Key Specifications

The following performance characteristics apply to the N7610B Signal Studio for Wi-SUN application.

Definitions

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).

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

The EVM measurements were made with an N9030A PXA signal analyzer with Option B1X (160 MHz bandwidth), using the Keysight 89601B VSA software with Option AYA for 2FSK and Option BHF for MR-OFDM modulation analysis.

The ACP measurement setting for 2FSK uses the definition in section 18.1.5.6 of the IEEE 802.15.4g-2012 standard. The ACP values for MR-OFDM are measured on the first out-of-band channels (upper and lower), which are adjacent to the in-band channel. The bandwidth for both the in-band and out-of-band channels are set as the Channel Spacing values defined in Table 148 of the IEEE Standard 802.15.4g-2012, i.e., 1200 kHz, 800 kHz, 400 kHz and 200 kHz for OFDM Options 1, 2, 3 and 4 respectively.

IEEE 802.15.4g PHY standard	Parameters		Characteristic (typical)		N5172B EXG, N5182A/82B MXG signal generator
MR-FSK	Frequency: 920 MHz				Amplitude: ≤ 13 dBm
2FSK	Modulation index/Bit rate (bps)	0.5/100	FSK Error (RMS)		0.53%
			ACP (dB)	Offset Frequency M1	–64.2
				Offset Frequency M2	–65.6
			FSK Frequency Deviation Offset		7.19%
			FSK Zero Crossing Error		0.07%
		1/100	FSK Error (RMS)		0.56%
			ACP (dB)	Offset Frequency M1	–69.2
				Offset Frequency M2	–65.7
			FSK Frequency Deviation Offset		7.27%
			FSK Zero Crossing Error		0.04%

IEEE 802.15.4g PHY standard	Parameters		Characteristic (typical)	N5172B EXG, N5182A/82B MXG signal generator
MR-OFDM	Frequency: 920 MHz			Amplitude: ≤ 13 dBm
Option 1		MCS 1	EVM (RMS)	0.13%
			ACP (dB)	–46.1
		MCS 3	EVM (RMS)	0.14%
			ACP (dB)	–46.1
Option 2		MCS 1	EVM (RMS)	0.13%
			ACP (dB)	–61.9
		MCS 3	EVM (RMS)	0.13%
			ACP (dB)	–62.0
		MCS 5	EVM (RMS)	0.13%
			ACP (dB)	–60.8
Option 3		MCS 1	EVM (RMS)	0.14%
			ACP (dB)	–59.7
		MCS 3	EVM (RMS)	0.14%
			ACP (dB)	–59.5
		MCS 5	EVM (RMS)	0.16%
			ACP (dB)	–60.0
Option 4		MCS 3	EVM (RMS)	0.15%
			ACP (dB)	–39.7
		MCS 5	EVM (RMS)	0.15%
			ACP (dB)	–39.6

IEEE 802.15.4 PHY standard	Parameters	Characteristic (typical)	N5172B EXG, N5182A/82B MXG signal generator
O-QPSK	Frequency: 2450 MHz		Amplitude: 0 dBm
		Offset EVM	0.19%

Software Licensing and Instrument 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, perpetual 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, please refer to the Licensing Options web page at **www.keysight.com/find/SignalStudio_licensing**

N7610B Signal Studio for short range communications

Model-Option	Description
Connectivity	
N7610B-1FP	Connect to E4438C ESG signal generator
N7610B-2FP	Connect to E8267D PSG signal generator
N7610B-3FP	Connect to N5182B MXG, N5172B EXG vector signal generator
N7610B-9FP	Connect to M9381A PXIe vector signal generator
Capability	
N7610B-QFP	Advanced 802.15.4g MR-FSK for Wi-SUN
N7610B-RFP	Advanced 802.15.4g MR-OFDM for Wi-SUN
N7610B-SFP	Advanced 802.15.4 O-QPSK/BPSK for ZigBee
N7610B-TFP	Advanced ITU-T G.9959 FSK/GFSK for Z-Wave

For detailed configuration assistance, refer to the Signal Studio Configuration Assistant web page at:
http://rfmw.em.keysight.com/wireless/helpfiles/all-in-one_config_asst/ssconfig.html

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Start with a 30-day free trial.
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Hardware configurations

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

PC requirements

A laptop or desktop PC is required to run Signal Studio software, as long as it meets or exceeds the minimum requirements: **www.keysight.com/find/SignalStudio_pc**

Additional Information

Measurement, user's and programming guides can be found on the product Web page in the document library: **www.keysight.com/find/n7610b**

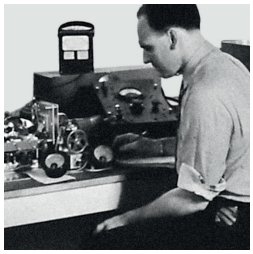
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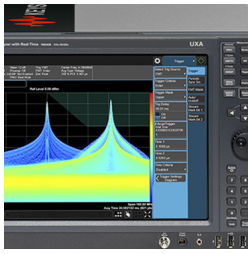
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