MAXEYE TECHNOLOGIES

Audio and Video Broadcasting Toolkits Signal Generation

(Universal Signal Generation Test Solution for Satellite, Terrestrial and Cable Broadcast Receivers)

Data Sheet

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1. Overview

MaxEye Technologies provides generation functions in LabVIEW and C for generating the standard complaint signals for various digital audio and video broadcasting standards. **Toolkit enables playing the generated waveform in real-time using NI RFSG Streaming mode.**

The following are the audio and video broadcasting toolkits currently being supported by MaxEye Technologies.

1. AM/FM/RDS/TMC
2. DVB-S
3. DVB-S2
4. DVB-T
5. DVB-T2
6. ISDB-T/Tb
7. DAB/DAB+/DMB
8. CMMB
9. DTMB
10. ATSC & ATSC-M/H
11. DRM/DRM+
12. DVB-C

2. Audio and Video Broadcast Toolkits

2.1. Technical Description

The MaxEye Audio and Video Broadcasting Toolkits extends LabVIEW tools and functions with National Instruments RF Signal Generator (NIRFSG) to generate digital video broadcasting test signals that confirm to their respective standard specifications for various standards. Table 1 gives the details of the standard specifications for each of the supported standard.

One of the significant feature of the toolkit is it allows storing the generated waveform in file and then playing **the waveform in real-time using NI RFSG Streaming mode**. This feature enables the testing of the received audio/video signals continuously for hours. The duration of the generated waveform in this mode is limited only by the available disk memory. The toolkit supports interactive user application (Soft Front Panel) to configure the various generation modes. The Soft Front Panel (SFP) can also be controlled remotely by using programming APIs (LabVIEW or C) to generate signals.

The MaxEye Audio and Video toolkit software provides support for MPEG 2 Transport streams as a one of the payload option with complete channel coding and modulation to support the specific needs of the design and verification of the digital video receivers, digital video transmitters and their components. The software also supports other payload options like Test

Patterns, User Defined Bits, Binary file and PN Sequence. The toolkit coding, modulation and other parameters can be easily configured using the LabVIEW API VIs to generate custom waveform for specific test requirements. The toolkit also supports adding impairments like AWGN, Multipath Channel Model, IQ impairments, frequency and clock offsets to stress the receivers under real world conditions.

Table 1 Digital Video Broadcasting Standard Specifications

Sl.no	Standard Name	Specifications
1	AM/FM/RDS	**IEC 62106:1999 RDS Standard,** Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87.5 to 108.0 MHz
2	DVB-S	**EN 300 421 V1.1.2 (1997-08)** Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for 11/12 GHz satellite services
3	DVB-S2	**ETSI EN 302 307 V1.2.1 (2009-08)** Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications (DVB-S2)
4	DVB-T	**ETSI EN 300 744 V1.6.1** (Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television)
5	DVB-T2	**ETSI EN 302 755 V1.3.1 (2012-04)** Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)
6	ISDB-T/Tb	**ARIB STD-B31 Version 1.6** TRANSMISSION SYSTEM FOR DIGITAL TERRESTRIAL TELEVISION BROADCASTING **ABNT NBR15601 –** Brazilian Standard, Digital Terrestrial Television – Transmission System
7.	DTMB	**GB 20600-2006** - Framing Structure, Channel Coding and Modulation for Digital Terrestrial Television Broadcasting
8	CMMB	**GY/T 220.1-2006** - Mobile Multimedia Broadcasting Part 1: Framing Structure, Channel coding and Modulation for Broadcasting Channel. **GY/T 220.2-2006** - Mobile Multimedia Broadcasting Part 2: Multiplexing
9	DAB/DAB+/DMB	**ETSI TS 102 427 V1.1.1 (2005-07) -** Digital Audio Broadcasting (DAB); Data Broadcasting - MPEG-2 TS streaming **ETSI TS 102 428 V1.1.1 (2005-06) -** Digital Audio Broadcasting (DAB); DMB video service; User Application Specification

		ETSI EN 300 401 V1.4.1 (2006-06) - Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers **ETSI TS 102 563 V1.1.1 (2007-02)** - Digital Audio Broadcasting (DAB); Transport of Advanced Audio Coding (AAC) audio
10	ATSC/ATSC-M/H	ATSC Digital TV Standard Part 2 – RF/Transmission Characteristics Document: A/53 Part 2:2011, 15 December 2011 ATSC-Mobile DTV Standard, Part 2 – RF/Transmission System Characteristics **Document A/153 Part 2:2009, 15 October 2009**
11	DRM & DRM+	ETSI ES 201 980 V3.1.1 (2009-08) - Digital Radio Mondiale (DRM); System Specification
12	DVB-C	EN 300 429 V1.2.1 (1998-04) - Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems.

