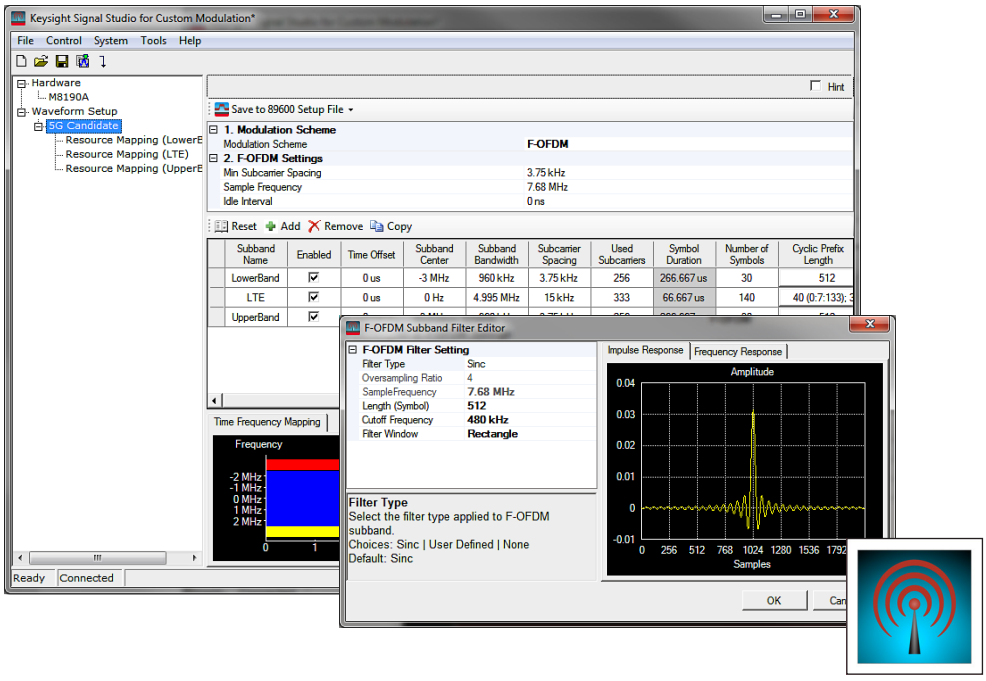
Keysight Technologies

Signal Studio for Custom Modulation

N7608B

Technical Overview



- Create 5G candidate modulation waveforms (FBMC, F-OFDM, GFDM, UFMC) with an easy-to-use graphical user interface
- Create custom OFDM and IQ waveforms for emerging wireless, 5G, and aerospace/defense custom/proprietary applications
- Customize OFDM and IQ quick setups for applications such as DAB, DVB-T/H, DVB-SH, ISDB-T, SOQPSK, DVB-S2X APSK and more
- Apply crest factor reduction to reduce peak-to-average ratio
- Use with Keysight sources for flexible RF/microwave frequency and modulation bandwidth configurations

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Simplify Custom Signal Creation

Keysight Signal Studio for custom modulation software is a flexible suite of signal-creation tools that will reduce the time you spend on signal simulation. 5G candidate modulations, custom OFDM, and IQ signals can quickly and easily be generated for component, transmitter, and receiver test of emerging standards and 5G applications. Accelerate the definition of popular signals such as DAB, DVB-T/H, WLAN, SOQPSK, and DVB-S2X APSK with convenient quick setups, then easily modify and customize them.

Component and transmitter test

Signal Studio uses 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 test signals include parametric test of components such as amplifiers and filters, and performance characterization and verification of RF sub-systems.

Receiver test

Signal Studio enables you to create signals for receiver uncoded bit-error-rate (BER) for early testing of receiver hardware.

Apply your signals in real-world testing

Once you set up your signals in Signal Studio, you can download them to a variety of Keysight instruments. This offers flexibility in generating signals at various carrier frequencies with different bandwidths for multiple applications. Signal Studio software provides a cost-effective way to tailor your test equipment to your measurement needs in design and development.

- Vector signal generators
  - X-Series: N5182A/B MXG and N5172B EXG
  - E8267D PSG
  - E4438C ESG
  - M9381A PXIe VSG
  - M9420A PXIe VXT
- Arbitrary waveform generator (AWG)
  - AWG M8190A
  - Add E8267D PSG with wideband IQ inputs to generate wide-bandwidth signals up to 44 GHz

Typical Measurements

Test components and transmitters:

- CCDF
- EVM
- Channel power
- Occupied bandwidth
- Spectrum

Test receivers:

- Component test along receiver chain
- Receiver sensitivity
- Uncoded BER

Component and Transmitter Test



Figure 1. Typical component test configuration using Signal Studio with an X-Series signal generator and analyzer.

