

MaxEye Digital Video Signal Analysis Toolkit

CMMB

Version 1.0

Getting Started Guide



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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 CMMB 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\CMMB\Generation\Examples.

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

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

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

Start->All Programs->MaxEye->Digital Video Toolkits->CMMB

3. Programming Examples

The CMMB Signal generation toolkit contains examples for performing the following

- Creating the waveform based on the standard specific user input parameters and then downloads the waveform to NI RFSG.
- Creating the waveform based on the standard specific user input parameters and then writes the waveform to the file.
- Playing the waveform using NIRFSG

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 CMMB Signal Generation Help.chm document, accessible at **Start->All Programs->MaxEye->Digital Video Toolkits->CMMB->Documentation.**



3.1. Create and Download Waveform

CMMB is a mobile television and multimedia standard developed and specified in China by the State Administration of Radio, Film and Television (SARFT). CMMB uses MFS (Multiplexed Frame Structure) stream format for carrying the audio, video and data elementary streams. The payload data is encoded using Reed-Soloman and LDPC error correction code.

The physical layer transmission system is designed to provide Physical Logical Channels (PLCHs) to the upper layer. The capacity and robustness of the each of the PLCH is configured using channel coding rate, constellation and time slot allocation. The PLCHs include one Control Logical Channel (CLCH) and up to 39 Service Logical Channels (SLCHs). The CLCH is always transmitted on the first time slot and it carries control information about SLCHs.

The duration of the physical layer frame is 1 sec and each frame contains 40 time slots. The duration of each time slot is 25 msec.

This Example is used to generate multiple CMMB superframes, download the waveform to the RFSG memory and then play the waveform in the memory continuously. The figure below shows the front panel of the Example VI.

The user configurations are divided in to three categories

- i. Hardware Settings
- ii. CMMB Global Settings
- iii. CLCH Configuration
- iv. SLCH Configuration
- v. Digital Video Payload Control Settings.



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The screenshot displays the Maxeye software interface with several configuration panels and a waveform graph. The panels include:

- Hardware Settings:** RFSG Resource (RFSG), Carrier frequency (466.000000M), Power Level (-30.00), External Attenuation (0.00), Headroom (12), Arb:Pre-filter Gain (-1).
- Frequency Reference:** Reference Source (PXI_CLK), Frequency (10.000E+6).
- Export Clock Settings:** Clk Output Terminal (Do not export signal).
- CLCH Configuration:** RS Coding Rate (RS(240,240)), LDPC Coding Rate (1/2), Interleaving Mode (Mode 1), Modulation Scheme (BPSK), Scrambler Initial Value (0000 1001 0011).
- CMMB Global Settings:** Number of Frames (13), Signal Bandwidth (8 MHz), Region Identifier (0), Transmission Identifier (128), Number of SLCHs (1).
- Digital Video Payload Control:** Payload Mode (MFS File by SLCH), Multiplexed File Path.
- SLCH Configuration:** SLCH Number of Time Slots (2), RS Coding Rate (RS(240,224)), LDPC Coding Rate (1/2), Interleaving Mode (Mode 1), Modulation Scheme (QPSK), Scrambler Initial Value (0000 0000 0001).
- Impairments:** Impairments Enabled? (False), AWGN Enabled (False), Carrier to Noise Ratio (60), Frequency offset (0), IQ Impairments (IDC offset, Q DC offset, IQ gain imbalance, all 0.00).
- error out:** status (0), code (0), source.
- Generating Frames:** 0.

The **Waveform Graph (Power vs Time)** shows a plot of Amplitude (ranging from -70 to 10) versus Time (ranging from 0 to 0.03). The plot area is currently empty.

error out
status code
0 0
source

Generating Frames
0

This VI (1) creates CMMB waveform (2) downloads the waveform to RFSG Memory and then (3) plays the waveform.
Note: Change Payload Mode to MPEG2TS File(s) to generate waveform using the MPEG2 Video and Audio.