The software supports generation of multiple frames/super frames with MPEG2 TS files or PN data as an input to support receiver sensitivity tests, video monitoring test applications and other test applications where the requirement for the test waveform length is multiples of the frame length. The generated waveform is stored in the Signal generator ARB memory and then the waveform is played using the NIRFSG.

Receiver Design, Verification and Manufacturing Tests

The MaxEye Signal generation software is an ideal test tool for generating the test signals with different configurations and conditions to completely test the receiver during design, verification and manufacturing floor to characterize the receiver performance. The receiver performance can be verified by doing BER analysis at the various stages of the receiver (BER after demodulation, BER after inner decoding and BER after outer decoding). The receiver test setup is shown in figure 2.

The software is also useful during R&D process to test the receiver algorithm design and implementation with ideal signal and signal with impairments for debugging and troubleshooting.

Figure 1 Receiver Test Setup

The following are some of the typical Receiver Measurements that can be performed using NI RFSG with the MaxEye Signal generation software.

1. Receiver Sensitivity Test
2. Maximum Input Level
3. Power Control
4. Intermodulation
5. Receiver Selectivity
6. Receiving blocking

Receiver Functionality Tests

The various functionalities of the receiver can be verified by generating custom test signals with MPEG2 TS files as an input to the signal generator software. The following are some of the receiver features that can be verified using the MaxEye Digital Video. **The toolkit supports storing the generated waveform in file and then playing back the waveform from file using NI RFSG streaming mode. The generated waveform size is not limited and only limited by the available disk memory in the controller.**

1. Channel Search/ Auto Tuning
2. EPG (MPEG2 TS input file should support this feature)
3. Subtitles (Ability of the receiver to decode and display subtitle information from the TS stream, MPEG2 TS input file should support this feature)
4. Decoded TS stream analysis (The decoded TS stream from the DUT can be analyzed online using TS analyzers)
5. Video Monitoring (Video quality monitoring using the user specific MPEG2 TS file)

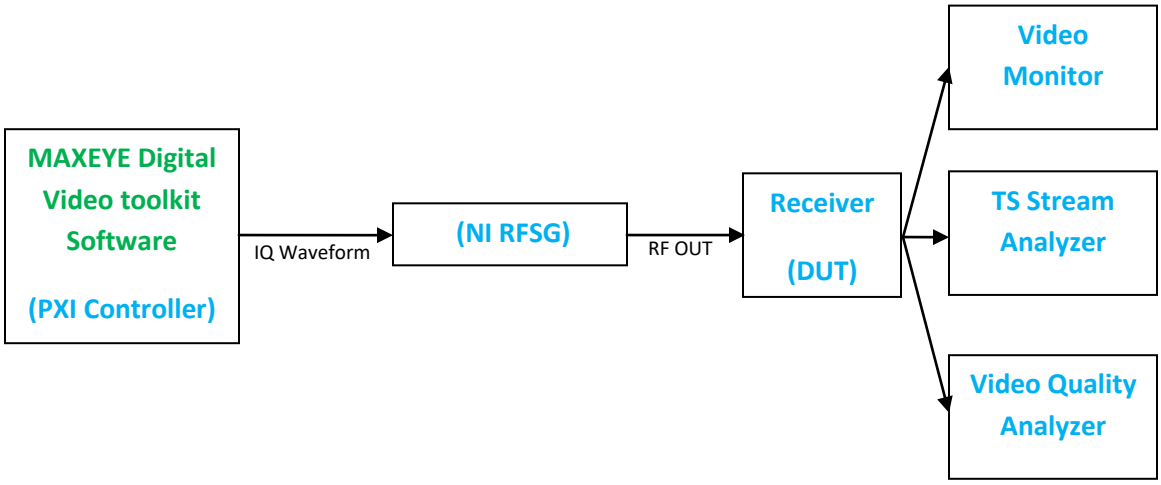


Figure 2 Receiver Functionality Test Setup

RF Components and Transmitter Testing

The MaxEye digital video toolkit generates spectrally correct signal to easily characterize the various RF components in the digital video receivers, transmitters, repeaters and gap-fillers with the NI RFSA and Spectral measurements toolkit. This enables the designers and manufactures to characterize the performance of the RF components during design and manufacturing of the RF components.

