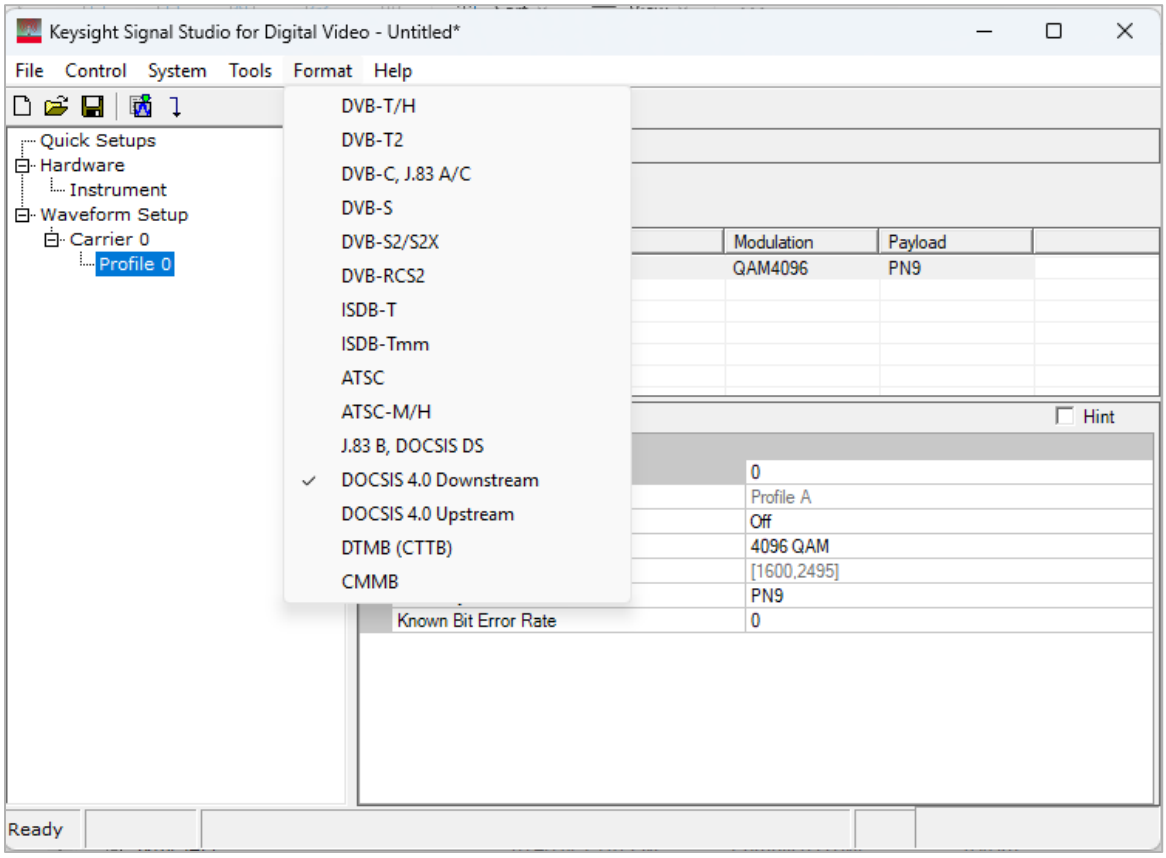
N7623C Signal Studio for Digital Video

2025 Update 1.0 release

Key Features

- Create Keysight validated and performance optimized reference waveforms compliant with DVB-T/H, DVB-T2, DVB-C/S/S2/S2X, ISDB-T/T_B/T_{SB}/T_{MM}, ATSC, ATSC-M/H, DTMB (CTTB), CMMB, J.83 Annex A/B/C, and DOCSIS 1.x/2.0/3.0/3.1/4.0 standards
- Perform BER tests with PN sequence, all 1s, all 0s, or user-defined data patterns or subjective evaluation with MPEG2-TS or ColorBar demo file
- Real-time fading, SFN simulation, MISO simulation, AWGN, and interferers for conformance testing with Signal Studio for Real-time Fading (N7605C)
- Accelerate the signal creation process with a user interface based on parameterized and graphical signal configuration and tree-style navigation



