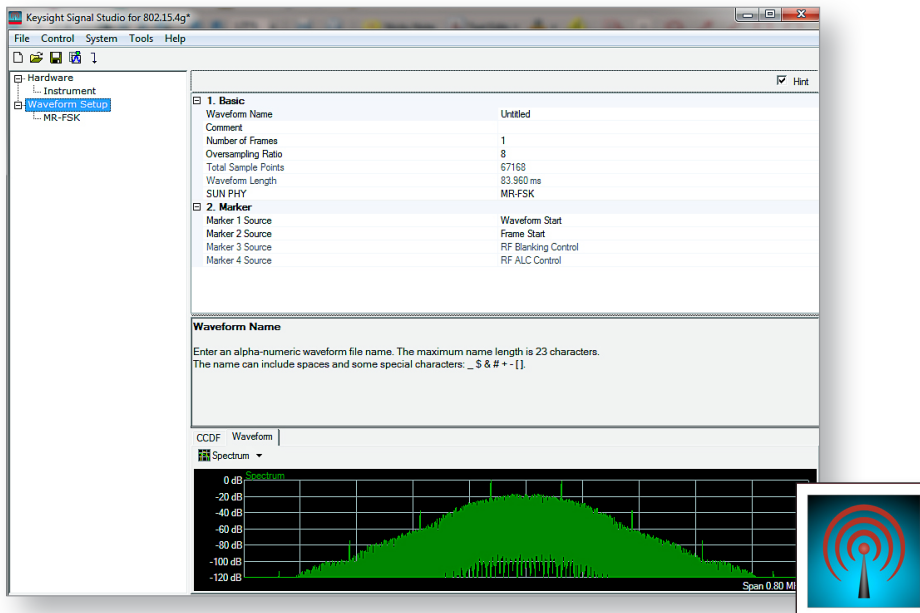


# Keysight Technologies

## Signal Studio for 802.15.4g Wi-SUN N7610B

### Technical Overview



- Create Keysight validated and performance-optimized reference signals compliant to IEEE 802.15.4g (Wi-SUN) PHY standards
- Support mandatory profiles for MR-FSK and MR-OFDM PHY mode respectively
- Provide signals with full channel coding, flexible configuration of MAC headers and data types for testing receivers
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation

## Simplify 802.15.4g Wi-SUN 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 802.15.4g Wi-SUN, 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 will create standards-based and custom test signals for component, transmitter, and receiver test.

### 802.15.4g PHY conformance tests

N7610B Signal Studio for 802.15.4g provides advanced capabilities to enable you to create fully channel-coded signals for receiver packet-error-rate (PER). 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
- Wi-SUN PHY conformance tests

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 set up 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 and EXG X-Series
  - PSG and ESG Series
- PXIe vector signal generator

### Typical receiver measurements

- Sensitivity
- Maximum input level
- Selectivity
- Blocking
- Intermodulation
- Spurious emissions
- Demodulation
- Power control

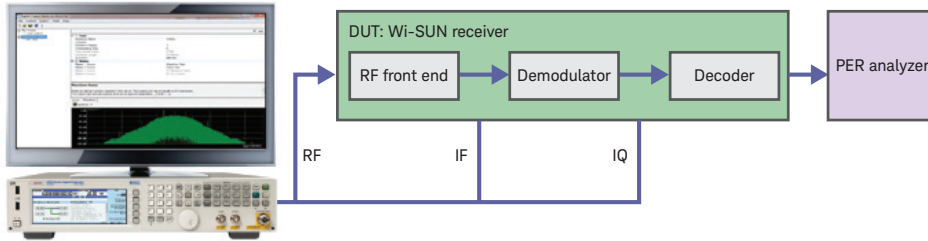


Figure 1. Generate fully channel-coded signals to evaluate the PER of your receiver with Keysight X-Series signal generators and Signal Studio's advanced capabilities.

Signal Studio's advanced capabilities address applications in IEEE 802.15.4g requirements and Wi-SUN conformance tests for receiver designs in all stages of development. Use the baseband signal to perform demodulation and decoding verification on ASIC and DSP chips. To thoroughly test the demodulation capabilities of a receiver, a fully-coded test signal is necessary. This level of coding enables you to determine if each functional stage of a receiver is operating correctly and enables you to use this test signal to perform PER measurements.