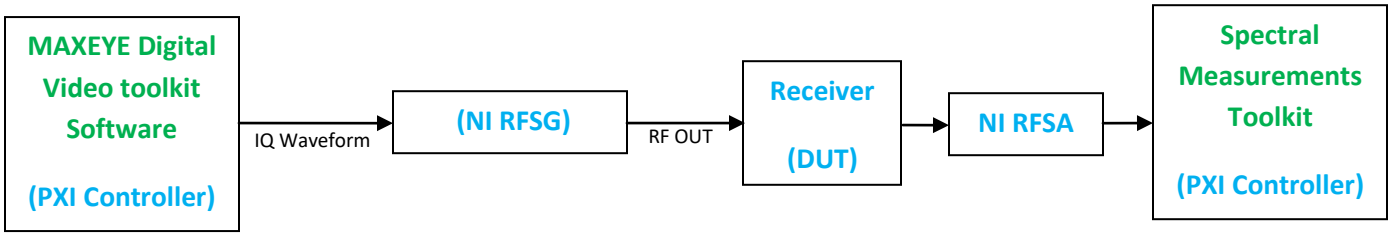


Figure 3 RF Components and Transmitter testing

The following are some of the transmitter measurements that can be performed using MaxEye Digital Video toolkit and NI spectral measurements toolkit with NI RFSG and NI RFSA hardware.

1. Adjacent Channel Leakage Ratio (ACLR)
2. Channel Power
3. Occupied Bandwidth

4. Spectral Emission Mask
5. CCDF

2.2. Key Features of the Toolkit

The following section has key features supported in the signal generation software for each digital video standard.

2.2.1 AM/FM/RDS

This toolkit offers standard based test solution for designing, evaluating and manufacturing AM/FM/RDS receivers. Radio Data System (RDS) is a communications protocol standard for transmitting digital information in traditional FM radio broadcast. RDS standardizes several types of information transmitted, including time, station identification and program information. RDS is also used for transmitting traffic information using Traffic Message Channel.

Radio Broadcast Data System (RBDS) is the official name used for the U.S. version of RDS. The two standards are only slightly different. MaxEye AM/FM/RDS toolkit supports both the European and US versions. The toolkit supports real-time signal generation.

AM/FM/RDS Specifications	Supported Configurations
Audio mode	Mono and Stereo
Modulation	FM Stereo, AM, RDS/RBDS modulation
RDS features	Program Service Name (PS), Program Type (PTY) Traffic Program (TP),Traffic Announcement (TA) Alternate Frequency (AF), Music Switch Code (MSC) Decoder Identification (DI) and Dynamic PTY Indicator Program Item Number (PIN) and Slow Labeling Codes Radio Text (RT) Clock Date and Time (CT) Enhanced Other Networks (EON) Traffic Message Channel (TMC)
Generic Signal Handling	Supported Configurations
Frequency	AM/FM band and any Custom carrier frequency
Payload configuration	Wav Files Tones
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate

	generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.
Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.2 DVB-S

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital video broadcasting-terrestrial (DVB-S) equipments. It is the original Digital Video Broadcasting Forward error correction and demodulation standard for Satellite Television. It is used via satellites serving every continent of the world. DVB-S is used in both Multiple Channel Per Carrier (MCPC) and Single channel per carrier modes for Broadcast Network feeds as well as for Direct Broadcast Satellite services. While the actual DVB-S standard only specifies physical link characteristics and framing, the overlaid transport stream delivered by DVB-S is mandated as MPEG-2, known as MPEG transport stream (MPEG-TS).

DVB-S Specifications	Supported Configurations
Symbol Rate	Upto 80MHz
Transport Stream Rate Adaptation	TS Bitrate adaptation depending upon the user signal configuration
Pulse shaping filter Type	Root Raised cosine, Raised Cosine, Gaussian and None
Pulse Shaping filter length	User configurable
Roll-off Factor	User configurable
Samples Per Symbol	User configurable
Number of TS Packets	User configurable
Interleaver Support	Native interleaver is supported
Code Rate	½. 2/3, 3/4, 5/6 and 7/8
Outer coder	Reed-Solomon
Inner coder	Convolutional with puncturing
Generic Signal Handling	**Supported Configurations**
Frequency	VHF/UHF band and any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	**Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.**
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW

	API VIs

2.2.3 DVB-S2

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital video broadcasting-terrestrial (DVB-S2) equipments. Digital Video Broadcasting - Satellite - Second Generation (DVB-S2) is a digital television broadcast standard that has been designed as a successor for the popular DVB-S system. It was developed by the DVB Project, an international industry consortium, and ratified by ETSI (EN 302307) in March 2005. Features include enhanced modulation schemes up to 32APSK, additional code rates, Constant and Variable Coding Modulation and the introduction of a generic transport mechanism for IP packet data including MPEG-4 audio–video streams, while supporting backward compatibility with existing MPEG-2 TS based transmission.