KEYSIGHT

Simplify Digital Video 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 digital video standards including DVB-T/H, DVB-T2, DVB-C/S/S2/S2X, ISDB-T/T_B/T_{SB}/T_{MM}, ATSC, ATSC-M/H, DTMB (CTTB), CMMB, J.83 Annex A/B/C, and DOCSIS 1.x/2.0/3.0/3.1/4.0, 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 advanced 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 coded, statistically correct signals include:

- Parametric test of components, such as amplifiers, filters, gap-filler and repeater
- 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), frame error rate (FER), packet-error-rate (PER), or subjective failure point (SFP) analysis.

Applications include:

- Performance verification and conformance test of receivers, during RF/baseband integration and system verification
- Coding verification of baseband subsystems, including FPGAs, ASICs, and DSPs
- Receiver chipset design and verification, performance test (IC design house or certification lab)
- Receiver module integration and verification (terminal vendors)
- Receiver manufacturing for phones (smart phones) or set top boxes

Typical digital video measurements

Component measurements

- IMD / NPR
- ACLR
- CCDF
- EVM / MER
- Modulation accuracy
- Channel power
- Occupied bandwidth
- Spectrum emissions

Receiver measurements

- Sensitivity
- Maximum input level
- Immunity to adjacent channel signal
- Immunity to co-adjacent signal
- Impulse interference test
- C/N performance in Gaussian and fading channels
- Blocking
- Performance in SFN network (pre-echo, post-echo and 0-dB echo)

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 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
  - N5186A MXG
  - M9383B/M9384B/M9484C VXG
  - X-Series: N5182B MXG/ N5172B EXG
  - E8267D PSG
- M8190A arbitrary waveform generator

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's advanced capabilities enable you to create and customize waveforms compliant with digital video standards, including DVB-T/H/T2/C/S/S2/S2X, ISDB-T/T_B/T_{SB}/T_{MM}, ATSC, ATSC-M/H, DTMB (CTTB), CMMB, J.83 Annex A/B/C and DOCSIS 1.x/2.0/3.0/3.1/4.0, 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 signals for ACLR, channel power, spectral mask, and spurious testing
- Set parameters such as channel power and data channel modulation type (BPSK, QPSK, 16QAM, 64QAM) for modulation verification and analysis, such as MER, BER tests
- Configure multi-carrier waveforms, each with different modulation settings, frequency offsets, power, baseband filter, and more
- 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

Receiver Test

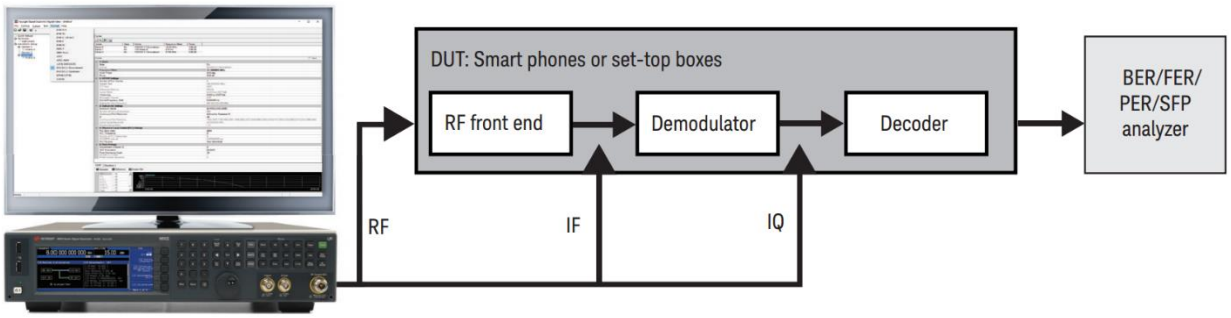


Figure 2. Generate fully channel-coded signals to evaluate the BER, FER, PER, or SFP of your receiver with Keysight X-Series signal generators and Signal Studio's advanced capabilities.

