MaxEye Digital Video Signal Generation Toolkit

DVB-S

Version 1.1

Getting Started Guide

Contents

For more information please contact info@maxeyetech.com

1. Introduction

MaxEye Technologies provides generation functions in LabVIEW for generating the standard complaint signals for various digital video broadcasting standards. This guide explains how to use the DVB-S signal generation toolkit using the programming examples.

2. Installed File Location

The example VIs are installed in, <LabVIEW>\vi.lib\addons\MaxEye\Digital Video Toolkits\DVB-S Generation\Generation\Examples.

The toolkit help files are installed in, <LabVIEW>\vi.lib\addons\MaxEye\Digital Video Toolkits\DVB-S Generation \Generation\Documentation.

The toolkit API files are intalled in, <LabVIEW>\vi.lib\addons\MaxEye\Digital Video Toolkits\DVB-S Generation\Generation\API.

You can also find a shortcut to the above location from the windows start menu.

Start->All Programs->MaxEye->Digital Video Toolkits->DVB-S Generation

3. Programming Examples

The DVB-S Signal generation toolkit contains examples for performing the following

  i.   Creating the waveform based on the standard specific user input parameters and then downloads the waveform to NI RFSG.
  ii. Creating the waveform based on the standard specific user input parameters and then writes the waveform to the file.
  iii. Playing the waveform using NI RFSG and NI USRP.
  iv. To create multi-carrier signal, reads the stored waveform from the files and then combines the waveforms into one multi-carrier waveform based on the centre frequencies of each waveform. The resulting multi-carrier waveform is stored in a file.

The programming examples are created using the LabVIEW API VIs. For more information about the API VI used in the example VIs refer to the MaxEye DVB-S Signal Generation Help.chm

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document, accessible at Start->All Programs->MaxEye->Digital Video Toolkits->DVB-S Generation>Generation->Documentation.

3.1. Create and Download Waveform

DVB-S is based on the ETSI standard EN 300 421(1997-08). It employs The system is intended to provide Direct-To-Home(DTH) services to the consumer. DVB-S transmits MPEG2TS stream in its single carrier. The toolkit has an example to demonstrate the functionality of creating DVB-S waveform, writing the waveform to the NI RFSG memory and then playing the waveform from the memory.

### 3.1.1 MaxEye DVBS RFSG Generate Multiple Frames

This Example is used to generate multiple DVB-S frames. In this mode one TS stream is used for generating the signal. The figure below shows the front panel of the Example VI.

The user configurations are divided in to three categories

- i.   Hardware Settings
- ii.   Signal Settings
- iii. Digital Video Payload Control Settings
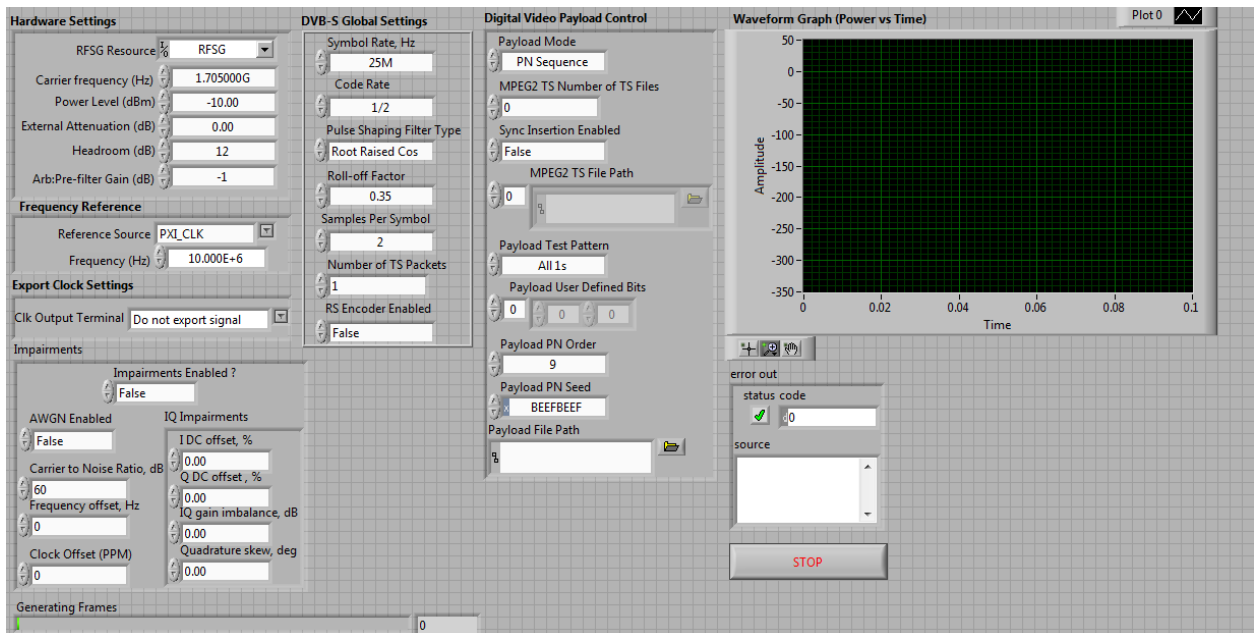
For more information please contact info@maxeyetech.com
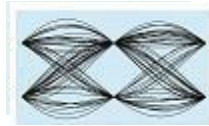
3.1.1.1 Hardware Settings