DVB-S2 Specifications	Supported Configurations
Input Stream Type	Single and Multiple Streams
Input Stream Format	Transport Stream
Coding and Modulation Type	Constant Coding and Modulation (CCM) and Variable Coding and Modulation (VCM)
Input Stream Synchronization Type	Inactive and Active
Symbol Rate	Upto 80MHz
Transport Stream Rate Adaptation	TS Bitrate adaptation depending upon the user signal configuration
Null Packet Deletion Type	Inactive and Active
Pulse shaping filter Type	Root Raised cosine, Raised Cosine, Gaussian and None
Pulse Shaping filter length	User configurable
Roll-off Factor	User configurable
Samples Per Symbol	User configurable
Pilot Insertion Enabled	False and True
FEC Frame Type	Normal and Short
LDPC Encoding	Supported all Code Rates and FEC Frame Length
BCH Encoding	Supported all Code Rates and FEC Frame Length
Code Rate	1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 and 9/10
Modulation Type	QPSK, 8PSK, 16 APSK and 32 APSK
PL Header Generation and Scramling	Supported
Multiple Frame Generation	Supported
Generic Signal Handling	**Supported Configurations**
Frequency	VHF/UHF band and any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	**Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.**
Impairment Handling	Carrier Frequency Offset

	Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW API VIs

2.2.4 DVB-T

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital video broadcasting-terrestrial (DVB-T) equipments. Digital video broadcasting-terrestrial (DVB-T) is the European based consortium standard for broadcast transmission of digital terrestrial television. DVB-T can transport compressed video data in an MPEG transport stream using OFDM modulation with channel coding (i.e. COFDM). This standard is adopted in more than 30 countries. The use of COFDM with appropriate guard interval allows optimal tradeoff between network topology and frequency efficiency. We support all the guard interval, interleavers and code rates specified in ETSI 300-744 standard. We also support both non-hierarchical and hierarchical transmission modes so that two completely separate data streams can be multiplexed in to a single signal. Detailed set of features discussed below.

DVB-T Specific	Supported Configurations
Transmission Mode	Hierarchical/Non- Hierarchical
Alpha	1,2 or 4 alpha modes
Mode(# of subcarriers)	2k and 8k modes
Bandwidth	6M,7M and 8M Hz
Modulations	QPSK,QAM16 and QAM64
Guard Intervals	1 /4, 1 /8, 1/16, 1/32
Cell Details Handling	One can enable or disable handling. TPS signaling will use the provided cell ID if you enable cell ID handling
Interleaver Support	Native interleaver is supported
TPS Handling	Transmission Parameter signaling is also included in the framing,
Outer coder	Reed-Solomon
Inner coder	Convolutional with puncturing
Convolution Code Rates for Non-Hierarchical stream	1 /2, 2/3, 3 /4, 5/6, 7 /8
Convolution Code Rate for High Priority stream	1 /2, 2/3, 3 /4, 5/6, 7 /8
Convolution Code Rate for Low priority stream	1 /2, 2/3, 3 /4, 5/6, 7 /8
Multiple Super Frame Generation	Supported
OFDM Windowing	Cosine Window, user configurable window length

Generic Signal Handling	Supported Configurations
Frequency	VHF/UHF band and any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	**Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.**
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.
Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.5 ISDB-T/Tb

This toolkit offers standard based test solution for designing, evaluating and manufacturing Integrated Services Digital Broadcasting Terrestrial (ISDB-T) equipments. The ISDB-T is a Japanese standard for digital terrestrial television and a derivative of ISDB-T, ISDB-Tb is developed by the Brazilian government and is being widely adopted in South America. Unlike the transmission standards already in use in the other parts of the world, the television, radio and data services are to be covered by one standard.

ISDB-T transmits compressed digital audio, video and other data in an MPEG transport stream, using Band Segmented OFDM modulation.

ISDB-T/Tb Specific	Supported Configurations
Hierarchical Layers	A,B and C (All format supported)
Version	Japan and Brazil Version
Transmission Mode(# of subcarriers)	Mode 1, Mode 2 and Mode 3 (All modes)
Bandwidth	6M,7M and 8M Hz (All Bandwidths)
Modulation Scheme	DQPSK,QPSK,QAM16 and QAM64(All mapping schemes)
Guard Intervals	1 /4, 1 /8, 1/16, 1/32 (All Guard Intervals)
Segment configuration	1,3, 13 segment configuration and other combinations also possible
Interleaver	Byte and Bit Interleaver
Partial Reception Mode	Supported
TMCC Signaling	Transmission and Multiplexing configuration control signal is added in the framing
Outer coder	Reed-Solomon
Inner coder	Convolutional with puncturing