Signal Studio enables you to create and customize waveforms to characterize the power and modulation performance of your components and transmitters. Easily manipulate a variety of signal parameters to simplify signal creation.

- Create spectrally-correct signals for channel power, spectral mask, and spurious testing
- View CCDF and OFDM resource mapping and modulation (5G candidate and custom OFDM), and data and idle segments (custom IQ) to graphically evaluate signal configuration and to investigate the effects on device performance
- Save 89600 VSA setup files for EVM testing with Keysight signal analyzers and oscilloscopes

Configure custom signals

5G candidate modulations

- Quickly and easily configure 5G candidate modulations such as FBMC, F-OFDM, GFDM, UFMC
- Set parameters such as FFT length, guard, and data subcarriers, and filter overlap factor (K) for extended IFFT and polyphase network for 5G candidate signals
- Apply 5G multiple access schemes such as SCMA or NOMA

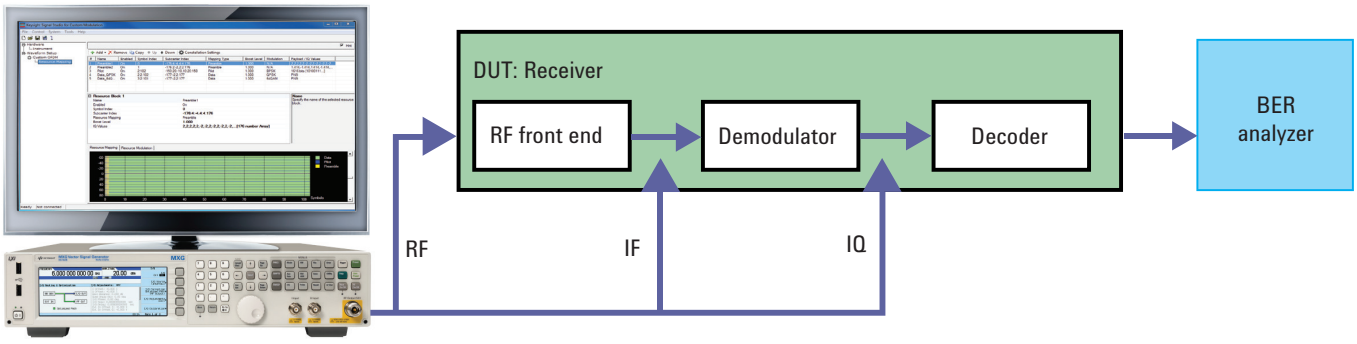
Custom OFDM

- Set parameters such as OFDM FFT length, guard interval, guard subcarriers, pilot, and data resource modulation type (BPSK, QPSK, 8PSK,16/32/64/128/256/512/1024/2048/4096 QAM, or user-defined constellations)
- Set flexible resource mapping with preamble, pilot, and data resource block types
- Easily add DFT-Spread, set variable Cyclic Prefix (CP) length, and generate Zadoff-Chu sequence
- Use customizable quick setups for WLAN 802.11a, DAB:Mode I, DVB-T/H:2K 1/8, DVB-SH:1K 1/32, ISDB-T (Mode 3, 1+12), DOCSIS3.1 and LTE

Custom IQ

- Set parameters such as custom IQ constellation settings for BPSK, QPSK, 8PSK, 16/32/64/128/256/512/1024/2048/4096 QAM, or user-defined constellations
- Use customizable quick setups for DVB-S2X (8/16/32/64/128/256 APSK) as well as SOQPSK, APCO25, TETRA, NXDN, dPMR, ARIB T61/98/102, and ARTM Multi-h CPM (Tier 0/I/II)
- Set parameters such as symbol rate, payload data sequence (PN, custom, user file), data length, and shaping filter characteristics

Receiver Test



Note: Payload data should be coded bits

Figure 2. Generate receiver test signals for early testing of your receiver with Keysight X-Series signal generators and Signal Studio.

Signal Studio for custom modulation can be used to generate custom test signals for early testing of receiver system and component hardware. Pair with 89600 VSA software on Keysight signal analyzers and oscilloscopes to evaluate receiver performance at various stages of the receiver chain (RF, IF, and IQ).

Early testing of receiver hardware

- Generate 5G candidate, custom OFDM, and IQ test signals for receiver testing
- Customize payload data: PN9, PN15, custom bit pattern, or user-defined file with coded bits for BER testing
- Customize 5G candidate, custom OFDM, and IQ: specify the number of frames, symbol rate, and symbol length
- Add real-time AWGN to signal generator for real-time noise, set the carrier-to-noise ratio, carrier bandwidth, and noise bandwidth
- Save custom OFDM 89600 VSA setup files for EVM testing with Keysight signal analyzers and oscilloscopes at RF, IF, and IQ
- View CCDF and OFDM resource mapping and modulation (5G candidate and custom OFDM), and data and idle segments (custom IQ) to graphically evaluate signal configuration and investigate the effects on device performance

Features Summary

Signal Studio for custom modulation allows you to create and customize waveforms to characterize the performance of your hardware for 5G candidate, custom OFDM, and IQ.