- Support multi-rate and multi-regional frequency and multi-data rates combinations defined in IEEE 802.15.4g specifications
- Support Wi-SUN MR-FSK and MR-OFDM of SUN PHY formats
- Set SHR and PHR in relevant tests separately
- Configure MAC header settings, MAC FCS, sequence control, data type, and data length
- Provide impairment tests with Symbol Timing Error, Frequency offset, and Frequency deviation

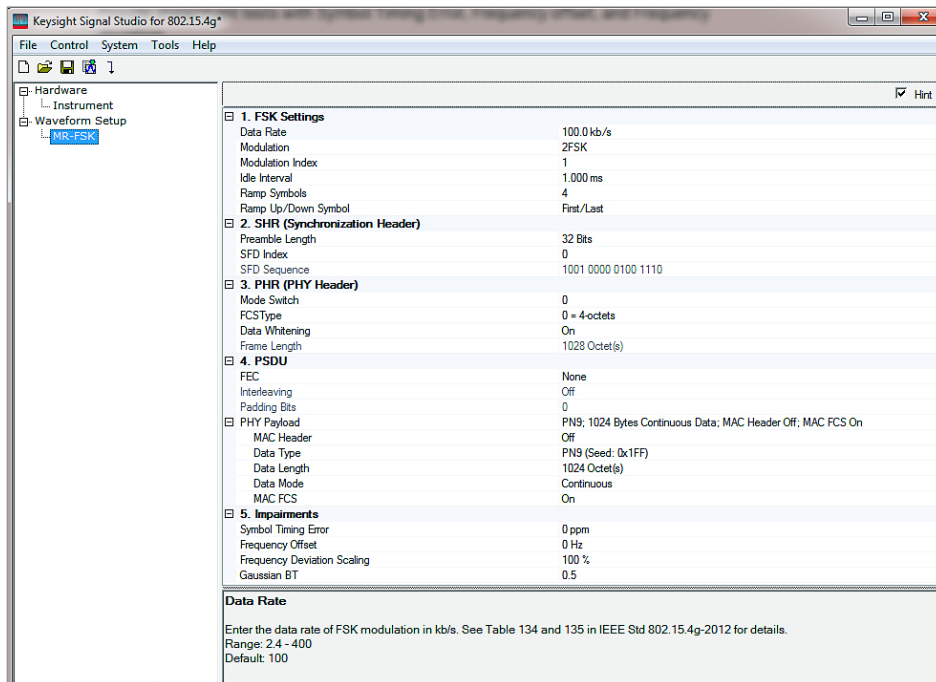


Figure 2. MR-FSK configuration user interface

## Features Summary

IEEE 802.15.4g PHY	Component and receiver testing Advanced waveform playback mode
MR-FSK	<ul style="list-style-type: none"> <li>- FSK setting               <ul style="list-style-type: none"> <li>- Data rate: 2.4 to 400 kb/s</li> <li>- Modulation: 2FSK, 4FSK</li> <li>- Modulation index: 0.33 to 2.0</li> <li>- Idle interval: 0 to 200 ms</li> <li>- Ramp symbols: 1 to 10</li> <li>- Ramp up/down symbol: First/Last, Center, All 1, All 0</li> </ul> </li> <li>- Synchronization header (SHR)               <ul style="list-style-type: none"> <li>- Preamble length for 2FSK: 32 to 8000 bits; for 4FSK: 64 to 16000 bits</li> <li>- SFD index: 0/1</li> <li>- SFD sequence: values as defined in Table 131 and 132 in standards</li> </ul> </li> <li>- PHY header (PHR)               <ul style="list-style-type: none"> <li>- Mode switch: 0/1</li> <li>- When mode switch = 0, FCS type: 0/1, Data whitening: on/off, Frame length: 1026 or 1028 octets</li> <li>- When mode switch = 1, Mode switch parameter entry: 0-3 , New mode FEC: On/off, New mode, page, modulation scheme and mode, Checksum, Parity check</li> </ul> </li> <li>- PSDU               <ul style="list-style-type: none"> <li>- FEC: None/RSC/NRNSC</li> <li>- Interleaving: On/off</li> <li>- Padding bits: 0</li> <li>- PHY payload:                   <ul style="list-style-type: none"> <li>-- MAC header: can be configured</li> <li>-- Data type: can be edited</li> <li>-- Data length: 0 to 2047 octets</li> <li>-- Data mode: continuous/truncated</li> <li>-- MAC FCS: On/off</li> </ul> </li> </ul> </li> </ul>
MR-OFDM	<ul style="list-style-type: none"> <li>- OFDM settings               <ul style="list-style-type: none"> <li>- Option: 1/2/3/4</li> <li>- Idle interval: 0 to 200 ms</li> <li>- Windowing length: 0 to FFT size x Oversampling rate/2 (depends on OFDM option selection)</li> <li>- Filter for STF symbols: On/off</li> </ul> </li> <li>- PSDU               <ul style="list-style-type: none"> <li>- MCS, modulation and coding, scramble, OFDM interleaving: varied according to definitions in standard</li> <li>- PHY payload:                   <ul style="list-style-type: none"> <li>-- MAC header: can be configured</li> <li>-- Data type: can be edited</li> <li>-- Data length: 0 to 2047 octets</li> <li>-- Data mode: continuous/truncated</li> <li>-- MAC FCS: On/off</li> </ul> </li> <li>- PHY header (PHR) information</li> </ul> </li> </ul>