Convolution Code Rates	1 /2, 2/3, 3 /4, 5/6, 7 /8
Time interleaving length	All possible configurations are supported
Energy dispersal	Supported
Delay adjustment	Byte and Bit level delay adjustments supported
Division of TS into Hierarchical layers	Supported (Separation of TS stream into multiple hierarchical layers)
MPEG2 TS Remultiplexing	Supported (Remultiplexing multiple TS files into one TS file as per ISDB-T standard)
OFDM Windowing	Cosine Window, user configurable window length
Generic Signal Handling	Supported Configurations
Frequency	Any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.
Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.6 DVB-T2

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital Video Broadcasting- Second Generation Terrestrial (DVB-T2) equipments. This system transmits compressed digital audio, video and other data in “physical layer pipes” (PLPs), using OFDM modulation with concatenated channel coding and modulation. The DVB-T2 Generation Toolkit from MaxEye Technologies supports ETSI EN 302 755 V1.3.1 (2012-04), “Digital Video Broadcasting (DVB); Frame structure, channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)”.

DVB-T2 Specific	Supported Configurations
Version	1.3.1
DVB-T2 Mode	Mode-B (Multiple PLP)and T2-Lite
Bandwidth	1.7Mhz, 5Mhz, 6Mhz, 7Mhz, 8Mhz and 10Mhz
Modulation	OFDM
Carrier Mode	Both Normal and Extended
FFT Size	1K, 2K, 4K, 8K, 16K and 32K
PLP Data Modulation Format	QPSK, 16QAM, 64QAM and 256 QAM

L1 Post Data Modulation Format	QPSK, 16QAM and 256 QAM
L1 Pre Data Modulation Format	BPSK
Guard Interval	1/128, 1/32, 1/16, 19/256, 1/8, 19/128 and ¼ of the FFT Size.
Scatter Pilot Pattern	PP0, PP1, PP2, PP3, PP4, PP5, PP6, PP7 and PP8.
PAPR Reduction Algorithm	No PAPR reduction, Tone Reservation based PAPR Reduction and L1 ACE
Number of OFDM Data Symbols.	User Configurable.
Forward Error Correction (Combined BCH + LDPC Rate)	½, 3/5, 2/3, ¾, 4/5 and 5/6.
Number of FEC Blocks	User Configurable.
PLP Data Frame Type	Both Long and Short.
Constellation Rotation	Supported.
MIMO Support	Supported
Stream Type Supported.	MPEG2 TS (Big-TS Mode and Separate TS Mode)
Mode Adaptation (BB Frame from TS stream)	Supported (Multiple PLP)
Input Stream Synchronizer	Supported
Null Packet Deletion	Supported
Stream Mode	Supports both Normal and High Efficiency Mode.
Multiple T2 Frame support	Yes.
Multiple Super frame Support	Yes.
Number of Time Interleaving Blocks per Interleaving Frame.	User Configurable.
Time Interleaving Type	All Formats Supported
Number of Interleaving Frames(IF) per T2 Frame	All Formats as per standard
OFDM Windowing	Cosine Window, user configurable window length
Reference Stream Generation	Support All test cases in the reference stream
Generic Signal Handling	Supported Configurations
Frequency	Any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.

Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.7 DAB/DAB+/DMB

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital Audio Broadcasting (DAB and DAB Plus), Terrestrial Digital Multimedia Broadcasting (T-DMB) equipments. Digital Audio Broadcasting (DAB) is a digital radio broadcasting standard for broadcasting audio signals. An upgraded version of the system is called DAB+. DAB is not forward compatible with DAB Plus. Terrestrial Digital Multimedia Broadcasting (TDMB) is a digital video broadcasting standard developed by South Korea as part of the national IT project for transmitting digital video, audio and data casting to mobile devices. The original DAB specification is based on ETSI EN 300401 and DAB Plus enhancement specification is based on ETSI TS 102563 standard. T-DMB is based on the ETSI standards TS 102427 and TS 102 428. T-DMB uses data stream mode on DAB to transmit the TS files.

The toolkit supports real-time signal generation.

