M42h 96G Video Analyzer/Generator

for HDMI® Testing

User Guide

Rev: 1

Table of Contents

1 About the M42h 96G Video Analyzer/Generator

1.1 Important Notes About this User Guide

This User Guide is based on the functionality of the M41h. Many of the functions described in this User Guide are not yet implemented in the M42h product but will be in a future release. In most cases, the features that are not currently supported, are noted in the main sections of this document. Also, please consult the Release Notes on the Software Downloads page for details on which functions are supported by any current release.

The Advanced Test Platform (ATP) GUI User Interface look and feel has changed somewhat but the content of the screens and arrangement of the elements are primarily the same. Overtime, all ATP GUI screens in this User Guide will be replaced with newer screen examples.

1.2 Scope of this User Guide – What is Not Covered in this User Guide

This User Guide documents the operation of the M42h 96G Video Analyzer/Generator. It is intended to be used with the M42h Quick Start Guide.

The User Guide describes the features and functions of the M42h 96G Video Analyzer/Generator as operated through the ATP Manager. The screen shots used are usually from the most current release of the ATP Manager. In some cases, there are functions of the external ATP Manager that will be covered in detail as well. These include: 1) provisioning the IP address of the M42h; 2) viewing the incoming video content from a source device; 3) viewing the incoming HDMI video metadata and DDC transactions in real time.

This User Guide does not cover procedures for **Compliance Testing**, one of the features of the M42h. The procedures for HDMI compliance testing are covered in the HDMI Forum MOIs.

2 About the M42h 96G Video Analyzer/Generator

2.1 Overview

This chapter provides an overview of the M42h 96G Video Analyzer/Generator and the ATP Manager features. The M42h 96G Video Analyzer/Generator is an analyzer and generator for testing HDMI 2.1 source and sink devices operating up to 600MHz TMDS character rate and up to 1485MHz pixel rate in FRL mode. It provides visibility into the HDMI protocol to help resolve common interoperability problems in HDMI® systems. The M42h 96G Video Analyzer/Generator parses HDMI streams from source devices with an FRL data rate of 96Gb/s.

The M42h 96G Video Analyzer/Generator enables you to specify the type of data that you want to capture. This could be:

- Data Analysis (Audio, Video, Data Island) - The M42h will capture all the audio packets, video data and the data islands, timing data and auxiliary data and show them encapsulated into the Fixed Rate Link (FRL) packets.
- Fixed Rate Link (FRL) Data Analysis - The M42h will capture the Fixed Rate Link (FRL) data and show the underlying TMDS data elements.
- TMDS Data Analysis - The M42h will only capture the data islands and video frames.
- Protocol Analysis – The M42h will capture the TMDS and Fixed Rate Link (FRL) protocol data such as the preamble and guard band data.

The ATP Manager is a GUI used to manage the M42h 96G Video Analyzer/Generator.

2.2 What Makes the M42h 96G Video Analyzer/Generator Unique?

The M42h 96G Video Analyzer/Generator analyzer provides visibility into the HDMI FRL and TMDS protocol, timing, control, and auxiliary data of incoming video stream from an HDMI 2.1 source device. It captures and decodes encrypted or unencrypted metadata (audio sample, InfoFrames, and other data packets) as well as HDMI DDC transactions.

2.3 What Options are Available with the M42h 96G Video Analyzer/Generator?

There are several options available with the M42h 96G Video Analyzer/Generator. You can purchase the M42h as a base level system with both video analysis and video generation function or you can purchase the M42h with only the video analysis function or only the video generation function. You can upgrade the video analysis-only or the video generator-only configurations to the full M42h base functionality using the available upgrades:

- Enhanced source functional testing (includes deep capture analysis, DSC functional testing Cable ID, HDR10+ CT, CEC, UHDA & Gaming compliance testing)
- Enhanced sink functional testing (includes DSC functional, Cable ID, CEC, HDR, Gaming compliance testing)
- Aux Channel Analyzer passive monitoring function for DDC channel
- eARC functional testing for Tx
- eARC functional testing for Rx
- eARC compliance testing for Tx
- eARC compliance testing for Rx
- TMDS source compliance testing
- TMDS sink compliance testing
- FRL, FEC, DSC source compliance testing
- FRL, FEC, DSC sink compliance testing
- HDCP source compliance testing
- HDCP sink compliance testing

Procedures for using these options are provided herein except for the FRL compliance tests which are described in the MOIs and available through the HDMI Forum.

2.4 Changes to this User Guide

This is a new User Guide.

2.5 M42h ATP Manager GUI

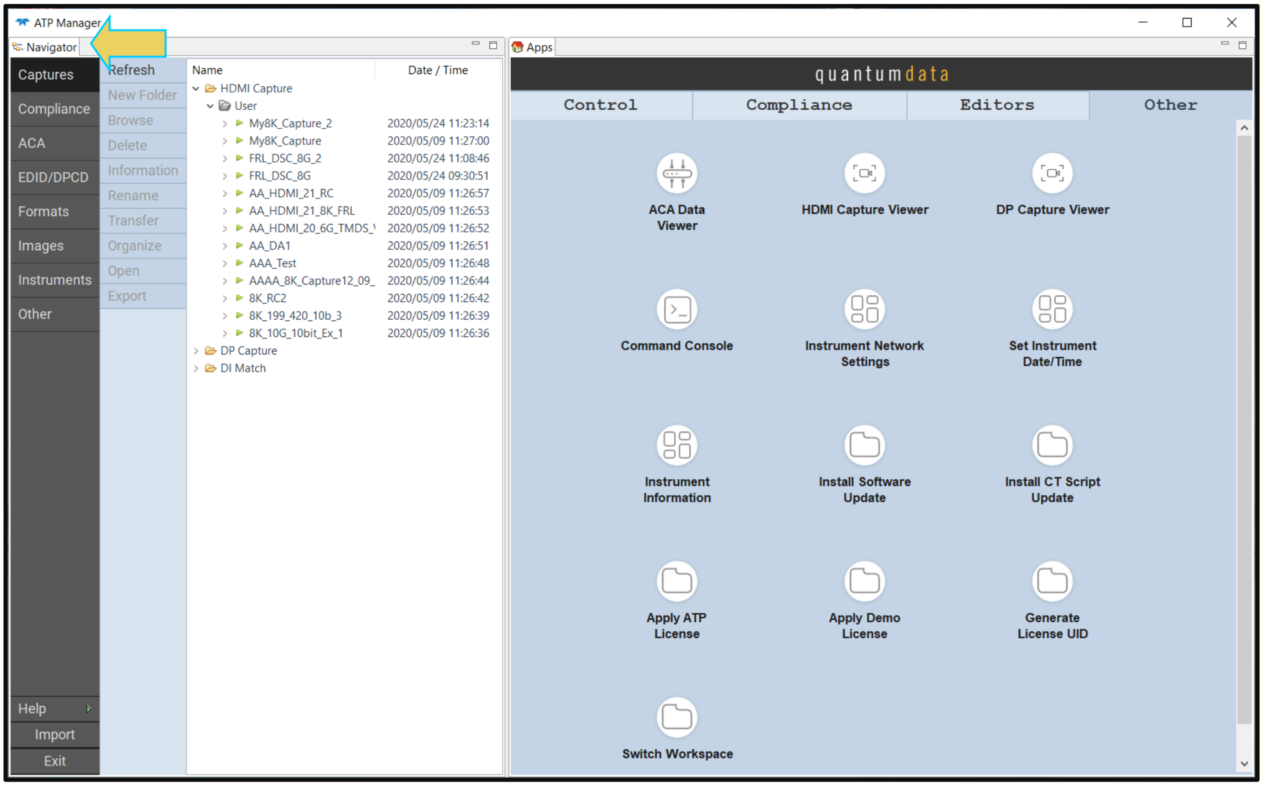
The M42h provides a graphical user-interface, ATP Manager, for operation. This GUI can run both on the M42h instrument itself (embedded ATP Manager) through external display or as a standalone application running on a PC (external ATP Manager). The look, feel, and functions are similar but not identical. The ATP Manager GUI is covered in detail in **Chapter 3**. The following provides the basic differences between the embedded and external screen layouts.

2.5.1 ATP Manager

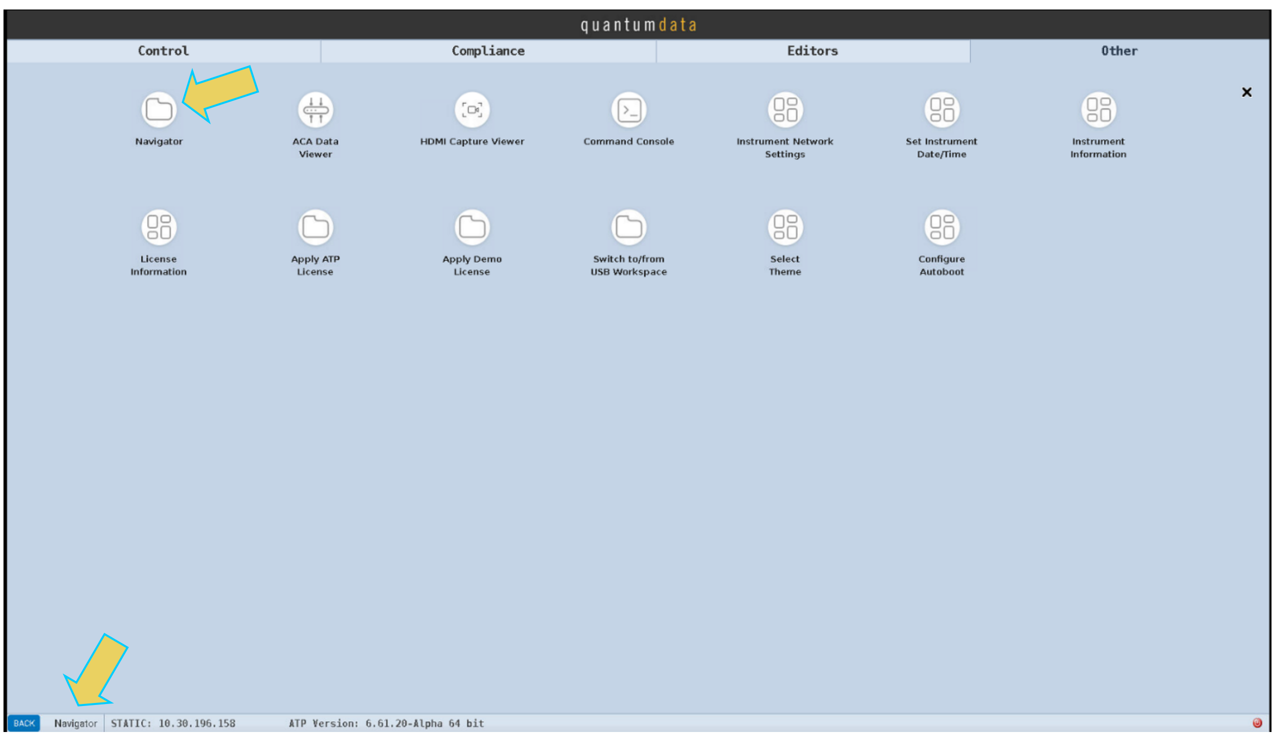
The external ATP Manager provides easy access to the captured data on your PC for sharing with others. It enables you to operate the M42h through a larger interface which allows you to use multiple panels at the same time.

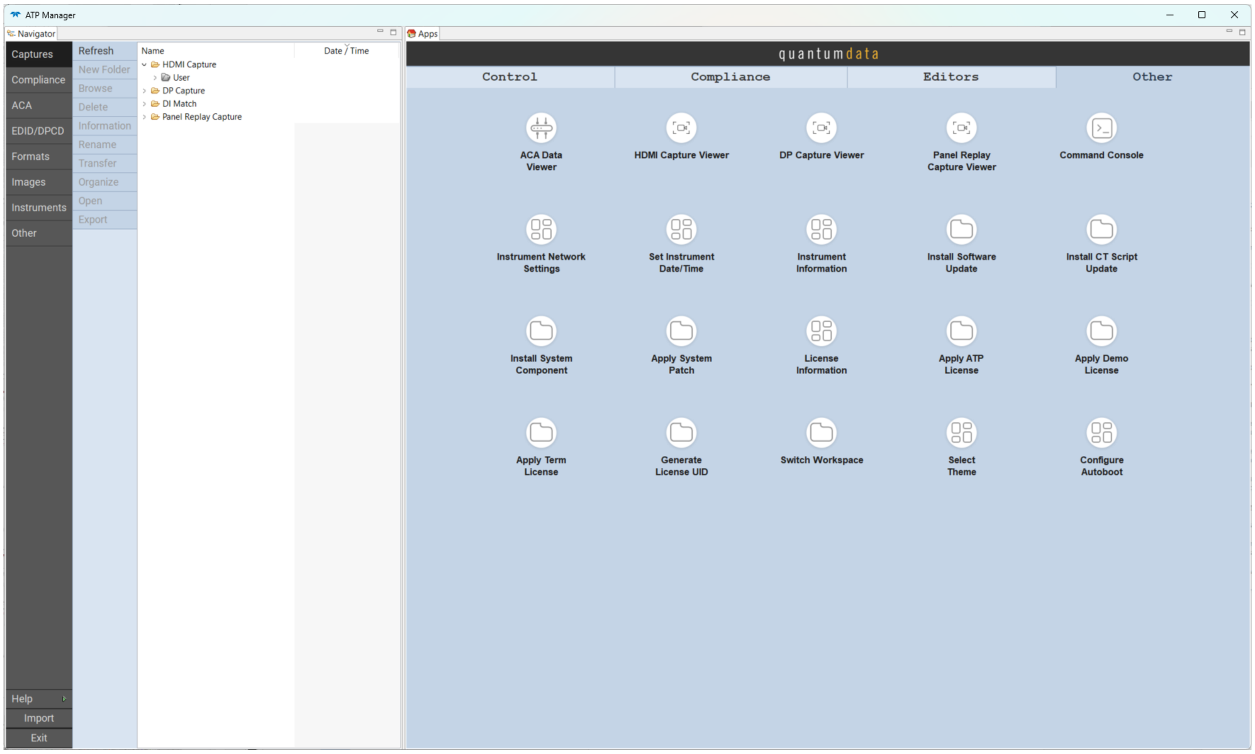
2.5.2 External ATP Manager and Embedded ATP Manager Screen Layout Differences

There are a few differences in the layouts between the *embedded* ATP Manager running on an external display and the *external* ATP Manager running on a host PC. The primary difference is the **Navigator** panel which enables you to access the data elements and test results from an instrument. On the PC-installed (external) ATP Manager, the **Navigator** panel is always present on the left side of the **ATP Manager** home screen as shown below.

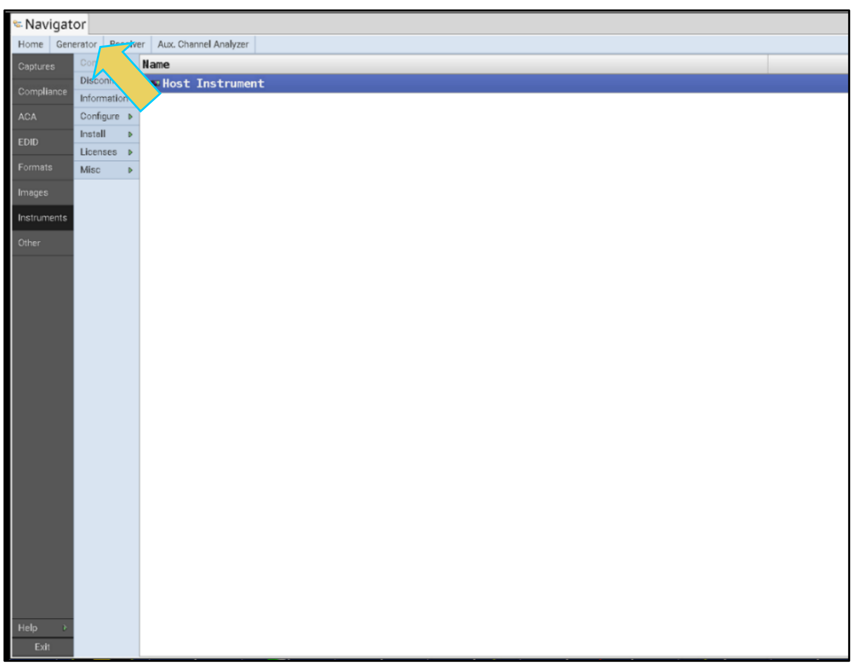


In the embedded ATP Manager (displayed on an external monitor), the **Navigator** screen must be opened from the **Apps** (Home) screen. The **Navigator** application can be accessed either from the **Navigator** icon on the **Other** page of the **Apps** screen, or from the **Navigator** button located in the lower left corner of any screen. See the below image of the embedded ATP Manager home screen.

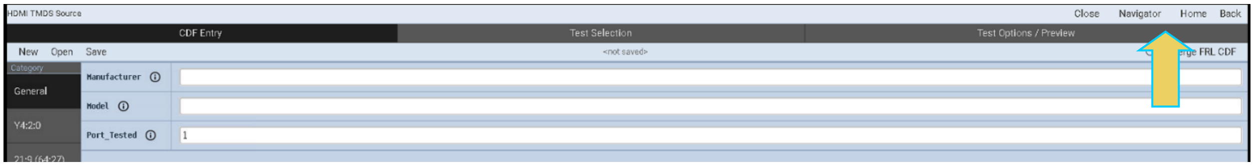




From the **Navigator** screen, return to the Apps (home) screen by clicking the **Home** button in the upper left corner. See the below image.



Within the numerous embedded ATP Manager screens, the **Navigator** and **Home** buttons typically appear in the upper right corner. See the below image.



2.6 Types of Data the M42h Allows You to View

By providing visibility into the HDMI FRL protocol, and the underlying protocol, video and data island blocks as well as SCDC data during FRL link training data, the M42h 96G Video Analyzer/Generator enables you to detect changes and identify anomalies in the HDMI 2.1 signal. The following is a list of the data types you can view:

- Fixed Rate Link (FRL)
  - Fixed Rate Link packets
  - Character blocks
  - Super blocks
  - FEC blocks
- Active Video
  - Guard bands
  - Preambles
- Data Islands
  - Guard bands
  - Preambles
- DDC transactions
  - EDID
  - SCDC
- Control data (Vsync, Hsync, encryption enable)
- eARC data
  - Common mode setup transactions
  - Differential mode LPCM and compressed audio.

3 Getting Started

The following sections provide instructions to get your M42h 96G Video Analyzer/Generator up and running. This User Guide should be used in conjunction with the Quick Start Guide.

3.1 What is Shipped with the M42h 96G Video Analyzer/Generator?

When a Teledyne LeCroy quantumdata M42h is shipped, it contains the following additional items:

- AC Power Line Cord
- CE mark declaration
- High Speed/high quality HDMI® Cable Category 4
  Note: Use of the high-quality HDMI cable is noted within the procedures of this User Guide.
- Ethernet Cable
- Mouse
- Quick Start Guide

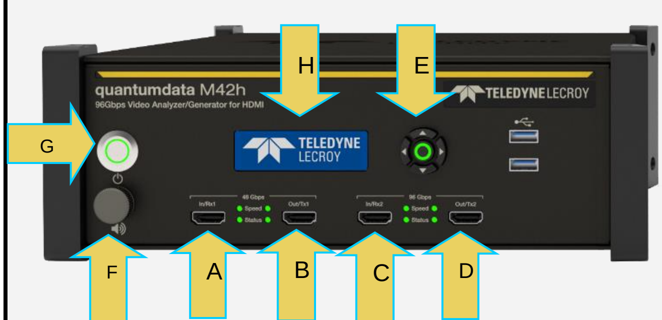
3.2 Getting the M42h Up and Running

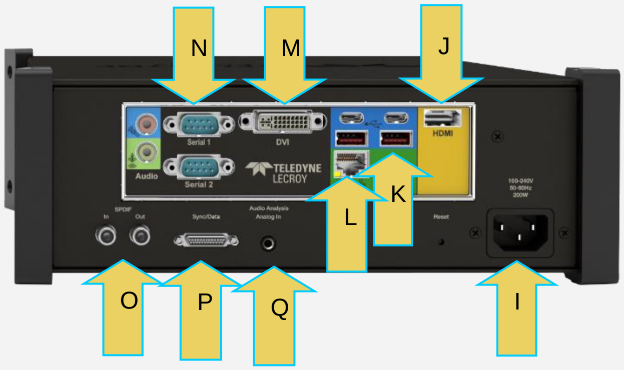
This section includes the following topics for interconnecting applicable components and making preliminary adjustments to optional operating modes.

- **Connector Description**
- **Set Up** (includes information regarding monitor selection)
- **Adjusting M42h Internal Fan Speed**
- **Changing the ATP Manager GUI Display Resolution**

3.2.1 Connector Description

The following table describes the connectors and controls on the M42h front and back panels.

<table>
<tr><th>M42h Configurations</th><th>Information / Function</th></tr>
<tr><td>Protocol Analyzer in M42h

</td><td>Front panel:
▪ A – HDMI 48G Rx port for analyzing HDMI 2.1 sources.
▪ B – HDMI 48G Tx port for testing HDMI 2.1 sinks.
▪ C – HDMI 96g Rx port for analyzing HDMI 2.2 sources.
▪ D – HDMI 96G Tx port for testing HDMI 2.2 sinks.
Note: LEDs (described in subsection 2.2.2 below).
▪ E – USB ports (2) used for connecting a mouse and keyboard.
▪ F – Volume knob for adjusting the internal speaker level. Used for eARC Rx audio only.
▪ G – Power button, press for on/off. See Note following table.</td></tr>
</table>

<table>
<tr><th>M42h Configurations</th><th>Information / Function</th></tr>
<tr><td>
</td><td>

- H – LCD Display (described in subsection 2.2.3 below).

Back panel:

- I – Power plug (100-240VAC 50/60Hz)
- J - HDMI – Admin port for connecting external HDMI UHD display for M42h ATP Manager.
- K - USB/USB-C (2 ea.) – For mouse & keyboard.
- L - RJ45 (2) - E1 Network for connecting host PC running ATP Mgr. E2 Aux – Not used
- M - DVI Not used.
- N - RS-232 (2) – Possible future use.
- O - Audio (2) – Possible future use.
- P – CrossSync – Possible future use.
- Q – 3mm Stereo Audio Jack Tip Ring Sleeve (future)

</td></tr>
</table>

Note: The M42h 96G Video Analyzer/Generator contains an internal speaker for audio monitoring. The speaker level is controlled by the front panel Volume knob. Audio monitoring and the volume control are specifically for eARC Rx audio.

3.2.2 M42h LEDs

- **Speed**: Red=TMDS, Green=FRL
- **Status**: Red=no HP/5V, Green=HP/5V

3.2.3 M42h LCD Display

The M42h is equipped with an LCD display.

- **Page 1** - IP Address and Release:
  M42h IP address e.g.: 10.211.177.50
  Release e.g.: example 7.46.02
- **Page 2** - Date:
  e.g.: Wednesday April 01, 2025
- **Page 3** - Format on 48G or 96G Tx port:
  e.g.: 3840x2160p60 RGB
- **Page 4** - eARC status on 48G or 96G Tx port:
  e.g.: disabled

- **Page 5** – 48G or 96G Rx Port configuration:
  e.g.: TMDS
- **Page 6** - eARC Tx configuration on 48G or 96G Rx:
  e.g.: enabled
  L-PCM 48kHz,24-bit,2ch
  6.144MHz clock

3.2.4 Set Up and Power On

The following procedure describes how to interconnect the applicable components to get your M42h 96G Video Analyzer/Generator up and running in the embedded ATP Manager configuration.

1. Remove the M42h from the shipping box and lay it flat or upright on your desktop or benchtop.

Flat Positioning

Upright Positioning

2. Connect the provided power cable to the M42h rear panel and to a suitable outlet (110-240V 50/60Hz) (see **G** in the previous **Connector Description** table).
3. Connect an external HDMI monitor to the **HDMI** connector on the M42h rear panel labeled: **to External Monitor** (see **H** in the previous **Connector Description** table).

   Important Note: You can connect a wide variety of displays to the HDMI admin port on the back of the M42h. However, if the incoming video from the source device under test is content protected with HDCP 2.3, then you must connect a display that supports HDCP 2.3 in order to see the incoming video in the Real Time window. You will receive a notification informing you of this.

   Selection of External Monitor:

   Due to HDCP content protection requirements, you will have to use an HDCP 2.2 or 2.3-enabled monitor to view HDCP protected content in the external ATP Manager. The following displays comply:

   - Dell UltraSharp 27” Monitor Model U2718Q.

- Dell UltraSharp 27” 4K Monitor Model U2720Q.
- ViewSonic 27" 4K UHD Monitor Model VX2776-4K-MHD.
- Acer 27” Monitor Model KW272U

For an up-to-date list, refer to the latest revision of the Quick Start Guide on the M42h product page https://teledynelecroy.com/protocolanalyzer/quantumdata-M42h.aspx.

The monitor setup is depicted below.

4. Connect a mouse to one of the USB ports on the front or rear panel of the M42h.
5. Optionally connect a keyboard to one of the other USB ports on the front or rear panel of the M42h. You can also use the virtual keyboards that present themselves in the ATP Manager.

You can fully operate the M42h through the *embedded* ATP Manager using this connection scenario with a keyboard, mouse, and external monitor. However, there is an alternative way with the *external* ATP Manager application running on a host Windows PC. You can operate the M42h from the external ATP Manager installed on a host PC as described in **Section 2.3**.

6. Power up the M42h via the power button on the front of the M42h.

The ATP Manager application will appear on the external display as shown below.

The M42h 96G Video Analyzer/Generator uses sink emulation with its HDMI Rx port connected directly to the source device under test. In the sink emulation mode, you monitor the HDMI transactions between the source device under test and the M42h 96G Video Analyzer/Generator’s Rx port.

Note: Use the high-quality HDMI cable provided with the M42h to interconnect the HDMI source or sink device under test.

Connect your HDMI source or sink device under test to the appropriate In/Rx or Out/Tx port on the front of the M42h. The connection for an HDMI source DUT is shown below.

3.2.5 Adjusting M42h Internal Fan Speed

Once the hardware is set up with an external display connected directly, you may optionally adjust the internal fan on the M42h unit from its full speed setting (default) to the standard speed.

Full Speed mode is enabled by default to meet the specification of maximum operating ambient temperature of 40°C. Full Speed is necessary for operating at ambient temperature between 30°C and 40°C. If you will be operating the unit at less than 30°C (86°F), you may safely change the fan to Standard Speed mode, which is quieter than the Full Speed setting.

Note: This procedure needs to be done on the M42h instrument itself using a display connected to the M42h with a keyboard connected to the USB-A port of the instrument.

The procedure for adjusting fan speed is as follows:

1. If not already off, power down the unit by pressing the power button once.
2. Once completely shut down (power button light is red), power the unit on by pressing the power button again.
3. While booting up, press the DEL key repeatedly to place into BIOS mode.

4. Once in BIOS mode, use the right arrow to select Advanced tab.
5. Use the down arrow to select NCT6106D HW monitor, and press Enter.
6. Press Enter again to select Fan Speed Control Mode.
7. Use up/down arrow keys to select Standard and press Enter
8. Press F4 key to prompt the Save & Exit Setup dialog box.
9. Press Enter to save configuration and exit.

The device will automatically reboot normally with the lower fan speed setting.

3.2.6 Changing the ATP Manager GUI Display Resolution

You can change the resolution that the ATP Manager GUI is displayed on the connected monitor using the Mint Linux utilities by following these steps:

1. Click on the lower right corner icon to access **Shutdown** menu. Under **GUI Application** click on the **Close** button. The ATP Manager GUI will close.
2. Once the ATP Manager is shutdown, click on the Mint icon (green **M**) on the lower left corner of the monitor to access the Mint Linux Controls.
3. Select the **Settings** primary menu on the left; on the right select **Display Configuration** secondary menu. The **Display Configuration** menu appears.
4. Set the resolution to **1080p** using the **Resolution** pull-down menu.

The resolution should change and persist through a reboot.

3.3 Managing the M42h with ATP Manager From a PC.

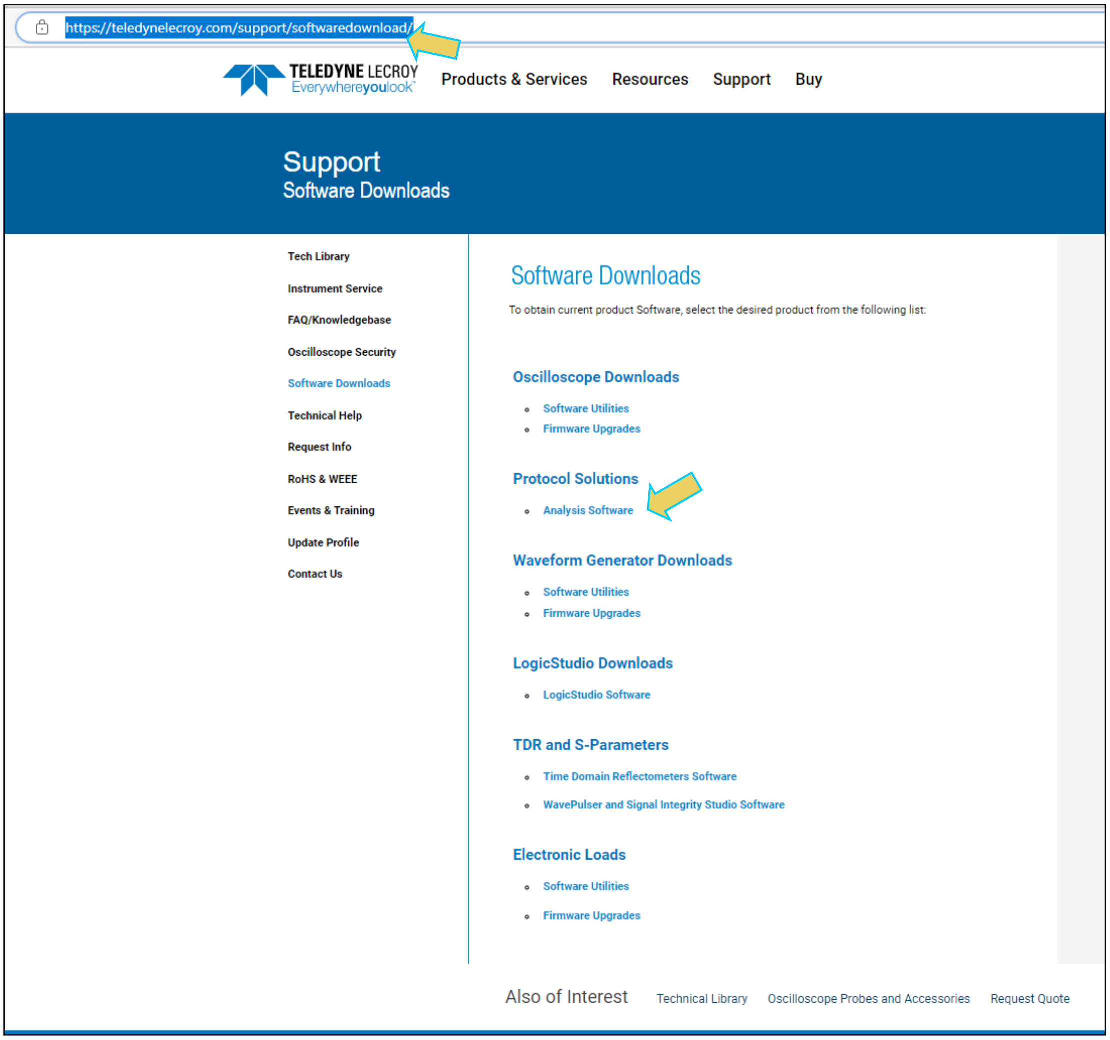
You can operate the M42h from the ATP Manager application installed on a host PC. You will have to first download and install the ATP Manager GUI application on your Windows PC. You will then need to connect your PC to the M42h over an Ethernet IP connection. These procedures are provided below.

3.3.1 Install the M42h ATP Manager GUI Application

Note: You must complete the procedures above before performing the following steps.

This procedure describes how to install the ATP Manager application on your host PC and connect to the M42h.

1. Download the ATP Manager GUI application from the quantumdata downloads page: https://teledynelecroy.com/support/softwaredownload/. Double click on ATP Manager 7.50 (or the latest release) and follow the installation prompts to install the ATP Manager on your Windows PC.

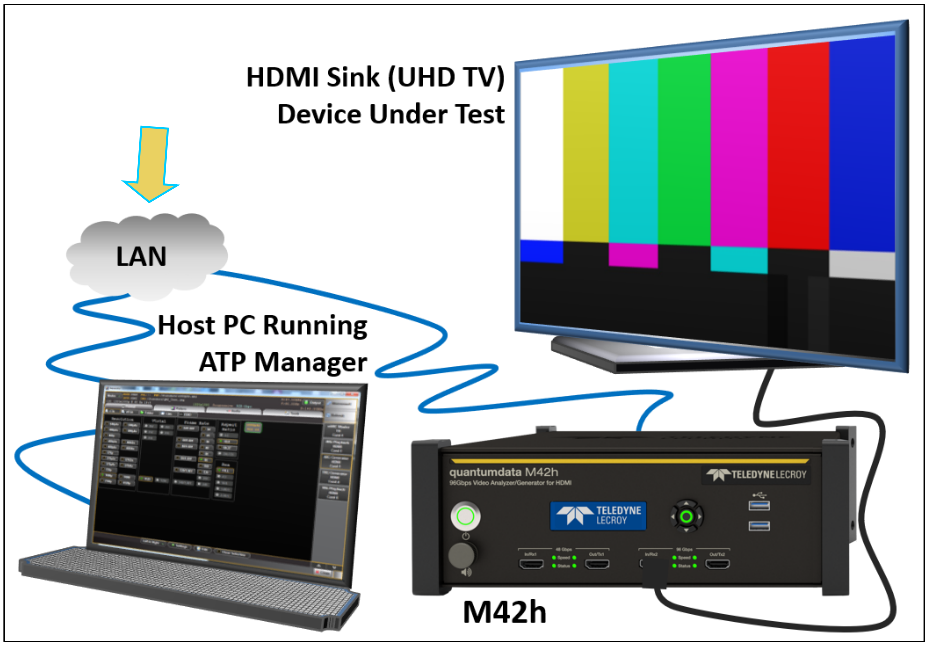


2. After installation completes, run the new ATP Manager. It should be available in the **Start** menu under **All Programs** → **Quantum Data**, and from an icon on your Desktop.

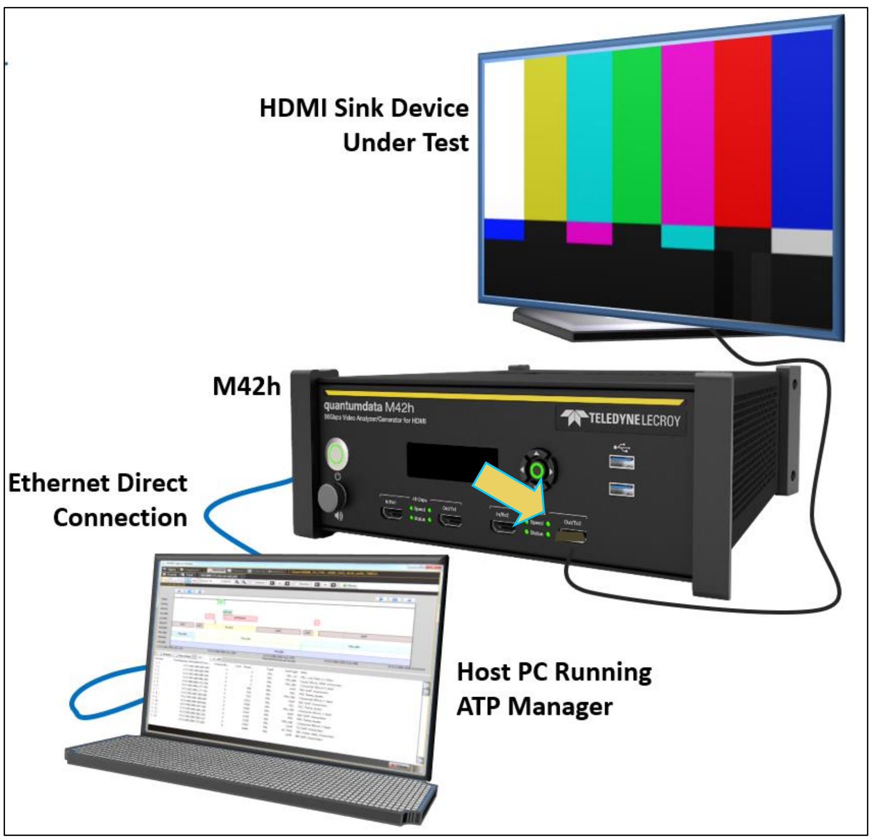
   Note: Verify that the version number in the title bar matches the version on the website.