Capabilities	5G Candidate	Custom OFDM	Custom IQ
Set the number of frames, sample rate, and oversampling ratio	Y	Y	Y
FBMC	Y		
F-OFDM	Y		
UFMC	Y		
GFDM	Y		
Interactive filter editor to configure filter in frequency domain, import filter coefficients, and view frequency and impulse responses	Y		
Set resource mapping parameters for preamble, pilots, and data subcarriers, including location and boosting of each resource block, IQ values for preamble, modulation, and payload for pilot and data	Y	Y	
Generate Zadoff-Chu sequence for pilot	Y	Y	
Add Multiple Access Scheme (SCMA and NOMA) to data channel	Y	Y	
Apply DFT-Spread before IDFT		Y	
Variable Cyclic Prefix		Y	
View constellation and edit settings graphically in an IQ constellation plot	Y	Y	Y
Select pre-defined constallations: OOK,2/4/8ASK, BPSK,QPSK,8PSK, 16-4096QAM	Y	Y	Y
Apply phase rotation, phase shift, differential, offset			Y
Customize payload data: PN9, PN15, PN23, Custom bit pattern or file import	Y	Y	Y
View data, pilot, and preamble resource mapping and resource modulation graphically as a function of symbols (X-axis)	Y	Y	
Use quick setups for WLAN 802.11a, DAB: Mode I, DVB-T/H:2K 1/8, DVB-SH:1K 1/32, ISDB-T (Mode 3, 1+12), DOCSIS3.1, and LTE that can be modified or customized		Y	
Configure OFDM waveforms and set parameters such as FFT length, upper and lower guard subcarriers, number of OFDM symbols, and idle interval		Y	
Save 89600 VSA setup files for EVM testing with Keysight signal analyzers and oscilloscopes at RF, IF, and IQ	Y	Y	Y
Use quick setups for DVB-S2X configurations that can be modified/customized (8/16/32/64/128/256 APSK)			Y
Modify or customize predeined SOQPSK configuration			Y
Set the filter type, characteristics, and length to be applied to the waveform: Low Pass, Gaussian, Root Nyquist, Nyquist, Rectangle, and User-Defined			Y
Configure data and idle segments with a graphical user interface which enables multiple segments to be Configured. View all the segments graphically as a function of symbols (X-axis)			Y
Specify the number of symbols, payload, and constellation which can be set to BPSK, QPSK, 8PSK,16/32/64/128/256/512/1024/2048/4096 QAM, or as custom IQ values			Y
Apply crest factor reduction to reduce peak to average ratio	Y	Y	Y

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.**

N7608B Signal Studio for Custom Modulation

Model-Option	Description
Connectivity	
N7608B-1FP	Connect to E4438C ESG signal generator
N7608B-2FP	Connect to E8267D PSG signal generator
N7608B-3FP	Connect to N5182B/72B MXG/EXG signal generator
N7608B-9FP	Connect to M9381A VSG and M9420A VXT
N7608B-AFP	Connect to M8190A arbitrary waveform generator
Capability	
N7608B-EFP	Custom IQ
N7608B-FFP	Custom OFDM
N7608B-GFP	5G Candidate

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/free_trials

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**

Additional Information

Websites

Signal Studio for Custom Modulation
www.keysight.com/find/n7608b

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

Signal Studio and Signal Creation Software
www.keysight.com/find/signalstudio

5G Test Solutions, Application Notes and Videos
www.keysight.com/find/5G

Literature

Signal Studio Software, Brochure, 5989-6448EN

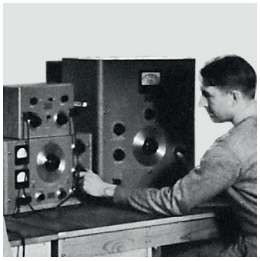
89601B/BN-AYA Vector Modulation Analysis, Technical Overview, 5990-6387EN

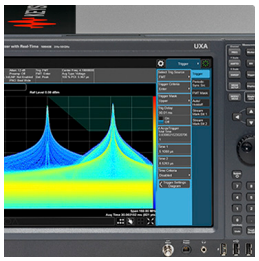
89601B/BN-BHF Custom OFDM Modulation Analysis, Technical Overview, 5990-6625EN

89601B/BN-BHK Custom IQ Modulation Analysis, Technical Overview, 5990-6625EN

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