T-DMB/DAB/DAB Plus Specific	Supported Configurations
Transmission Mode	Mode I, II, III and IV
Input Mode	ETI File and User Configuration
Transmission Channels	Main Service Channel (MSC)(Carries Video, Audio and Data service components) Fast Information Channel (FIC)(Carries Multiplex configuration information) Synchronization Channel
Transport Mechanism	Stream Mode
Transmission Mode(# of subcarriers)	Mode 1, Mode 2 and Mode 3 (All modes)
Service Configuration	Service Label, Service ID, Multiple Service components in one service, Multiple Services in one Ensemble. Service component level labels and IDs.
EPG	Support of EPG Generation through DAB ETI Files available from WorldDAB Forum.
Energy Dispersal	For MSC and FIC
Modulation Scheme	DQPSK
Guard Intervals	All Guard Intervals as per the specification
Convolutional Coding	Supported with all possible puncturing patterns (different code rates)
RS coding	RS(204,188)
Time Interleaving	Supported
Frequency Interleaving	Supported
Video Service	Using Data stream mode of DAB
OFDM Windowing	Cosine Window, user configurable window length
Generic Signal Handling	**Supported Configurations**
Frequency	Any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)

Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.
Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.8 CMMB

This toolkit offers standard based test solution for designing, evaluating and manufacturing China Mobile Multimedia Broadcasting (CMMB) equipments. CMMB is a mobile television and multimedia standard developed and specified in China by the State Administration of Radio, Film and Television (SARFT).

CMMB Specific	Supported Configurations
Physical Logical Channel (PLCH)	Supports both CLCH (Control Logical Channel) and SLCH (Service Logical Channel)Generation Supports 1-39 SLCH in one frame
Bandwidth	2 and 8 MHz
Beacon	1 Transmission ID and 2 synchronization signal
Modulation Scheme	BPSK,QPSK, 16QAM
Forward Error Correction	ReedSolomon + LDPC code
Code Rates	1/2 and 3/4
Interleaver	Byte and Bit Interleaver
Interleaver mode	All modes supported
Scrambling	Supported
Multiple frame generation	Supported
OFDM Windowing	Cosine Window
MFS File Handling	Automatic detection of service channel configuration from the MFS file supported
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Generic Signal Handling	Supported Configurations
Frequency	Any Custom carrier frequency
Payload configuration	MFS File Random Pattern PN Sequence derived (Seed, order)
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset

	Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW API VIs

2.2.9 DTMB

This toolkit offers standard based test solution for designing, evaluating and manufacturing Digital Terrestrial Multimedia Broadcast (DTMB) equipments. The DTMB is a TV standard for mobile and fixed terminals used in China, HongKong and Macau. The DTMB standard uses many advanced technologies to improve their performance, for example, a pseudo-random noise code (PN) as a guard interval that allows faster synchronization system and a more accurate channel estimation, Low-Density Parity-Check (LDPC) encoding to protect against errors.

DTMB transmits compressed digital audio, video and other data in an MPEG transport stream using either single carrier or multi-carrier mode. Bit-rate: from 4.813Mbit/s to 32.486Mbit/s

DTMB Specific	Supported Configurations
System Subcarrier Mode	Supported both single carrier and multi carrier mode
Symbol Rate	7.56 MHz
Frame Header Mode	Mode 1, Mode 2 and Mode 3 (All modes)
Oversampling ratio	2
Modulation Scheme	4QAM, 4QAM-NR, 16QAM, 32QAM, 64QAM
Forward Error Correction	BCH + LDPC code
Code Rates	0.4, 0.6 and 0.8
Interleaver	Symbol Interleaver
Interleaver mode	All modes supported
System Information	Generation of system information symbols based on the signal configuration
Pulse shaping filter	Root Raised cosine filter with roll off 0.05
Pulse Shaping filter length	User configurable
Frequency domain interleaving	Supported
Scrambling	Supported
Multiple frame generation	Supported
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Generic Signal Handling	Supported Configurations
Frequency	Any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)

Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW API VIs

2.2.10 ATSC & ATSC-M/H

This toolkit offers standard based test solution for designing, evaluating and manufacturing ATSC equipments. ATSC standards are a set of standards developed by the Advanced Television Systems Committee for digital television transmission over terrestrial, cable, and satellite networks. ATSC digital television is published as an A/53 standard. Part 2 of the standard has specifications for the physical layer. ATSC-M/H (Advanced Television Systems Committee - Mobile/Handheld) is a standard in the USA for mobile digital TV, that allows TV broadcasts to be received by mobile devices). ATSC-M/H is published as an A/153 standard.

ATSC-M/H is an extension to the available digital TV broadcasting standard ATSC A/53. ATSC is optimized for a fixed reception in the typical North American environment and uses 8VSB modulation. The ATSC transmission scheme is not robust enough against Doppler shift and multipath radio interference in mobile environments, and is designed for highly directional fixed antennas. To overcome these issues, additional channel coding mechanisms are introduced in ATSC-M/H to protect the signal. ATSC-M/H is a service for mobile TV receivers and partly uses the 19.39 Mbit/s ATSC 8VSB stream.