3. Connect your PC to the M42h using an Ethernet cable. The connection is made to the Rj45 jack on the back of the M42h labeled E1 to Network as shown below.

The Ethernet IP connection from the host PC to the M42h can be accomplished through your corporate network or you can connect directly. Both scenarios are depicted in the images below.

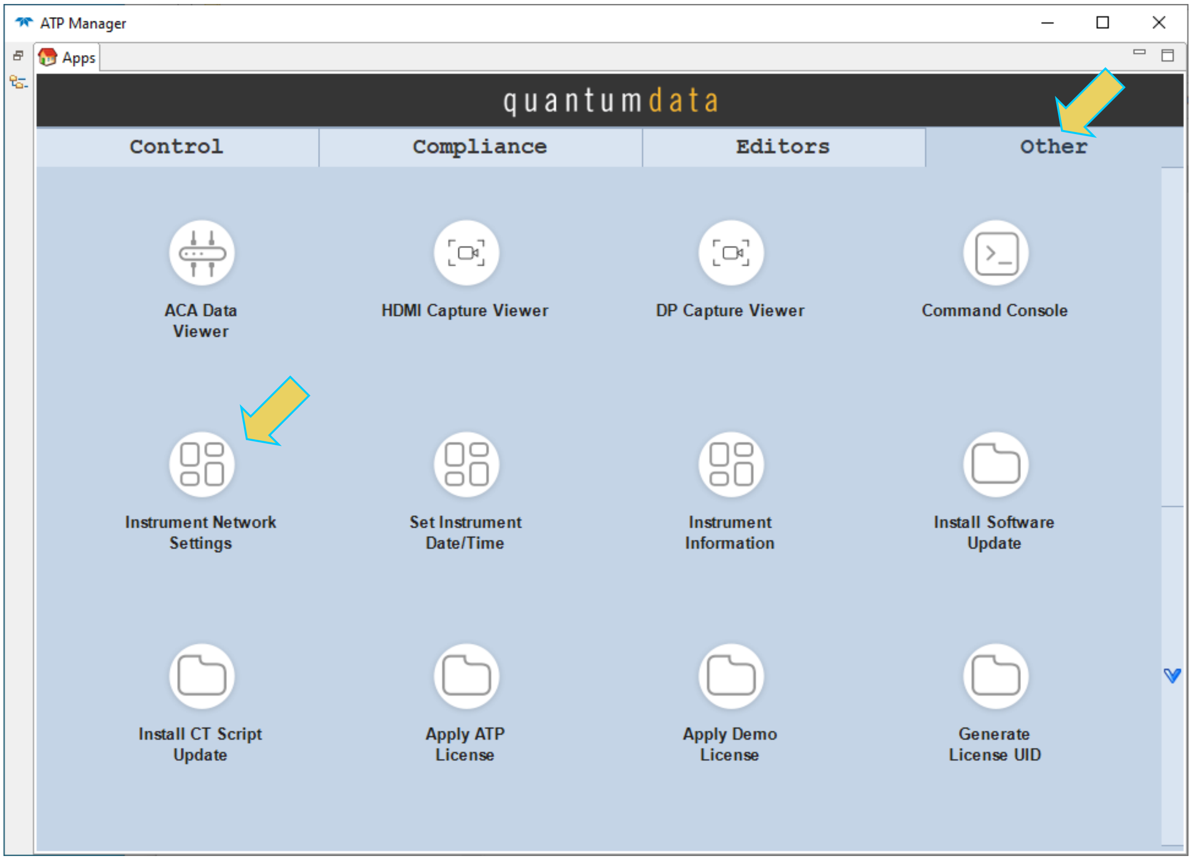


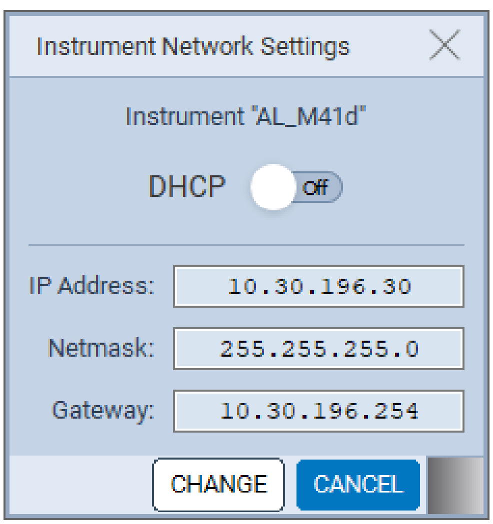
PC Running ATP Manager w/ Ethernet Connection thru Corporate LAN



PC Running ATP Manager with Ethernet Direct Connection

4. From the **Other** page on the **Apps** panel of the **ATP Manager** screen, select the **Instrument Network Settings** application. A dialog box appears enabling you to set DHCP or specify an IP address. Sample screen shots of these windows are shown below.

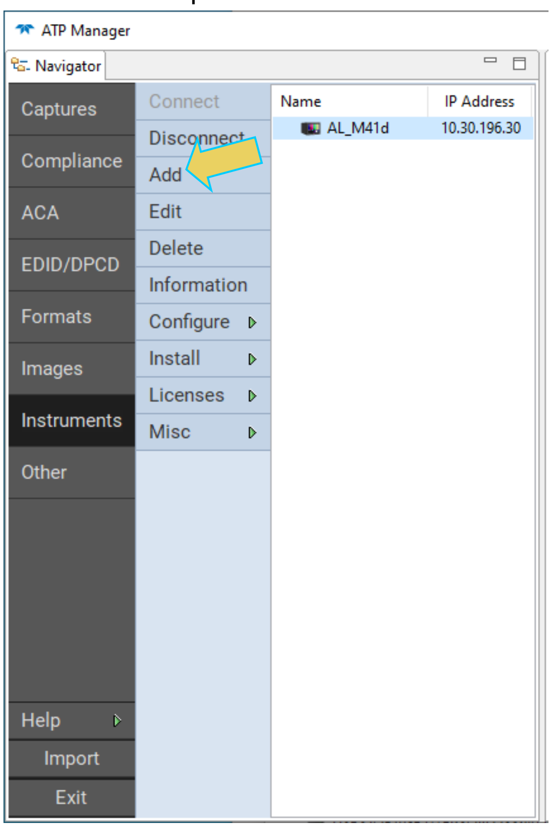




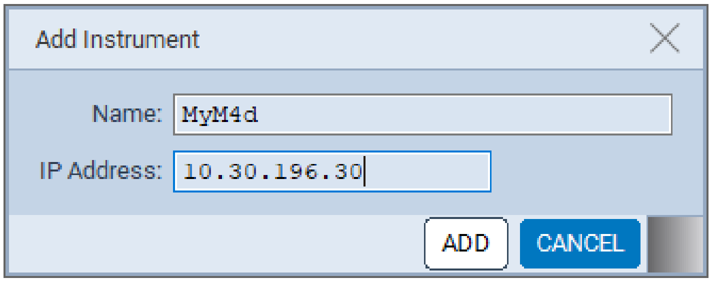
5. Ensure **DHCP** is toggled **Off** and enter the IP address. Click the **CHANGE** button.
Note: Be sure to use an IP address that is compatible with your corporate LAN or with your PC if you are connecting directly.

6. Power cycle the M42h with the power button on the front panel.

7. A dialog box will appear on the ATP Manager. Select **Shutdown**. Wait five seconds and reapply power.
8. Add your M42h to the ATP Manager application using the green + Add icon or the + Add item on the Instrument pull-down menu identified below.

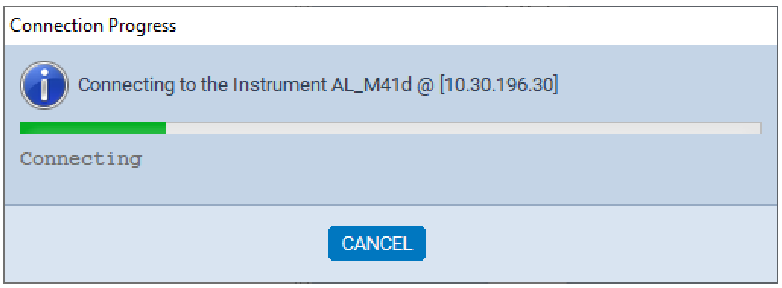


The **Add Instrument** dialog appears enabling you to enter the name and IP information for the M42h that you are trying to connect to (below).



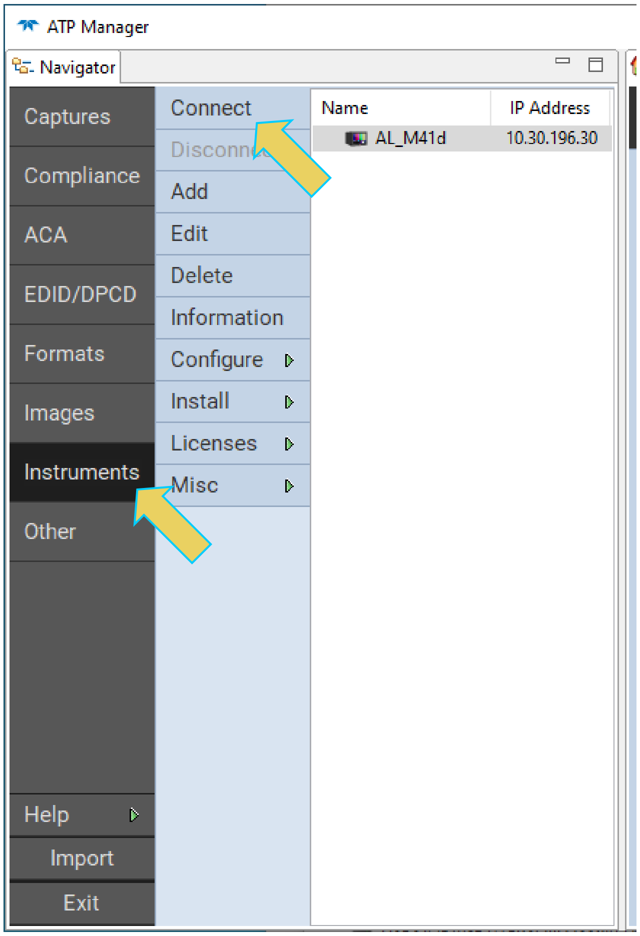
9. Enter the name (any suitable name) and IP address of the M42h that you want to connect to in the **Add Instrument** dialog box (above) and click on the **Add** activation button.

   You will see a series of messages on dialog boxes providing the progress. One example is shown below:

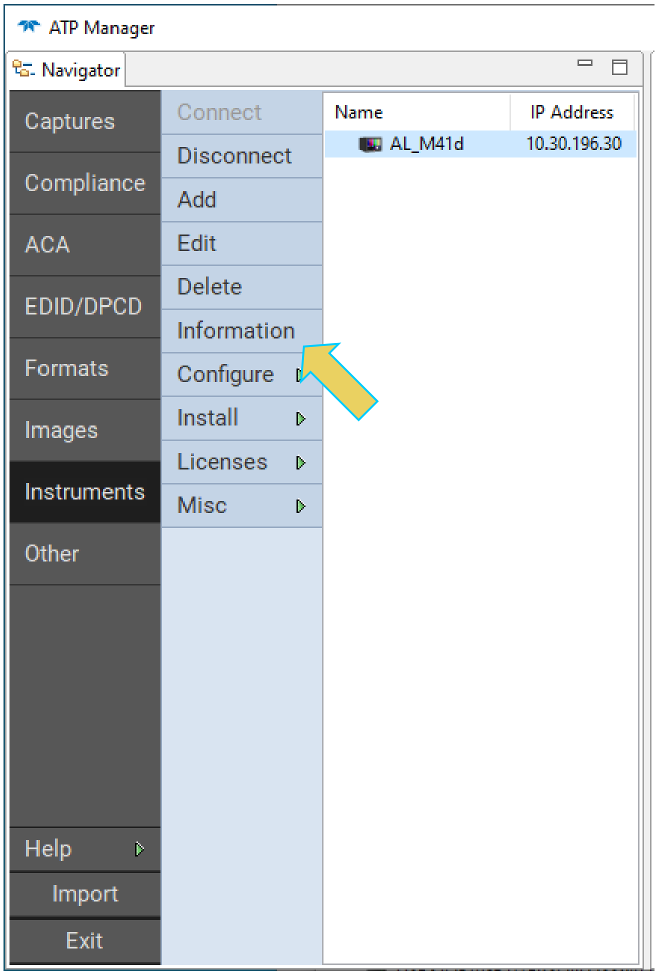


   The M42h with the IP address you entered appears on the list in the **ATP Navigator** panel. The ATP Manager application will automatically connect to the M42h once you add the M42h to the application.

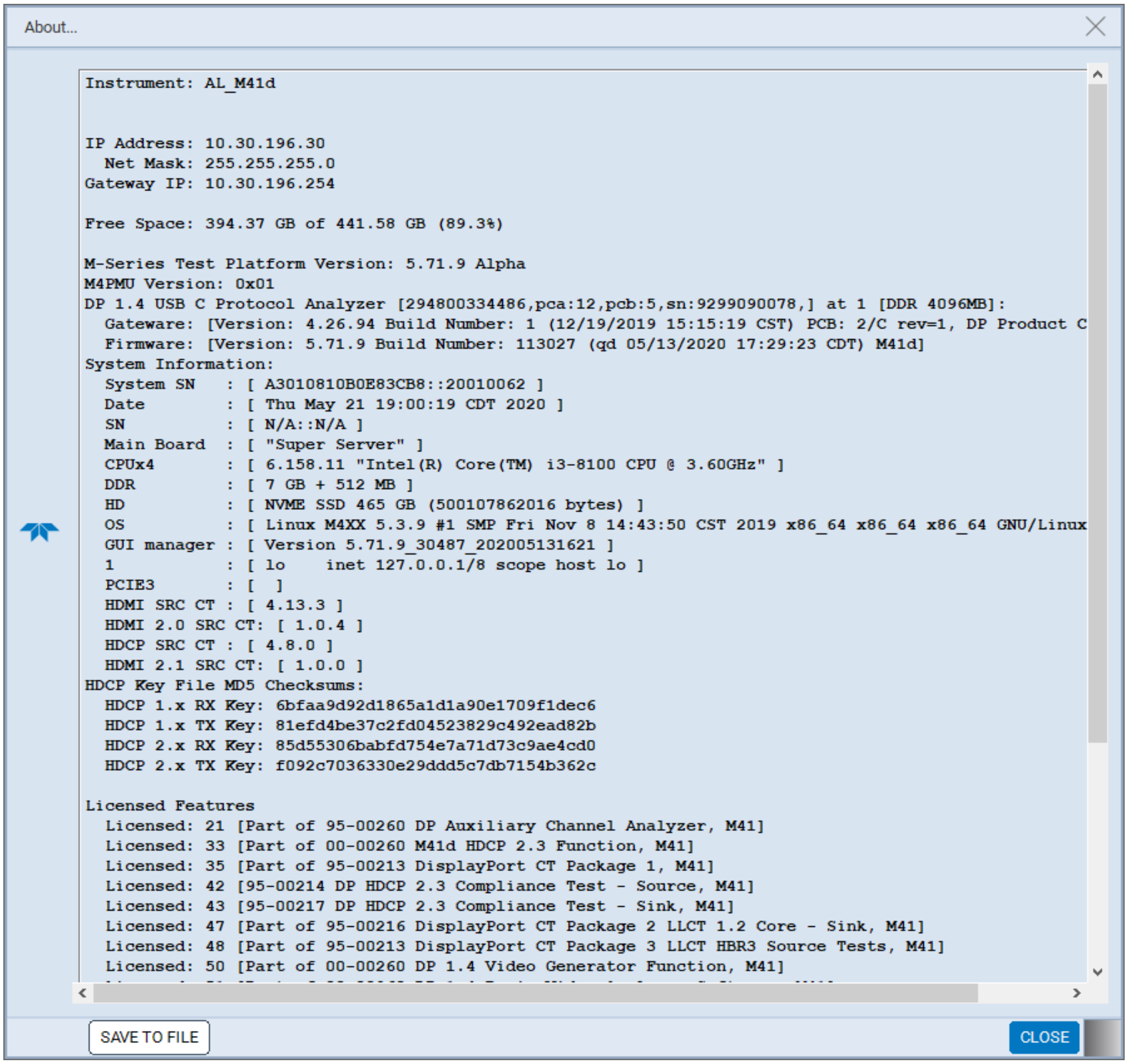
10. If not already connected, connect to the M42h using either the **Connect** icon or the **Connect** item on the right click menu as shown in the screen below. Note that you can also double click on the M42h in the **Instrument** dialog box to initiate a connection.


ATP Manager
Navigator
Captures
Compliance
ACA
EDID/DPCD
Formats
Images
Instruments
Other
Help
Import
Exit
Connect
Add
Edit
Delete
Information
Configure
Install
Licenses
Misc
Name
IP Address
AL_M41d
10.30.196.30

Once the connection is made the information about the connected M42h is available via the right click menu as shown below.



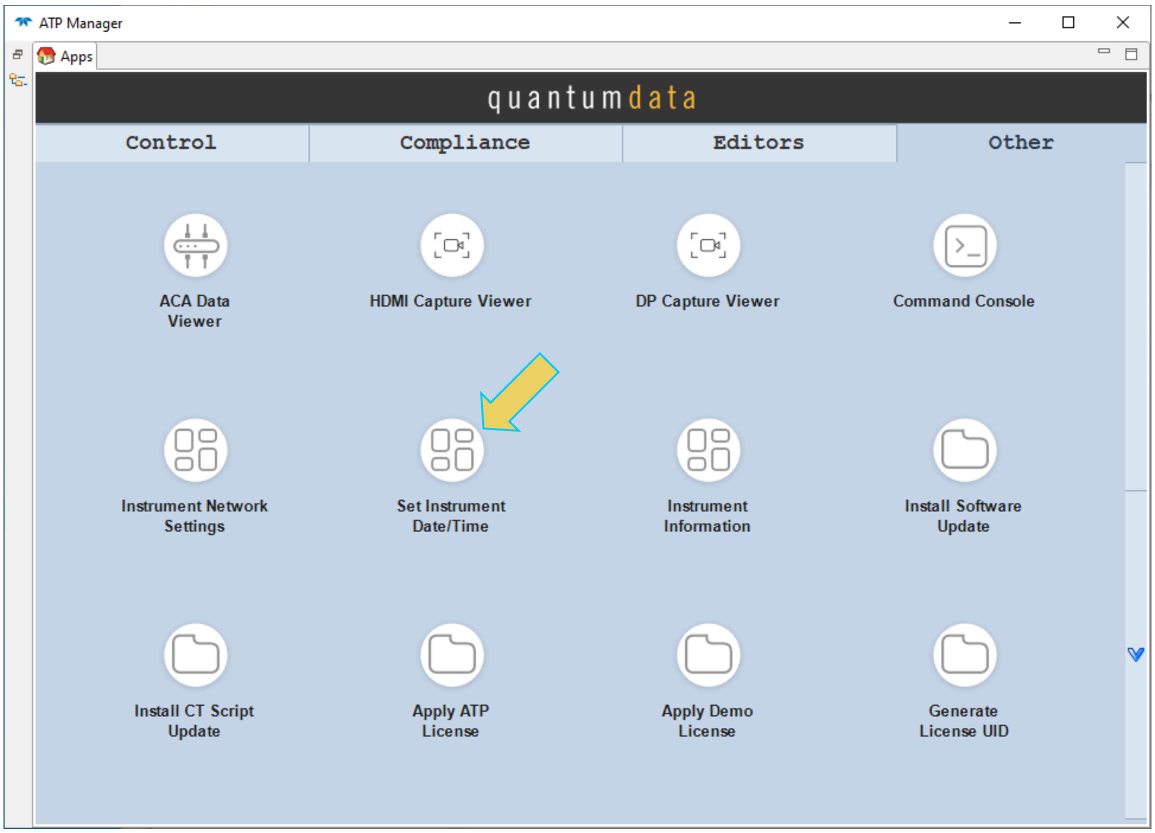
The information is then displayed in a separate window. The information on the **About…** window tells you the firmware and hardware release and version information as well as what options you have. This information will be helpful if you call quantumdata customer support during an upgrade process.



3.3.2 Setting the Instrument Date and Time

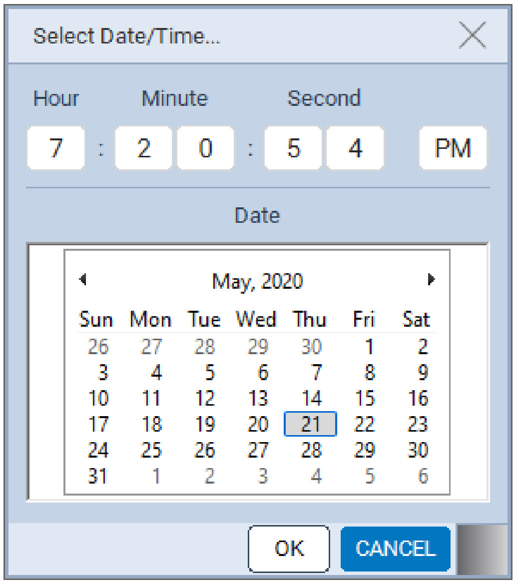
This procedure describes how to set a ATP Manager's data and time from your PC. The procedure assumes that you have connected to an M42h through the external ATP Manager.

1. From the **Other** page of the **Apps** (home) screen, select **Set Instrument Date/Time**.



The **Select Date/Time**… dialog box appears as shown below:

2. Set the time buttons and calendar.



3. Click **OK**.

3.4 M42h 96G Video Analyzer/Generator Operational Modes

3.4.1 Capture, Store and Post Analysis

The Capture and Post Analysis mode is the typical mode of operation and the mode used to analyze HDMI 2.1 data and is available both through the embedded GUI ATP Manager and the remote host PC ATP Manager. You can capture various sets of data: 1) Data islands, 2) Data islands with video and audio, 3) Control data and 4) DDC SCDC transactions.

3.4.2 Real Time Monitoring

The Real Time Monitoring mode enables you to view the incoming video and essential video and timing parameters. You can also view the metadata through the flyout panels. The Real Time mode works in for both TMDS and FRL modes. To view the incoming video in Real Time you need to connect an external monitor to the HDMI monitor port on the back.

3.4.3 M42h Data Analysis Capture Modes

The M42h 96G Video Analyzer/Generator can view different types of data in a capture and store application.

Fixed Rate Link (FRL) and Forward Error Correction (FEC) Analysis

The M42h 96G Video Analyzer/Generator will capture all the FRL and FEC protocol packets and elements and depict them graphically on the Event Plot and in table form in the Decode window. The underlying TMDS video and protocol elements such as the preamble and data island blocks are also shown.

3.5 M42h 96G Video Analyzer/Generator Analysis Configurations

The M42h 96G Video Analyzer/Generator uses sink emulation with its HDMI Rx port connected directly to the source device under test. In the sink emulation mode, you monitor the HDMI transactions between the source device under test and the M42h 96G Video Analyzer/Generator's Rx port.

Note: Use the high-quality HDMI cable provided with the M42h.

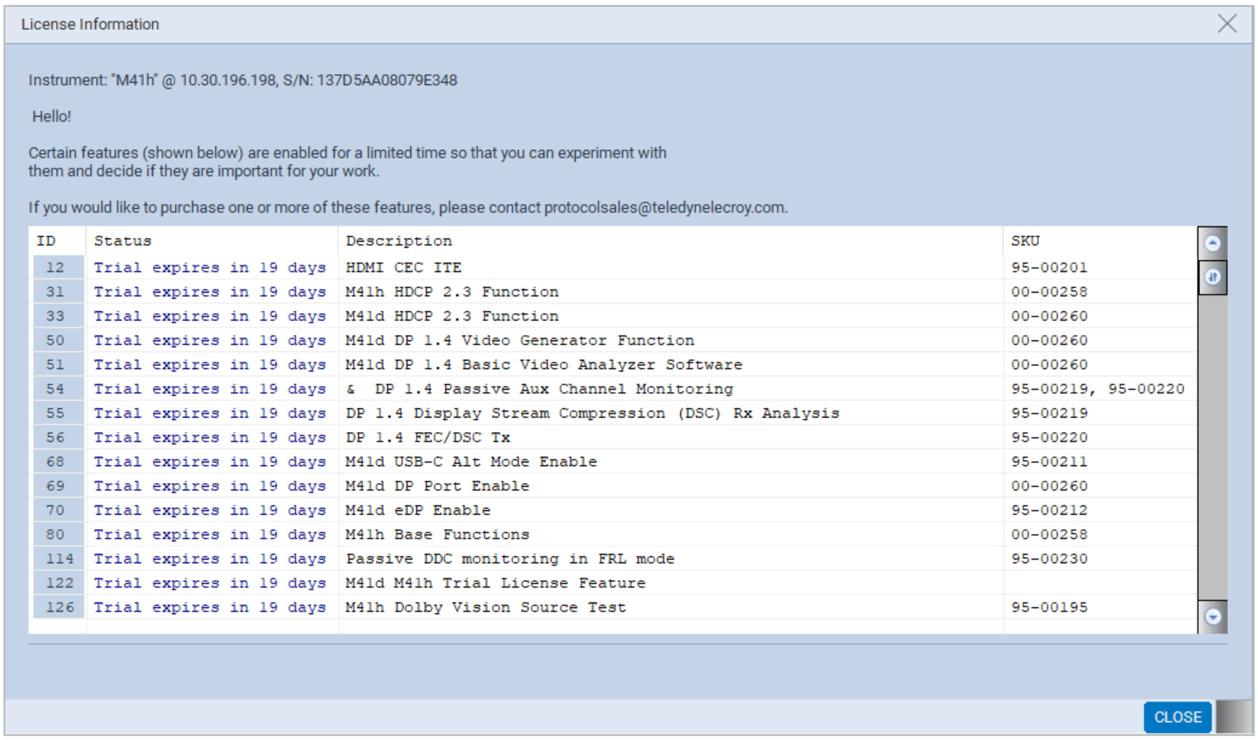
HDMI 2.1 Source Analysis Configuration – M42h ATP

3.6 Compliance Test Trial Licenses

Important Note: This function is not yet implemented on the M42h.

In addition to a demo license, the M42h includes a Compliance Test Trial License pre-loaded prior to shipment and functional upon first start-up.

This trial license offers users the ability to test specific Compliance Tests prior to purchasing the license required for full access to the Compliance Test Suite. The trial Compliance Test set includes various frequently used tests for each source and sink. The next subsection contains a table with a full listing of Compliance Tests offered within this trial.


License Information

Instrument: "M41h" @ 10.30.196.198, S/N: 137D5AA08079E348

Hello!

Certain features (shown below) are enabled for a limited time so that you can experiment with them and decide if they are important for your work.

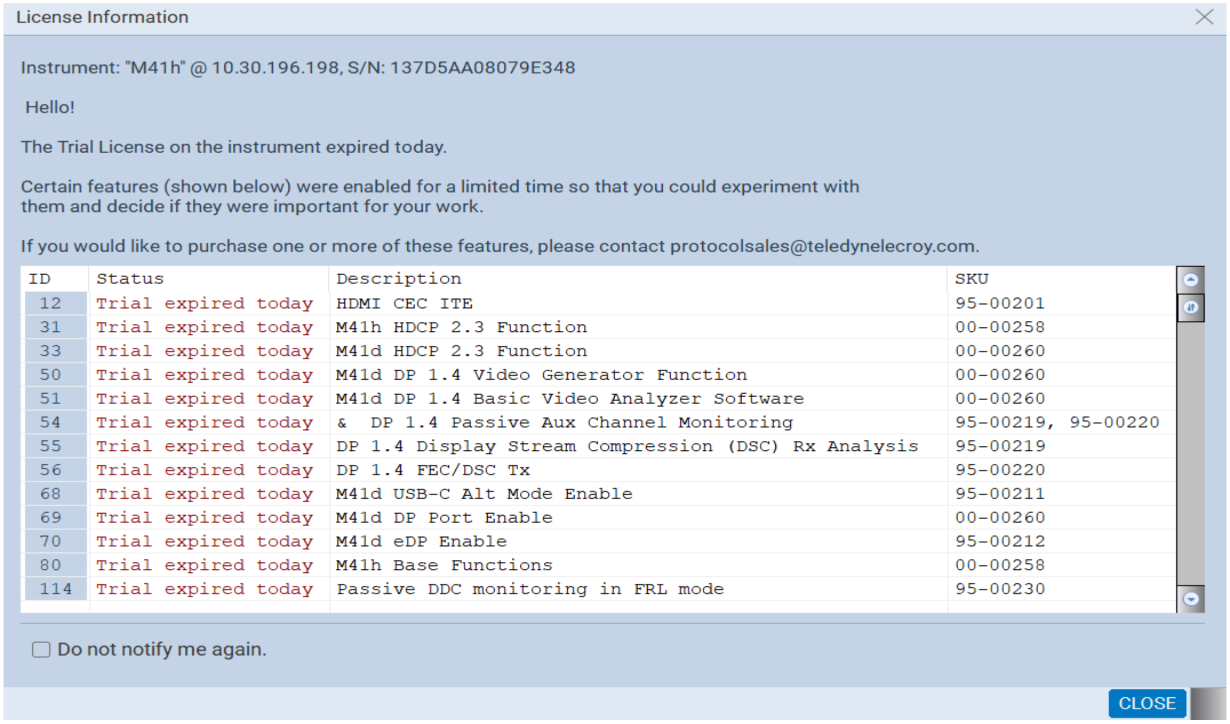
If you would like to purchase one or more of these features, please contact protocolsales@teledynelecroy.com.

ID	Status	Description	SKU
12	Trial expires in 19 days	HDMI CEC ITE	95-00201
31	Trial expires in 19 days	M41h HDCP 2.3 Function	00-00258
33	Trial expires in 19 days	M41d HDCP 2.3 Function	00-00260
50	Trial expires in 19 days	M41d DP 1.4 Video Generator Function	00-00260
51	Trial expires in 19 days	M41d DP 1.4 Basic Video Analyzer Software	00-00260
54	Trial expires in 19 days	& DP 1.4 Passive Aux Channel Monitoring	95-00219, 95-00220
55	Trial expires in 19 days	DP 1.4 Display Stream Compression (DSC) Rx Analysis	95-00219
56	Trial expires in 19 days	DP 1.4 FEC/DSC Tx	95-00220
68	Trial expires in 19 days	M41d USB-C Alt Mode Enable	95-00211
69	Trial expires in 19 days	M41d DP Port Enable	00-00260
70	Trial expires in 19 days	M41d eDP Enable	95-00212
80	Trial expires in 19 days	M41h Base Functions	00-00258
114	Trial expires in 19 days	Passive DDC monitoring in FRL mode	95-00230
122	Trial expires in 19 days	M41d M41h Trial License Feature	
126	Trial expires in 19 days	M41h Dolby Vision Source Test	95-00195

CLOSE

The Trial License comes pre-loaded on each instrument and is functional upon first-start up. The trial period takes effect when activated on the instrument during the manufacturing process. The trial license will last 30 days for domestic shipments and 45 days for non-domestic shipments, allowing ample time after receiving the instrument for utilization.

Time remaining on the trial period will be displayed upon startup of the instrument GUI. The following screenshot demonstrates the message received with an expired trial.



Note: In the event that shipment is delayed, or extenuating circumstances occur, please contact Teledyne-LeCroy PSG support for an extension/re-issuance of the trial license.

3.6.1 Accessible Tests with CT Trial License

Refer to the following table for a reference of the Compliance Tests included within the CT Trial License. The table includes the corresponding Compliance Test Suite (CTS) that would include the trial Compliance Test when licensed. Also shown are CTS SKU and License Key for a convenient reference when contacting Support for full licenses.

Trial Compliance Test	Corresponding Compliance Test Suite	CTS SKU	CTS License Key
HDMI TMDS Source	M42h HDMI TMDS Source CTS *(requires 00-00258 and 95-00195)*	**95-00305**	**2:25:38:81:88**
HDMI TMDS Sink	M42h HDMI TMDS Sink CTS *(requires 00-00258 and 95-00201)*	**95-00307**	**3:6:24:27:82:90**
HDMI FRL Source	M42h HDMI FRL & DSC Source CTS *(requires 00-00258 and 95-00195)*	**95-00304**	**66:78**
HDMI FRL Sink	M42h HDMI FRL & DSC Sink CTS *(requires 00-00258 and 95-00201)*	**95-00306**	**67:79**
HDMI eARC Tx	M42h HDMI eARC Tx CTS *(requires 95-00201 and 95-00204)*	**95-00311**	**59**
HDMI eARC Rx	M42h HDMI eARC Rx CTS *(requires 95-00195 and 95-00199)*	**95-00312**	**60**
HDMI HDCP 2.3 Tx	M42h HDCP 1.4 & 2.3 Source CTS *(requires 00-00258 and 95-00195)*	**95-00308**	**13:28:31:89**

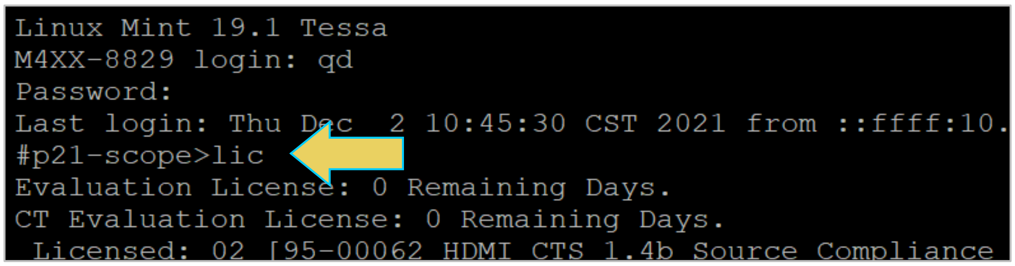
HDMI HDCP 2.3 Rx	M42h HDCP 2.3 Sink CTS *(requires 00-00258 and 95-00201*	**95-00312**	**29:31**

3.6.2 CT Evaluation License Information via Command Line

Easily determine the remaining time on the CT Trial License in the command line of the M42h. For procedures to access the instrument's command line, see the chapter on **Command Line Interface**.

Within the command line interface, simply enter the command **`lic`**

The resulting output will display two pertinent lines, indicating remaining days on the general Evaluation License as well as the CT Trial License, as shown below.