Hardware Settings

RFSG Resource	RFSG
Carrier frequency (Hz)	1.705000G
Power Level (dBm)	-10.00
External Attenuation (dB)	0.00
Headroom (dB)	12
Arb:Pre-filter Gain (dB)	-1

Frequency Reference

Reference Source	PXI_CLK
Frequency (Hz)	10.000E+6

Export Clock Settings

Clk Output Terminal	Do not export signal

RFSG Resource – Configure the resource name used in NI Measurement and Automation explorer for the NI PXIe-5673/5673E device.

Carrier Frequency (Hz) – Center Frequency of the DVB-S signal in Hz.

Frequency Shift (Hz) – Specifies the amount of frequency offset added to the baseband signal.

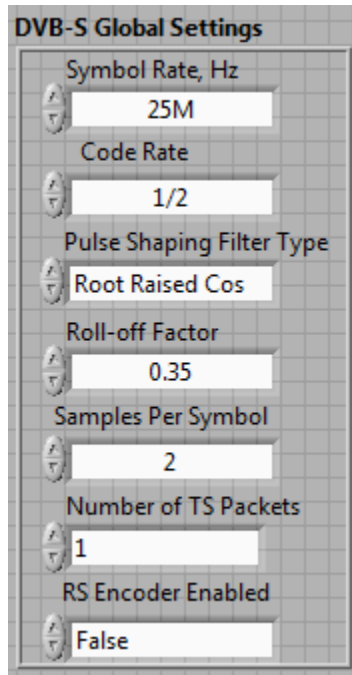Power Level (dBm) – Average Power level of the signal in dBm.

Headroom (dB) – Configure the Headroom value higher than PAPR of the signal to be generated. Refer MaxEye DVB-S Signal Generation Help.chm.

External Attenuation (dB), Arb:Pre-filter Gain (dB), Reference Source, Frequency (Hz), Clk Output Terminal – Refer NI RFSG Signal Generators help file.

3.1.1.2 Signal Settings

The Signal Settings includes the DVB-S standard specific configuration. The help for each of the properties are available in DVB-S Signal Generation Help.chm file.

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DVB-S Global Settings

Symbol Rate, Hz	25M
Code Rate	1/2
Pulse Shaping Filter Type	Root Raised Cos
Roll-off Factor	0.35
Samples Per Symbol	2
Number of TS Packets	1
RS Encoder Enabled	False

The Number of TS Packets property decides the length of waveform to be generated. To generate longer duration of the waveform increase the Number of TS Packets value. The duration of each Frame created depends on the Bandwidth, Mode and Guard Interval property values. Refer DVB-S standard EN 300 421 for the symbol duration.
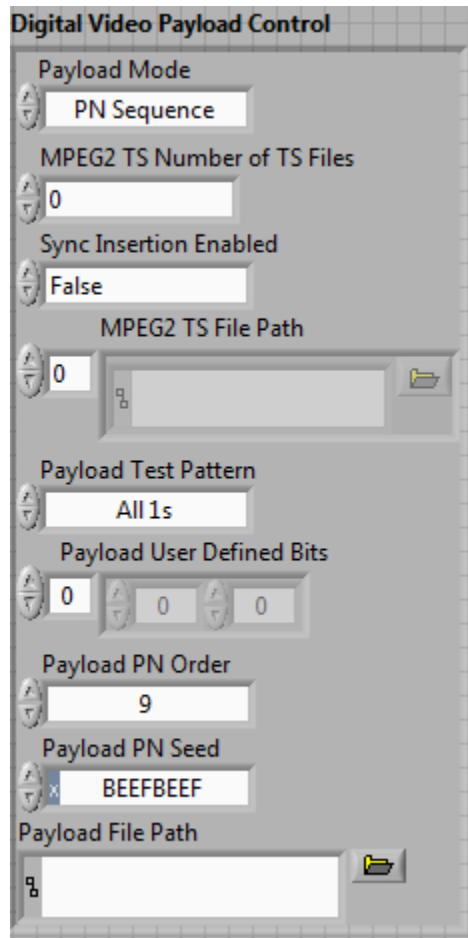
3.1.1.3 Digital Video Payload Control Settings