ATSC & ATSC-M/H Specific	Supported Configurations
Modulation Type	8 VSB
Supported service multiplex	Main Service and M/H Service multiplex
RS Frame Mode	Single
SCCC Mode	Paired, Separate
SCCC Code Rate	1/4,1/2
Modulation	8 VSB
RS Code Rate	RS(235,187), RS(223,187), RS(211,187)
Support for Multiple Parade	Yes
Pulse shaping filter	Root Raised cosine filter with roll off 0.1152
Pulse Shaping filter length	User configurable
Multiple frame generation	Supported
Packet Timing and PCR adjustment	Supported
M/H Signalling Channel	TPC
Generic Signal Handling	**Supported Configurations**
Frequency	Any Custom carrier frequency

Payload configuration	Multiplexed TS File Mode TS File IP Stream Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW API VIs

2.2.11 DRM/DRM+

This toolkit offers standard based test solution for designing, evaluating and manufacturing DRM equipments. DRM is the only global open digital radio system which can be used in all frequency bands (AM and VHF). DRM system can be used to cover large geographic areas as well as rural and local markets and when on the move. A low power local service option is also available.

DRM/DRM Plus Specific	Supported Configurations
Robustness Mode	A, B, C, D and E
Signal Bandwidth	4.5 KHz, 5 KHz,9 KHz, 10 KHz, 18 KHz, 20 KHz and 100 KHz
Channel Coding	Energy Dispersal, Convolutional code with all protection levels
Mapping	QPSK, 16QAM and 64QAM Standard Mapping Symmetrical Hierarchical Modulation
Multi level coding	1, 2 and 3 levels
Multiple frame generation	Supported
Number of Services	4 (Audio + Data services)
Channels	Main Service Channel Service Description Channel Fast Access Channel
Generic Signal Handling	**Supported Configurations**
Frequency	Any Custom carrier frequency
Payload configuration	Multiplexed Audio File Random Pattern User Defined Bits PN Sequence derived (Seed, order)
Realtime streaming	Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.

Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
Soft Front Panel	The Soft Front Panel allows engineers to quickly generate the signals by selecting appropriate generation mode and other configurations.
LabVIEW and C Remote APIs	Remote C and LabVIEW APIs for configuring the various toolkit parameters and reading the output parameters.
Remote LabVIEW and C Examples	Programming Examples using the toolkit C and LabVIEW APIs.

2.2.12 DVB-C/J.83 Annex A/C

This toolkit offers standard based test solution for designing, evaluating and manufacturing DVB-C equipments. DVB-C stands for "Digital Video Broadcasting - Cable" and it is the DVB European consortium standard for the broadcast transmission of digital television over cable. This system transmits an MPEG-2 or MPEG-4 family digital audio/digital video stream, using a QAM modulation with channel coding. The standard was first published by the ETSI in 1994, and subsequently became the most widely used transmission system for digital cable television in Europe. It is deployed worldwide in systems ranging from the larger cable television networks (CATV) down to smaller satellite master antenna TV (SMATV) systems.

DVB-S Specifications	Supported Configurations
Symbol Rate	Upto 80MHz
Transport Stream Rate Adaptation	TS Bitrate adaptation depending upon the user signal configuration
Pulse shaping filter Type	Root Raised cosine, Raised Cosine, Gaussian and None
Pulse Shaping filter length	User configurable
Roll-off Factor	User configurable
Samples Per Symbol	User configurable
Number of TS Packets	User configurable
Interleaver	Convolutional Interleaver
Modulation Type	16 QAM, 32 QAM, 64
Outer coder	Reed-Solomon
Generic Signal Handling	Supported Configurations
Frequency	VHF/UHF band and any Custom carrier frequency
Payload configuration	TS File Random Pattern PN Sequence derived (Seed, order)
Realtime streaming	**Realtime streaming of the stored waveform from file using NIRFSG Streaming mode.**
Impairment Handling	Carrier Frequency Offset Clock Offset DC Offset Gain Imbalance

	Quadrature Skew Carrier to Noise (SNR)
Common Toolkit Features	
LabVIEW API	The toolkit properties are configured using the Set/Get LabVIEW API Vis. All API VIs has documentation support and Icons.
Programming Examples	Programming Examples to help users using the LabVIEW API VIs

3. Minimum System Requirements

This section lists the minimum system requirements for using this toolkit. Before installing the Digital Video Toolkit software, verify that your system meets the following requirements:

- Windows 10 /Windows 7 with all available critical updates and service packs
- 16GB of free hard drive space
- 4GB of RAM
- NI LabVIEW 2015 Run-Time Engine or NI LabVIEW 2015(32 bit and 64 bit), NI LabVIEW 2016 Run-Time Engine or NI LabVIEW 2016(32 bit and 64 bit) Full Development System or Professional Development System is used for Remote LabVIEW Examples.
- Microsoft Visual Studio Express 2012 for Windows Desktop or Later Version is used for Compiling Remote C Examples.