4 The ATP Manager

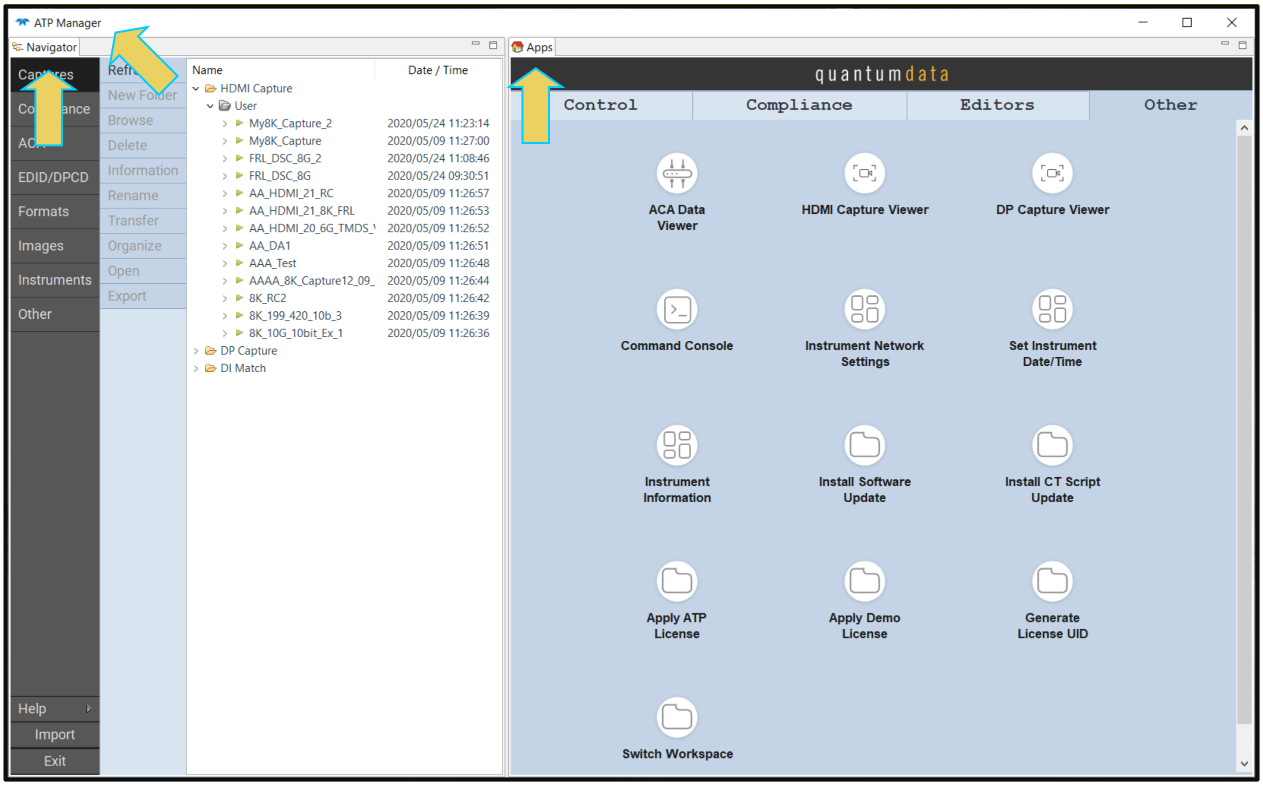
Important Note: Some of the features described in this Chapter are not currently supported, but will be in a future release of the M42h.

4.1 Overview

This chapter describes the ATP Manager panels on the external ATP Manager. The ATP Manager is an application that runs on your local PC. It enables you to examine the data captured by the M42h 96G Video Analyzer/Generator through a user-friendly graphical interface.

Note: The M42h embedded ATP Manager displayed on a connected monitor works almost identically.

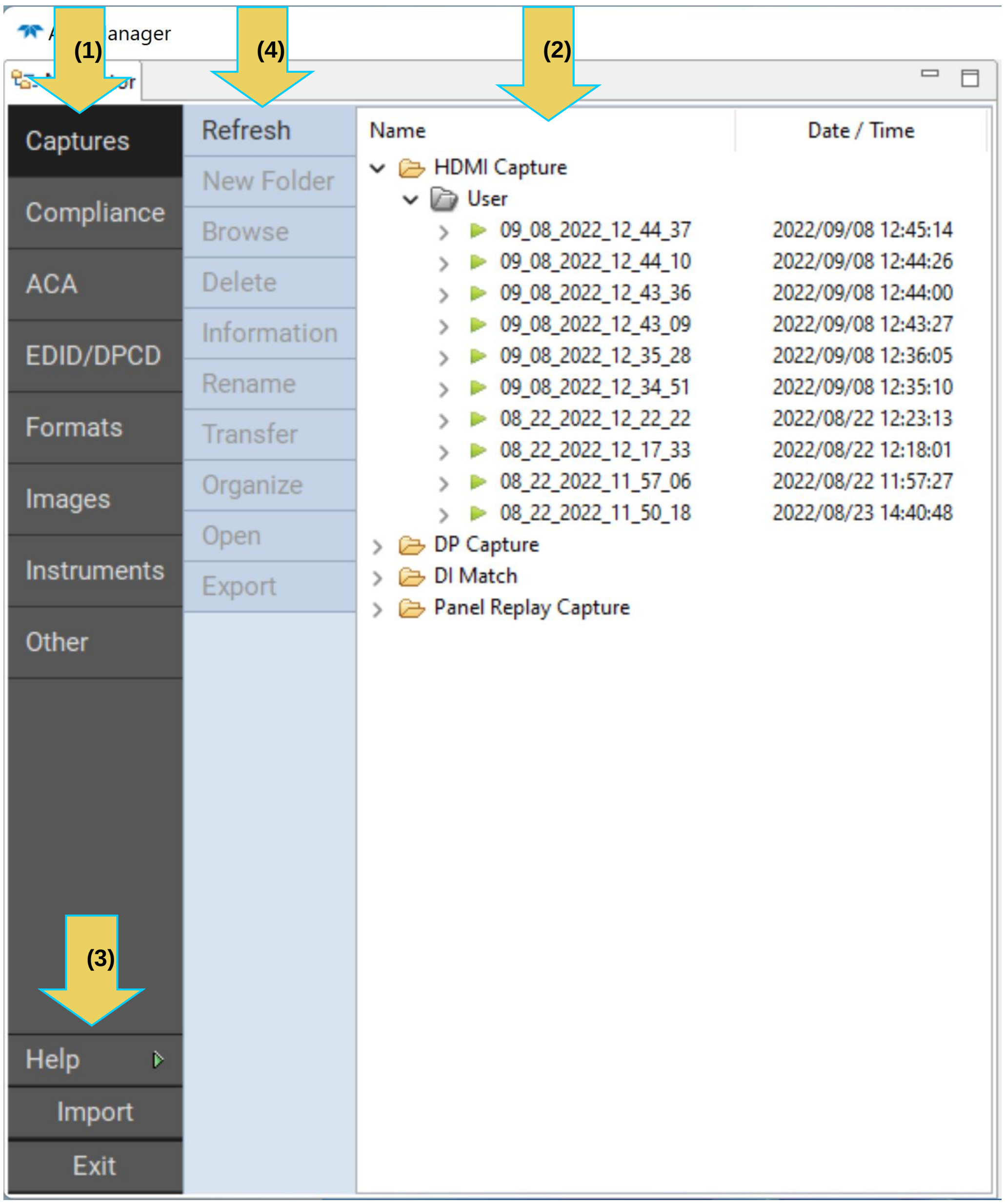
The **ATP Manager** screen includes two panels: **Navigator** panel and **Apps** panel.



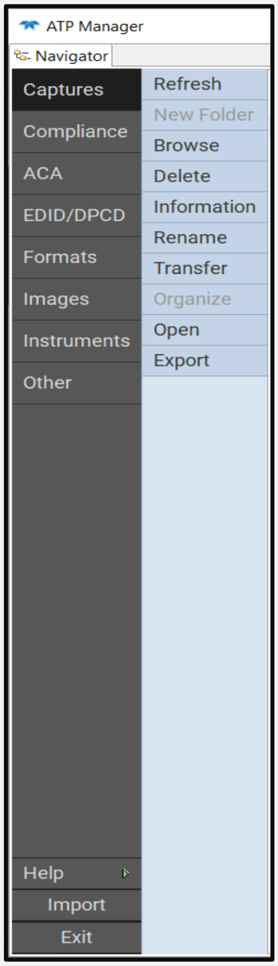
4.2 Navigator

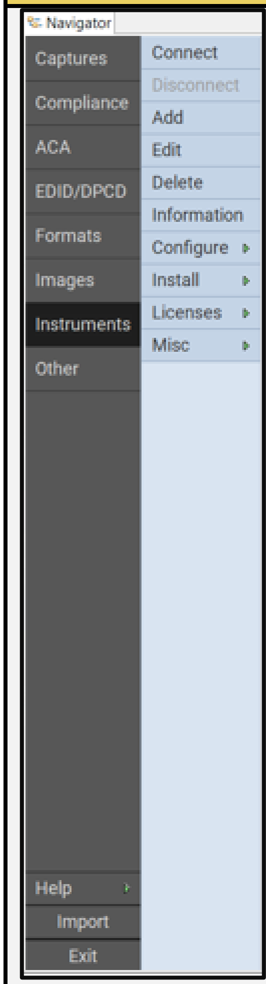
The **Navigator** panel is shown in the figure below. The left column **(1)** includes a static list of eight tabs which provide applicable directories (files) in the right panel **(2)**; the three tabs at the bottom of the column **(3)** provide general functions. The center panel **(4)** comprises a dynamic list of tabs that become highlighted (enabled) as their function becomes applicable when navigating through the directories.

Note: You can right-click on the files displayed in the right panel for additional functions.



The menu is shown in the figure below. There are several tabs which are described in the table

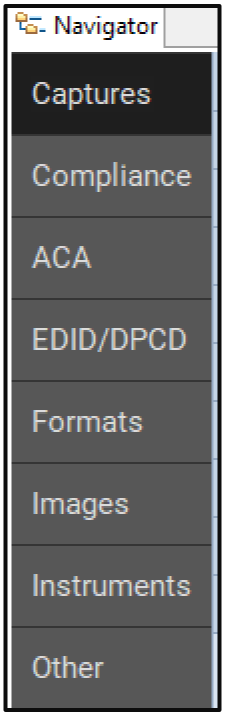
Top-Level Menu Items	Selection	Function
File 	Refresh	Refreshes the view of capture files.
	New Folder	Enables you to create a new folder.
	Browse	Opens a Windows browse window to the stored location of the captures.
	Delete	Enables you to delete a capture file from the M42h Manager application (on the host PC or the M42h if using the embedded ATP.
	Information	Enables you to view the information related to connected M42h.
	Rename	Enables you to rename a capture file.
	Transfer	Enables you to transfer files between the M42h and the host PC that the external ATP Manager is running on.
	Open…	Opens a capture or whatever data file type (examples: compliance data, format or image list, EDID, ACA file, etc.) is highlighted in the GUI. You must select a data file type for this option to be available.
	Export...	Enables you to export a capture file that you have highlighted in the M42h Manager. The file is compressed to a zip file.
Instrument	Connect	Clicking on this item will initiate a connection to the M42h that is selected in the list. This item will not be highlighted if you have not selected an M42h.
	Disconnect	Clicking on this item will initiate a disconnection from the M42h that is selected in the list that you are currently connected to. This item will not be highlighted if you have not selected an M42h.
	Add	Clicking on this item opens the Add Instrument dialog box which enables you to define an M42h. Note that you can have multiple M42hs defined in the

Top-Level Menu Items	Selection	Function
		ATP Manager. This action is required before connecting to an M42h.
	Edit	Enables you to edit the name of the IP address of the selected M42h.
	Delete	○ Enables you do delete the selected M42h instrument from the external ATP Manager.
	Information	Provides information about the M42h that the M42h Manager is currently selected. This information includes: ○ M42h Name ○ IP address of the M42h ○ Netmask ○ Gateway IP address ○ Hardware revisions of the M42h circuit boards ○ Firmware/Gateware version of the release applied to the M42h ○ Serial number of the M42h ○ OS version Licensed options applied to the M42h
	Configure	Opens a submenu for: - Setting the network IP address, Netmask and Gateway as well as enabling and disabling DHCP. - Setting the Date and time.
	Install	Opens a submenu for: - Installing new firmware or gateware. - Enables you to apply an upgrade to the M42h compliance test application scripts. - Upgrade System Components - Enables you to apply an upgrade to the M42h HDMI Source Compliance Test application or any other optional application. - Installing GUI components MORE
	Licenses	Opens a submenu for: - Generating a UID file MORE. - Apply ATP License key file (QDATP.lic) that enables you to activate a license key obtained from Quantum Data Customer Support for an option.

Top-Level Menu Items	Selection	Function
		- Apply an old license (No longer used). - Applying a Demo License key file that enables you to activate a license key temporarily for an optional feature.
	Misc	Opens a submenu for: - Calibrate the LCD - Enables you to calibrate the embedded display for touch accuracy. - Configurating the Auto Boot feature which enables you to reboot a remote M42h (requires a 3rd party network controlled device at the M42h). - Real Time Screen Capture enables you to capture a screen from the Basic Analyzer “Real Time” mode screen displayed on the display connected to the HDMI Admin port on the back of the M42h. - Real Time Data Capture enables you to capture a screen from the ACA Remote Control.

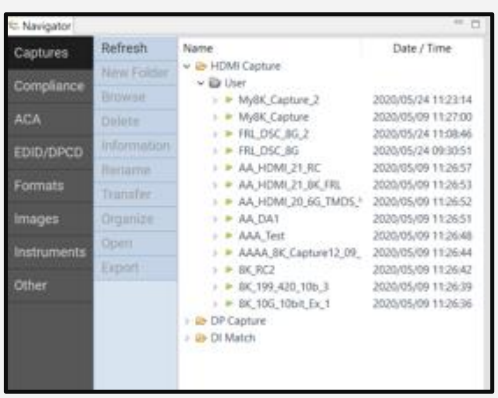
4.3 Navigator Panel

The **Navigator** panel is shown in the figure below. There are a set of sub-tabs which provide access to data associated with each type of tab.

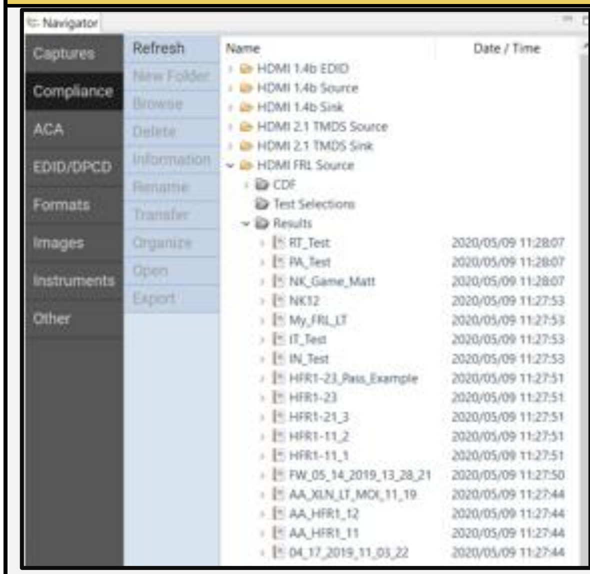


4.3.1 M42h Navigation Panels

The M42h **Navigator** panel provides a set of tabs to access a variety of data sets and panels as shown in the screen examples in the table below. The **Navigator** tabs are described in the table that follows these screens. These also appear on the right-click menus of the directories where the various data types are stored.

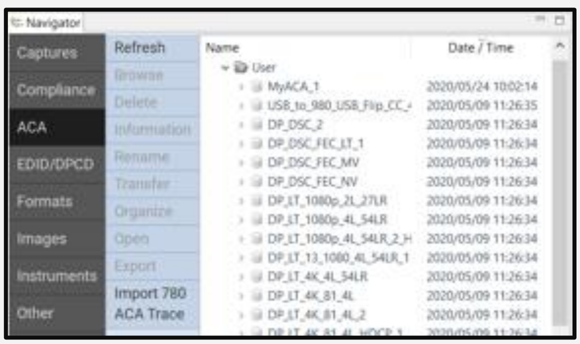
Navigator Tab	
Captures Provides access to the list of captures.  **Compliance** Provides access to the data for the various compliance tests.	**Execute a Capture** - Initiates a capture on the selected M42h device. This requires that your source device is connected to the M42h and that it is sending video. Only appears when the **Navigator/Capture** tab is selected. **Transfer data to/from instrument** - Opens up the FTP browser enabling you to transfer data to and from the host PC and the M42h instrument. Available for all **Navigator** tabs except **Instruments** tab. **Create new folder** - Enables you to create a folder under the highlighted directory. Available for all **Navigator** tabs except **Instruments** and **ACA** tab. **Organize (move/copy) local data** - Opens the FTP browser enabling you to transfer data between locations on the

Navigator Tab



ACA

Provides access to ACA trace files that have been saved.



EDID

Provides access to EDID files that have been saved.

host PC. Available for all **Navigator** tabs except **Instruments** and **ACA** tab.

Open Selected Item in a file browser - Opens a window to the folder location of the selected file. Available for all **Navigator** tabs except **Instruments** tab.

Delete the Selected Item - Deletes a data item that you have selected. Available for all **Navigator** tabs except **Instruments** tab.

Show Information about selected item - Provides information about the selected data type and the M42h used to capture the data. Available for all **Navigator** tabs except **Instruments** tab.

Open [the Selected item] - Loads the selected data item into the M42h Manager for viewing and analysis. Available for all **Navigator** tabs except **Instruments** tab.

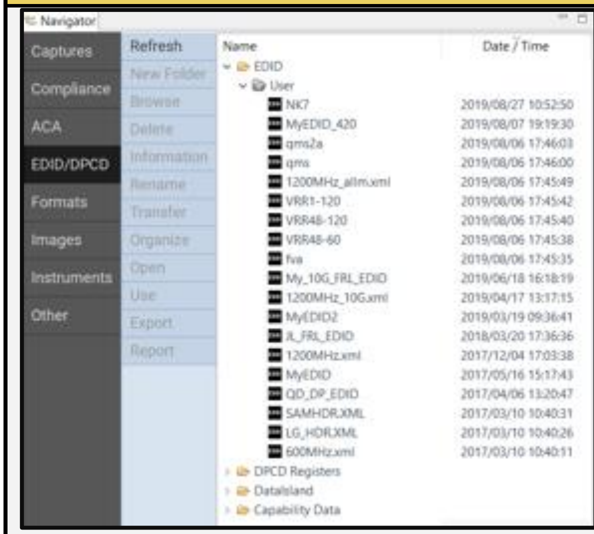
Use Selected Item on Instrument [the Selected item] - Applies the selected data item into the M42h instrument. Available only for the **EDID**, **Formats** and **Images** tabs.

Connect – Enables you to connect to the selected M42h if you have not already established a connection to it. This item will not be available if you have already connected to the selected device. Only appears when the **Navigator/Instrument** tab is selected.

Disconnect – Enables you to disconnect from the selected M42h, if you have already established a connection to it. This item will not be available if you are not already connected to the selected device. Only appears when the **Navigator/Instrument** tab is selected.

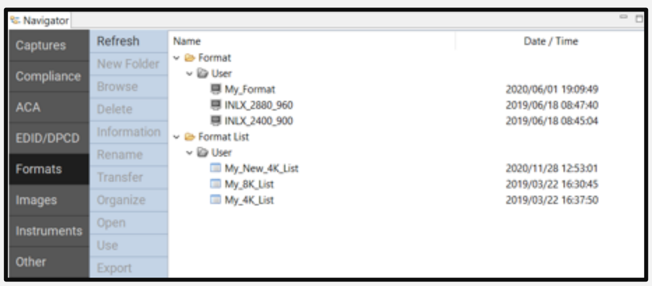
Add - Enables you to add or define an M42h instrument in the M42h Manager application. This is required before connecting to an M42h. Only appears

Navigator Tab



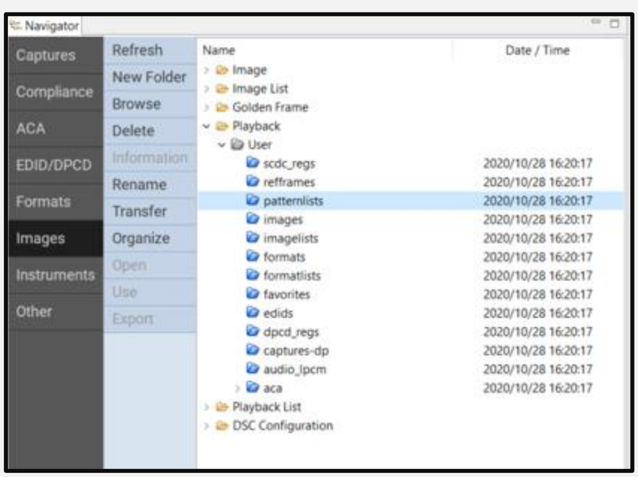
Formats

Provides access to format files that have been saved and format library lists that have been configured.



Images

Provides access to bitmap image files that have been saved and image library lists that have been configured.

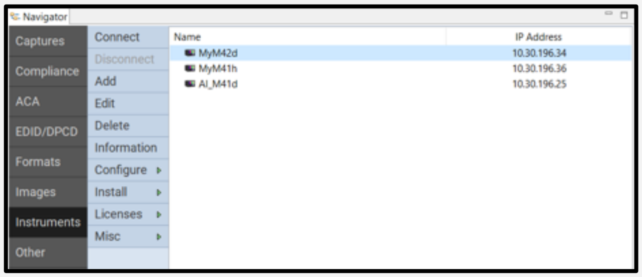


Instruments

when the **Navigator/Instrument** tab is selected.

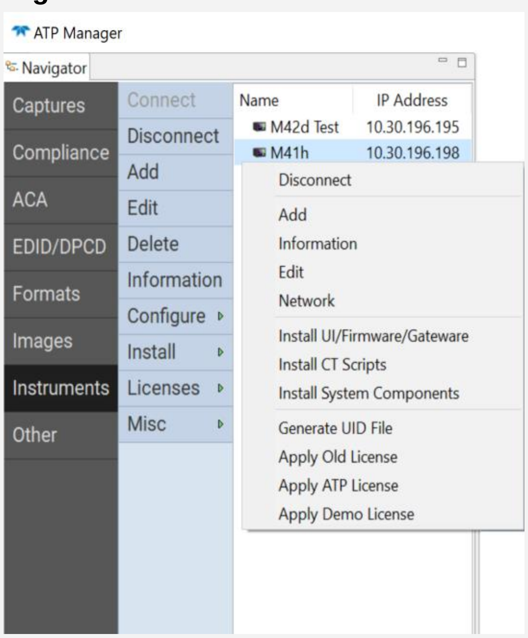
Edit Instrument Information - Enables you to edit name and IP address of the M42h that you have selected. Only appears when the **Navigator/Instrument** tab is selected.

Instrument Network Information - Allows you to view and set the network information such as the M42h IP address, subnet mask and gateway IP address. Only appears when the **Navigator/Instrument** tab is selected.

Navigator Tab	
Provides access to any instruments that have been configured through the ATP Manager. 	

4.3.2 M42h Navigation Instruments Panel and Right-Click Items

The M42h **Navigator Instruments** panel provides a set of right-click functions when a specific M42h instrument is selected. These are described in the following table.

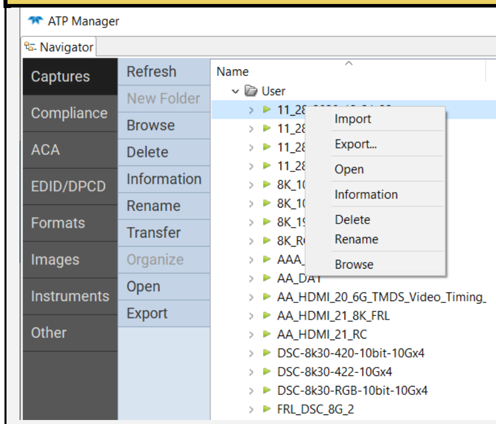
Navigator Panel - Item	**Function**
Right-click on an Instrument 	**Connect/Disconnect** – Enables you to connect or disconnect to the selected M42h, if you have not already established a connection to it. This item will not be available if you have already connected to the selected device. **[Instrument] Information** - Provides information about the M42h that the ATP Manager is currently connected to. This information includes: ○ M42h Name ○ IP address of the M42h ○ Netmask ○ Gateway IP address ○ Hardware revisions of the M42h circuit boards ○ Firmware/Gateware version of the release applied to the M42h ○ Serial number of the M42h ○ OS version ○ Licensed options applied to the M42h **Edit Instrument Entry** - Enables you to edit certain information about the M42h that you have selected. **[Instrument Network] Configure** - Allows you to view and set the network information such as the M42h IP address, subnet mask and gateway IP address. **Upgrade GUI Application** - Upgrade GUI Application - Enables you to apply an upgrade of the

Navigator Panel - Item	Function
	M42h built-in GUI. You can download new GUI release from the Quantum Data website. **Upgrade Firmware/Gateware** - Enables you to apply an upgrade of the M42h built-in GUI as well as the firmware and gateware of an M42h ATP. You can download new GUI release and firmware and gateware from the Quantum Data website on the downloads page. **Upgrade HDMI CT Scripts** - Enables you to apply and upgrade to the optional HDMI Compliance Test application. You can download new releases from the Quantum Data website. **Upgrade System Components** - Enables you to apply an upgrade to the M42h HDMI Source Compliance Test application or any other optional application. You can download new releases from the Quantum Data website. **Generate UID File** - This enables you to activate a license for an optional feature you have purchased. When you click on this item, a text file will appear showing a license key that you will send to Quantum Data Customer Support to activate an option on the M42h system and(s). **Apply Old License** – No longer used. **Apply ATP License** - This is a license key file (QDATP.lic) that enables you to activate a license key obtained from Quantum Data Customer Support for an option. **Apply Demo License** - This is a license key file that enables you to activate a license key temporarily for a specific feature option.

4.3.3 M42h Navigation Captures Panels and Right-Click items

The M42h **Navigator Capture** panel provides a set of right-click functions when a specific M42h instrument is selected. These are described in the following table.

Navigator Panel - Item	Function
Right-click on M42h Capture	Import - Enables you to import a zipped capture file that resides on the M42h Manager host PC. You can then disseminate this file to other colleagues who can view

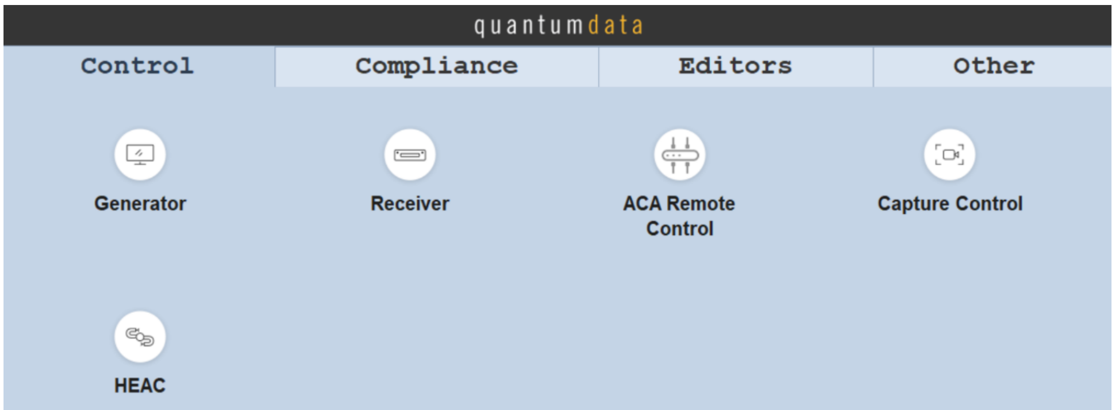
Navigator Panel - Item	Function
	the captured data using the ATP Manager, i.e. they do not need the M42h Protocol Analyzer. Export - Enables you to export a capture file that resides on the M42h Manager host PC. All captured data is zipped up into a single file. Open [the Selected Capture] - Loads the selected capture into the M42h Manager for viewing and analysis. [Capture] Information - Provides information about the selected capture and the M42h used to capture the data: Delete [a Capture] - Enables you to delete a capture from the M42h Manager application. Rename - Enables you to rename a capture file. A useful practice might be to rename the file to include the device tested.

4.4 Apps Panels

The **Apps** panel is shown in the figure below. The **Apps** panel provides access to all the capture related applications, compliance tests and various other utilities. There are four pages to the **Apps** panel, and several applications within each page:

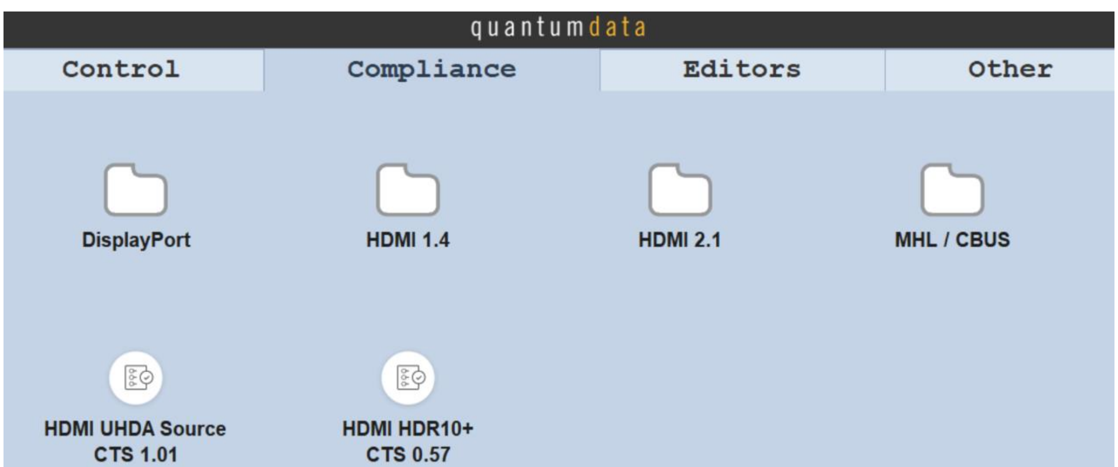
Control

- Generator
- Receiver (HDMI 2.1)
- ACA Remote Control
- Capture Control
- HEAC



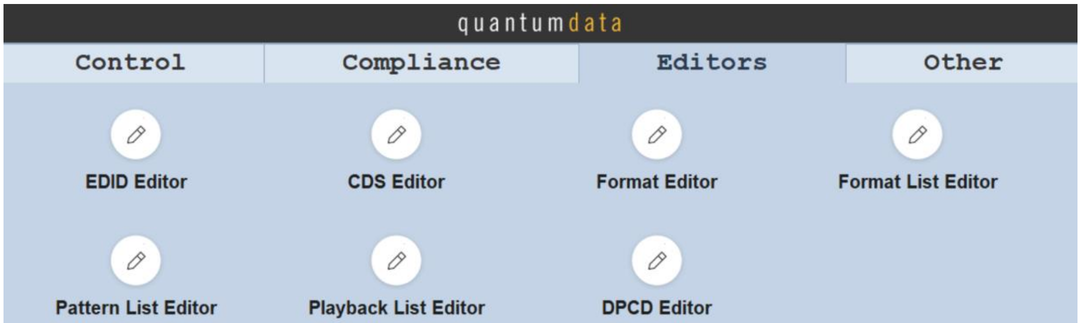
Compliance (Tests)

- HDMI 1.4 (directory)
- HDMI 2.1 (directory)
- MHL/CBUS (directory)
- UHDA Source CTS
- HDMI HDR10+ CTS



Editors

- EDID Editor
- CDS Editor
- Format Editor
- Format List Editor
- Pattern List Editor
- Playback List Editor



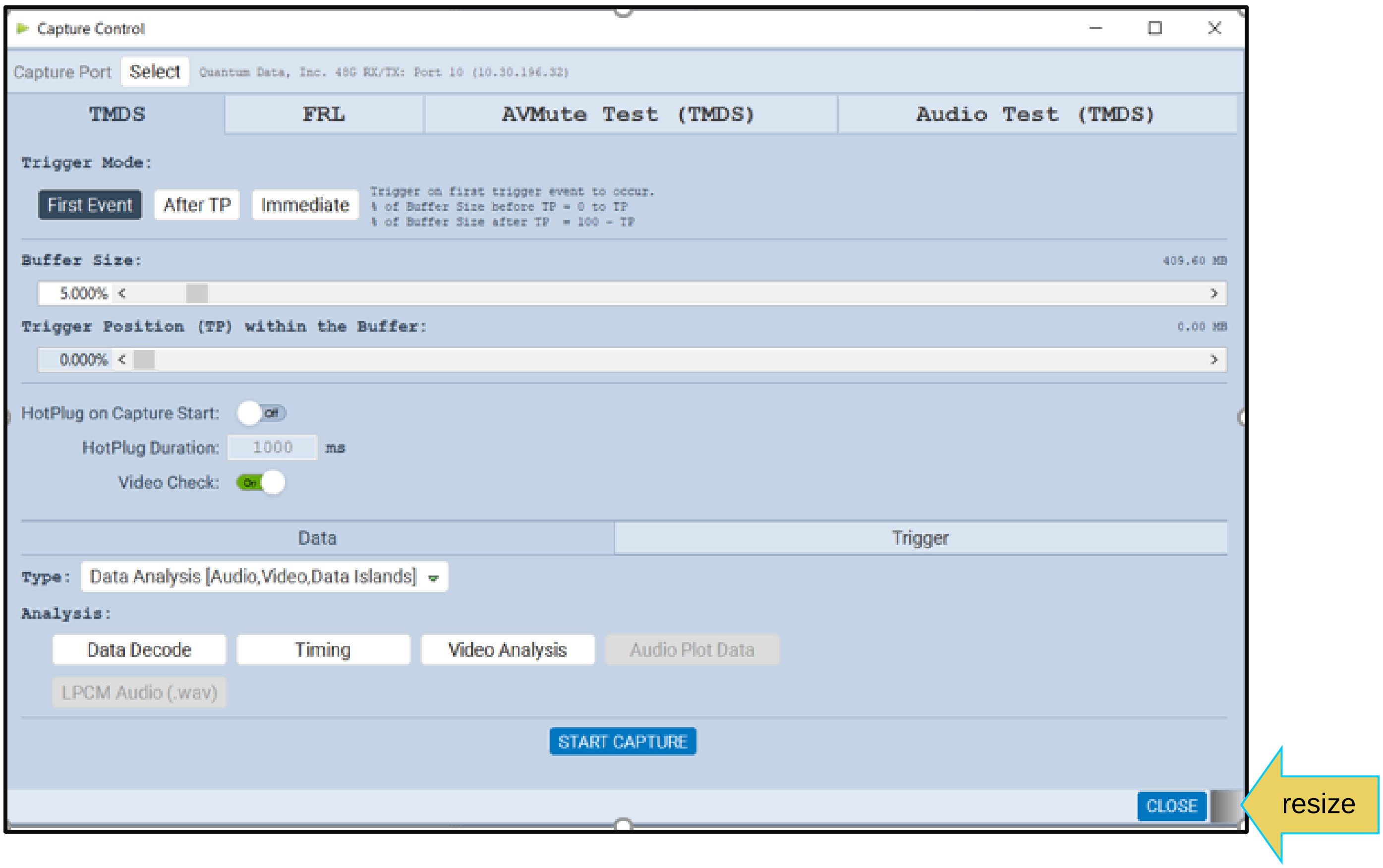
Other (Note: any applications not applicable to M42h instrument have been left off this list**)**

- ACA Data Viewer
- HDMI Capture Viewer
- Command Console
- Instrument Network Settings
- Set Instrument Date/Time
- Instrument Information
- Install Software Update
- Install CT Script Update
- Install System Component
- Apply ATP License
- Apply Demo License
- Generate License UID
- Switch Workspace
- Select Theme
- Configure Autoboot

5 Capture Control Panel

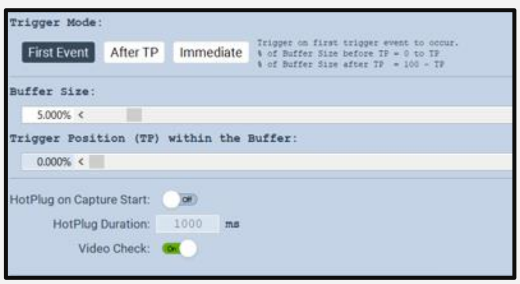
Important Note: This function is only partially implemented on the M42h at this time. Especially note that capturing of TMDS streams is not supported in the initial releases of the M42h.