Signal Studio's advanced capabilities address applications in digital video receiver test, including the verification of baseband designs, the integration of the baseband and RF modules, and the manufacturing of phones (smart phones) and set-top boxes. Using the waveform playback mode enables transport-channel coding to validate digital video receiver characteristics and performance. The real-time mode enables you to define the parameters of non-repeating signals and generate signals with MPEG2-TS file streaming for hours.

- Create real-time digital video signals for receiver design, verification and performance test
- Perform auto-stuffing and PCR adjustment with the real-time mode
- Perform BER tests with a PN9/PN15/PN23 sequence, all 1s, all 0s, or user-defined data patterns, or subjective evaluation with a user-defined MPEG2-TS file or ColorBar demo file
- Create multi-path signals for SFN (Single Frequency Network) tests
- Create signals with real-time fading, AWGN and interference tests using Signal Studio for Real-time Fading (N7605C)

Features Summary

Digital video receiver / component testing	Advanced waveform playback mode	Advanced real-time mode
DVB-T/H [1, 2, 3]		
2k, 4k, 8k modes	✓	✓
5, 6, 7, 8 MHz bandwidth	✓	✓
Modulation: QPSK, 16QAM, 64QAM	✓	✓
Baseband filter: On/Off	✓	✓
DVB-H enabled: On/Off	✓	✓
Real-time adjustments to signal parameters		✓
DVB-T2 [1, 2, 3]		
Real-time adjustments to signal parameters		✓
Version 1.2.1	✓	✓
Single PLP	✓	✓
Multi-PLP		✓
SISO	✓	✓
1.7, 5, 6, 7, 8, 10 MHz bandwidth	✓	✓
FEC LDPC + BCH 1 /2, 3/5, 2/3, 3 /4, 4/5, 5/6	✓	✓
QPSK, 16QAM, 64QAM, 256QAM	✓	✓
FFT Size: 1K, 2K, 4K, 8K, 16K, 32K	✓	✓
Guard Interval: 1 /4, 19/256, 1 /8, 19/128, 1/16, 1/32, 1/128	✓	✓
DVB-C (J.83 Annex A/C) [1, 2, 3]		
Real-time adjustments to signal parameters		✓
16QAM, 32QAM, 64QAM, 128QAM, 256QAM,1024QAM	✓	✓
Variable symbol rate	✓	✓
Baseband shaping and modulation	✓	✓
Known Bit Error Rate (requires Option PFP)	✓	
DVB-S [1, 2, 3]		
Real-time adjustments to signal parameters		✓
Modulation: QPSK	✓	✓
Transport multiplex adaptation and randomization for energy dispersal	✓	✓
Outer coder RS (204,188)	✓	✓
Inner coder convolutional coding	✓	✓
Variable symbol rate	✓	✓
Baseband shaping and modulation	✓	✓

1. Supported payload includes data pattern (all 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet), color bar sample, and MPEG-TS file.
2. Real-time mode supports PN23 and PCR adjustment.
3. Waveform playback mode supports static multi-path simulation for SFN testing for up to 20 paths. Real-time mode supports static multi-path simulation for up to 4 paths.