3.1.1.1 Hardware Settings

The screenshot shows the **Hardware Settings** panel with the following values:

- RFSG Resource: RFSG
- Carrier frequency (Hz): 50.000000M
- Frequency Shift (Hz): -25.000000M
- Power Level (dBm): -30.00
- 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

For more information please contact info@maxeyetech.com



RFSG Resource – Configure the resource name used in NI Measurement and Automation explorer for the NI PXIe-5611 device.

Carrier Frequency (Hz) – Center Frequency of the CMMB signal in Hz.

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

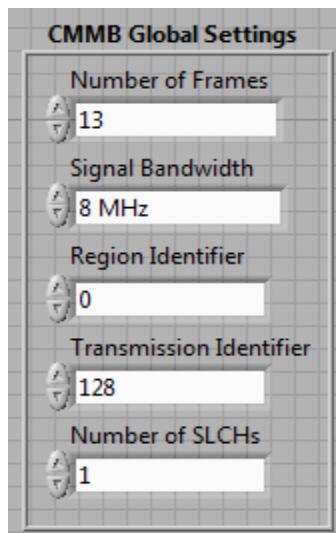
Power Level (dBm) – Average Power level of the signal in dBm.

Headroom (dB) – Configure the Headroom value higher than PAPR of the signal to be generated. Refer MaxEye CMMB 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 CMMB Global Settings

The Global Settings includes the CMMB standard specific configuration. The help for each of the properties is available in CMMB Signal Generation Help.chm file.



The Number of Frames property decides the length of waveform to be generated. To generate longer duration of the waveform increase the Number of Frames. The duration of one Frame is sec.

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3.1.1.3 CLCH Configuration

CLCH Configuration

CLCH Configuration

RS Coding Rate
RS(240,240)

DPC Coding Rate
1/2

Interleaving Mode
Mode 1

Modulation Scheme
BPSK

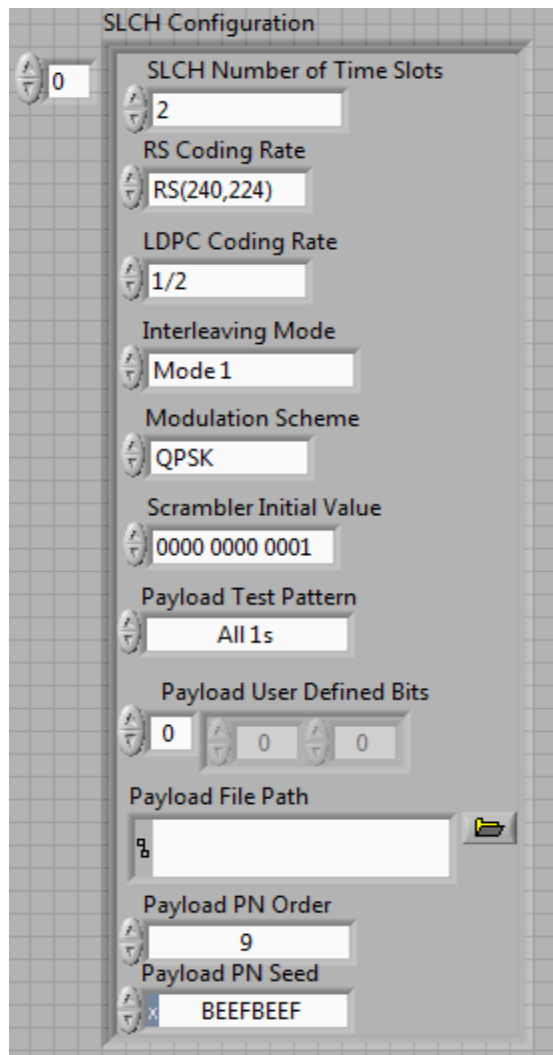
Scrambler Initial Value
0000 1001 0011

The CLCH carries the information about the service logical channels and it is always transmitted on the first time slot in every frame. The toolkit allows user to configure the coding rate, interleaving mode, modulation scheme and Scrambler Initial Value properties for CLCH even though these values are fixed in the standard.