MaxEye Digital Video Toolkit allows you to configure various payload settings. The possible payload options are

i.   PN Sequence – In this mode configure Sync Insertion Enabled, Payload PN order and PN Seed properties and the toolkit ignores other properties in the Digital Video Payload Control. The toolkit generates pseudo random sequence based on the PN order and seed value, the generated bit sequence is used as a payload for generating the signal. Use this mode for testing the receiver performance for random payload values. When the number of super frames is more than 1 then the toolkit maintains payload continuity across the super frames.

ii.   User defined bits – In this mode configure Sync Insertion Enabled and Payload User Defined Bits property and the toolkit ignores other properties in the Digital Video Payload Control.

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iii. Test Pattern – In this mode configure Sync Insertion Enabled and Payload Test Pattern property and the toolkit ignores other properties in the Digital Video Payload Control. The possible values for the Test Pattern are All 1s, All 0s, 10101010 and 01010101. This mode is used for generating signal with known test patterns.

iv. Test File – In this mode configure the Sync Insertion Enabled and Payload File Path property and the toolkit ignores other properties in the Digital Video Payload Congtrol. This mode is used for generating signal with the data from the file.

v. MPEG2TS File(s) – In this mode configure the MPEG2 TS Number of TS Files and MPEG2 TS File Path property and the toolkit ignores other properties in the Digital Video Payload Control.

Digital Video Payload Control

Payload Mode

PN Sequence

MPEG2 TS Number of TS Files

0

Sync Insertion Enabled

False

MPEG2 TS File Path

0

Payload Test Pattern

All 1s

Payload User Defined Bits

0 0 0

Payload PN Order

9

Payload PN Seed

x BEEFBEEF

Payload File Path

3.2. Create and Save Waveform in File

This Example is used to generate multiple DVB-S frames and the generated waveform is stored in a file for play back. Use this example

- To generate and store the custom waveforms based on your test requirement.
- To avoid generating the waveform at the beginning of your test every time. This reduces your test starting time as some of the signal configuration will take longer to generate the waveform.
- For generating the longer duration waveform as the RFSG memory size is limited.
- For testing your receiver for continuous signal reception.
- For receiver functionality verification tests that require longer duration of video to be played.
- For receiver sensitivity measurement (BER) for longer duration.