Digital video receiver / component testing	Advanced waveform playback mode	Advanced real-time mode
DVB-S2 [1, 2, 3]		
Real-time adjustments to signal parameters		✓
Powerful FEC system based on LDPC (Low-Density Parity Check) codes concatenated with BCH codes	✓	✓
4 constellations (QPSK, 8PSK, 16APSK, 32APSK)	✓	✓
A set of three spectrum shapes with roll-off factors 0,35, 0,25, and 0,20	✓	✓
DVB-S2X [1, 3]		
Modulation: 8PSK, 8APSK to 256 APSK	✓	
Coding Rate: 1/5 to 77/90 (33 types)	✓	
Rolloff factors: 0.05-0.35	✓	
ISDB-T [1, 2, 3]		
Real-time adjustments to signal parameters		✓
Japan and Brazil standards support	✓	✓
Outer coder (RS coder), Inner coding	✓	✓
Energy dispersal conducted at each hierarchical layer	✓	✓
Mapping: DQPSK, QPSK, 16QAM, 64QAM	✓	✓
1 segment, 3 segments, or 13 segments signal generation	✓	✓
Phase compensation of segment for consecutive transmission	✓	✓
Payload supports		
- Data pattern: All 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet	✓	✓
- Color bar sample	✓	✓
- MPEG-TS file (seamless loop-back)	✓	✓
- TS file wizard with three layers (A, B, and C) assignment	✓	✓
ISDB-T_{MM} [1]		
Support up to 33 segments with bandwidth of 14.5 MHz	✓	
Two super segment types: Type A, Type B	✓	
Flexible assignment of 33 segments to type A or type B super segments	✓	
Modulation: DQPSK, QPSK, 16QAM, 64QAM	✓	
Outer coder (RS coder), Inner coding	✓	
Built-in AC builder	✓	
Phase compensation for connected transmission	✓	
For type A super segment: 13 segments	✓	
Up to 3 hierarchical layers (A, B, and C)	✓	
Assign programs in TS to each layer	✓	
For type B super segment: up to 14 conjugated single segments	✓	
Configure each segment independently	✓	

1. Supported payload includes data pattern (all 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet), color bar sample, and MPEG-TS file.
2. Real-time mode supports PN23 and PCR adjustment.
3. Waveform playback mode supports static multi-path simulation for SFN testing for up to 20 paths. Real-time mode supports static multi-path simulation for up to 4 paths.

Digital video receiver / component testing	Advanced waveform playback mode	Advanced real-time mode
ATSC [1]		
Data organization (Sync Mux)	✓	
Modulation: 8VSB, 16 VSB	✓	
Pilot addition	✓	
ATSC-M/H		
Modulation type: 8VSB	✓	
Parade configuration including:		
- NoG (number of groups)	✓	
- RS frame mode: Single	✓	
- SCCC Mode: Separate/Paired	✓	
- RS code rate: (235, 187), (223, 187), (211, 187)	✓	
- SCCC code rate for Region A, B, C, D: 1 /2, 1 /4	✓	
Payload supports		
- Data pattern: All 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet	✓	
- Color bar sample	✓	
- Multiplexed TS	✓	
- Main Service: MPEG-TS	✓	
- M/H Service: IP stream or video & audio file	✓	
DTMB (CTTB) [1]		
BCH and LDPC coding for 3 data rates	✓	
Modulation: 4QAM-NR, 4QAM, 16QAM, 32QAM, 64QAM	✓	
Single carrier and multi-carrier modulation (C=1 and C=3780)	✓	
Framing: Frame header mode 1, 2, 3	✓	
Filter: SRRC with settable roll-off factor (default value is 0.05)	✓	
J.83 Annex B (DOCSIS DS) [1]		
Input signal: Modified MPEG-2 transport stream	✓	
Variable symbol rate	✓	
Constellation 64-QAM, 256-QAM	✓	
CMMB		
Physical layer bandwidth: 8 MHz	✓	
Provides transmission rate configurable transmission channels	✓	
Physical logical channel (PLCH) includes	✓	
CLCH (Control logic channel): carrying control information	✓	
SLCH (Service logic channel): carrying broadcasting service	✓	
Provide CMMB TS library	✓	
Payload supports		
- Data pattern: All 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet	✓	
- Multiplexed MFS file	✓	
- MFS file by each SLCH	✓	
- CMMB TS library	✓	

1. Supported payload includes data pattern (all 1s, all 0s, PN9, PN15, user defined pattern, NULL TS packet), color bar sample, and MPEG-TS file.