3.1.1.4 SLCH Configuration

The SLCH carries useful data information. The CMMB standard allows up to 39 SLCHs. The number of slots for each SLCH is configurable and the total number of time slots of all the SLCHs should be less than or equal to 39. Based on the Payload Mode property in the Digital Video Payload Control the corresponding payload properties in the SLCH should be configured.

For example, if the payload mode is PN Sequence then PN order and PN Seed properties should be configured. If the payload mode is MFS File by SLCH then user need to configure Payload File Path property for each SLCH separately.



3.1.1.5 Digital Video Payload Control Settings

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

- i. PN Sequence – In this mode configure Payload PN order and PN Seed properties and the toolkit ignores other payload SLCH properties. 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 superframes.

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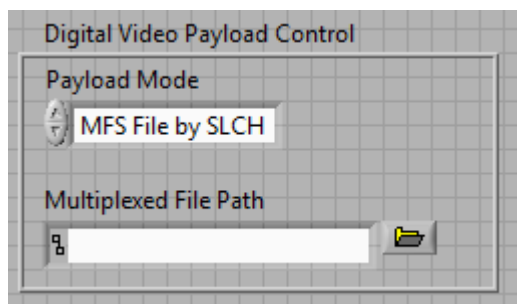


ii. Userdefined bits – In this mode configure Payload User Defined Bits property and the toolkit ignores other payload SLCH properties.

iii. Test Pattern – In this mode configure Payload Test Pattern property and the toolkit ignores other payload SLCH properties. 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. MFS File by SLCH – In this mode configure Payload File Path property and the toolkit ignores other payload SLCH properties. This mode is used for generating signal with the MFS data for each SLCH.

v. Multiplexed File – In this mode configure the Multiplexed File Path property and the toolkit ignores all SLCH related properties as the control information is decoded from the Multiplexed File.



3.2. Create and Save Waveform in File

This Example is used to generate multiple CMMB Super 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 additional input Waveform File Path to store the generated waveform in a file.

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.

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3.3. Play Waveform from File

This example reads the CMMB waveform from the file created using the previous example in section 3.2 and then downloads the waveform to NI RFSG Memory and then plays the waveform in real-time. 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.

resource name
RFSG

Center Frequency (Hz)
466.0000M

Power Level (dBm)
0.00

Pre-filter Gain (dB)
-3.00

Frequency Reference

Reference Source PXI_CLK

Frequency (Hz) 10.000E+6

Export Clock Settings

Clk Output Terminal Do not export

NOT GENERATING

STOP

waveform file path (dialog if empty)

Write Block Size in Samples
1048576

Streaming Waveform Size in Samples
104857600

error out

status	code
✓	x0

source

File Progress

Space Available in Streaming Waveform (S) 0

In order to configure new settings you must stop the example using the STOP button and then run the example with the new settings.

This VI (1) reads the CMMB waveform from the file (2) downloads the waveform to NI RFSG Memory and then (3) plays the waveform. The Steps (1), (2) and (3) is repeated till the VI is stopped. This VI plays the waveform in realtime using NI RFSG streaming mode.