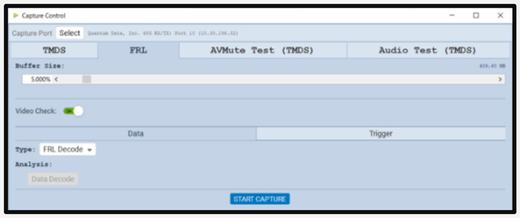
The **Capture Control** panel enables you to setup the capture HDMI® parameters. The figure below shows the **Capture Control** panel and its control and selection items. You can resize the window with the box on the lower right corner of the panel indicated by the arrow below.



The following table describes the functions of the **Capture Control** panel.

<table>
<tr><th>Capture Control Panel - Function</th><th colspan="2">Item - Description</th></tr>
<tr><td colspan="3">Instrument Selection

</td></tr>
<tr><td></td><td colspan="2">The Select button above allows you to select which M42h system you want to use assuming you have more than one. Typically, you will only have a single M42h system on the network in which case the text next to the Select button will indicate your M42h system.</td></tr>
<tr><td>Capture Trigger Configuration</td><td colspan="2">Enables you to define the capture trigger criteria. Use the information below.</td></tr>
<tr><td rowspan="4">
</td><td>Trigger Mode</td><td>Note: Supported in FRL mode, but not in TMDS mode.
First Event – The capture function will trigger on the first Scrambler Reset character sequence of the first Super Block.
After TP (Trigger Position) – No Trigger will occur until TP is reached.
Immediate – No Trigger; Data recording begins immediately upon Capture start.</td></tr>
<tr><td>[Capture] Buffer Size Slider</td><td>Enables you to set the size of the captured data in percent. This is a slider that provides an indication (on the left) of the percent of the total possible size to be captured (max is 8Gbytes). A lower value will require less time for the captured data to accumulate.</td></tr>
<tr><td>[Capture] Trigger Position within Buffer Slider</td><td>Enables you to set the percentage of the capture from zero up to 100.</td></tr>
<tr><td>HotPlug on Captured Start</td><td>Causes a HotPlug event when the data capture begins, in other words when you click on the Start Capture activation button. Enables you to specify the length of the HotPlug pulse</td></tr>
</table>

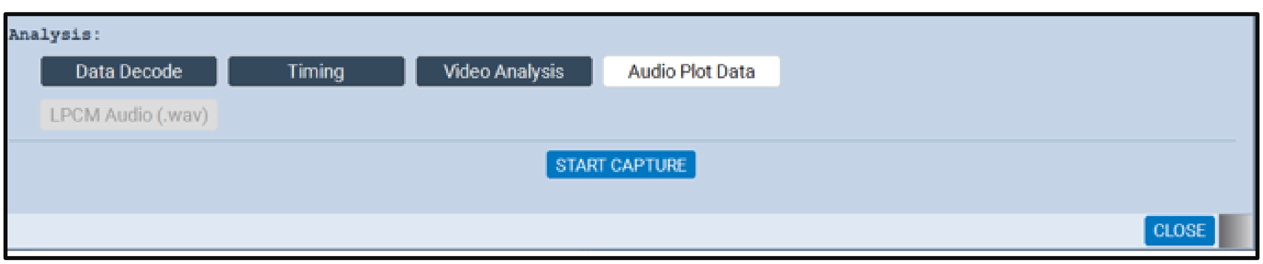
Capture Control Panel - Function	Item - Description	
		in milliseconds. A HotPlug pulse, issued by the M42h, will reinitiate HDCP authentication if the video content from the source is content protected.
	Video Check	Verifies that there is incoming video prior to a capture.
	Start Capture (Capture Tab)	Initiates a capture using the criteria defined in the **Data**, **Trigger** and **Match** tabs below.
	Data Tab (Capture Tab)	Currently, there is a default Type and there are no other configurations supported. • FRL Decode – Supports the capture and storage of FRL and FEC protocol elements while also showing underlying TMDS elements.
	Trigger Tab (Capture Tab)	The only currently supported trigger is the initial scrambler reset in a Super Block.

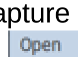
5.1 Capture Viewer Panel

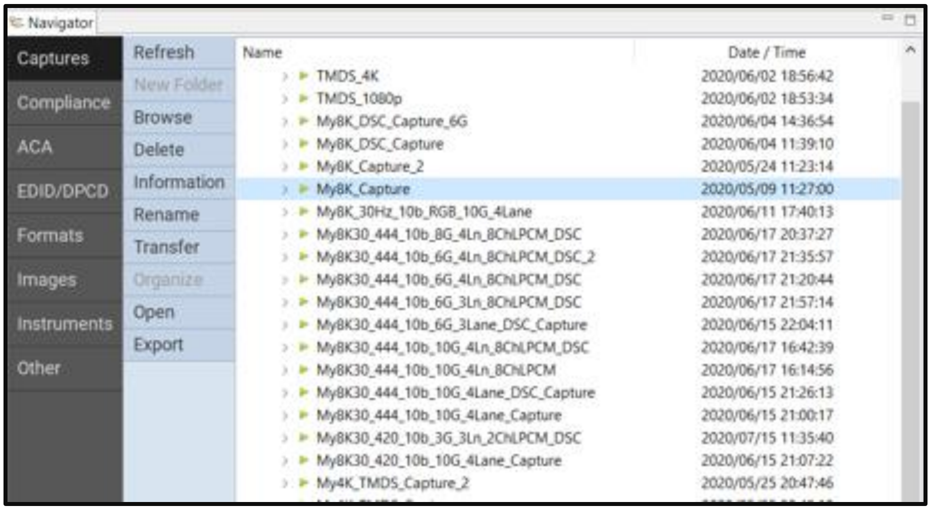
The Capture Viewer Panel is on the 4th page **Other** of the Apps panel. It provides access to the following windows for viewing captured data:

- **Event Plot –** Provides graphical view of metadata.
- **Decode –** Provides tabular view of metadata.

When you open a capture the **Event Plot** and **Decode** windows will always be shown by default.

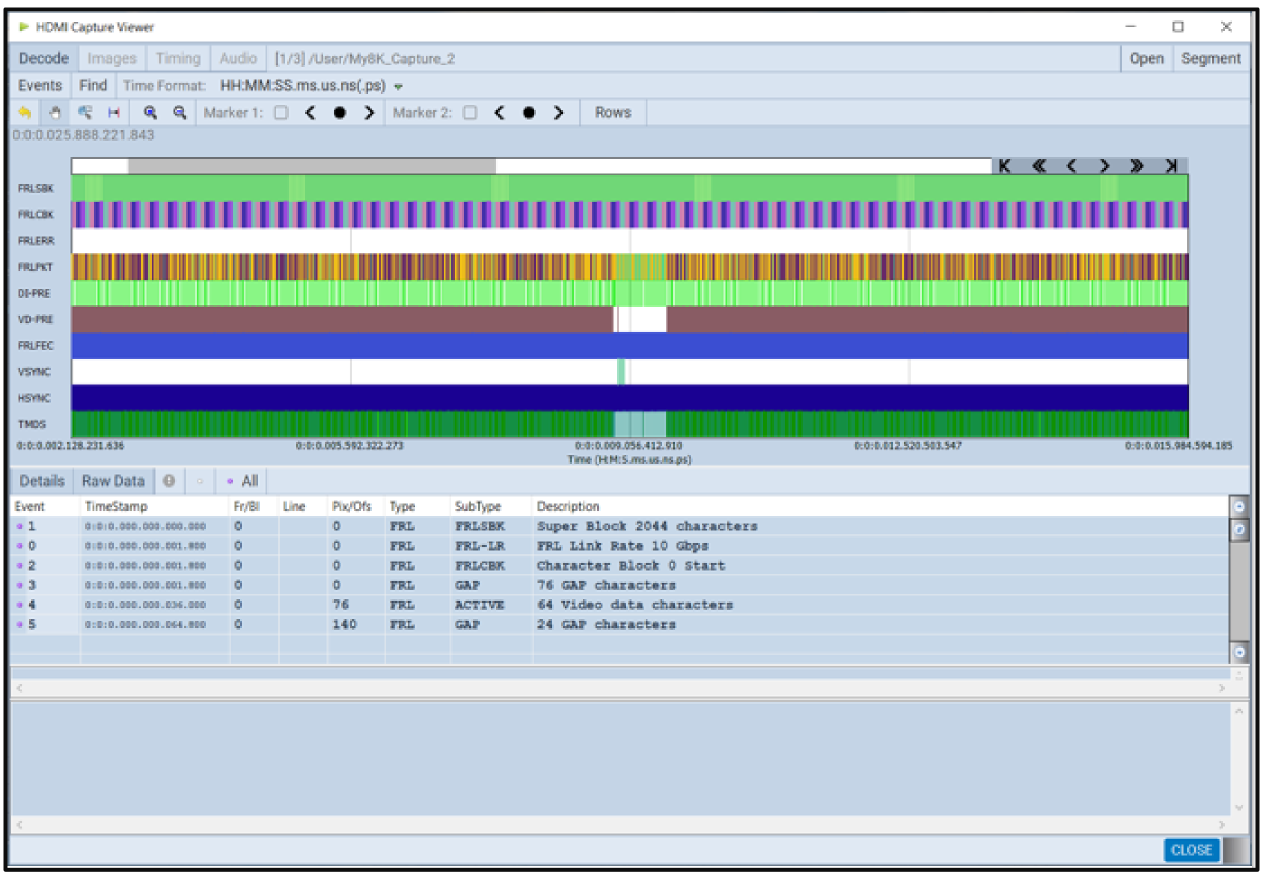


You can open a capture for viewing in the **Event Plot** or **Decode** window either from the **Navigator** panel or the **Open**  button on the top of the window. When you select Open a dialog box appears enabling you to select a capture:

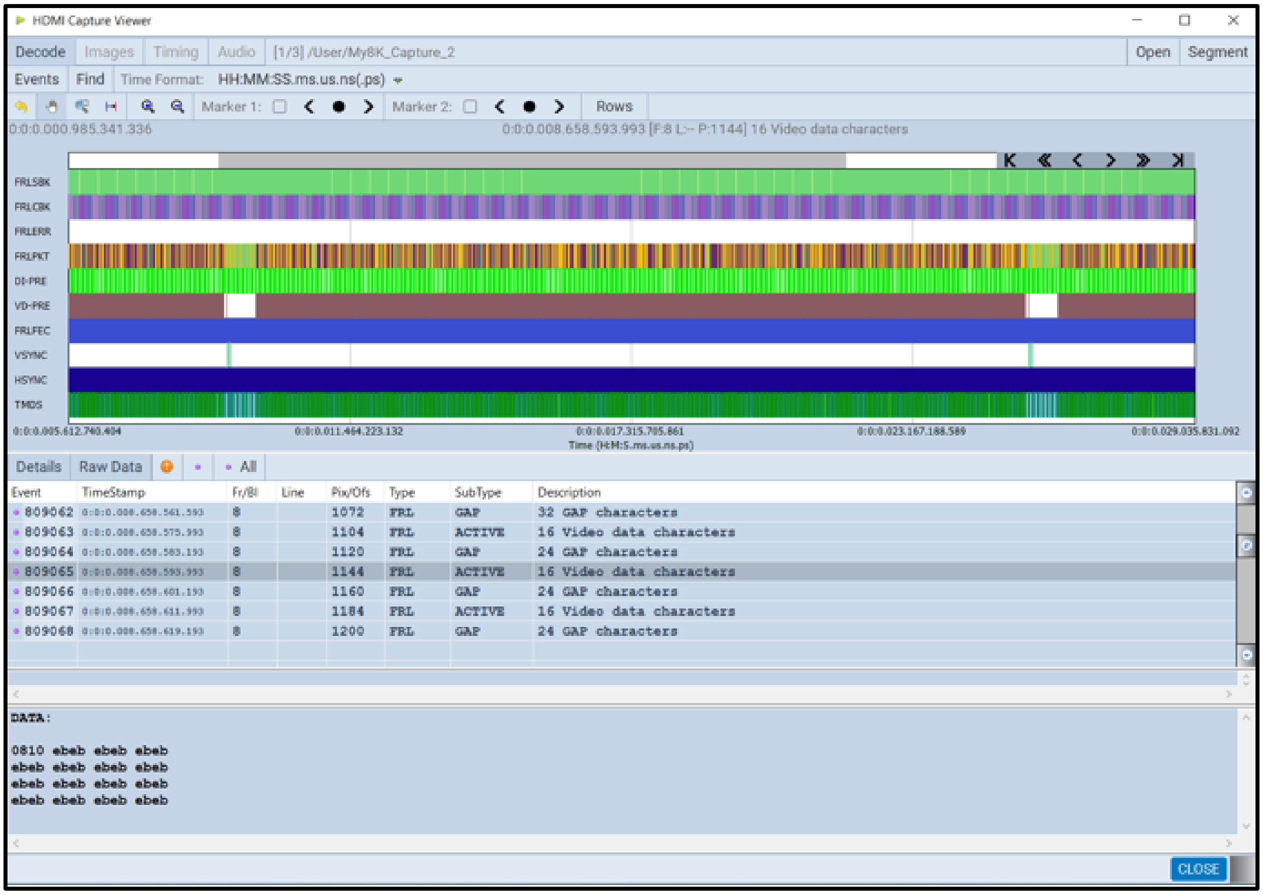


5.2 Decode Panel

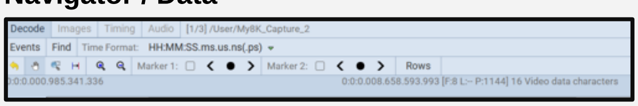
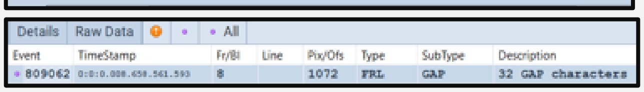
The **Decode** panel (shown below) is the primary panel for examining data at the detail level. The example shows data captured in the Data Analysis mode where the FRL, FEC and TMDS data are captured.



When you select a packet in the **Decode** panel that packet is highlighted in the **Event Plot** panel. It is only visible if the **Event Plot** is zoomed to show each distinct packet. Refer to the screen shot below.

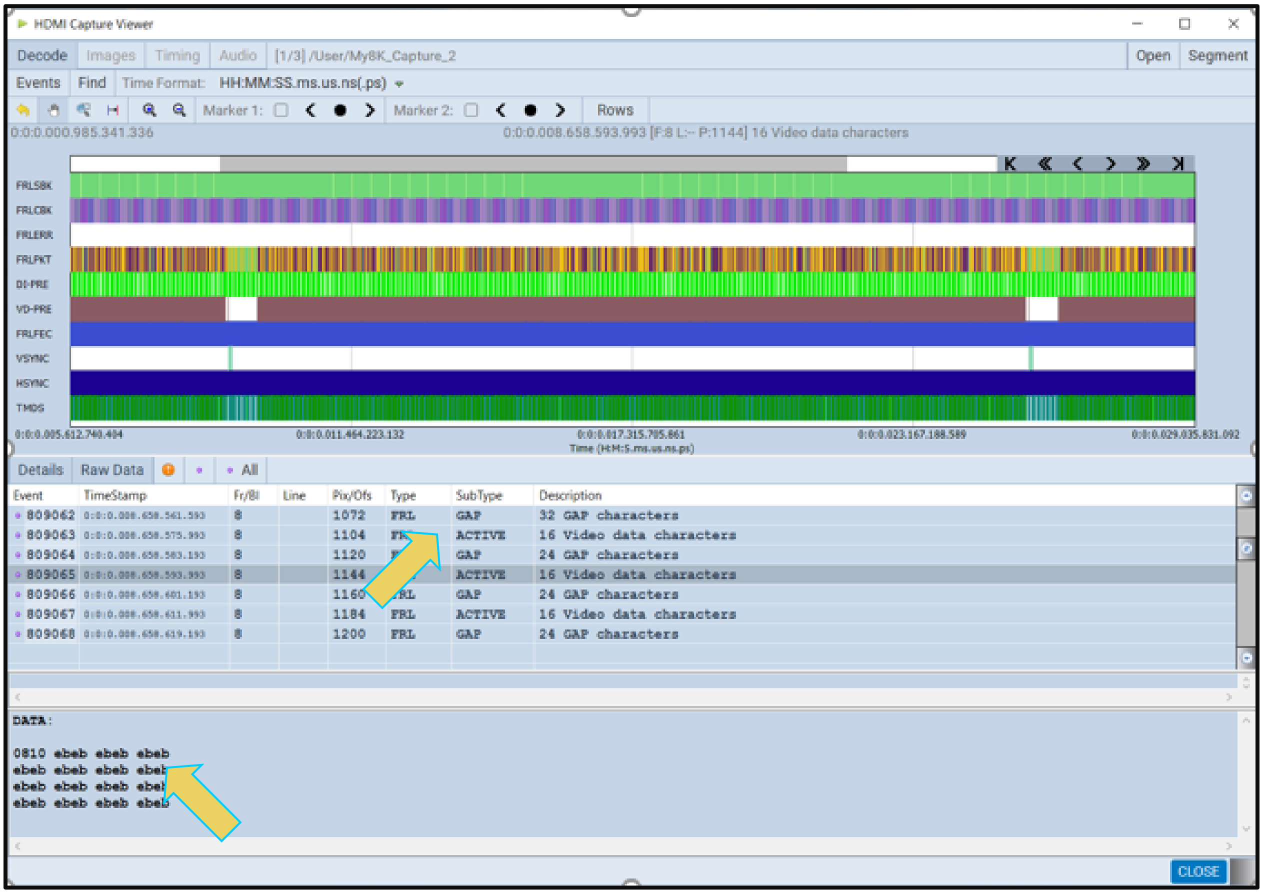


The following table describes the activation buttons available through the **Decode** panel. In some cases, clicking on these buttons opens a dialog box. These dialog boxes are described in detail in the following the table.

Decode Status	Function
Navigator / Data   	**User path status** – shows the name of the capture file and its location. **Segment** – Large captures are broken into smaller distinct sections called segments to make them more manageable and to improve speed and performance. When you click on the Segment activation button, a dialog box appears enabling you to select and load another segment. This dialog box is described further below. **Events** – The Events activation button enables you to filter the captured data by

Decode Status	Function
	type. When you click on the Events button a dialog box appears enable you to select or deselect data types individually or a page at a time. This dialog box is described further below. **Find** – The Find activation button enables you to locate captured data by type. When you click on the Find button a dialog box appears to enable you to specify a data type to search on individually or a page at a time. This dialog box is described further below. **Details** – The Details activation button enables you to toggle the view of the Details subpanel. The Details subpanel provides a human readable text description of the data of the record that is highlighted. **Raw Data** – The Raw Data activation button enables you to toggle the view of the hex data on and off. **Marker** – The Marker enables you to flag certain important records for easy identification. You can also flag a record by double-clicking on the record. **Clear Marker** – The Clear Marker and Clear All enable you to clear the flags on specific records or all records. You can also clear the flag on a record by double-clicking on the record.

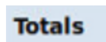
There is a vertical scroll bar available on the right side of the **Decode** panel. This enables you to browse through the **Decode** records. The buttons enable you to advance downward or upward one record at a time. The button is a scroll button that you can slide up or down.


HDMI Capture Viewer
Decode Images Timing Audio [1/3] /User/My8K_Capture_2 Open Segment
Events Find Time Format: HH:MM:SS.ms.us.ns(.ps)
Marker 1: Marker 2: Rows
0:0:0.000.985.341.336
0:0:0.008.658.593.993 [F:8 L:-- P:1144] 16 Video data characters
FRLSBK
FRLCBK
FRLERR
FRLPKT
DI-PRE
VD-PRE
FRLFEC
VSYNC
HSYNC
TMDS
Details Raw Data All
Event TimeStamp Fr/Bl Line Pix/Ofs Type SubType Description
809062 1072 FRL GAP 32 GAP characters
809063 1104 ACTIVE 16 Video data characters
809064 1120 GAP 24 GAP characters
809065 1144 ACTIVE 16 Video data characters
809066 1160 GAP 24 GAP characters
809067 1184 FRL ACTIVE 16 Video data characters
809068 1200 FRL GAP 24 GAP characters
DATA:
0810 ebeb ebeb ebeb
ebeb ebeb ebeb ebeb
ebeb ebeb ebeb ebeb
ebeb ebeb ebeb ebeb
CLOSE

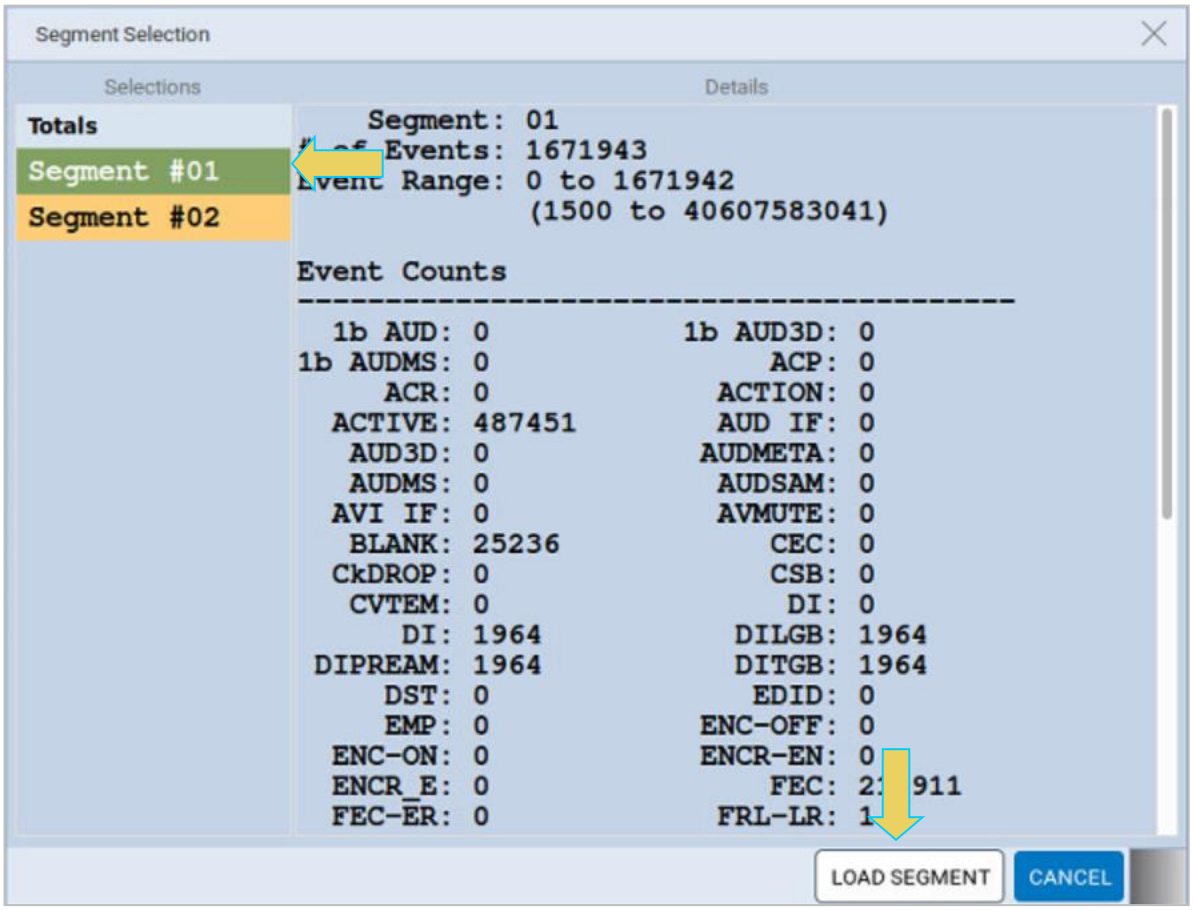
5.2.1 Working with Segments in the Decode Panel

Large captures are broken into smaller distinct sections called segments to make them more manageable and to improve speed and performance. When you click on the Segment activation button 

, a dialog box appears (shown below) enabling you to select and load another segment. The Selections section on the left lists the segments in the capture. The Details section on the right shows you the packet makeup of the segment as well as the number of packets and the range of packets in the overall capture.

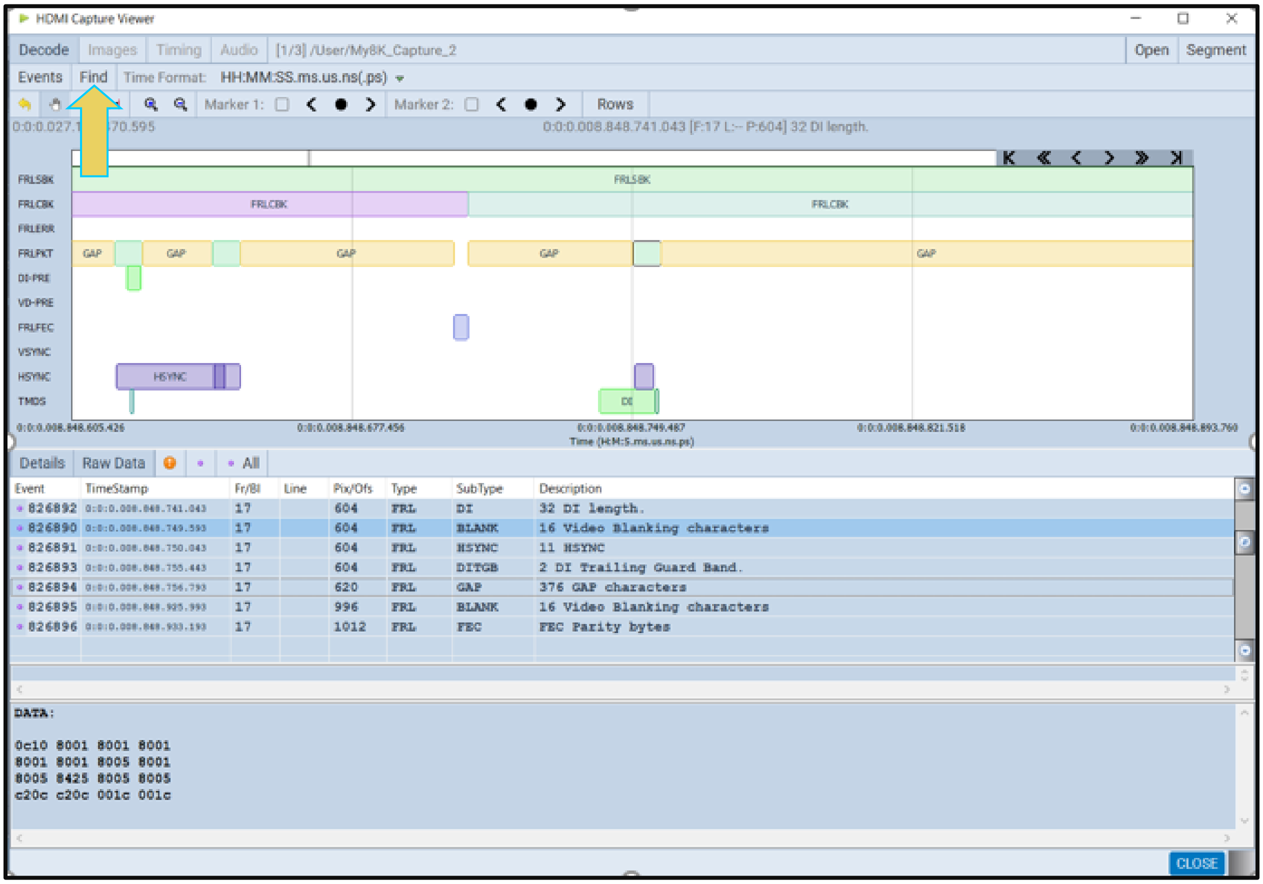
From the Selections panel you can select and load a different segment by highlighting a segment and then clicking on the **Load Segment** activation button on the bottom right. You can also select any segment to view its packet contents in the Details panel. If you wish to view the total packets of all segments simply highlight the Totals 

 button.



5.2.2 Searching for Data in the Decode Panel

You can search for data in the **Decode** panel using the search function. The search function is accessible using Find on the upper left of the **Decode** panel. In the example below, a search for the next occurrence of an AVI InfoFrame is being initiated. You can specify a search forward (**Find Next**) or backward (**Find Previous**).



5.2.3 Post-Capture Filter Selection Tab

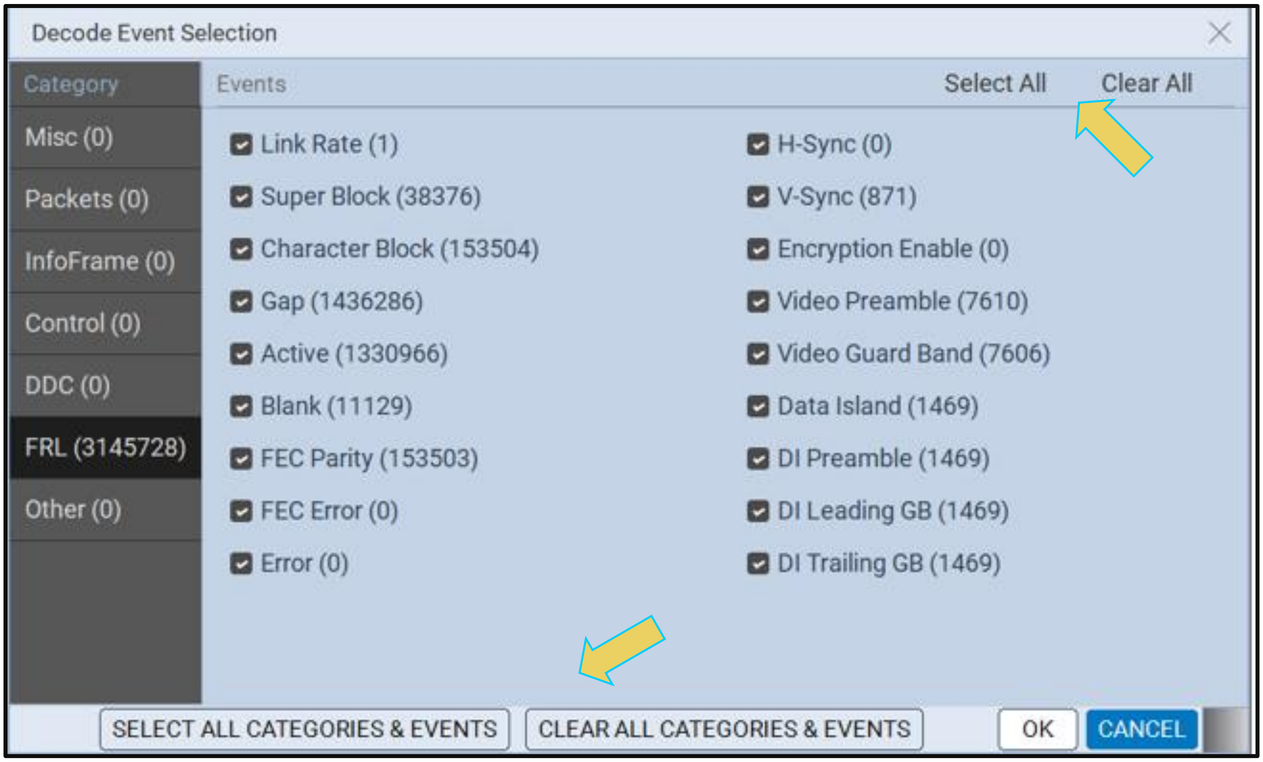
The **Post-Capture Events** button Events on the **Decode** panel enables you to do the following:

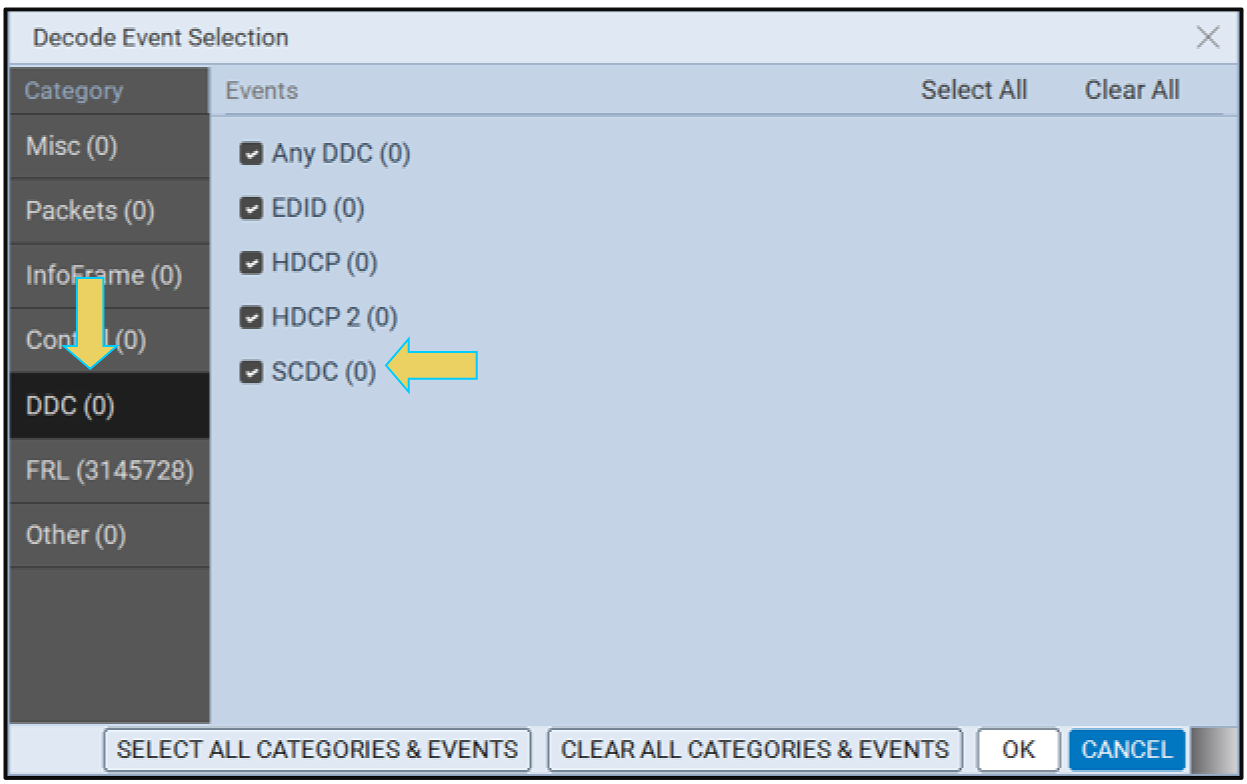
Specify the data that you want to view in the **Event Plot** and **Decode** panels.

View the number of packets for each data type and each category of data type. These are shown in parentheses after each data type or on the tab for each category.

The screens below show the **Post-Capture Decode Event Selection** panel and its control and selection items. In this example all items are checked meaning that the **Decode** panel will show all the data captured.