Digital video receiver / component testing	Advanced waveform playback mode	Advanced real-time mode
BER Tools		
Known bit error rate: Range upper limit is 1E-4, lower limit is dependent on the frame length		
DOCSIS 3.1 / 4.0		
Carrier type: DOCSIS 3.1 DS and US		
Modulation bandwidth: 24 – 192 MHz		
FEC coding		
Multi-carrier		
Payload supports:		
• Fixed pattern		
• PN sequence		
• User files		
Multi-profile for DS		
Mixed modulation		
PLC information for DS		
Exclusive bands		
Wizard for cable loading generation		

Supported standards

DFS standard	Specification	Version	Release date
DVB-C	ETSI EN 300 429	V1.2.1	April 1998
DVB-T/H	ETSI EN 300 744	V1.5.1	November, 2004
DVB-T2	ETSI EN 302 755	V1.2.1	February, 2011
DVB-S	ETSI EN 300 421	V1.1.2	August, 1997
DVB-S2	ETSI EN 302 307	V1.1.2	June, 2006
DVB-S2X	ETSI 302 307-2	V1.1.1	March, 2014
ISDB-T	ARIB STD-B31	V1.5	July, 2003
ISDB-T_{MM}	ARIB STD-B46	V1.0	November, 2010
ATSC	ATSC A/53 (formerly Annex D)		January, 2007
ATSC-M/H	A/153 Part 2: 2009		October, 2009
J.83B	ITU-T Recommendation J.83		April, 1997
DTMB (CTTB)	GB20600-2006		August, 2006
CMMB	GY/T 220.1-2006		October, 2006
DOCSIS 4.0	CM-SP-PHYv4.0-I01-190815	Version I01	August, 2019

Supported test configurations

Test items	Receiver chipset design or conformance test	Receiver module integration and verification	Receiver manufacturing
Max signal input	■	■	□
Min signal input (Sensitivity)	■	■	■
C/N in Gaussian	■	■	□
C/N in multi-path fading without Doppler shift	■	■	
C/N in multi-path fading with Doppler shift	■	■	
Immunity to analog signal in other channel	■	□ [1]	
Immunity to digital signal in other channel	■	□ [1]	
Immunity to co-channel interference of analog TV	■	□ [1]	
Guard interval utilization in SFN network	■	□	
Impulse interference test	■	□ [1]	
Cellular signal blocking	■	□ [1]	
Degradation criteria	BER or SFP	BER or SFP	SFP
Recommended solution	N5186A/N5182B/ N5172B + interference signal +N7623C	N5186A/N5182 B/ N5172B +N7623C	N5186A/N5182B/ N5172B +N7623C

1. More than one signal generator is needed to generate both the wanted signal and the interference signal.

Legend:

■	Recommended test item
□	Optional test item
SFP	Subjective failure point

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.
- Subscription (Time-based): License is time limited to a defined period, such as 12, 24 or 36 months

N7623C Signal Studio for Digital Video License

Waveform Playback License (N7623EMBC)

Software license type	Software license	KeysightCare subscription
Node-locked perpetual	SW1000-LIC-01	SW1000-SUP-01
Node-locked time-based	SW1000-SUB-01	Included
Transportable perpetual[1]	SW1000-LIC-01	SW1000-SUP-01
Transportable time-based[1]	SW1000-SUB-01	Included

One-month KeysightCare Support and Subscription extension[3]

Support subscription	Description
SW1000-SUP-01	1-month of support subscription for node-locked perpetual licenses
SW1000-SUP-01	1-month of support subscription for transportable perpetual licenses

1. Transportable license is not supported on N5186A.

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. Download and use it free for 30 days to make measurements with your analysis hardware: www.keysight.com/find/n7623embc

Request your free trial license today: 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

Websites

www.keysight.com/find/SignalStudio

www.keysight.com/find/n7623embc

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

Signal Studio and Signal Creation Software: www.keysight.com/find/signalstudio_software

Literatures

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