For more information please contact info@maxeyetech.com



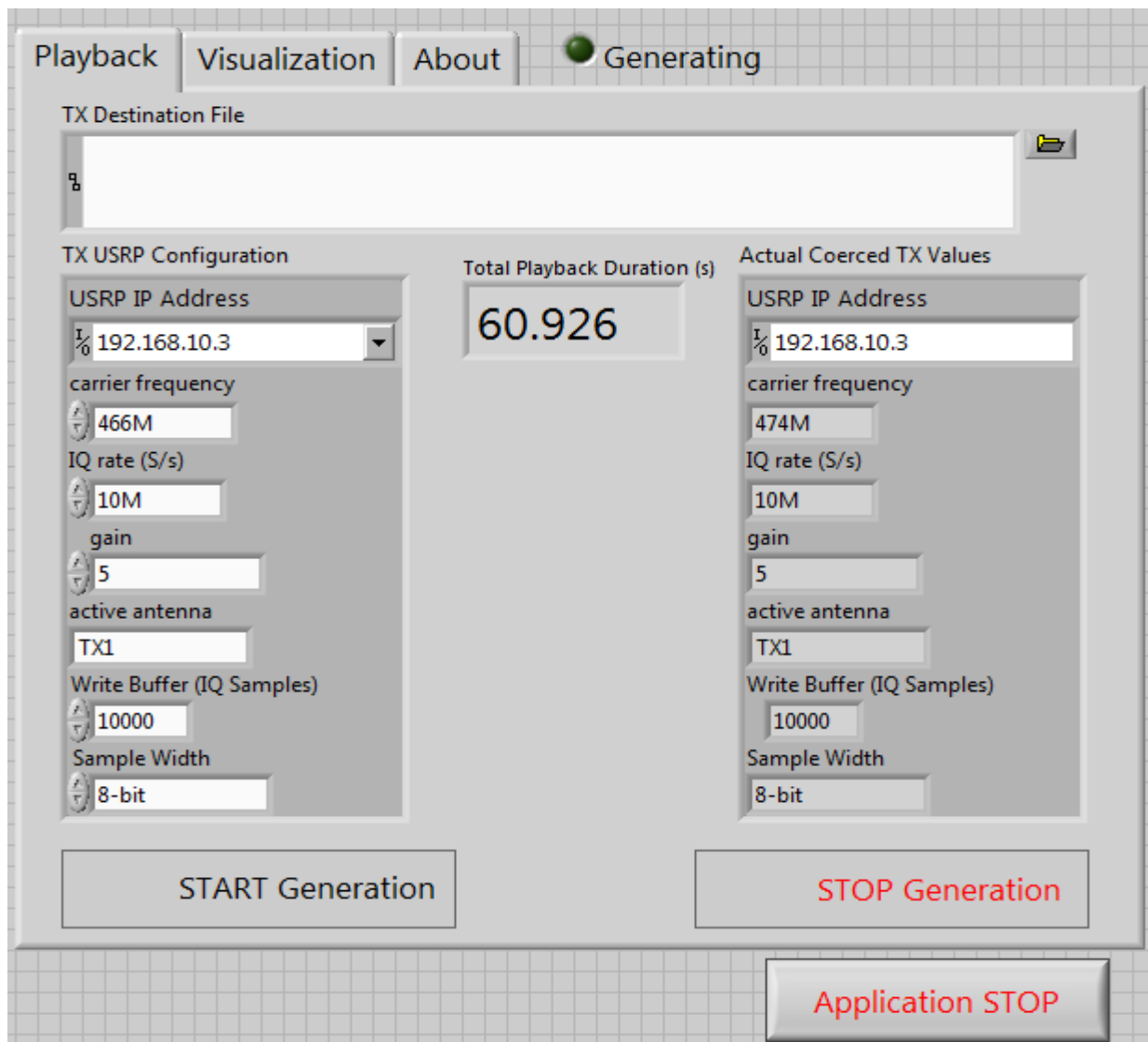
3.4 Play Waveform from File (USRP)

3.4.1 MaxEye CMMB USRP Play Waveform from File

This example reads the CMMB 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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3.4.1.1 TX USRP Configuration

TX USRP Configuration

USRP IP Address
192.168.10.3

carrier frequency
1.705G

IQ rate (S/s)
10M

gain
5

active antenna
TX1

Write Buffer (IQ Samples)
10000

Sample Width
8-bit

USRP IP Address – IP address of the NI USRP

Carrier Frequency – Center Frequency of the CMMB 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.