## Supported Standards and Test Configurations

The following standards are supported by the N7610B Signal Studio for Wi-SUN application.

Wi-SUN format	IEEE technical specification
MR-FSK	802.15.4g-2012
MR-OFDM	

## Performance Characteristics

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 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 89601B VSA software with Option AYA for 2FSK and Option BHF for MR-OFDM modulation analysis.

The ACP measurement settings for 2FSK use 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 bandwidths 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 Option 1, 2, 3 and 4 respectively.

**IEEE 802.15.4g**

<b>PHY standard</b>	<b>Parameters</b>	<b>Characteristic (typical)</b>		<b>N5172B EXG, N5182A/82B MXG</b>	
MR-FSK	Frequency: 920 MHz			Amplitude: $\leq 13$ 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%			
MR-OFDM	Frequency: 920 MHz			Amplitude: $\leq 13$ 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	

## 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](http://www.keysight.com/find/SignalStudio_licensing)

### N7610B Signal Studio for 802.15.4g Wi-SUN

Model-Option	Description
<b>Connectivity</b>	
N7610B-1FP	Connect to E4438C ESG vector signal generator
N7610B-2FP	Connect to E8267D PSG vector signal generator
N7610B-3FP	Connect to N5182B MXG or N5172B EXG vector signal generators
N7610B-9FP	Connect to M9381A PXIe vector signal generator
<b>Capability</b>	
N7610B-QFP	Advanced MR-FSK
N7610B-RFP	Advanced MR-OFDM

### Hardware configurations

To learn more about required hardware configurations, please visit: [www.keysight.com/find/SignalStudio\\_platforms](http://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](http://www.keysight.com/find/SignalStudio_pc)

## Additional Information

### Websites

Access the comprehensive online documentation, which includes the complete software HELP, download the software, and request a trial license.

[www.keysight.com/find/N7610B](http://www.keysight.com/find/N7610B)

Signal Studio software

[www.keysight.com/find/SignalStudio](http://www.keysight.com/find/SignalStudio)

### Literature

*Signal Studio Software*, Brochure, 5989-6448EN

### 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](http://www.keysight.com/find/SignalStudio_trial)

**myKeysight**

**myKeysight**

[www.keysight.com/find/mykeysight](http://www.keysight.com/find/mykeysight)

A personalized view into the information most relevant to you.



**Three-Year Warranty**

[www.keysight.com/find/ThreeYearWarranty](http://www.keysight.com/find/ThreeYearWarranty)

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



**Keysight Assurance Plans**

[www.keysight.com/find/AssurancePlans](http://www.keysight.com/find/AssurancePlans)

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



[www.keysight.com/quality](http://www.keysight.com/quality)

Keysight Electronic Measurement Group  
DEKRA Certified ISO 9001:2008  
Quality Management System

**Keysight Channel Partners**

[www.keysight.com/find/channelpartners](http://www.keysight.com/find/channelpartners)

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

**Americas**

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

**Asia Pacific**

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

**Europe & Middle East**

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:  
[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)  
(BP-07-10-14)