Note that you can select or deselect all items on a page with the **Select All** Select All or **Clear All** Clear All buttons or you can individually select an item. You can also select and deselect all items on all pages with the **Select All Categories & Events** and **Clear All Categories & Events** buttons. SELECT ALL CATEGORIES & EVENTS CLEAR ALL CATEGORIES & EVENTS


Decode Event Selection
Category
Misc (0)
Packets (0)
InfoFrame (0)
Control (0)
DDC (0)
FRL (3145728)
Other (0)
Events
Select All
Clear All
Link Rate (1)
Super Block (38376)
Character Block (153504)
Gap (1436286)
Active (1330966)
Blank (11129)
FEC Parity (153503)
FEC Error (0)
Error (0)
H-Sync (0)
V-Sync (871)
Encryption Enable (0)
Video Preamble (7610)
Video Guard Band (7606)
Data Island (1469)
DI Preamble (1469)
DI Leading GB (1469)
DI Trailing GB (1469)
SELECT ALL CATEGORIES & EVENTS
CLEAR ALL CATEGORIES & EVENTS
OK
CANCEL


Decode Event Selection
Category
Misc (0)
Packets (0)
InfoFrame (0)
DDC (0)
FRL (3145728)
Other (0)
Events
Select All
Clear All
Any DDC (0)
EDID (0)
HDCP (0)
HDCP 2 (0)
SCDC (0)
SELECT ALL CATEGORIES & EVENTS
CLEAR ALL CATEGORIES & EVENTS
OK
CANCEL

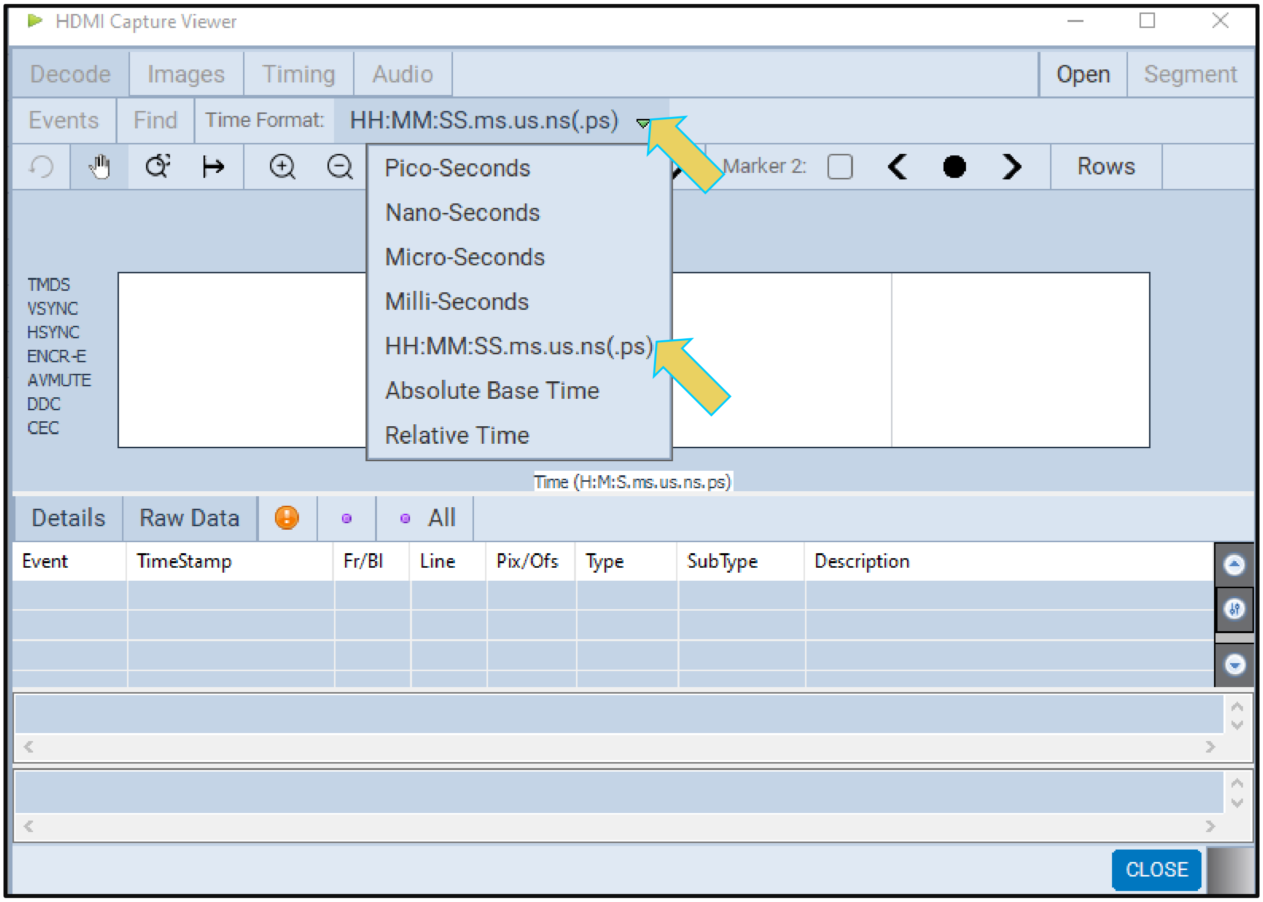
5.2.4 Decode Record Field Descriptions

The **Decode** panel enables you to select the individual protocol transactions (records). When you highlight a transaction, the details for the selected transaction, are shown in the lower panels. There are two lower panels: top and bottom. The top lower panel shows the data for the selected transaction parsed out in human readable form. The bottom panel shows the data for the selected transaction parsed out in hex form. The following table describes the information on the **Decode** panel.

Field	Function
Packet	Lists the packet numbers in sequential order beginning from the first packet captured.
Timestamp	Provides the timestamp in nanoseconds for each transaction since the beginning of the captured data.
Frame	Lists the frame number of the record. The frame count begins when the capture begins and are counted sequentially.
Line	Lists the line number of the frame.
Pixel	Lists the pixel number in the line.
Type	The type of data of the selected record. This could be one of: TMDS or DDC.
SubType	The SubType of the data for a selected record. This is a more specific designation of the type of data. For example, for a Type of TMDS this could be a data island such as an audio sample, InfoFrame, control signal, etc.
Info	A description of the data of a selected line.

5.2.5 Decode Timing Mode

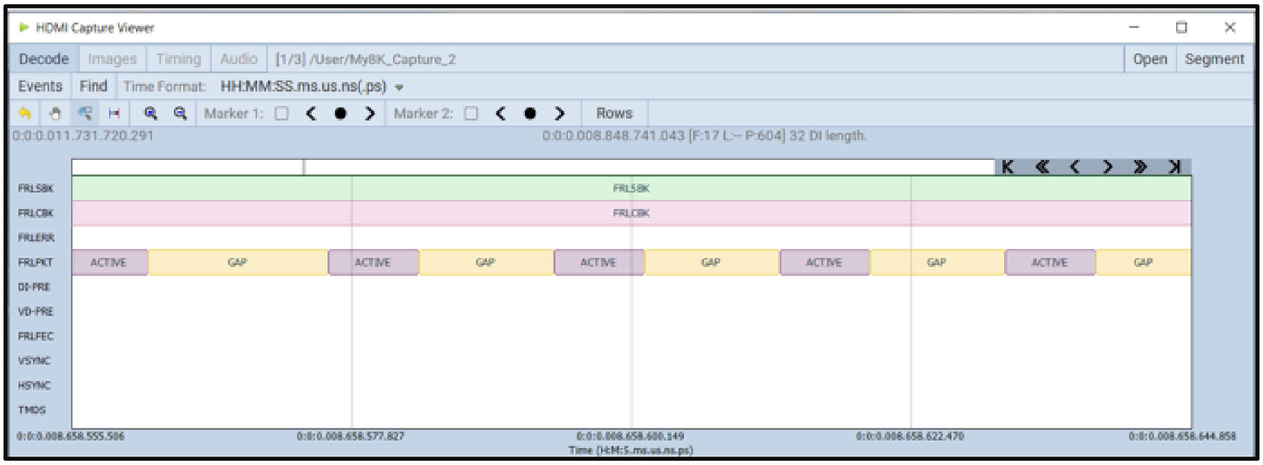
The **Capture Viewer** provides a pull-down menu to define how the time stamps are displayed on the **Decode** records. This is shown below. The table that follows the screen image defines each option:



Right-click option	Description
Nano-Seconds [HHMMSSmsusns]	Time is shown in nanoseconds. The baseline time is the time of the last boot of the M42h.
Micro-Seconds [HHMMSSmsusns]	Time is shown in microseconds. The baseline time is the time of the last boot of the M42h.
HH:MM:SS.ms.us.ns	Time is shown in relative time meaning the time from the previous event listed.
Absolute Base Time	Time for each item is shown from the time of the beginning of the capture.
Relative Time	Time is shown in relation to the previous item.
Milli-Seconds [HHMMSSms.usns]	Time is shown in milliseconds. The baseline time is the time of the last boot of the M42h.

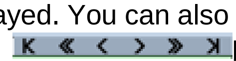
5.3 Event Plot Panel

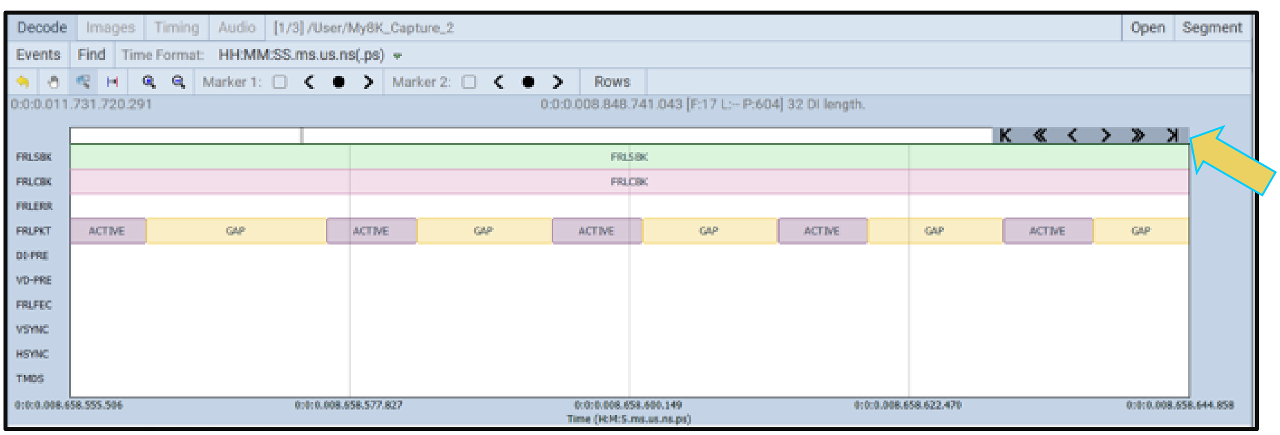
The **Event Plot** panel (shown below) is the primary panel for locating the data for high level navigation to the detail level provided by the **Decode** panel. The vertical axis is the data types. The **Event Plot** panel provides a set of data types labeled on the left of the panel that inform you of the type of data for that layer. (You can change this configuration.) The horizontal axis is time. The scale along the bottom of the **Event Panel** shows the timestamp for each point in time.



5.3.1 Locating Data in the Event Plot Panel

The **Event Plot** enables you to locate data by searching for specific data types, panning, scrolling, and zooming using various techniques. You can filter the data by type to limit the amount of data to sift through. You can synchronize the **Decode** and **Timing** panels to the **Event Plot** or you can synchronize the **Event Plot** to the **Decode** panel.

A scroll bar is provided to enable you to quickly browse through the data. The scroll bar is under the set of functions just above the data panel where the data is displayed. You can also scroll to the end, scroll by page, or scroll incrementally in either direction using the  buttons. See the screen shot below.



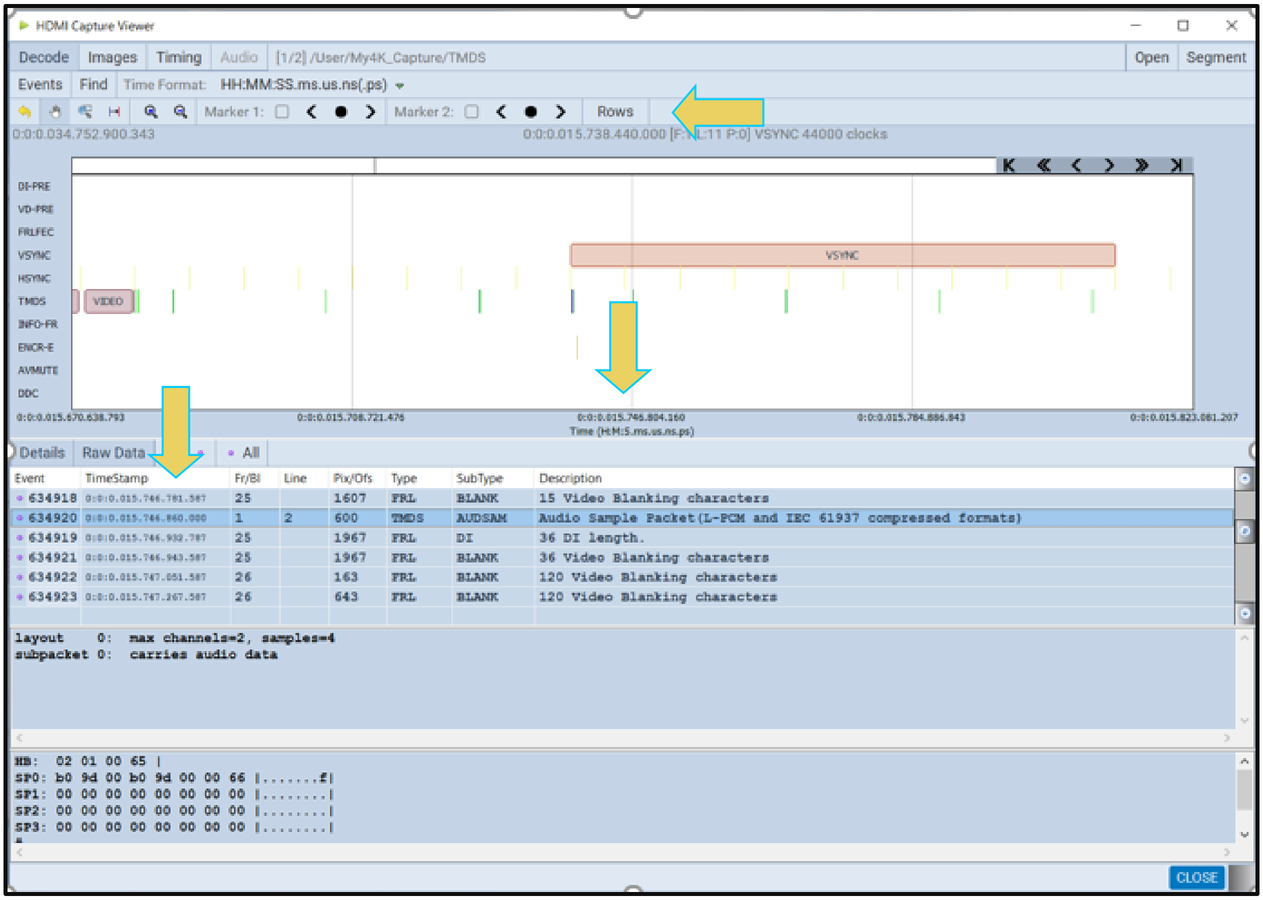
5.3.2 Zooming in the Event Plot Panel

You can zoom in and zoom out and pan across the data using the sliders provided. You can also zoom by surrounding a specific section of the captured data. These functions are described in the following table.

Even Plot Zoom & Panning	Function
Zoom and Panning 	**Surround** – You can select an area of the Event Plot by clicking and dragging across. When you do this the new view will be limited to the horizontal range that you selected. The midpoint of the selection will become the new center of the data displayed. **Zoom %** – The Zoom % function enables you to enter a specific zoom amount in the associated field provided. **Zoom In/Out** – The Zoom In/Out function buttons enables you to zoom in and zoom out by clicking on the activation button. The centered point will remain the same. **Panning** – The panning function enables you to scan across the data quickly by clicking and dragging. **Pointer** – The pointer enables you to click on any point and obtain information such as the data packet type and the timestamp, about that data packet. The information is displayed in a dark panel just above the scroll bar.

5.3.3 Viewing the Time Stamps of the Data

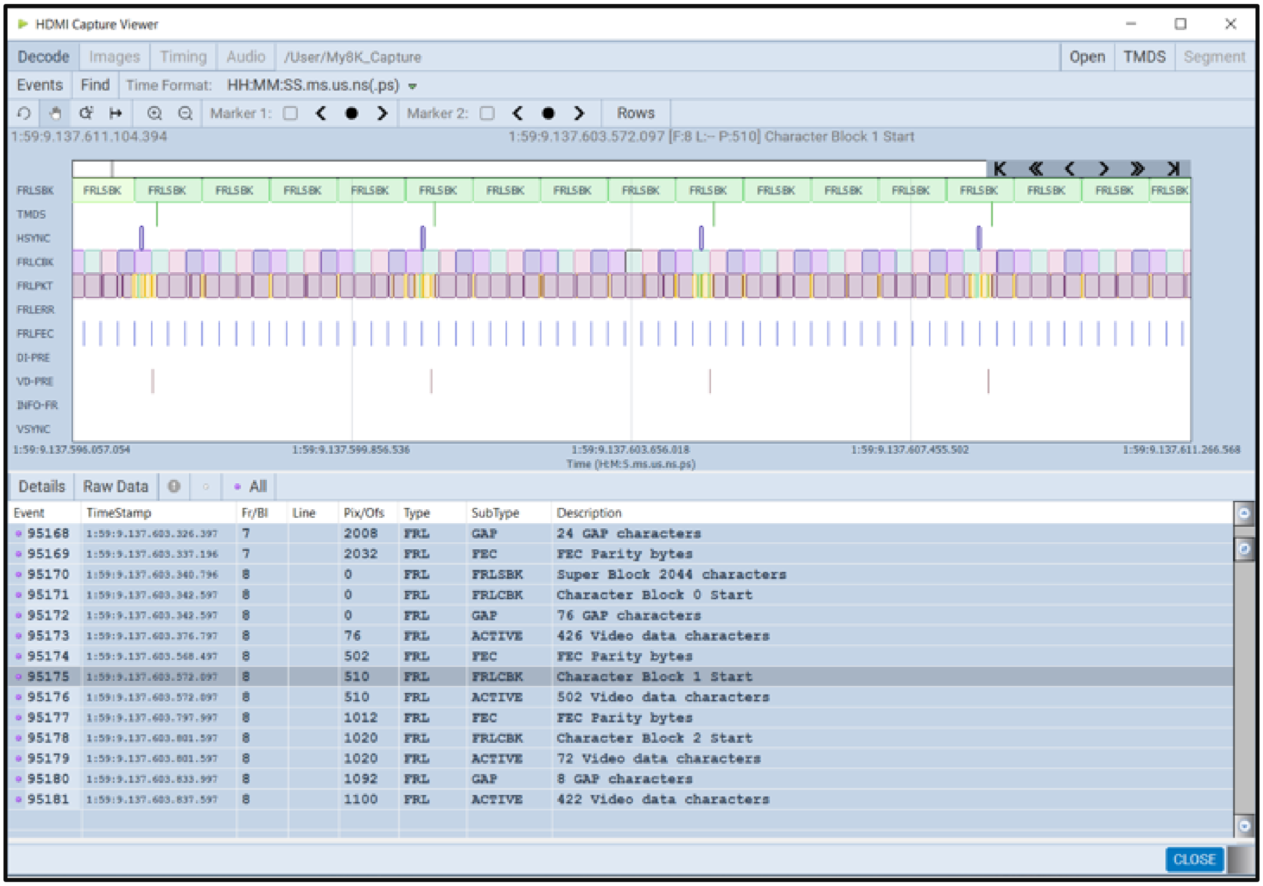
The timestamp indicated on the dark status panel indicates the location of the scroll bar. When you scroll or pan through the data, the time stamps are shown in the status panel. If you use the pointer tool to select a particular point, the timestamp and data element will be shown in the center of the dark status panel. In the example below, a selection has been made on an AVI InfoFrame either with the pointer tool or in the **Decode** panel.

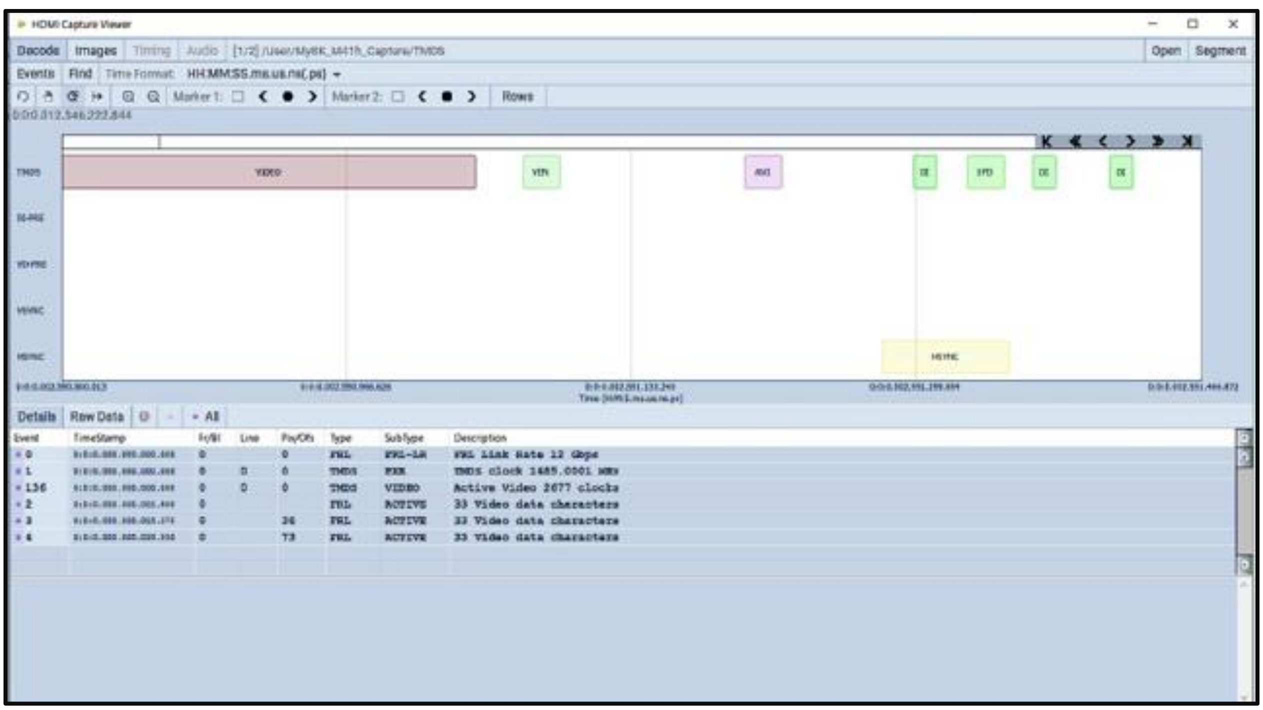


5.3.4 Surrounding and Zooming

The **Event Plot** provides a Range Zoom tool . You can select an area of the **Event Plot** by clicking and dragging across. When you do this the new view will be limited to the horizontal range that you selected. The midpoint of the selection will become the new center of the data displayed. The two screens below show an example of a surrounding segment of data.

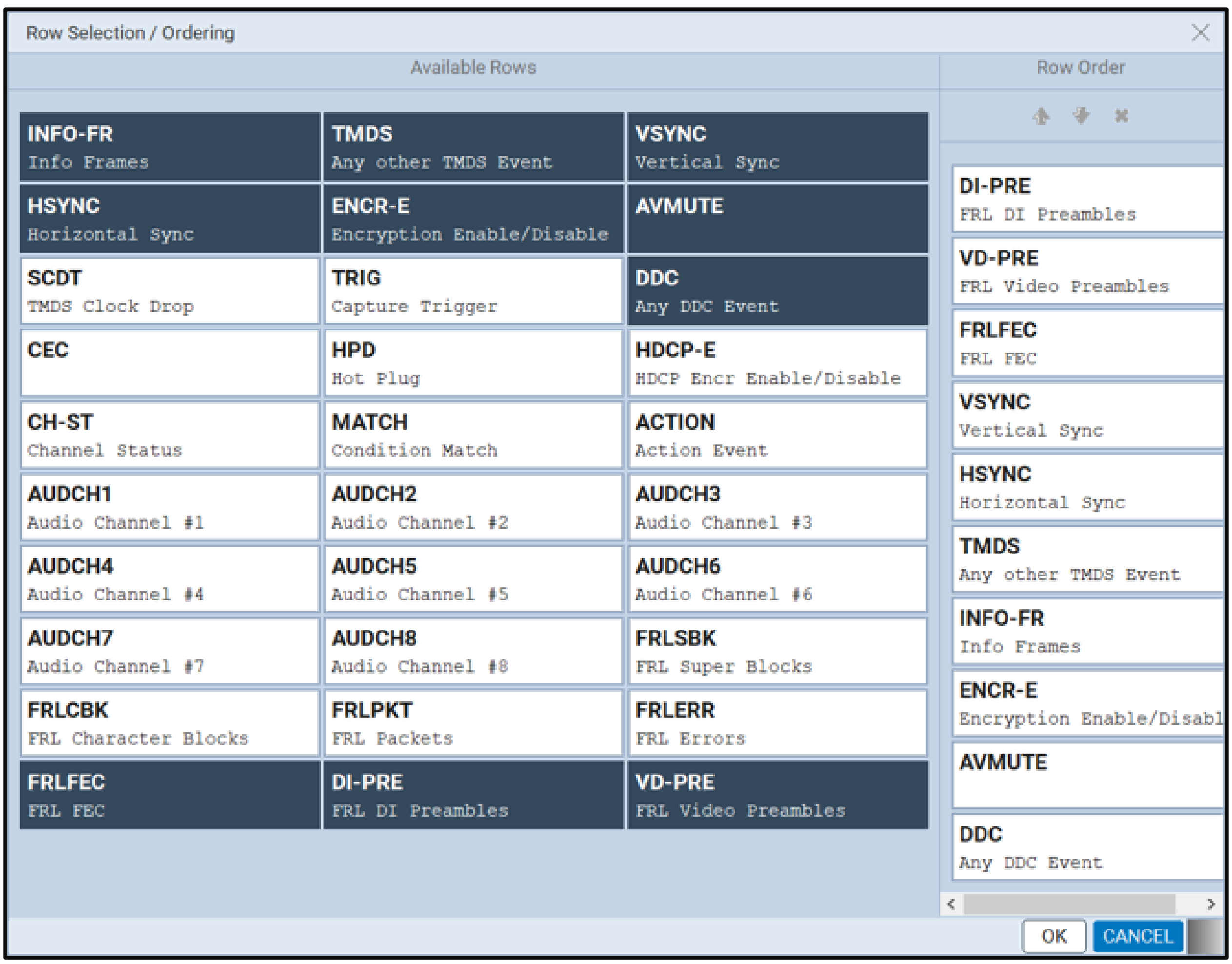
The dotted indicates the resultant section that is surrounded. The second view shows the resulting view.


HDMI Capture Viewer
Decode
Images
Timing
Audio
/User/My8K_Capture
Open
TMDS
Segment
Events
Find
Time Format:
HH:MM:SS.ms.us.ns(.ps)
Marker 1:
Marker 2:
Rows
1:59:9.137.611.104.394
1:59:9.137.603.572.097 [F:8 L:-- P:510] Character Block 1 Start
FRLSBK
TMDS
HSYNC
FRLCBK
FRLPKT
FRLERR
FRLFEC
DI-PRE
VD-PRE
INFO-FR
VSYNC
1:59:9.137.596.057.054
1:59:9.137.599.856.536
1:59:9.137.603.656.018
Time (H:M:S.ms.us.ns.ps)
1:59:9.137.607.455.502
1:59:9.137.611.266.568
Details
Raw Data
All
Event TimeStamp Fr/Bl Line Pix/Ofs Type SubType Description
95168 1:59:9.137.603.326.397 7 2008 FRL GAP 24 GAP characters
95169 1:59:9.137.603.337.196 7 2032 FRL FEC FEC Parity bytes
95170 1:59:9.137.603.340.796 8 0 FRL FRLSBK Super Block 2044 characters
95171 1:59:9.137.603.342.597 8 0 FRL FRLCBK Character Block 0 Start
95172 1:59:9.137.603.342.597 8 0 FRL GAP 76 GAP characters
95173 1:59:9.137.603.376.797 8 76 FRL ACTIVE 426 Video data characters
95174 1:59:9.137.603.568.497 8 502 FRL FEC FEC Parity bytes
95175 1:59:9.137.603.572.097 8 510 FRL FRLCBK Character Block 1 Start
95176 1:59:9.137.603.572.097 8 510 FRL ACTIVE 502 Video data characters
95177 1:59:9.137.603.797.997 8 1012 FRL FEC FEC Parity bytes
95178 1:59:9.137.603.801.597 8 1020 FRL FRLCBK Character Block 2 Start
95179 1:59:9.137.603.801.597 8 1020 FRL ACTIVE 72 Video data characters
95180 1:59:9.137.603.833.997 8 1092 FRL GAP 8 GAP characters
95181 1:59:9.137.603.837.597 8 1100 FRL ACTIVE 422 Video data characters
CLOSE


HDMI Capture Viewer
Decode
Images
Timing
Audio
Open
Segment
Events
Find
Time Format:
HH:MM:SS.ms.us.ns(.ps)
Marker 1:
Marker 2:
Rows
VIDEO
Details
Raw Data
All
Event TimeStamp Fr/Bl Line Pix/Ofs Type SubType Description

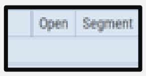
5.3.5 Selecting Data to View in the Event Plot

The **Event Plot** enables you to select what data elements to display. You use the Rows Rows button to access the dialog box. The following dialog box will appear allowing you to select what data to display in the **Event Plot**.



5.3.6 General Controls – Event Plot

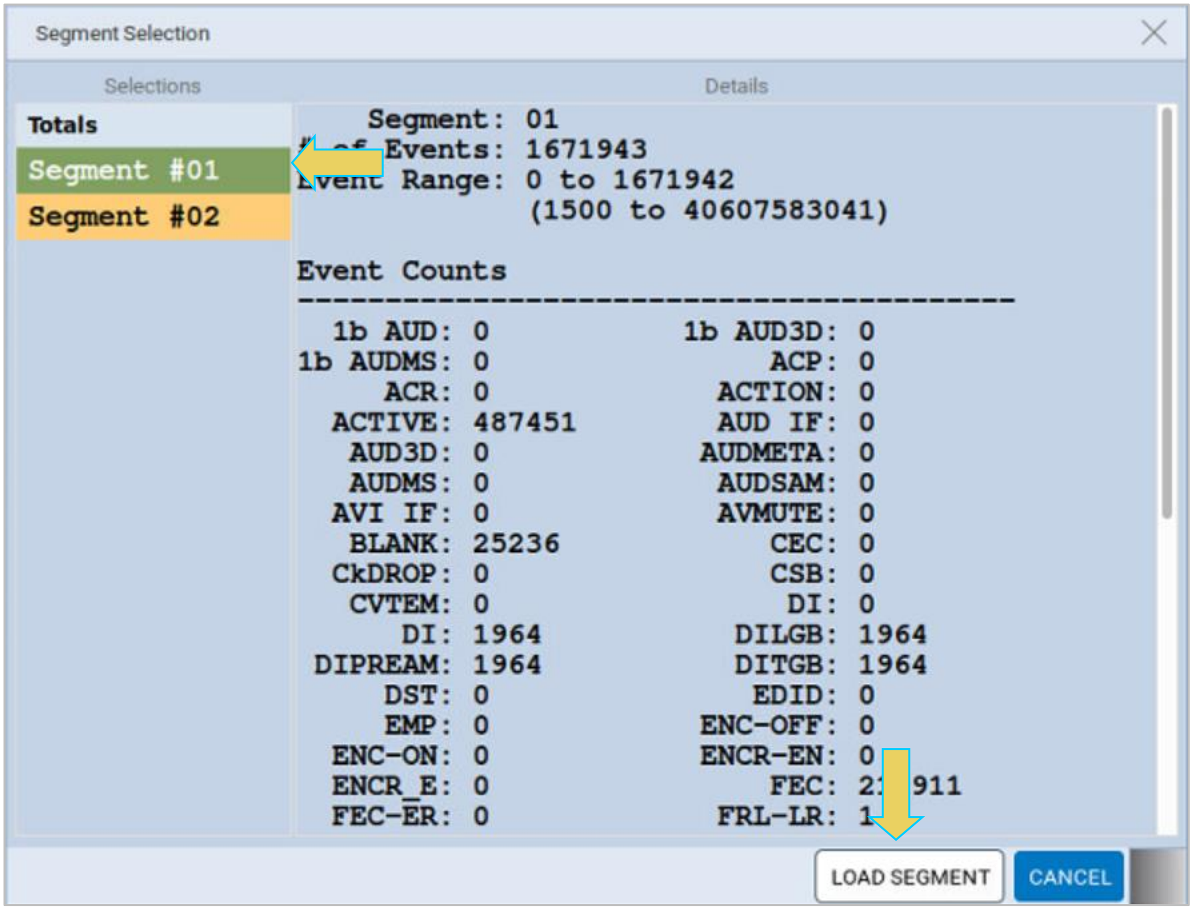
The various other controls in the **Event Plot** are described in the tables and screens that follow.

Even Plot	Function
General Control   	**User path status** – shows the name of the capture file and its location. **Segment** – Large captures are broken into smaller distinct sections called segments to make them more manageable and to improve speed and performance. When you click on the Segment activation button, a dialog box appears enabling you to select and load another segment. In the example to the left, there are no segments to the button is grayed out. This dialog box is described further below. **Events** – The Events activation button enables you to filter the captured data by type. When you click on the Events button a dialog box appears to enable you to select or deselect data types individually or a page at a time. This dialog box is described further below. **Rows** – The Rows activation button enables you to configure the data types that appear in the Event Plot window. When you click on this a dialog box appears enabling you to configure the rows. This dialog box is described further below. **Find** – The Find activation button enables you to locate captured data by type. When you click on the Find button a dialog box appears to enable you to specify a data type to search on. This dialog box is described further below.

5.3.7 Working with Segments in the Event Plot Panel

The Segments in the **Event Plot** panel work the same way they do as the **Decode** panel. Large captures are broken into smaller distinct sections called segments to make them more manageable and to improve speed and performance. When you click on the Segment activation button, a dialog box appears (shown below) enabling you to select and load another segment. This dialog box is shown below. The Selections section on the left lists the segments in the capture. The Details section on the right shows you the packet makeup of the segment as well as the number of packets and the range of packets in the overall capture.

From the Selections panel you can select and load a different segment by highlighting a segment and then clicking on the Load Segment activation button on the bottom right. You can also select any segment to view its packet contents in the Details panel. If you wish to view the total packets of all segments simply highlight the Totals Totals button.



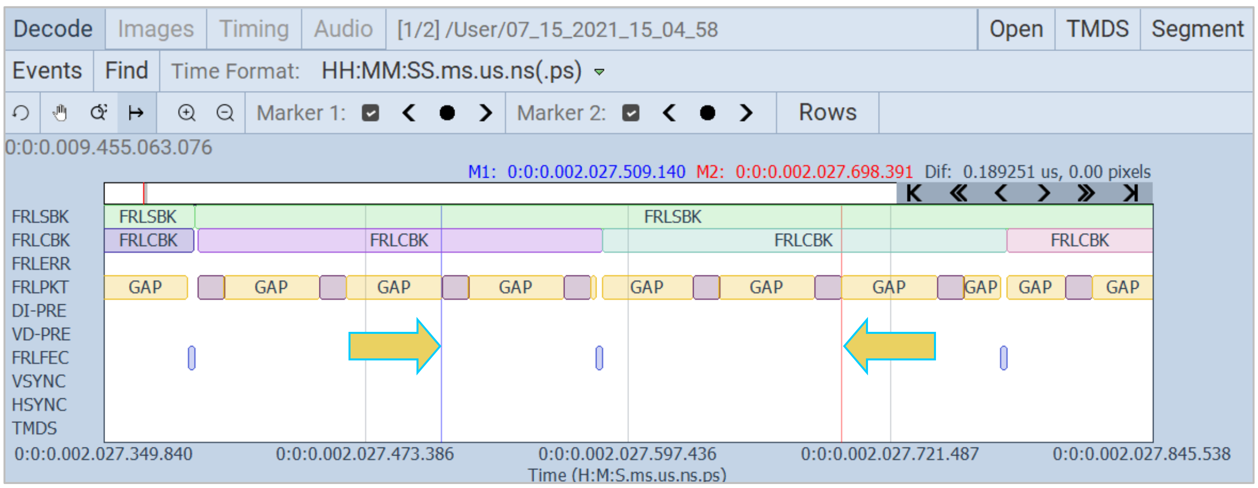
5.3.8 Working with Markers

The **Event Plot** panel enables you to view the data at a high level and identify points of interest for further analysis. You can set two cursors or "markers" in the **Event Plot** panel at particular points of interest.