LabVIEW 2015:

- NI RFSG 15.0 or later version
- NI RFSA 15.0 or later version
- NI DAQmx 15.0 or later version
- NI Streaming 5840 Host v16.0.

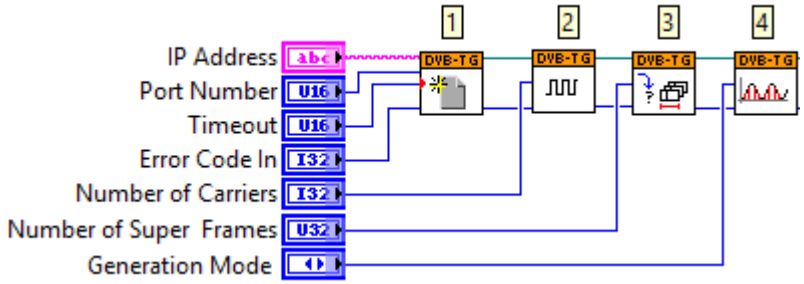
LabVIEW 2016:

- NI RFSG 16.0 or later version
- NI RFSA 16.0 or later version
- NI DAQmx 16.0 or later version
- NI Streaming 5840 Host v16.0.

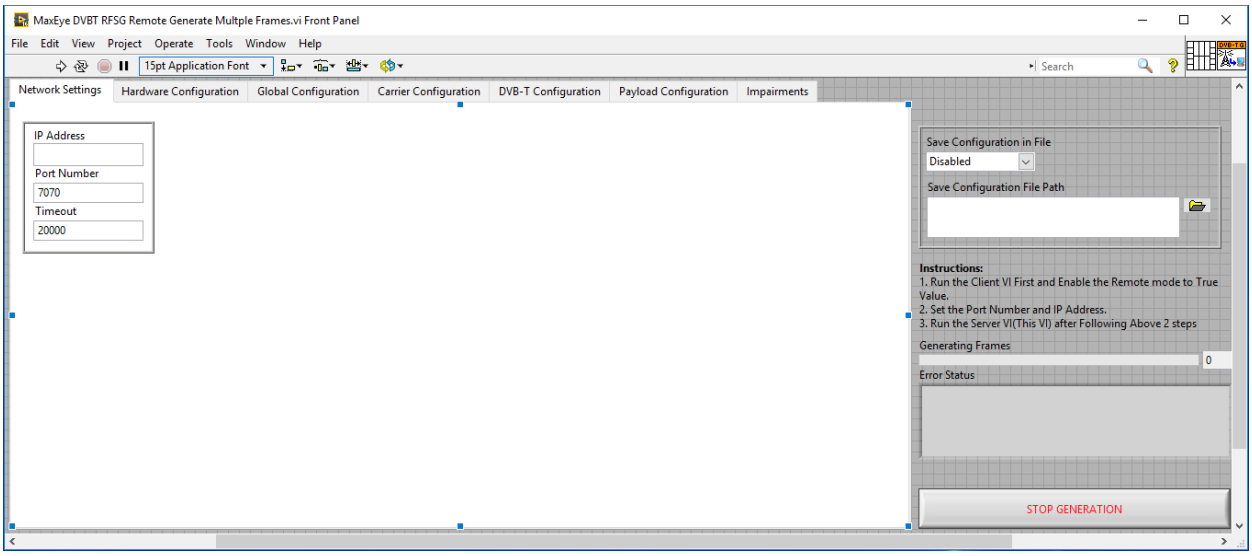
4. Toolkit Remote APIs

The MaxEye Digital Video Signal Generation toolkit allows user to configure settings such as IP Address, Port Number, Timeout, Number of Carriers, Number of Super Frames, Generation Mode and other standard specific parameters using the LabVIEW Programming API. The diagram below shows how the programming VIs are used for configuring the signal settings remotely to the user interactive Soft Front Panel (SFP). Each of the LabVIEW programming API

VI has documentation support to the users to give more details about the functionality of the API VI and its input and output.



The diagram below shows the front panel of one of the DVB-T toolkit remote example. The toolkit examples helps the users to send the various configurations to the user interactive soft front panel (SFP) to generate the standard complaint signals to meet the specific test requirements.



5. Software Maintenance and Support

MaxEye offers cost effective software maintenance and support for your application development and automated test environment with free software upgrade for all the supported features of the toolkits. MaxEye offers technical support through our engineers who are domain experts in the digital video broadcasting test solutions. For more details about our support program please contact us at info@maxeyetech.com.

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