Signal Studio for V2X 2019

N7626C

- Create Keysight validated and performance optimized reference signals in compliance with 3GPP based cellular V2X signals (PC5 Sidelink)
- Create fully coded V2X signals
- Provide fixed reference channel (FRC) wizard for cellular V2X signals
- Support multi-UE scheduling
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation

Simplify Cellular V2X 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.

Typical Measurements

<table>
<thead>
<tr>
<th>Component and Transmitter Test</th>
<th>Receiver Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACLR</td>
<td>CCDF</td>
</tr>
<tr>
<td>EVM</td>
<td>Channel Power</td>
</tr>
</tbody>
</table>

| Occupied Bandwidth | | |

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Component and Transmitter Test

Signal Studio’s 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.

- Parametric test of components, such as amplifiers and filters
- Performance characterization and verification of RF sub-systems and transmitters

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

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/EXG X-Series
  - PSG
  - M9381A PXe VSG
  - M9383B/M9384B Microwave Signal Generator
  - First generation MXG
  - ESG-C
- M9420A/M9421A PXe VXT
- E6640A EXM Communication Test Set
- M8190A Wideband AWGN

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1. This instrument only supports waveform playback only
2. PSG E8267D needs use manual power search with ALC turned off to get accurate power.
Component and Transmitter Test

Figure 1: Typical component test configuration using Signal Studio basic capabilities with a Keysight X-Series signal generator and X-Series signal analyzer.

Signal Studio generates RF performance optimized V2X waveform which enables you 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 V2X signals for channel power, spectral mask, and spurious testing
- Set parameters such as signal bandwidth and channel modulation type (QPSK, 16QAM and 64 QAM) for modulation verification and analysis, such as EVM tests
- 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
- Adjust baseband filter to achieve a balance among ACPR, EVM, and narrow resource block spectrum performance

Figure 2: V2X signal measurement with N9080EM4E LTE V2X measurement application

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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 for V2X can be used to generate cellular based V2X signals for early testing of receiver system and component hardware. Pair with X-Series measurement application on Keysight signal analyzers and oscilloscopes to evaluate receiver performance at various stages of the receiver chain (RF, IF, and IQ).

Testing of Receiver Hardware

- Create 3GPP standard Release 14 and 15 defined cellular V2X signals for V2X (V2V, V2I, V2P or V2N) direct communication using PC5 interface
- Quickly configure and generate Fixed Reference Channels (FRC)
- Create V2X signals with fully coded PSSCH and PSCCH for BLER and BER tests
- Support multi-UE scheduling
- Support retransmission
- Support SCI auto generation

Figure 4: V2X FRC Wizard with Table A8.2-1 as example
Features Summary

Signal Studio for V2X allow you to create 3GPP standard-based V2X signals for sidelink testing.

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>N7626EMBC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Sidelink transmission mode 3 and 4</td>
<td>Y</td>
</tr>
<tr>
<td>Preconfigured FRC signals with transport channel coding (A8.2-1/2/3)</td>
<td>Y</td>
</tr>
<tr>
<td>Sidelink channels: PSCCH and PSSCH with adjacency ON/OFF</td>
<td>Y</td>
</tr>
<tr>
<td>Support bandwidth 1.4, 3.5, 10, 15, and 20 MHz</td>
<td>Y</td>
</tr>
<tr>
<td>Support QPSK/16QAM/64QAM with MCS index (0 to 28 for Tx Format 0 and 0 to 31 for Tx Format 1)</td>
<td>Y</td>
</tr>
<tr>
<td>Support retransmission</td>
<td>Y</td>
</tr>
<tr>
<td>Support multiple UE scheduling (Up to 300 vehicles)</td>
<td>Y</td>
</tr>
<tr>
<td>Support SCI auto generation</td>
<td>Y</td>
</tr>
<tr>
<td>RB overlapping check on/off</td>
<td>Y</td>
</tr>
<tr>
<td>Waveform length up to 1024 frames (10,240 ms)</td>
<td>Y</td>
</tr>
<tr>
<td>Support both single carrier and multi-carrier</td>
<td>Y</td>
</tr>
<tr>
<td>Graphical display for frame resource allocation</td>
<td>Y</td>
</tr>
<tr>
<td>Export waveform files (encrypted Signal Studio waveform file)</td>
<td>Y</td>
</tr>
<tr>
<td>Live Connection to Signal Generators, PXIe VXT/VSG, EXM and AXIe AWG</td>
<td>Y</td>
</tr>
<tr>
<td>Offline waveform file playback</td>
<td>Y</td>
</tr>
</tbody>
</table>