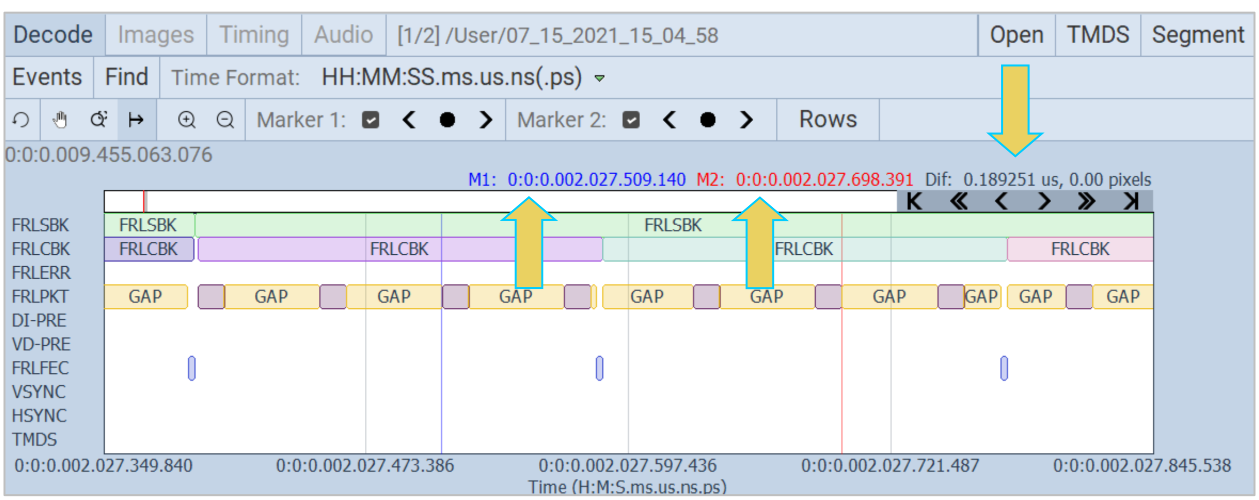
The **Event Plot** will show you the time difference between the two cursors. You can fine tune the position of the cursors with the left and right arrows associated with each marker 

. The ● center allows you to center the particular marker on the Event Plot window.

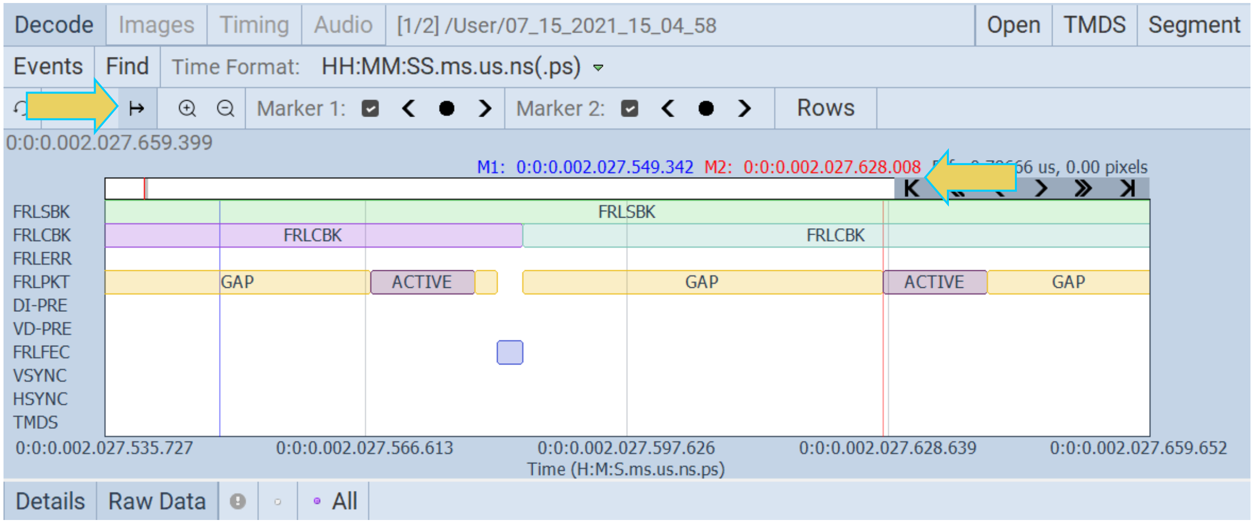
The screens below show the markers being set and the resulting markers placed in the **Event Plot** panel. Note that you can also set the markers using the right-click menu. This is typically the preferred method because the markers will appear exactly where you right-click.



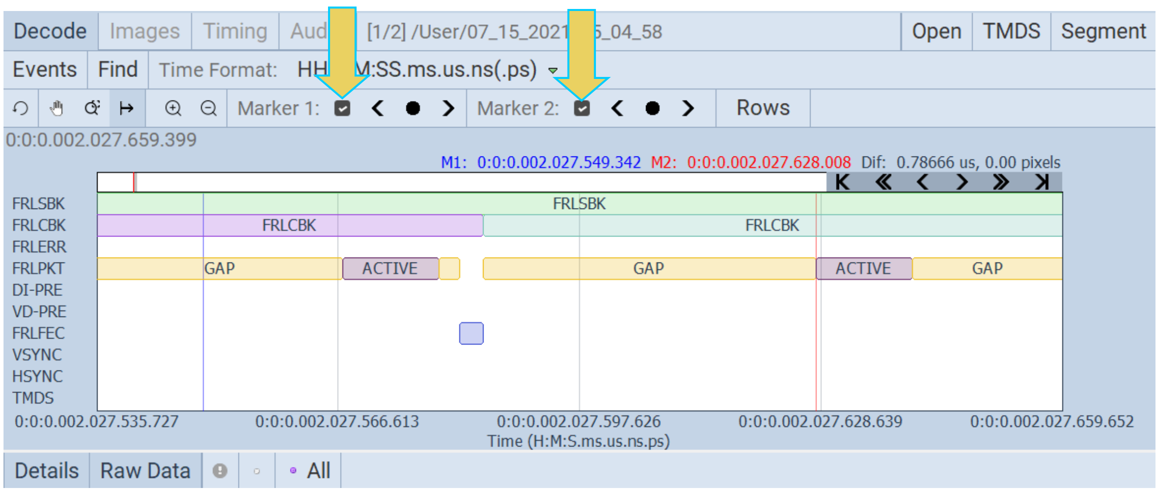
You can see the timestamp associated with each marker just above the area where the data is shown. The text to the right shows the difference in microseconds and pixels between the two markers.

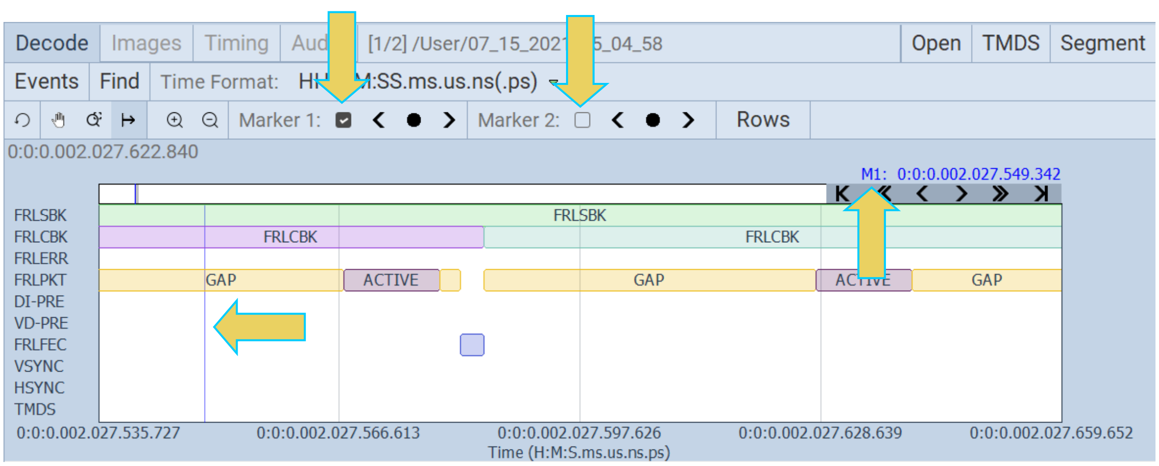


You can also set the markers with the Marker tool as shown below. When you begin the sweep the Marker tool cursor will appear as shown in the menu bar.



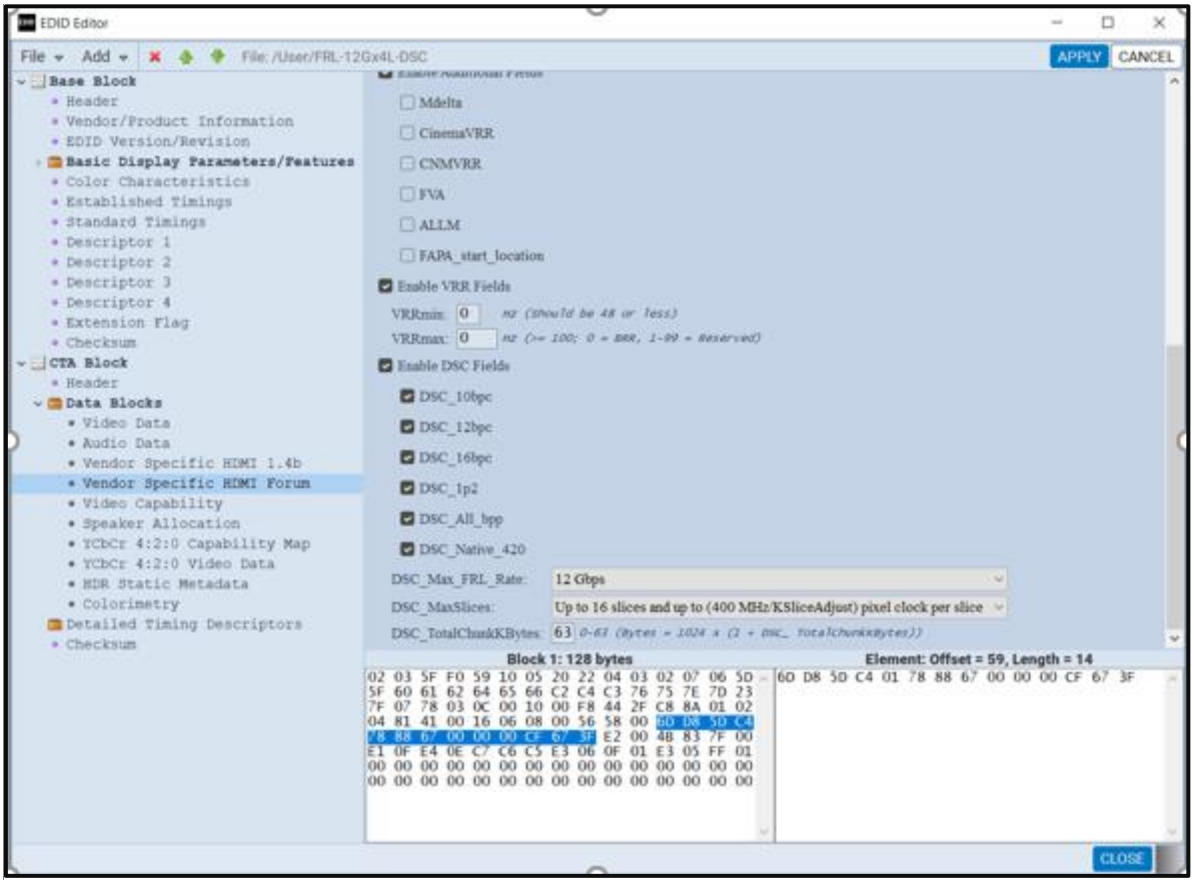
You can remove the marker using the check boxes associated with each Marker on the top menu bar. Refer to the screens example below.





6 EDID Editor Panel

The **EDID Editor** panel enables you to modify existing EDIDs or create new ones through a graphical interface. You can import .xml based EDID files from your PC for use on the M42h 96G Video Analyzer/Generator Rx port. In this way you can emulate any EDID at the M42h 96G Video Analyzer/Generator Rx port to ensure that your source responds correctly to it. A sample screen shot of the **EDID Editor** is shown below.



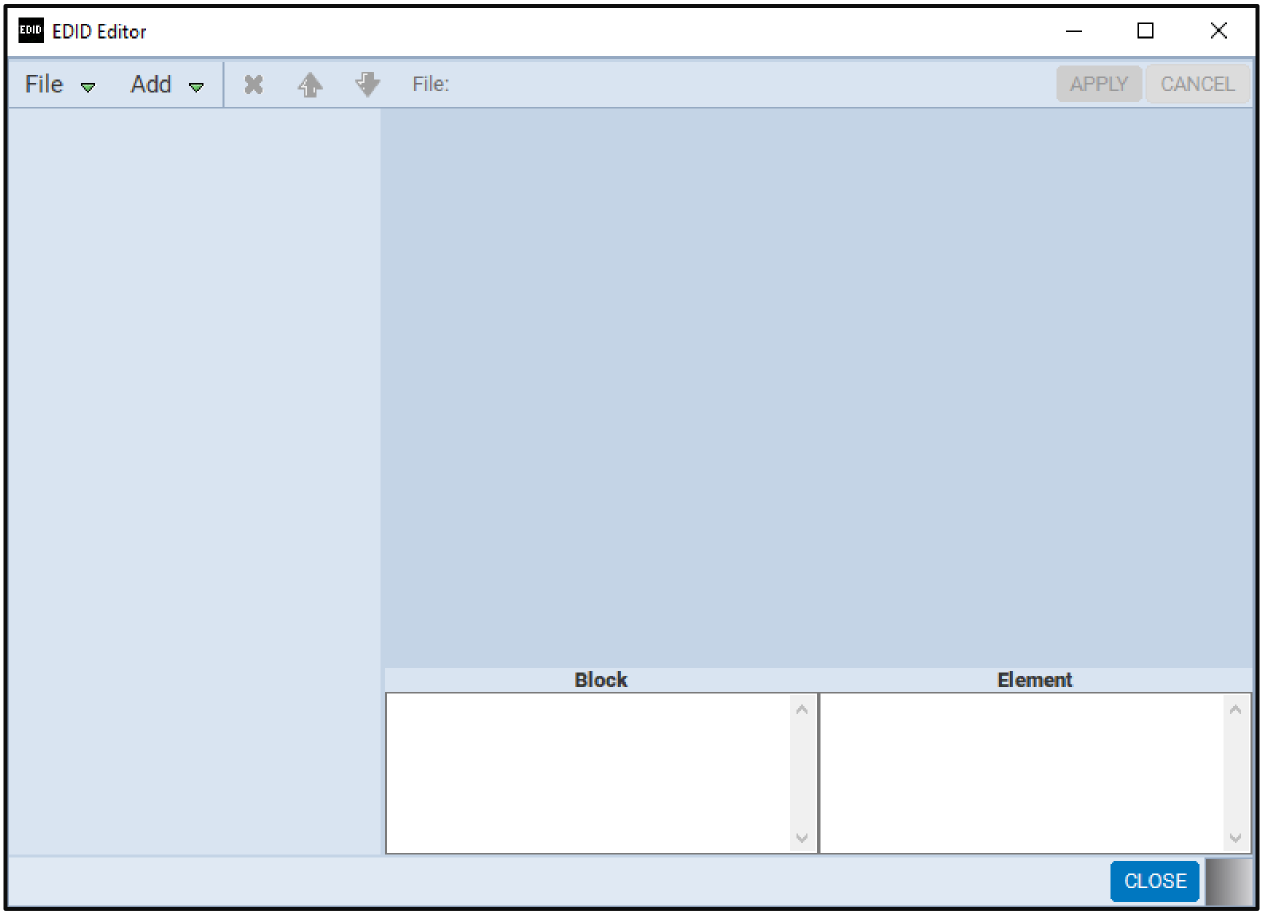
6.1 Opening the EDID Editor

You may have many EDIDs stored in the EDID directory of the external ATP Manager suite of directories. You can open any one of these EDIDs, modify and resave under a different name.

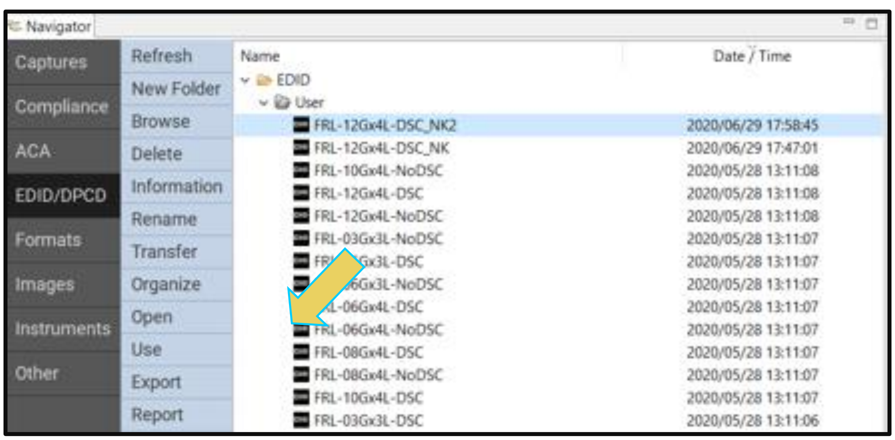
To open an EDID stored on your host PC:

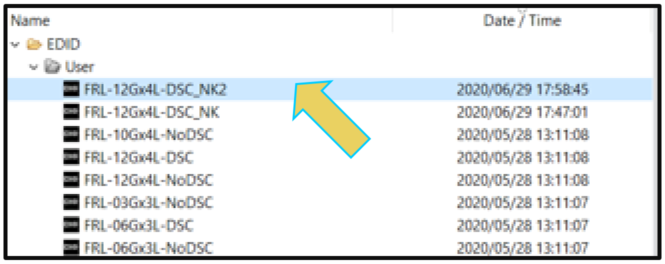
1. Open the EDID Editor from the Editors page on the App panel.

   The EDID Editor opens without an EDID loaded as shown below.



1. Open an EDID stored on the PC.

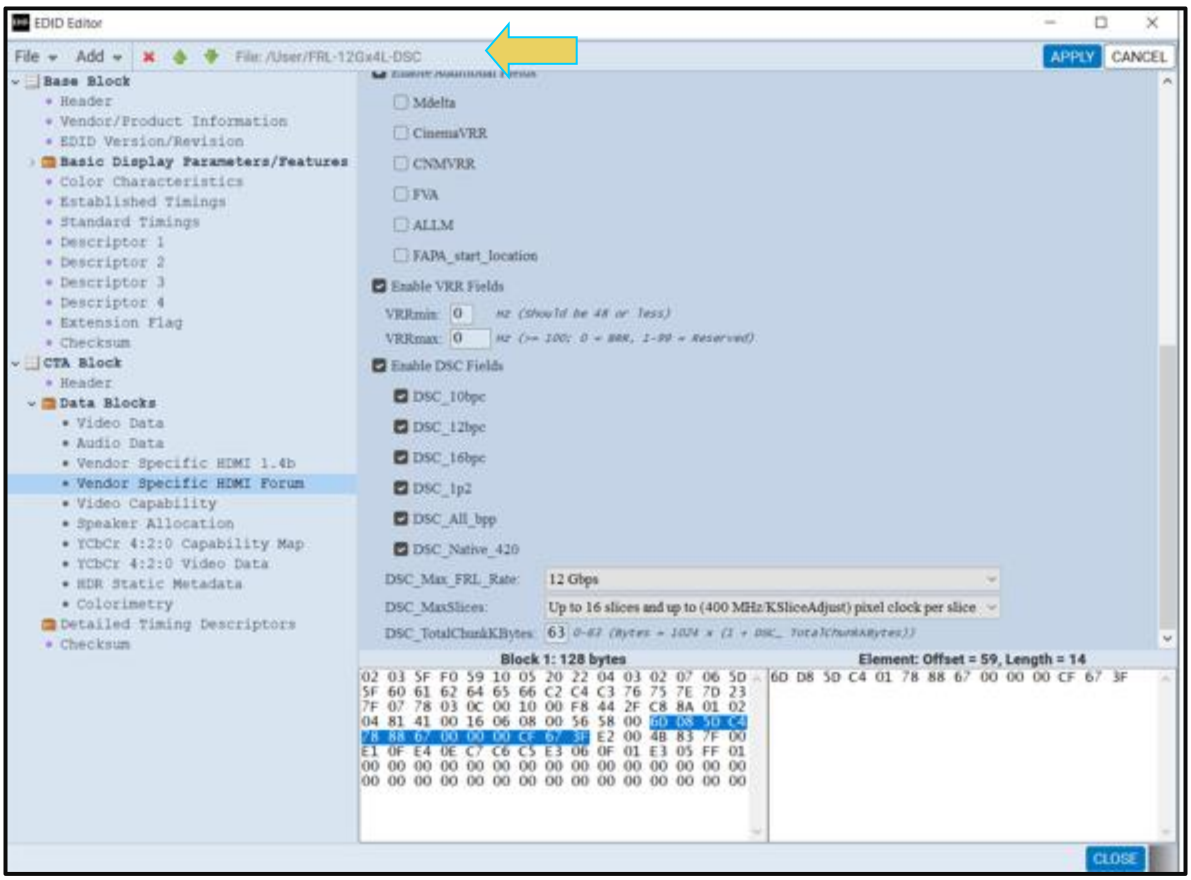




2. Select the EDID and click on the OK activation button. Click Cancel if you cannot find an appropriate EDID.

Note: You must have downloaded EDIDs or saved EDIDs into the EDID directory to see them in the EDID navigator tab shown above. You can use the Quantum Data EDID Library to obtain these EDIDs. The EDID Library which uses a naming convention for all its EDIDs; these are represented in the screen shot above. Also note that there is a M42h EDID Library Application Note available on the EDID Library website which describes how to use the EDID Library with the M42h 96G Video Analyzer/Generator.

Once you load an EDID the name appears on the status strip on the top of the panel as shown below.

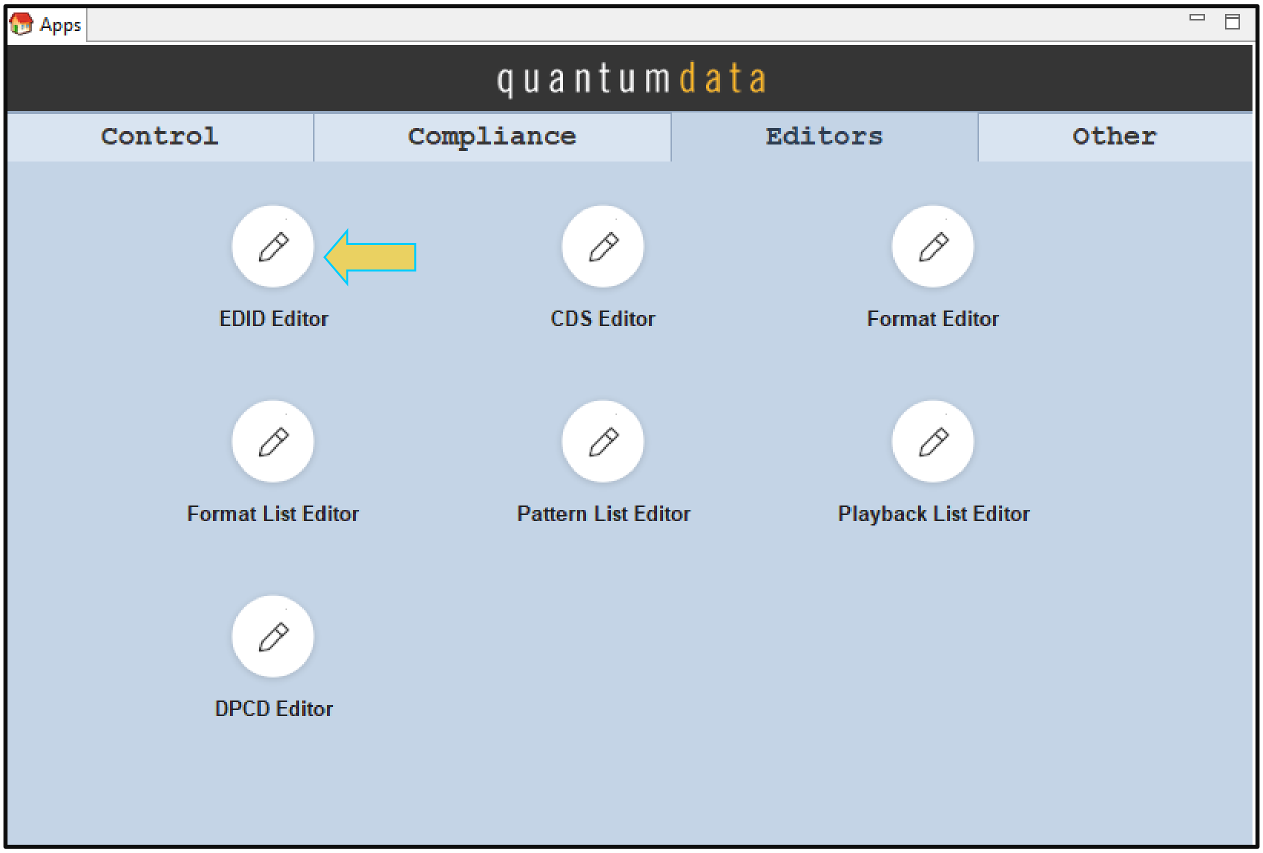


6.2 Loading an EDID into the EDID Editor

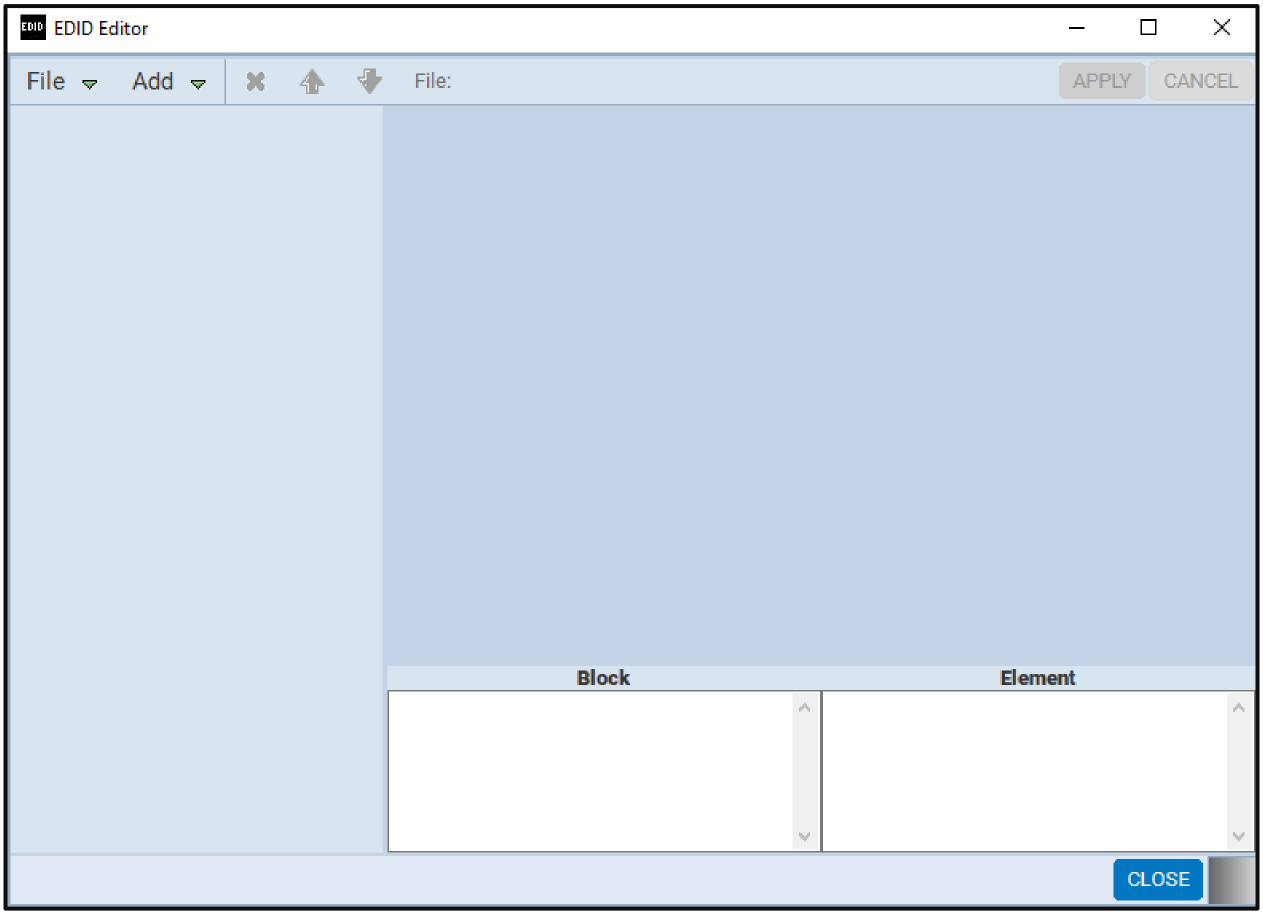
You can either load a new EDID or modify an existing EDID. When modifying an existing EDID case, you may have many EDIDs stored in the EDID directory of the external ATP Manager suite of directories. You can open any one of these EDIDs, modify and resave under a different name.

To open the EDID Editor:

1. Open the EDID Editor from the Editors page on the App panel. Click on **EDID Editor**.

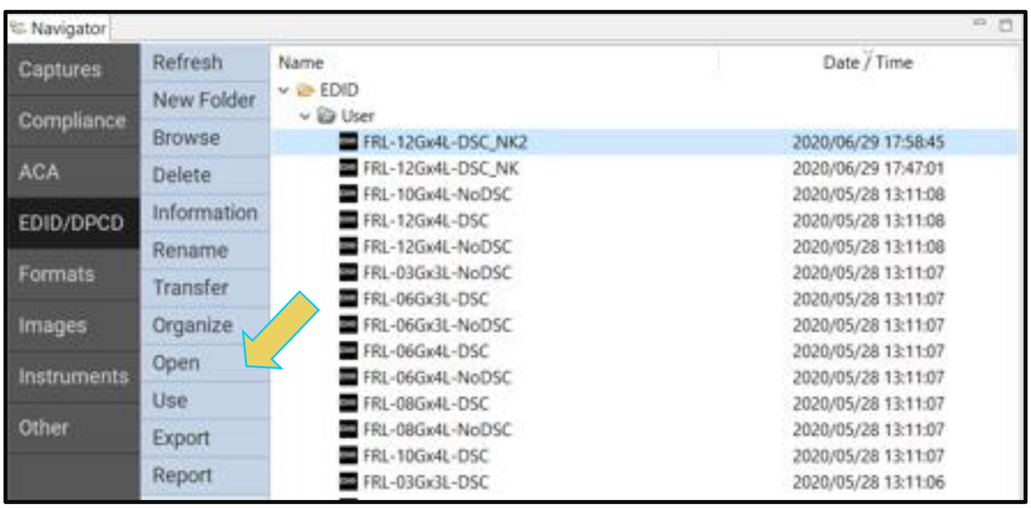


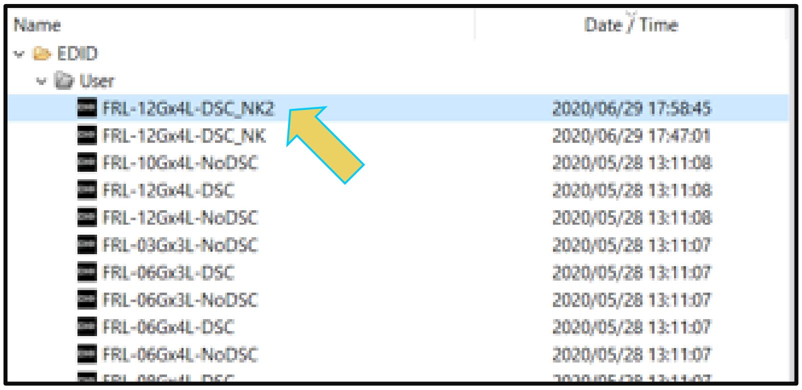
The EDID Editor opens up without an EDID loaded as shown below.



To open an EDID stored on your PC.