The figure below shows the front panel of the Example VI.
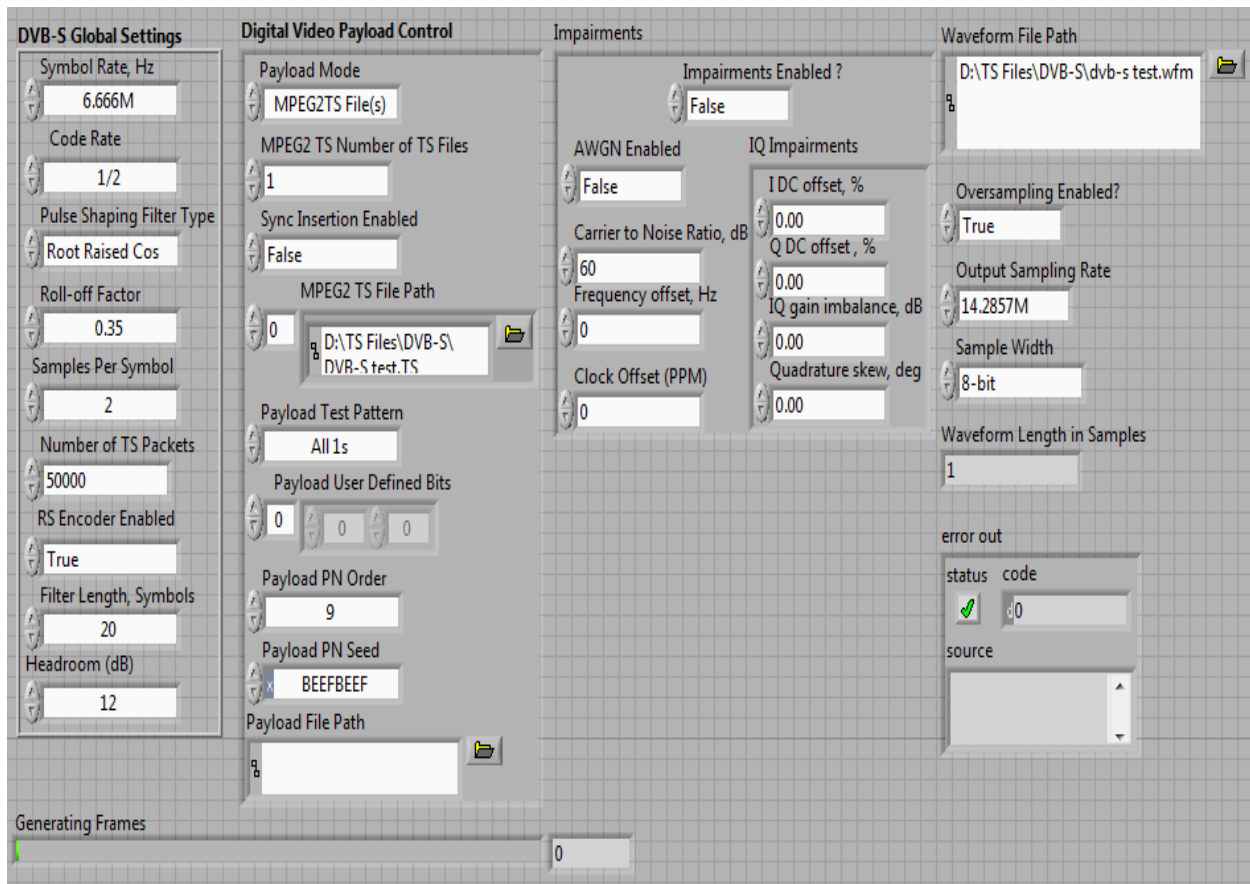
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The toolkit configurations are same as specified in section 3.1.

This example requires the following additional input parameters.

1. **Waveform File Path** – The toolkit writes the generated waveform in a file specified by this file path control.
2. **Oversampling Enabled** – set this property value to TRUE if resampling is required.
3. **Output Sampling Rate (Hz) –** Configure this control to a suitable value if Oversampling Enabled property is set to TRUE.
4. **Output Sample Width –** The default sample width of the output waveform is 8-bits. The available options are 8-bits and 16-bits. We recommend 16-bits sample width for better signal quality of the generated waveform.