Supported Standards

<table>
<thead>
<tr>
<th>Specification</th>
<th>Name</th>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>3GPP TS36.211</td>
<td>Physical channels and modulation</td>
<td>15.4.0</td>
<td>2018-12</td>
</tr>
<tr>
<td>3GPP TS36.212</td>
<td>Multiplexing and channel coding</td>
<td>15.4.0</td>
<td>2018-12</td>
</tr>
<tr>
<td>3GPP TS36.213</td>
<td>Physical layer procedures for control</td>
<td>15.4.0</td>
<td>2018-12</td>
</tr>
<tr>
<td>3GPP TS36.331</td>
<td>Radio Resource Control (RRC)</td>
<td>15.4.0</td>
<td>2018-12</td>
</tr>
<tr>
<td>3GPP TS36.521-1</td>
<td>Protocol specification User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing</td>
<td>15.4.0</td>
<td>2018-12</td>
</tr>
<tr>
<td>3GPP TS36.306</td>
<td>User Equipment (UE) radio access capabilities</td>
<td>15.3.0</td>
<td>2018-12</td>
</tr>
</tbody>
</table>
Ordering Information

Software Licensing and Configuration

Signal Studio offers flexible licensing options, including:

- **Node-locked**
  Allows you to use the license on one specified instrument/computer.

- **Transportable**
  Allows you to use the license on one instrument/computer at a time.
  This license may be transferred to another instrument/computer using Keysight’s online tool.

- **Floating**
  Allows you to access the license on networked instruments/computers from a server, one at a time. For concurrent access, multiple licenses may be purchased.

- **Time-based**
  License is time limited to a defined period, such as 12-months.

N7626C Signal Studio for V2X

Waveform Playback Licenses (N7626EMBC)

<table>
<thead>
<tr>
<th>Software License</th>
<th>Description</th>
<th>Support Subscription</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Y5B-001-A 3</td>
<td>Node-locked perpetual</td>
<td>R-Y6B-001-z 2</td>
</tr>
<tr>
<td>R-Y4B-001-z 1</td>
<td>Node-locked time-based</td>
<td>Included</td>
</tr>
<tr>
<td>R-Y5B-004-D 3</td>
<td>Transportable perpetual</td>
<td>R-Y6B-001-z 2</td>
</tr>
<tr>
<td>R-Y4B-004-z 1</td>
<td>Transportable time-based</td>
<td>Included</td>
</tr>
</tbody>
</table>

One-month software support subscription extension 3

<table>
<thead>
<tr>
<th>Support Subscription</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Y6B-501</td>
<td>1-month of support subscription for node-locked perpetual license</td>
</tr>
<tr>
<td>R-Y6B-504</td>
<td>1-month of support subscription for transportable perpetual license</td>
</tr>
</tbody>
</table>

1. z means different time-based license duration. F for six months, L for 12 months, X for 24 months, and Y for 36 months.
2. z means different support subscription duration. L for 12 months (as default), X for 24 months, Y for 36 months, and Z for 60-months.
3. Support subscription must be purchased for all perpetual licenses with 12-months as the default. All software upgrades and KeysightCare support are provided for software licenses with valid support subscription.
4. Support subscription for all perpetual licenses can be extended with monthly support extensions.
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

Model Numbers and Options
To learn more about Signal Studio licensing, model numbers and options, please visit:
www.keysight.com/find/signalstudio_model

Additional Information
Websites
www.keysight.com/find/SignalStudio

Comprehensive Online Documentation
www.keysight.com/find/signalstudio_support

Signal Studio for V2X
www.keysight.com/find/n7626c

Signal Studio for LTE, LTE-Advanced and LTE-A Pro FDD
www.keysight.com/find/n7624c

Signal Studio for LTE and LTE-Advanced TDD
www.keysight.com/find/n7625c

Signal Studio Pro for 5G NR
www.keysight.com/find/n7631c

LTE V2X measurement application
www.keysight.com/find/n9080em4e
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

Literature

Signal Studio Software, Brochure, 5989-6448EN

www.keysight.com/...