1. Open an EDID stored on the PC.

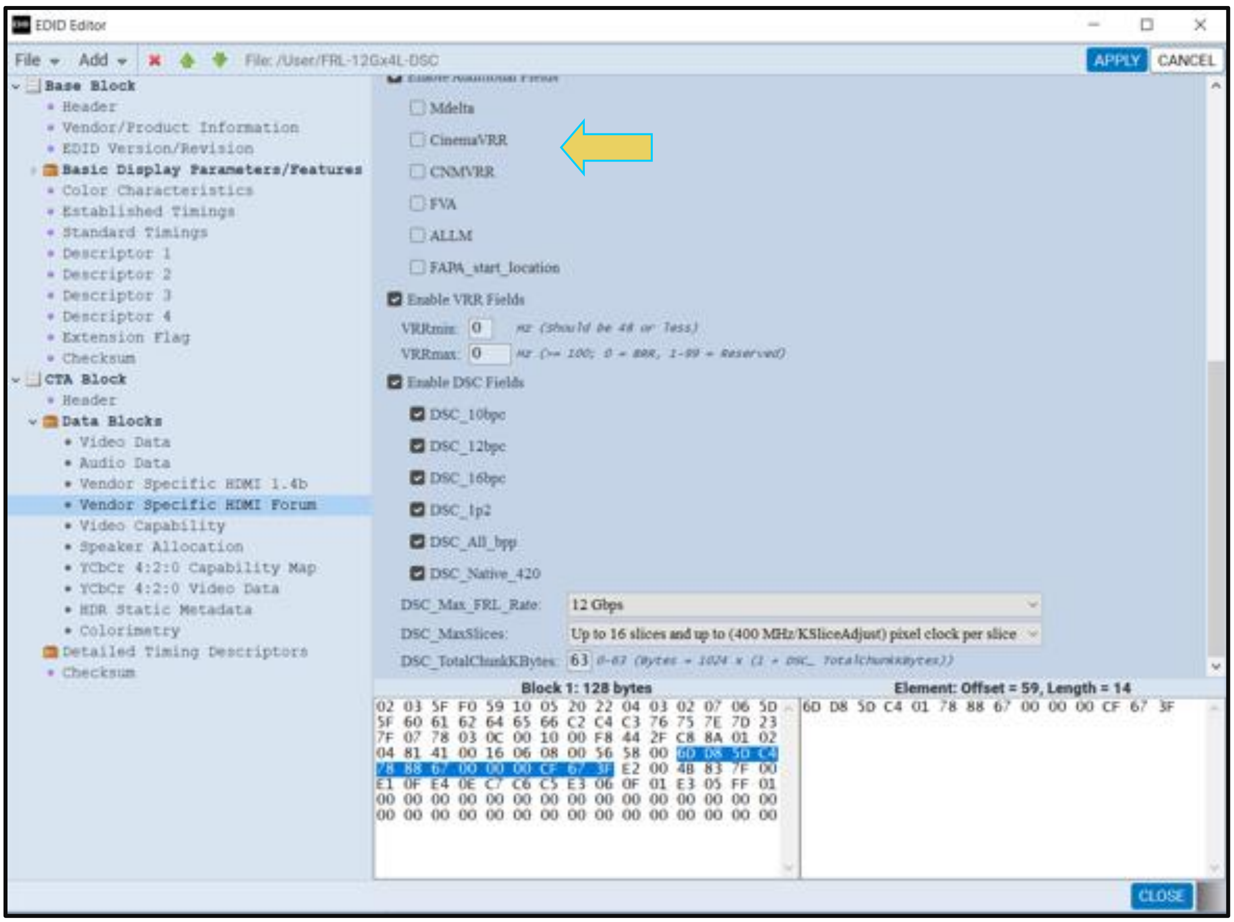




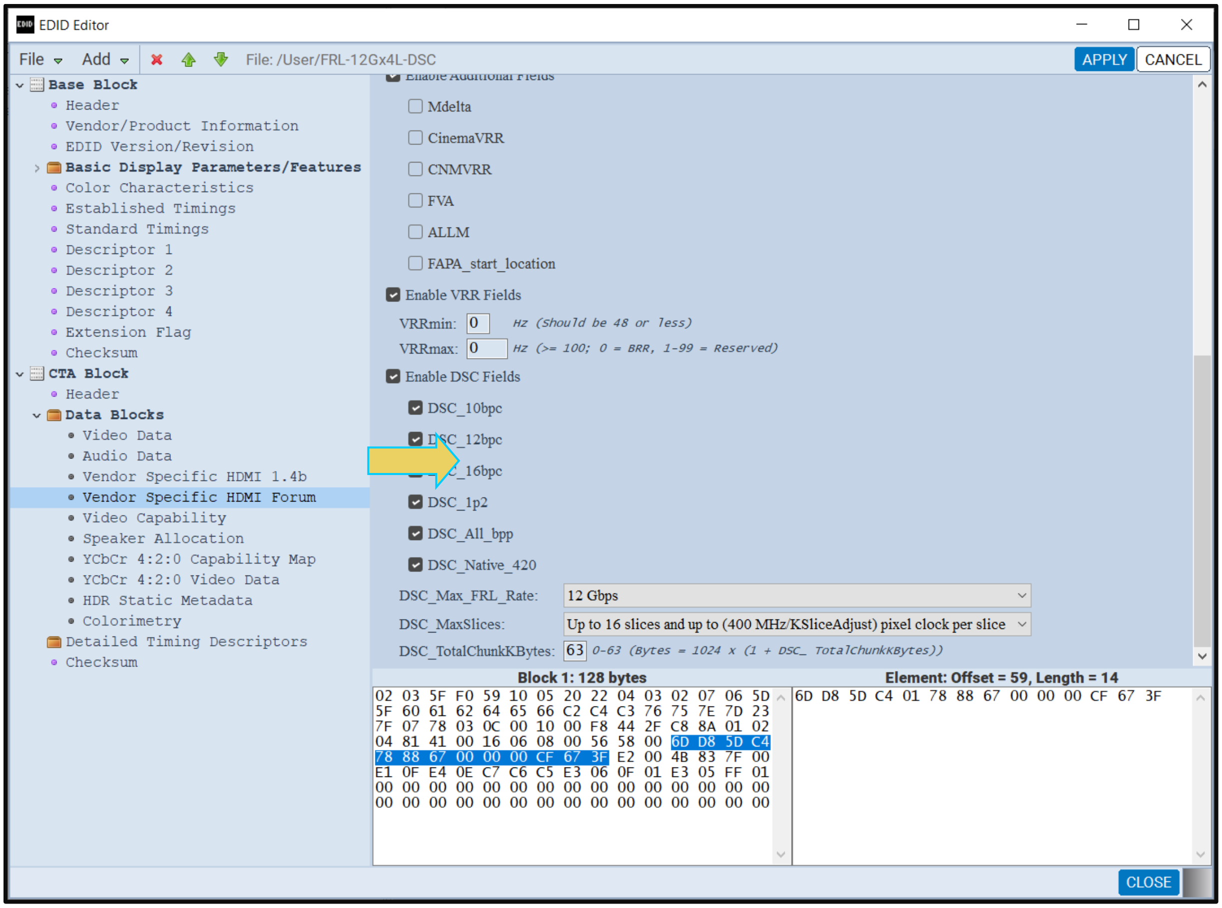
3. Select the EDID and click on the OK activation button. Click Cancel if you cannot find an appropriate EDID.

Note: You must have downloaded EDIDs or saved EDIDs into the EDID directory to see them in the EDID navigator tab shown above.

Once you load an EDID the name appears on the status strip on the top of the panel as shown below.



The following example shows an EDID that indicates support for Display Stream Compression (DSC).



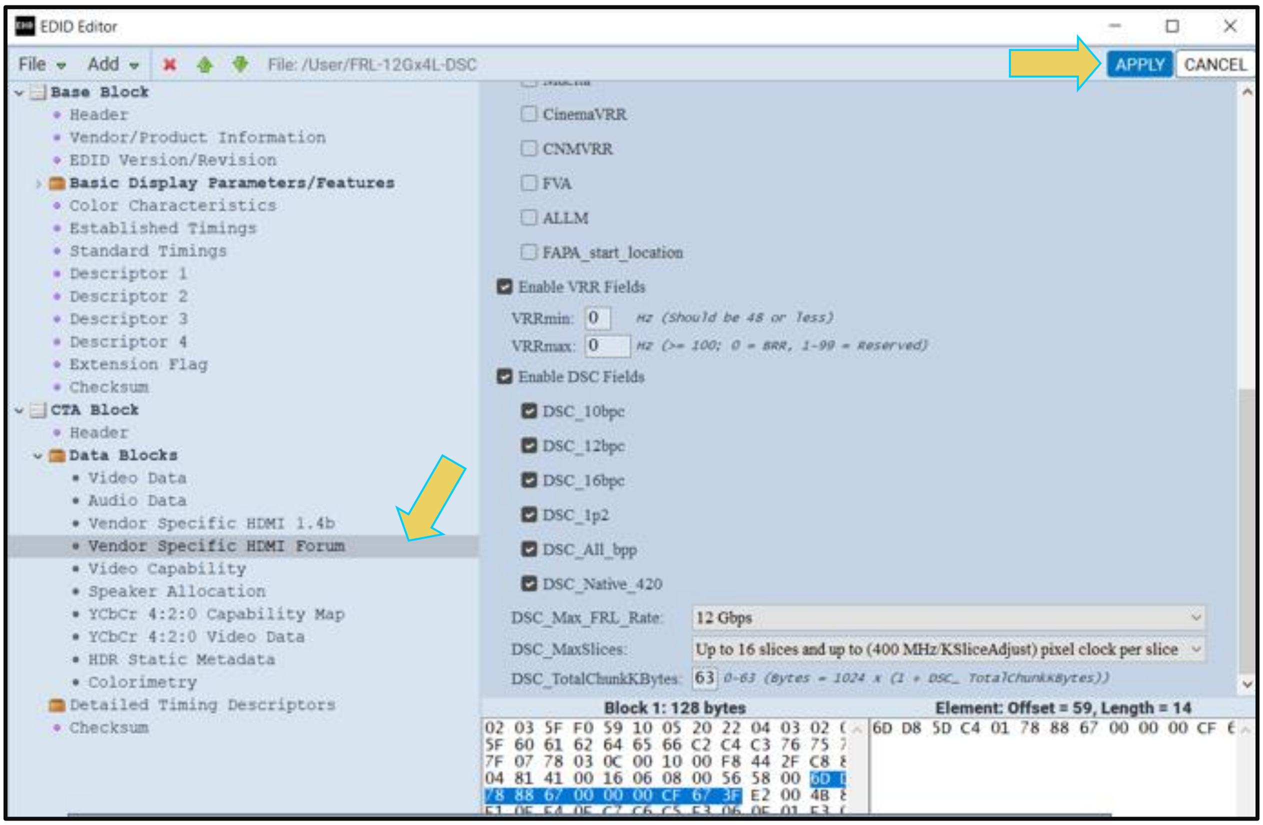
6.3 Making Modifications to an EDID with the EDID Editor

Once you have loaded an EDID you can make changes to individual field values, add data blocks, delete data blocks, add timings, delete timings or audio formats supported, etc. You can enable or disable parameters using radio buttons or check boxes and you can change values through pull-down menus or text field boxes.

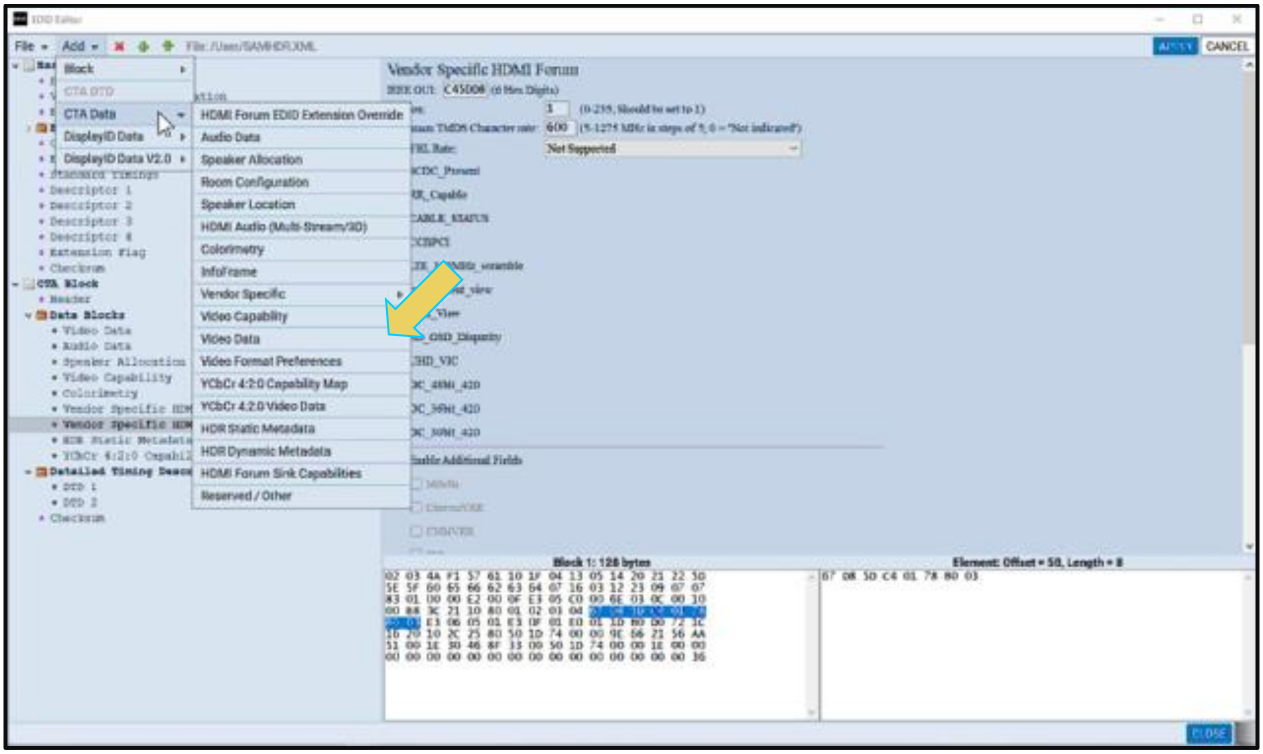
To make a change to an EDID loaded into the EDID Editor:

1. To make a change to an existing EDID on an existing data block, select that data block using the navigator panel EDID Elements on the left.

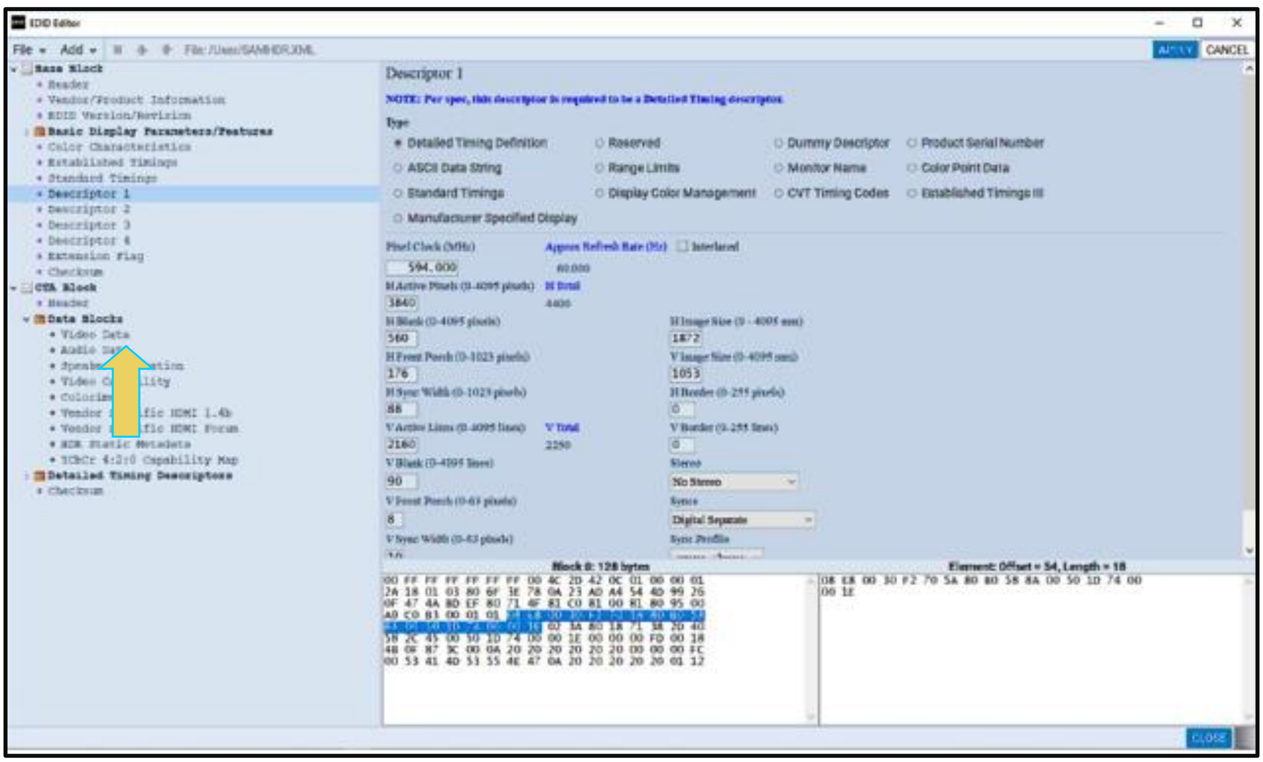
   Use the check boxes or fields to make the change, then click on the **Apply** activation button to enable the change. The example below shows the Deep Color definition being changed in the Vendor Specific block.



To add a block into an EDID, use the right-click menus or pull-down menus as shown below (adding a Video Data Block into the CEA Extension block):

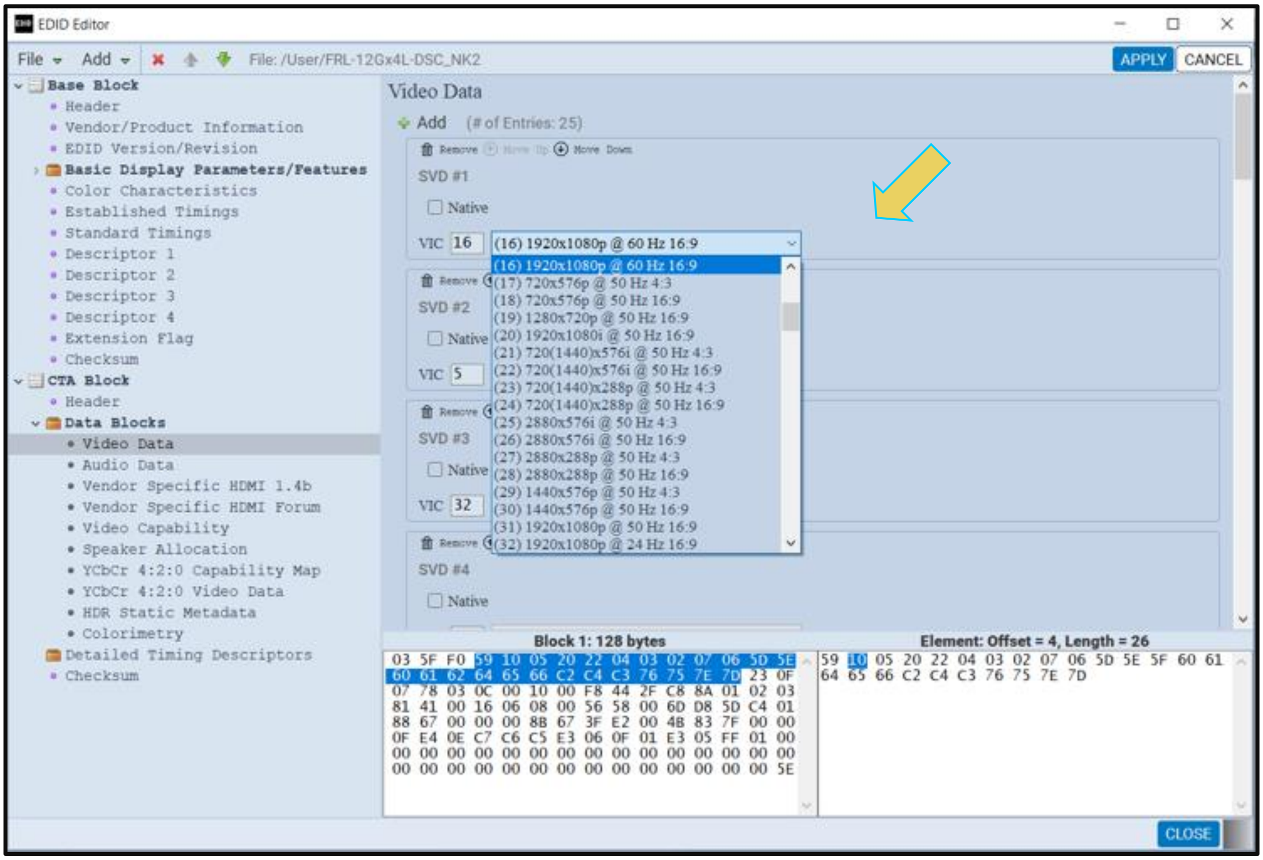


2. Select the block of EDID data that you wish to view or modify using the EDID Elements list on the left of the **EDID Editor** panel. Examples below.

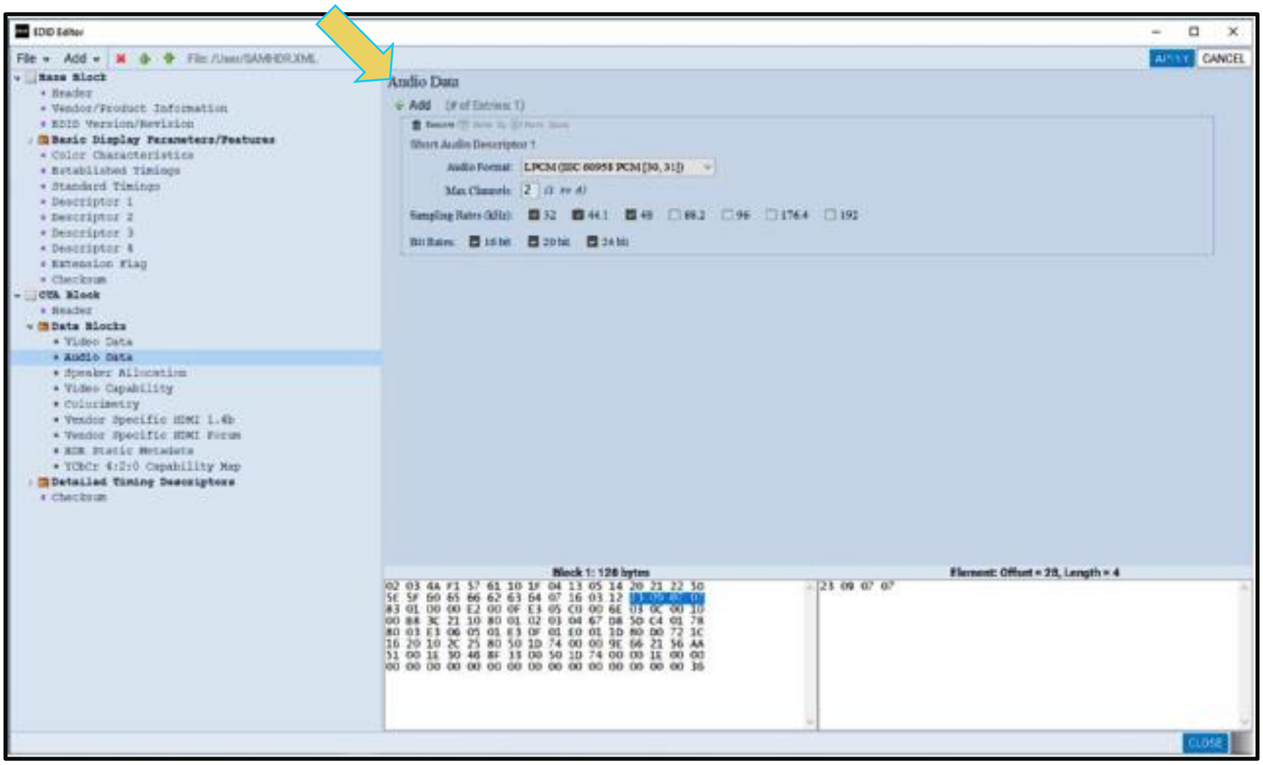


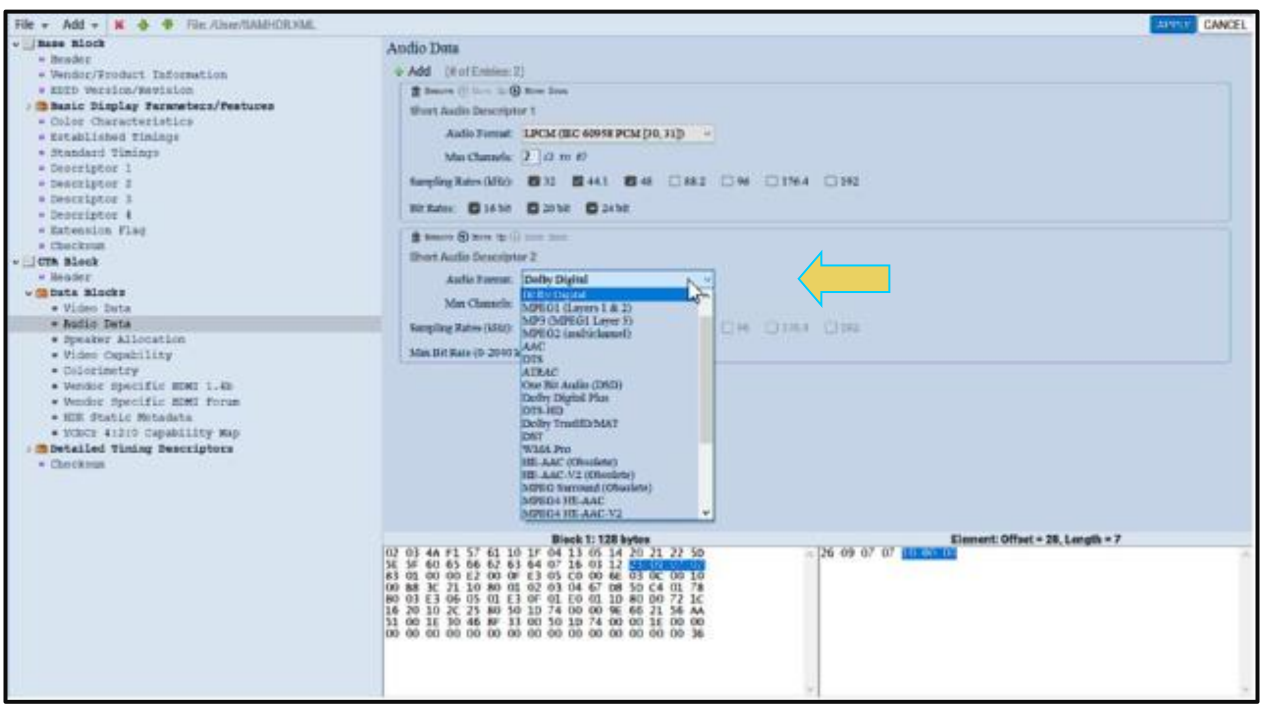
3. Define the new data block in accordance with your specifications.

The example below shows a **Video Data** block's Native timing being defined.



The second example shows additional audio descriptor added to an **Audio Block**. The first screen example only a single audio descriptor, the second screen example shows selecting the audio format. To add a descriptor you click on the **Add** Add activation button.





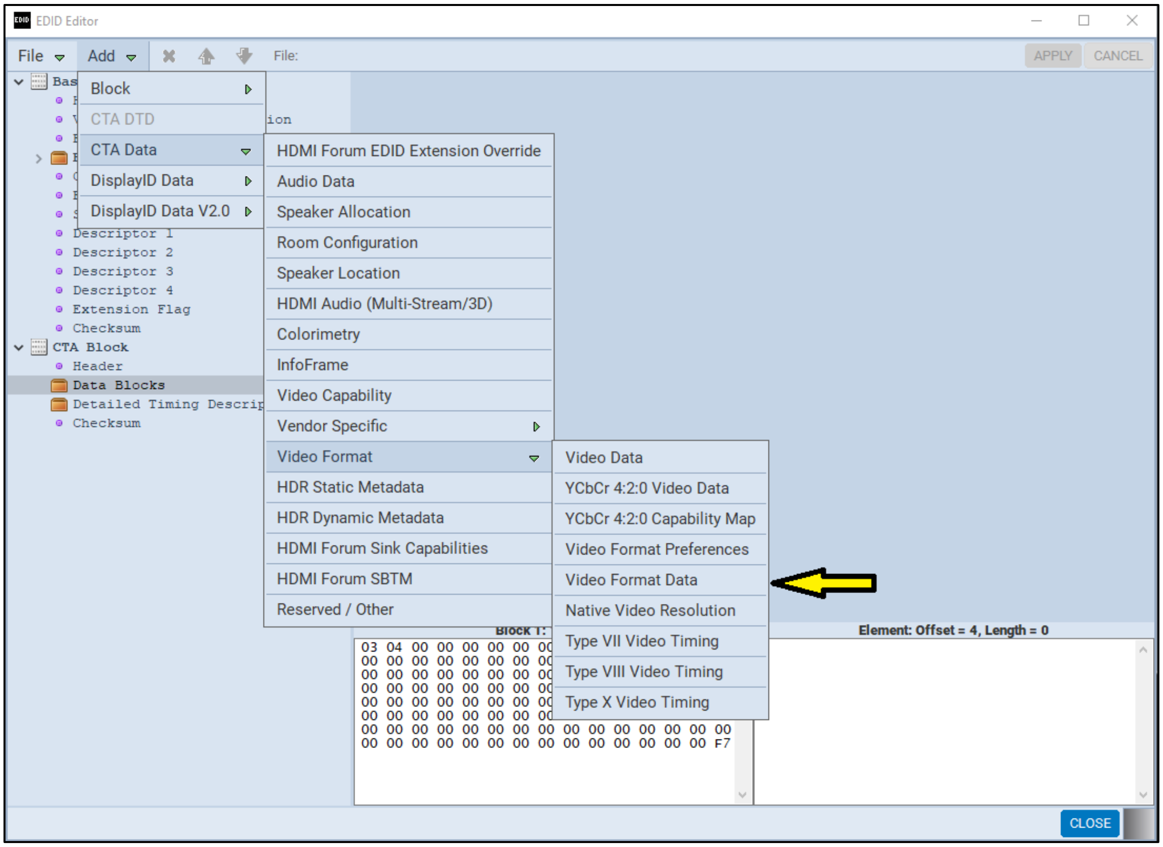
4. Click the **Apply** APPLY button to save the change. Then click on Close to exit the **EDID Editor**.

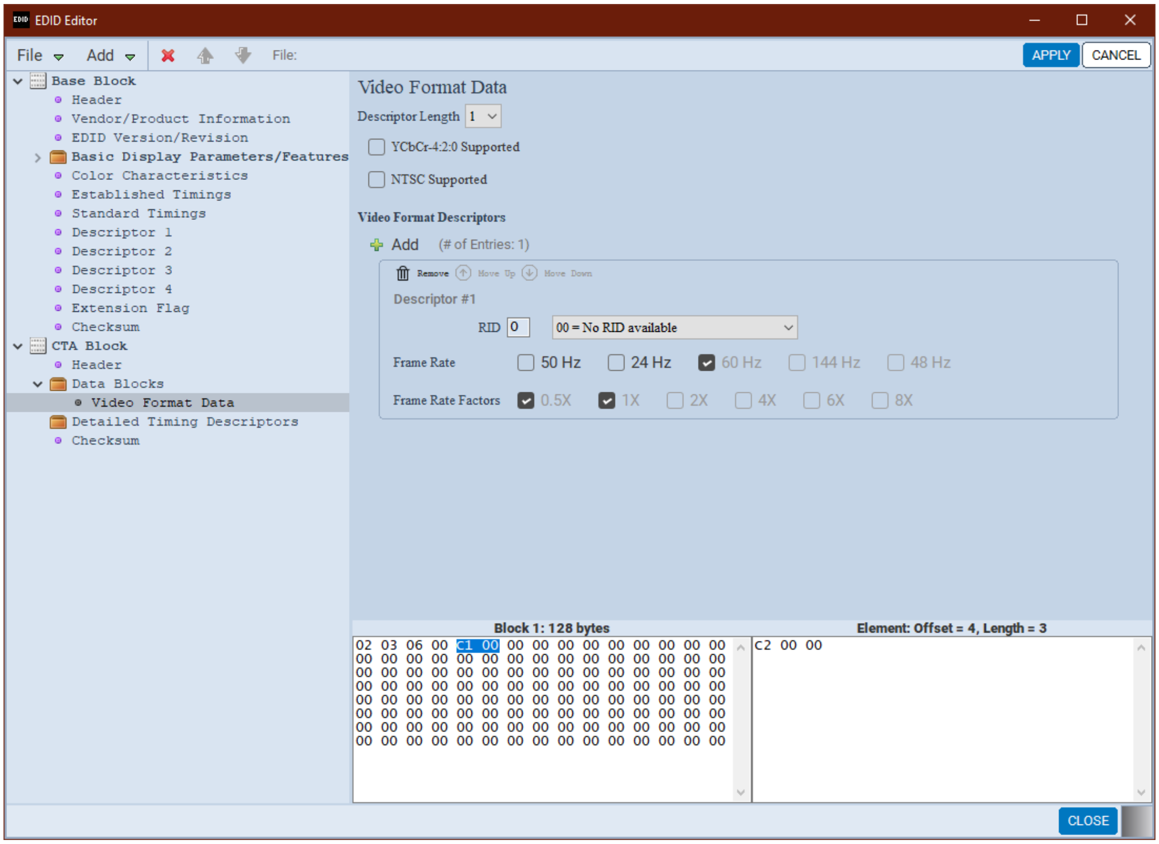
Once you make a change on a particular EDID block you use the **Apply** button to invoke the change.

Use the following table as a guide to make other changes in the **EDID Editor**.

Item	Item - Column	Description
EDID Edit	**Append CEA Block**	Adds a CEA extension block to the existing VESA block.
	Append CEA DTD	Adds a CEA Detailed Timing Data block.
	Add CEA Speaker Allocation Data Block	Enables you to add a new Speaker Allocation Data Block to the CEA extension block.
	Add CEA Colorimetry Data Block	Enables you to add a new Colorimetry Data Block to the CEA extension block.
	Add CEA Video Capability	Enables you to add a new Video Data Block to the CEA extension block.
	Add CEA Audio Data Block	Enables you to add a new Audio Data Block to the CEA extension block.
	Add CEA Video Data Block	Enables you to add a new Video Data Block to the CEA extension block.
	Add CEA Vendor Specific Data Block - General	Enables you to add a new Vendor Specific Data Block to the CEA extension block.
	Add CEA Vendor Specific Data Block - HDMI	Enables you to add HDMI information to new Vendor Specific Data Block to the CEA extension block.
	Insert CEA Vendor Specific Audio Data Block	Enables you to add a new Vendor Specific Audio Data Block to the CEA extension block.
	Add CEA Vendor Specific Video Data Block	Enables you to add a new Vendor Specific Video Data Block to the CEA extension block.
	Delete Element	Deletes a selected EDID element or block.

A new Optimized Video Timing (OVT) data block has been added to the EDID Editor as shown below.



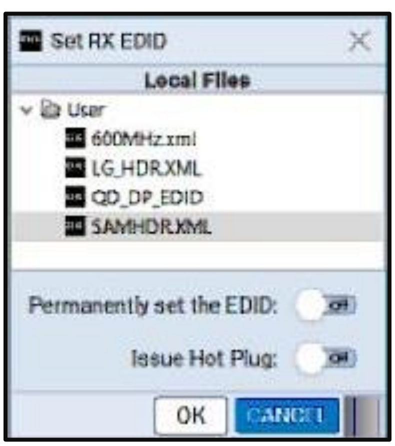


6.4 Emulating a Specific EDID

Once you have loaded an EDID and made your changes to it you can assign it to the M42h 96G Video Analyzer/Generator Rx port for emulation and testing your source device. This subsection describes how you can do that.

To assign an EDID to the Rx port:

1. Select Set M42h Rx EDID.



.

2. Select an EDID to assign to the M42h 96G Video Analyzer/Generator’s Rx port. Click OK after selecting the EDID.

Note that there are two check box options on the dialog box. The following is a description of each:

Permanently set the M42h HDMI Protocol Analyzer’s EDID – This means that the EDID that you provision will persist through a reboot of the M42h. Otherwise, the default M42h EDID will be reprovisioned when a reboot occurs.

Issue Hot Plug – This means that the M42h HDMI 2.1 Protocol Analyzer will issue a hot plug when you click the Ok activation button on this dialog box.

7 Basic Analyzer (Snap Shot "Real Time" Mode)

Important Note: The Basic Analyzer "Real Time" functionality is not currently supported in the M42h. It will be supported in a future release. The information below is provided for future reference only. Only the Timing Analyzer segment of the functionality is currently supported.

7.1 Overview

This chapter describes how to view the incoming HDMI® TMDS and FRL video metadata in real time using the Real Time mode. ***The Real Time mode is only available through the embedded GUI using an external monitor. It is not supported through the ATP Manager operating on a remote host PC***.

The Real Time mode allows you to view the following data in a series of **snap shots** of the incoming video frames:

Video – View the incoming video even when encrypted with HDCP 2.2 (in TMDS mode only).

InfoFrames – View the AVI, Audio, Vendor Specific InfoFrames.

Data Islands – View various other data islands such as General Control Packet and Source Product Descriptor.

Video Timing Data – View the format, resolution, color depth, video type and specific pixel values.

DDC Data – View the DDC transactions such as the EDID and HDCP 2.2 transactions.

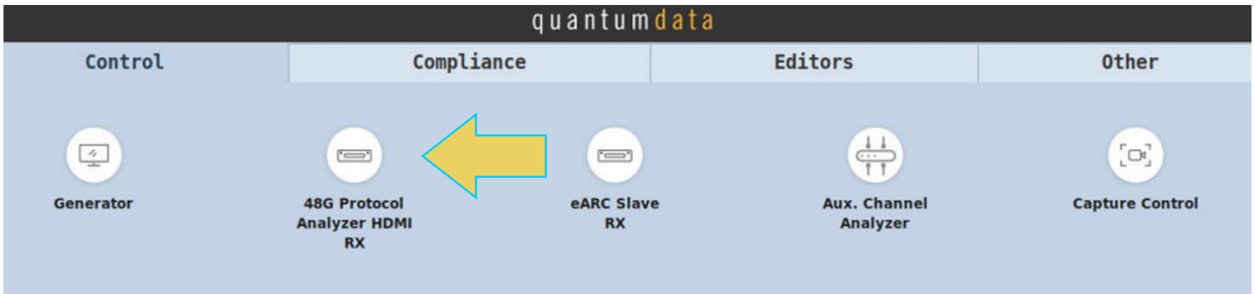
7.2 Accessing the Real Time mode

The Real Time mode can be accessed from the App panel **Control** using the procedures below.