3.3.   Play Waveform from File

This example reads the DVB-S waveform from the file created using the previous example in section 3.2 and then downloads the waveform in real-time to NI RFSG Memory and then plays the waveform. This example is created using the NI RFSG streaming example available in the NI website.
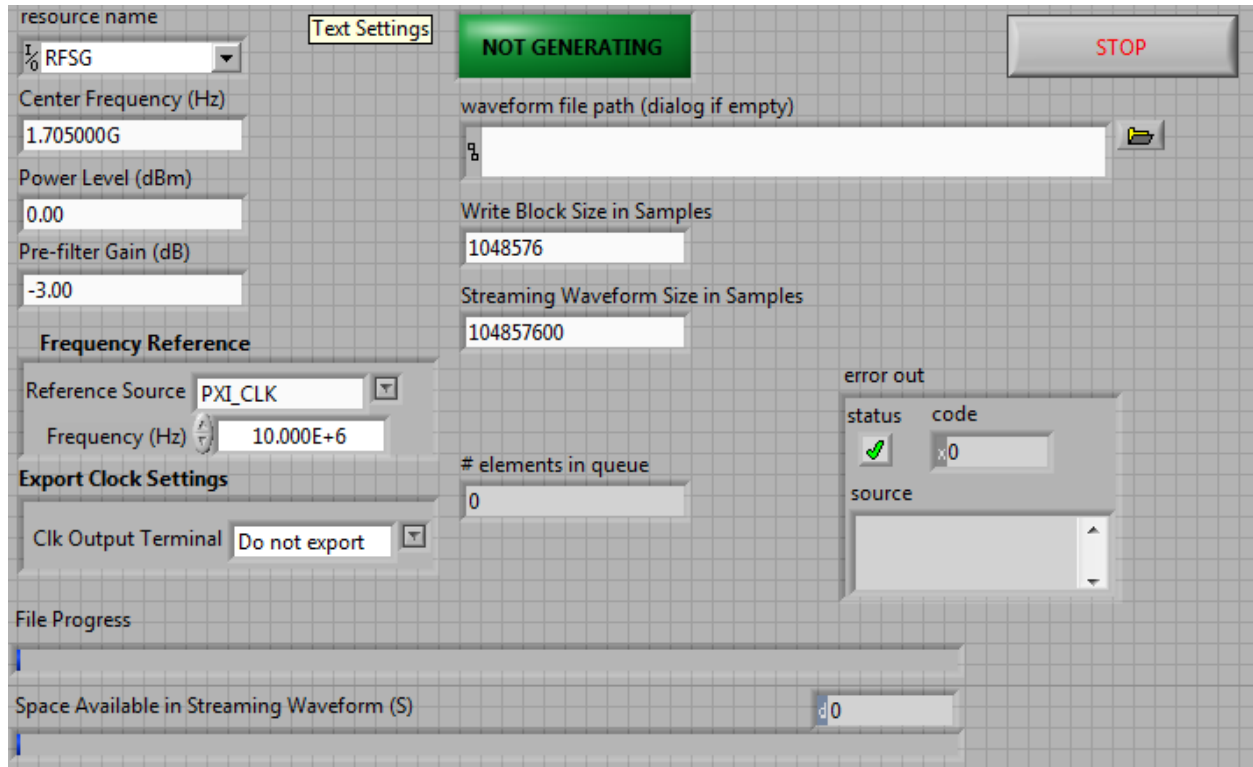
This example uses NI RFSG in streaming mode for playing the waveform in real-time. The performance of this example is related to the performance of your CPU and available RAM memory.

The figure below shows the front panel of the Example VI. For more information about NI RFSG streaming refer to the web link below.

http://zone.ni.com/reference/en-XX/help/371025K-01/rfsg/streaming/

Sample Width – use the same sample width value used for storing the waveform in the file.

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3.4 Play Waveform from File (USRP)

3.4.1 MaxEye DVBT USRP Play Waveform from File

This example reads the DVB-S waveform from the file created using the example mentioned in the Section 3.2 and then downloads the waveform in real time to NI USRP memory and then plays the waveform.

The performance of this example is related to the performance of your CPU and available RAM memory.

The figure below shows the front panel of the Example VI.

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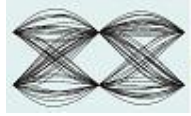
Playback | Visualization | About | ● Generating

TX Destination File

D:\DVB-S\test.wfm

TX USRP Configuration

Total Playback Duration (s)

60.926

Actual Coerced TX Values

TX USRP Configuration	Actual Coerced TX Values
USRP IP Address	**USRP IP Address**
192.168.10.3	192.168.10.3
carrier frequency	carrier frequency
1.705G	474M
IQ rate (S/s)	IQ rate (S/s)
10M	10M
gain	gain
5	5
active antenna	active antenna
TX1	TX1
Write Buffer (IQ Samples)	Write Buffer (IQ Samples)
10000	10000
Sample Width	Sample Width
8-bit	8-bit

START Generation

STOP Generation

Application STOP

For more information please contact info@maxeyetech.com
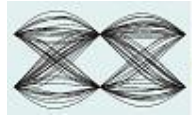
3.4.1.1 TX USRP Configuration

USRP IP Address – IP address of the NI USRP

Carrier Frequency – Center Frequency of the DVB-S signal in Hz.

IQ Rate (S/s) – Rate of the baseband I/Q data in samples per second (S/s).

Sample Width – configure the sample width used to generate waveform file.

Active Antenna, Gain, Expected Peak, coerced IQ rare, coerced carrier frequency, and coerced gain – Refer NI USRP help file.

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3.4.1.2 Visualization

The spectrum of the generated waveform can be monitored in the Visualization Tab as in the example VI shown below. Enable Display button needs to be set to ON state in order to view the spectrum.