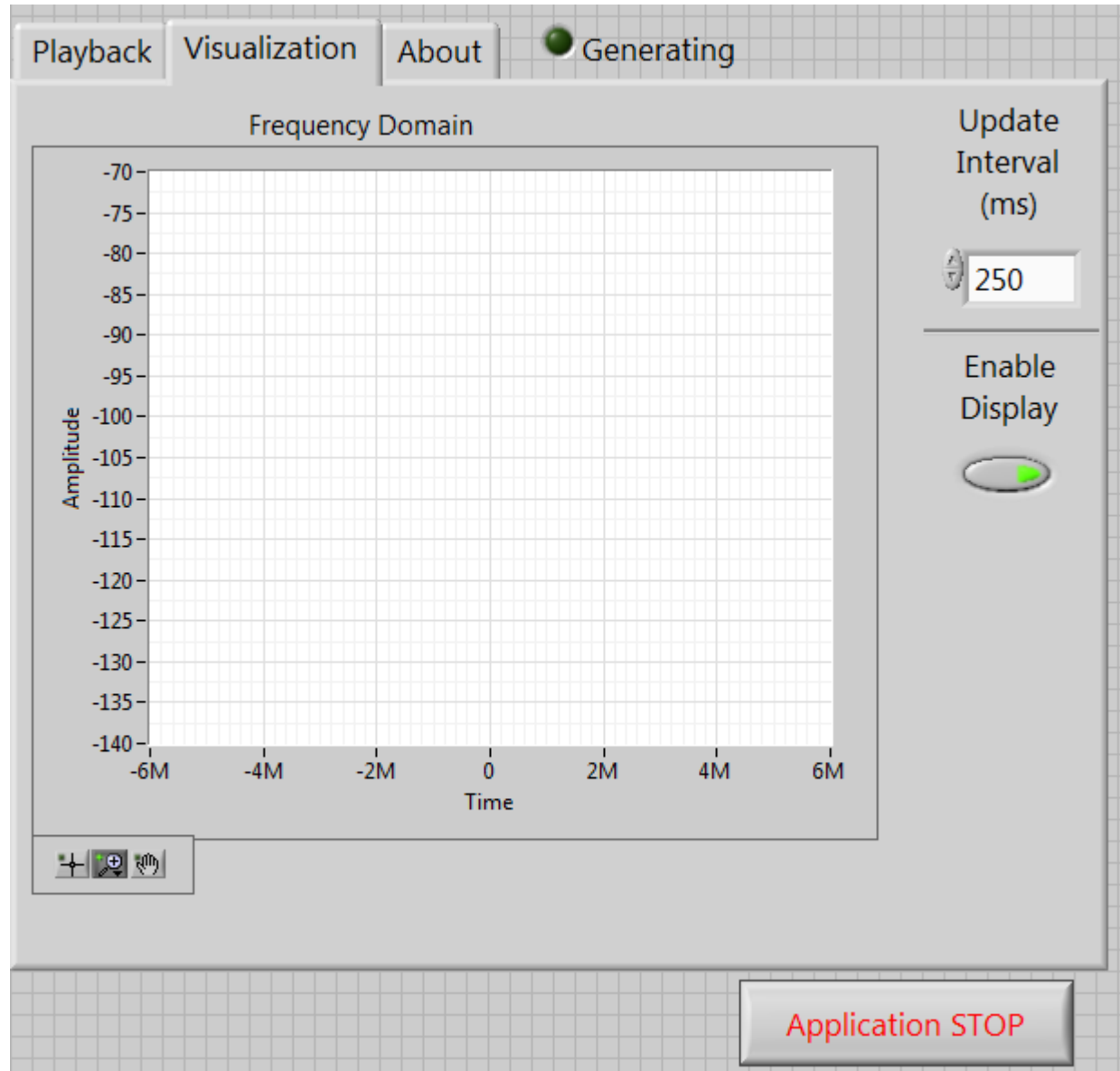
Active Antenna, Gain, Expected Peak, coerced IQ rare, coerced carrier frequency, and coerced gain
– Refer NI USRP help file.



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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.



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