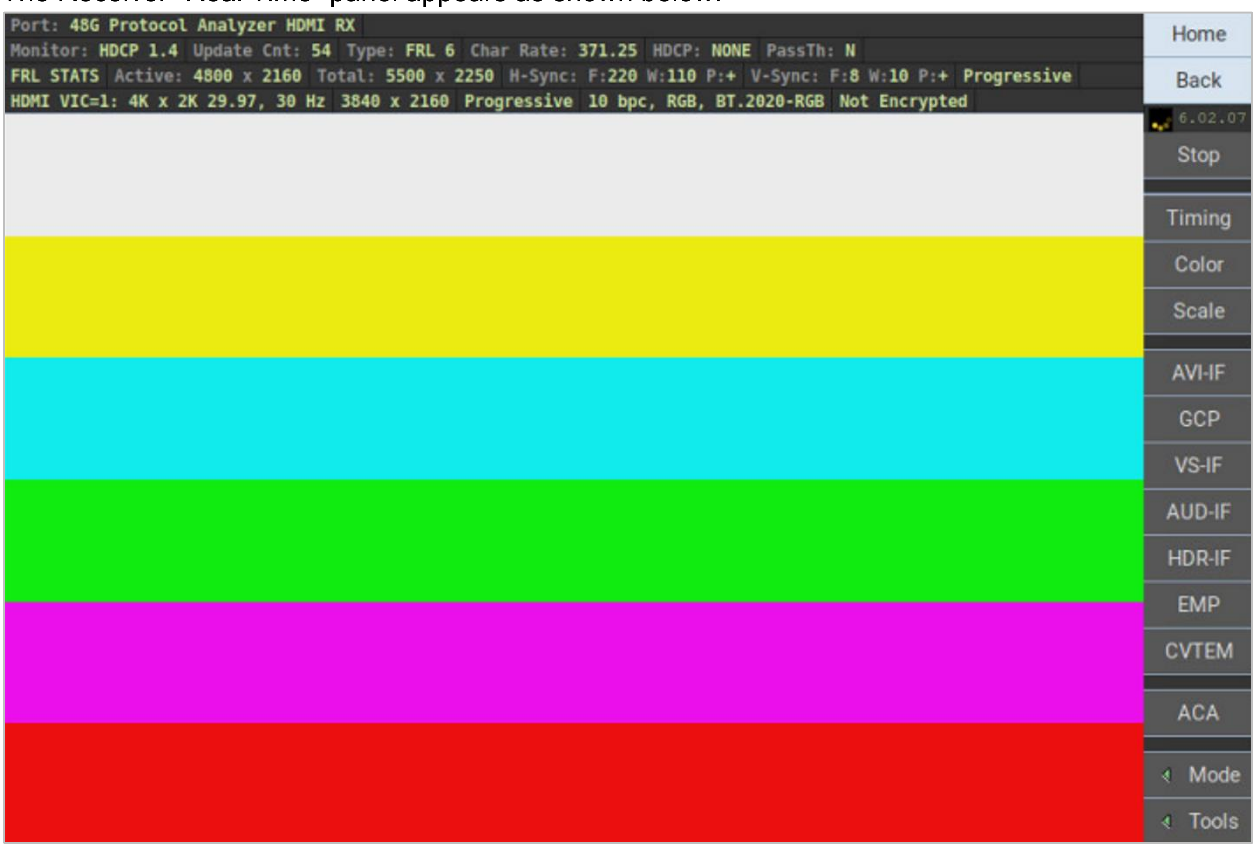
To access the Real Time mode:

1. Select the **96G Protocol Analyzer HDMI RX** within the **Control** tab on the embedded ATP Manager home screen.

   Note: The Real Time viewing windows are not available on the PC-based external ATP Manager.



The Receiver "Real Time" panel appears as shown below:



7.3 Real Time Mode Overview

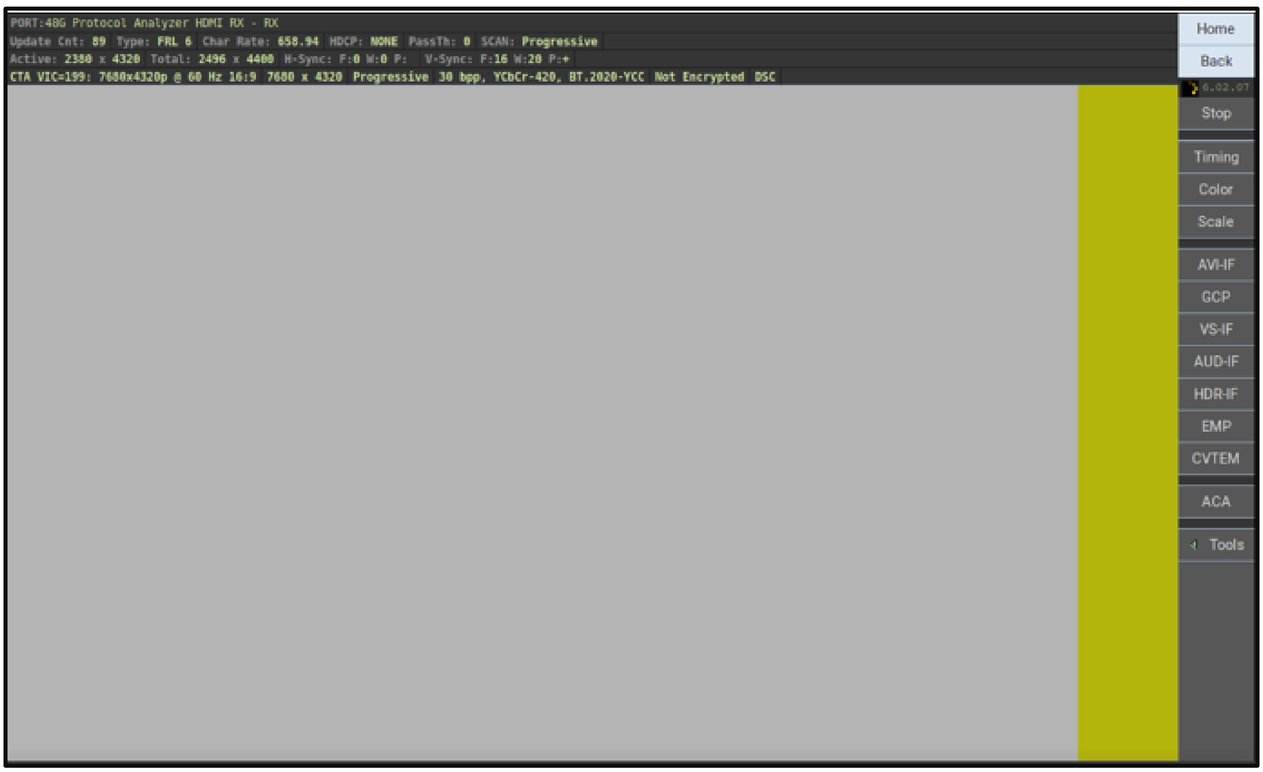
This section describes the **Real Time** mode user-interface.

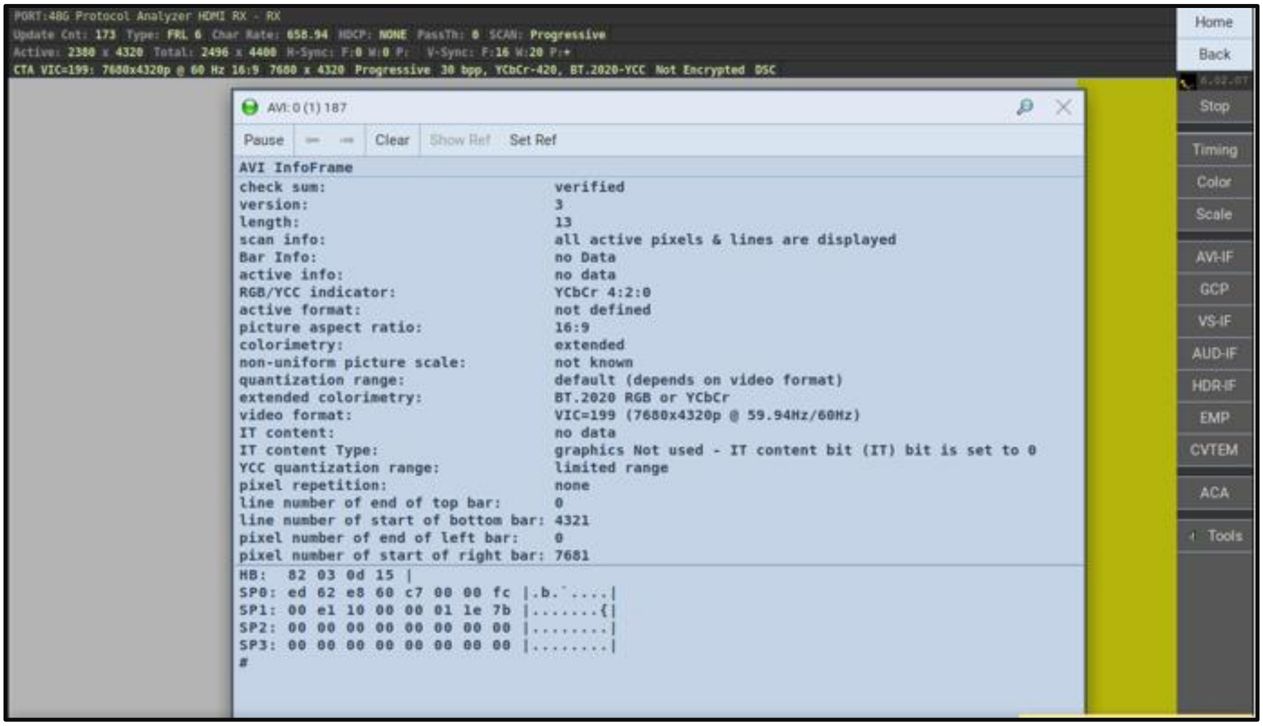
7.3.1 Real Time Mode - Interface Description

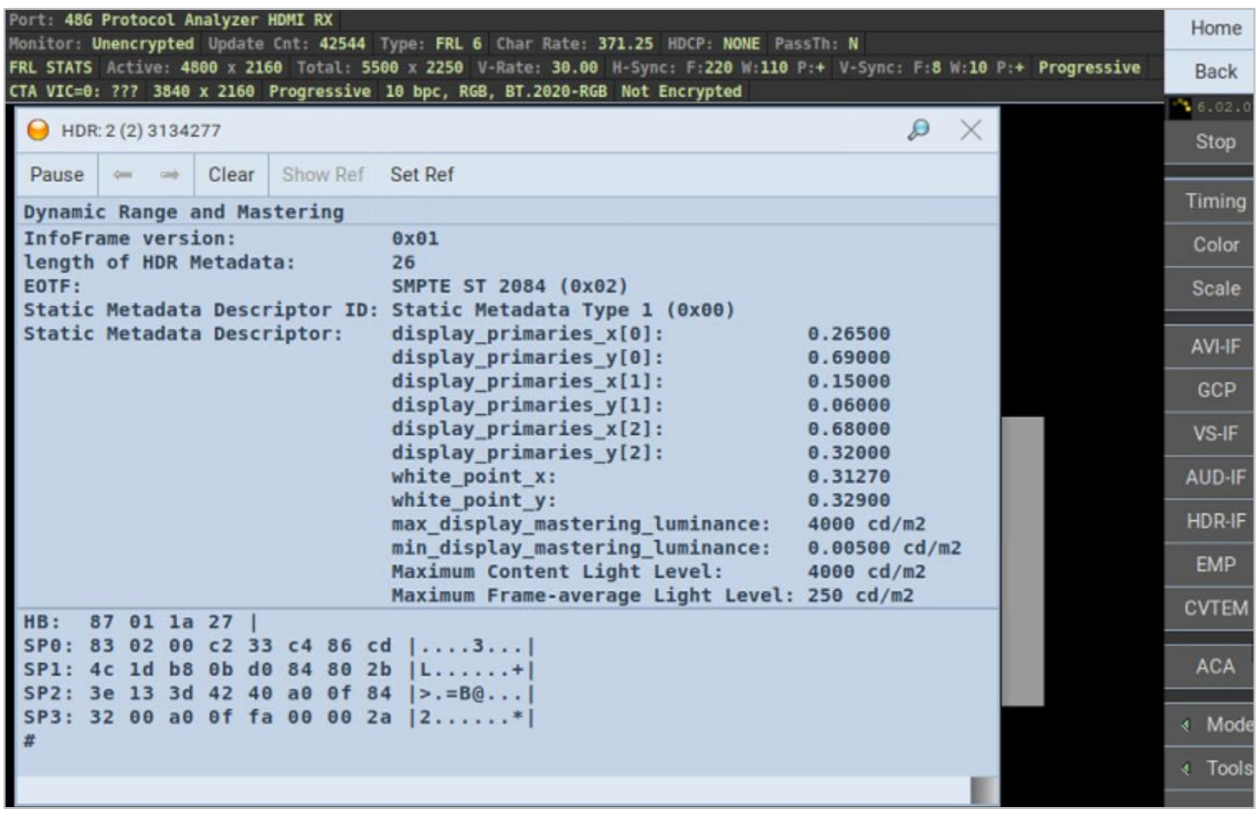
This subsection describes the functions of the main interface of the **Real Time** mode. The Real Time mode is supported in both the TMDS and FRL modes.

The **Real Time** mode interface is shown in the example screens below. The first screen image shows the **Real Time** mode without any of the viewing windows open in the TMDS mode. This screen shows you the **Real Time** mode with only the main control panel on the right and the dashboard on the top and the incoming video image. The second **Real Time** screen example shows incoming TMDS with HDCP 2.3 authentication and encryption and with the AVI InfoFrame dialog box shown. The third **Real Time** screen shows Real Time mode with incoming TMDS with HDR active and the HDR InfoFrame dialog box shown. The final screen example shows incoming HDMI stream in the FRL mode at 1485MHz pixel rate with an 8K resolution.

The table that follows describes the data in the Real Time dashboard (or Status Bar).



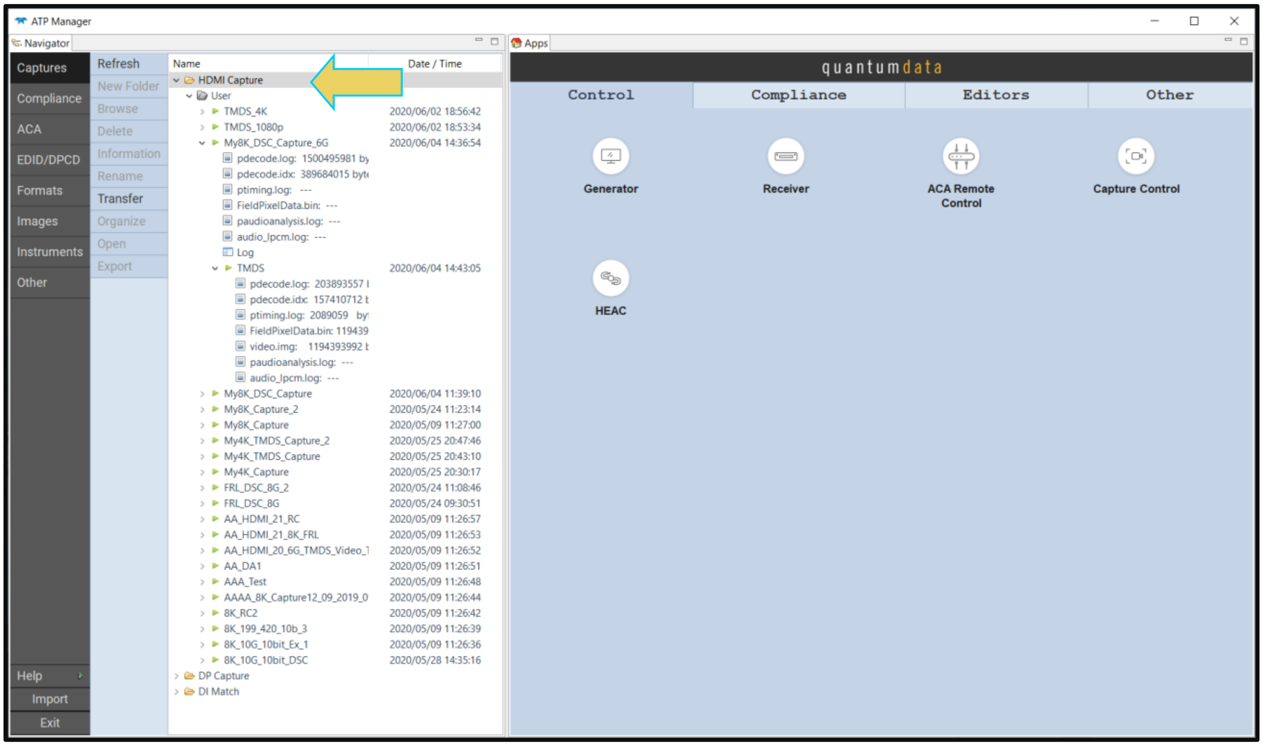

AVI: 0 (1) 187
Pause
Clear
Show Ref
Set Ref
AVI InfoFrame
check sum: verified
version: 3
length: 13
scan info: all active pixels & lines are displayed
Bar Info: no Data
active info: no data
RGB/YCC indicator: YCbCr 4:2:0
active format: not defined
picture aspect ratio: 16:9
colorimetry: extended
non-uniform picture scale: not known
quantization range: default (depends on video format)
extended colorimetry: BT.2020 RGB or YCbCr
video format: VIC=199 (7680x4320p @ 59.94Hz/60Hz)
IT content: no data
IT content Type: graphics Not used - IT content bit (IT) bit is set to 0
YCC quantization range: limited range
pixel repetition: none
line number of end of top bar: 0
line number of start of bottom bar: 4321
pixel number of end of left bar: 0
pixel number of start of right bar: 7681
HB: 82 03 0d 15 |
SP0: ed 62 e8 60 c7 00 00 fc |.b.`....|
SP1: 00 e1 10 00 00 01 1e 7b |.......{|
SP2: 00 00 00 00 00 00 00 00 |........|
SP3: 00 00 00 00 00 00 00 00 |........|
#
Home
Back
Stop
Timing
Color
Scale
AVI-IF
GCP
VS-IF
AUD-IF
HDR-IF
EMP
CVTEM
ACA
Tools


Port: 48G Protocol Analyzer HDMI RX
Monitor: Unencrypted Update Cnt: 42544 Type: FRL 6 Char Rate: 371.25 HDCP: NONE PassTh: N
FRL STATS Active: 4800 x 2160 Total: 5500 x 2250 V-Rate: 30.00 H-Sync: F:220 W:110 P:+ V-Sync: F:8 W:10 P:+ Progressive
CTA VIC=0: ??? 3840 x 2160 Progressive 10 bpc, RGB, BT.2020-RGB Not Encrypted
HDR: 2 (2) 3134277
Pause
Clear
Show Ref
Set Ref
Dynamic Range and Mastering
InfoFrame version: 0x01
length of HDR Metadata: 26
EOTF: SMPTE ST 2084 (0x02)
Static Metadata Descriptor ID: Static Metadata Type 1 (0x00)
Static Metadata Descriptor: display_primaries_x[0]: 0.26500
display_primaries_y[0]: 0.69000
display_primaries_x[1]: 0.15000
display_primaries_y[1]: 0.06000
display_primaries_x[2]: 0.68000
display_primaries_y[2]: 0.32000
white_point_x: 0.31270
white_point_y: 0.32900
max_display_mastering_luminance: 4000 cd/m2
min_display_mastering_luminance: 0.00500 cd/m2
Maximum Content Light Level: 4000 cd/m2
Maximum Frame-average Light Level: 250 cd/m2
HB: 87 01 1a 27 |
SP0: 83 02 00 c2 33 c4 86 cd |....3...|
SP1: 4c 1d b8 0b d0 84 80 2b |L......+|
SP2: 3e 13 3d 42 40 a0 0f 84 |>.=B@...|
SP3: 32 00 a0 0f fa 00 00 2a |2......*|
#
Home
Back
Stop
Timing
Color
Scale
AVI-IF
GCP
VS-IF
AUD-IF
HDR-IF
EMP
CVTEM
ACA
Mode
Tools

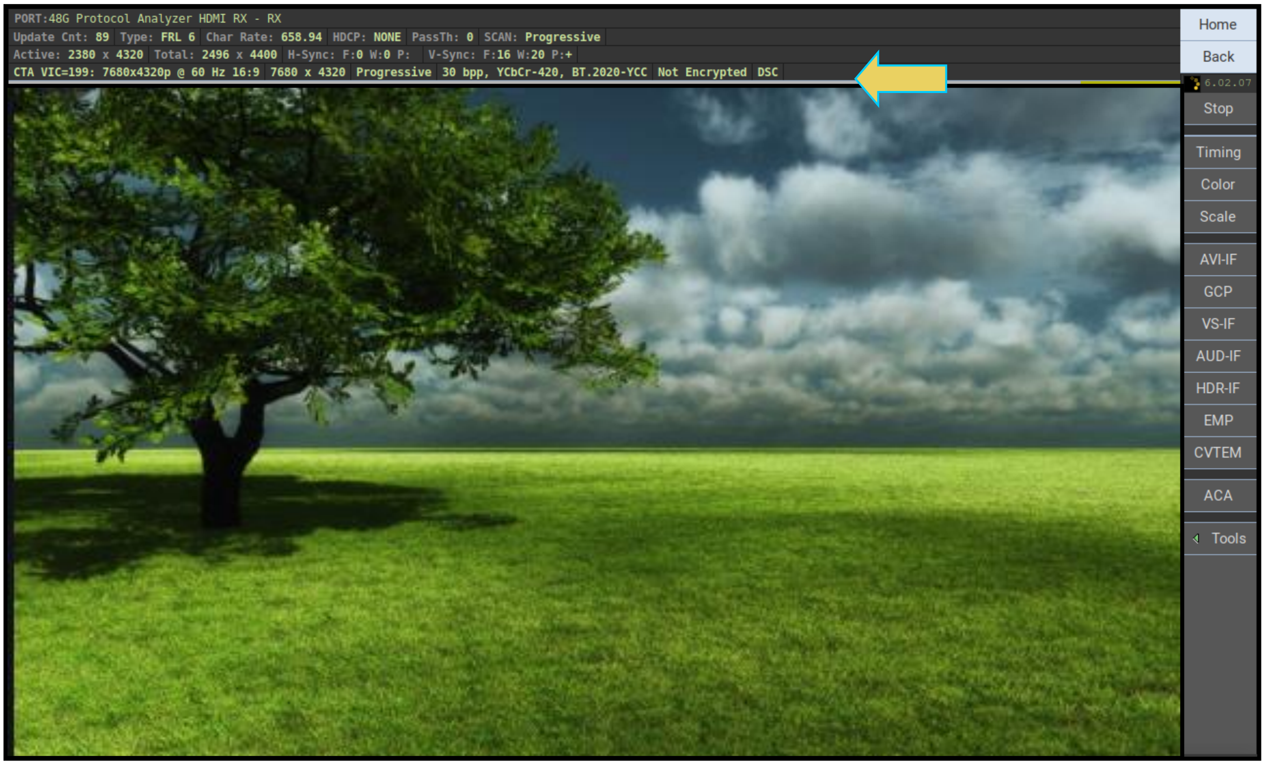
7.4 Viewing the Display Stream Compression (DSC) Capture

You can view the data of an FRL Display Stream Compression stream through the Capture Viewer. You can view these FRL/DSC captures under in the Navigator as shown below. The incoming DSC stream is captured as a series of snapshots of the incoming frames. The feature does not support capturing of every frame.

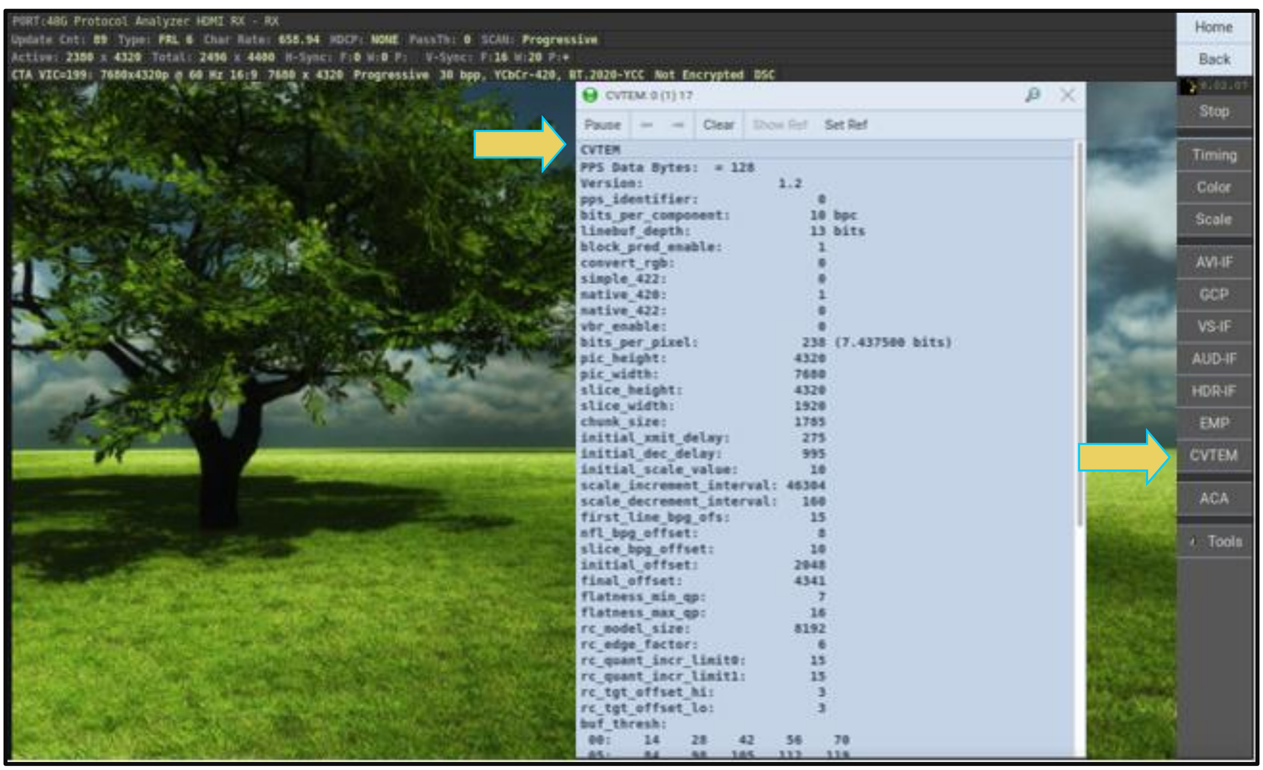
Note: It may take some time for the initial image to appear in the analyzer window.



The following example shows an incoming stream with Display Stream Compression (DSC) active.



The following screen shows the Compressed Video Transport Extended Metadata packet (CVTEM) which shows the DSC Picture Parameter Set (PPS).

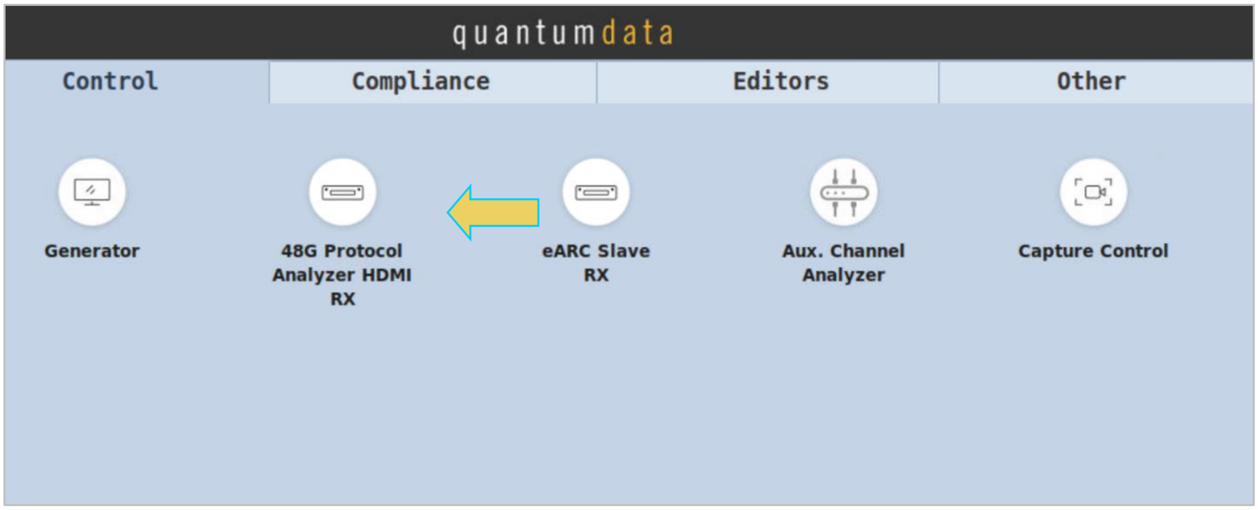


7.4.1 Disabling DSC Video Processing in Realtime

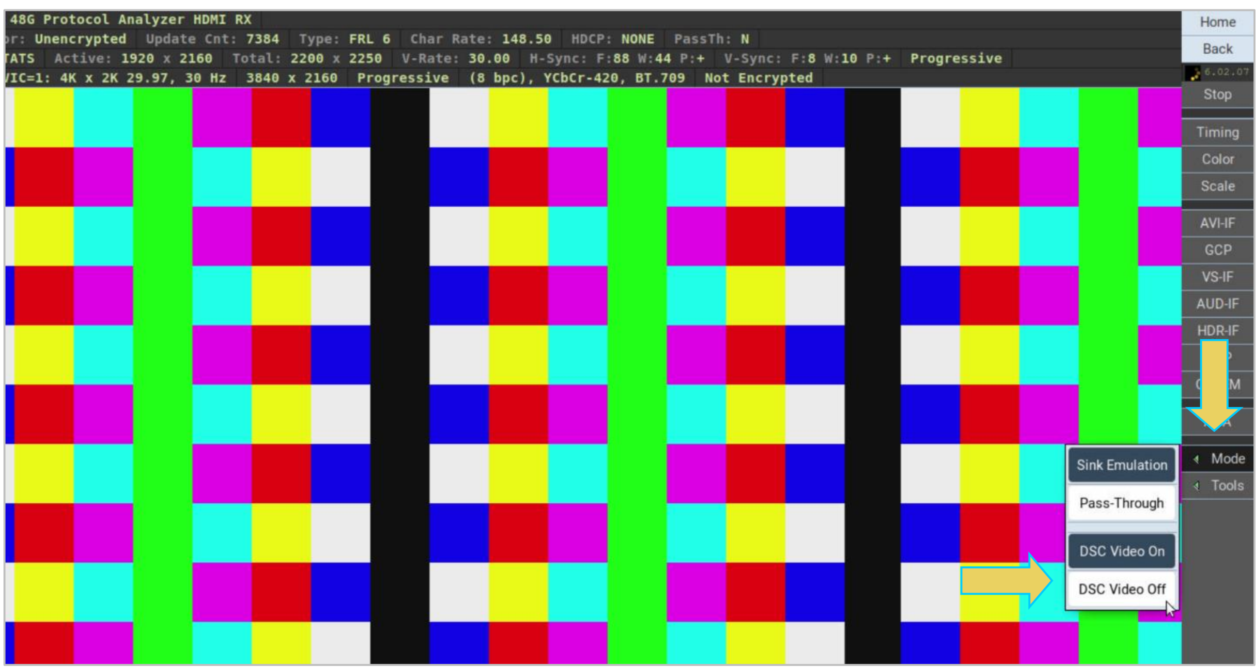
The M42h 96G Video Analyzer has the option to disable DSC video decoding in real-time while allowing Data Island processing and timing measurements. Useful for checking timings, taking captures, and checking Data Island contents such as AVI Infoframes, Audio Packets, and CVTEMs.

Use the following procedure to disable DSC Video processing:

1. Navigate to the Real-Time viewer (Basic Analyzer)

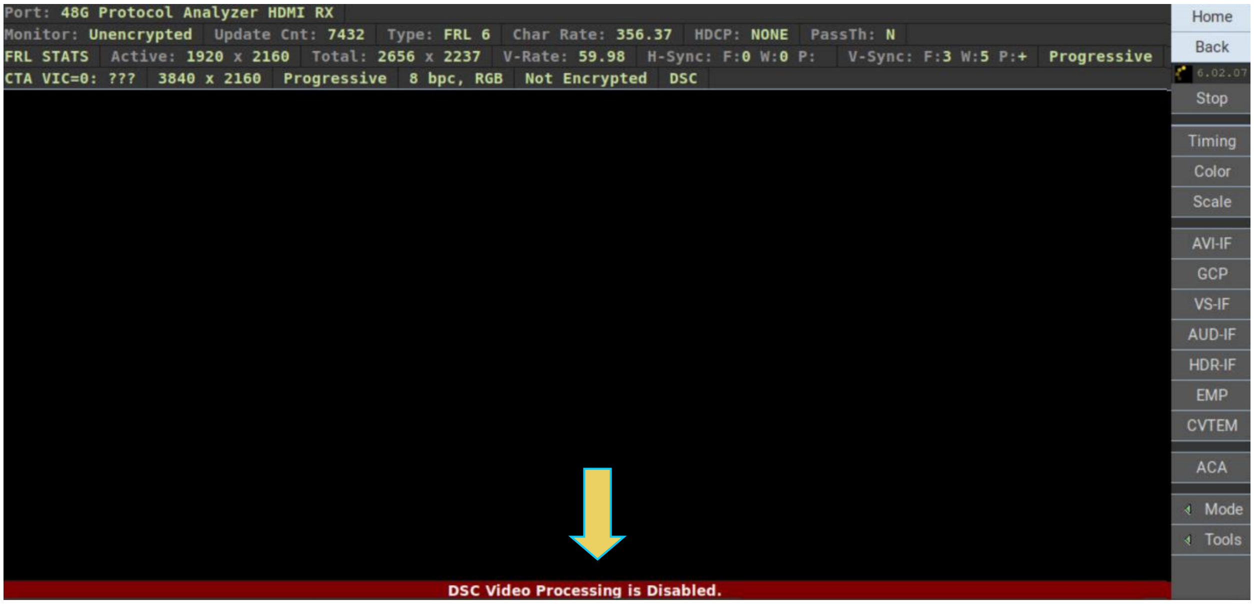


2. Within the right-side toolbar, select Mode, and turn DSC Video Off



3. In this mode, when the DSC video is detected, the dashboard will continue to update:

4. You will see the following message at the bottom of the screen when the incoming video from the source DUT is stable:

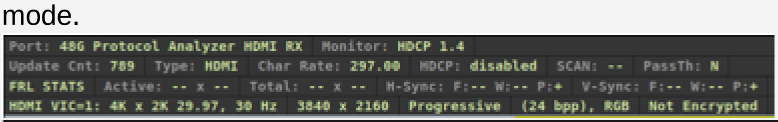


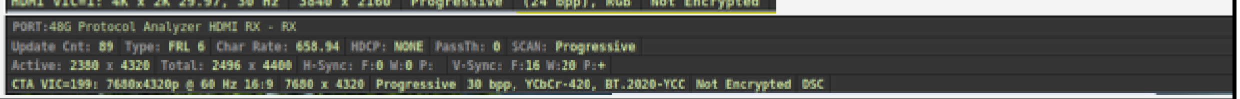
7.5 Dashboard Panel

This subsection describes the dashboard components on the top of the Real Time panel. Refer to the table below for a description of these components.

Real Time Mode – Dashboard Items

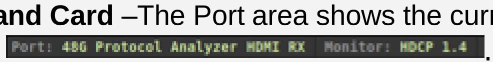
Two example Dashboards are shown. The first with TMDS mode and the second in the FRL mode.





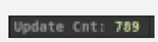
The following items are on the Real Time dashboard:

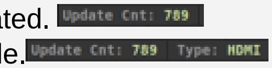
Top Row Items – and Port:

Port and Card –The Port area shows the current Rx port that is being displayed on the Real Time Mode 

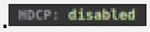
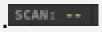
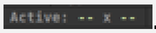
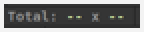
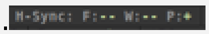
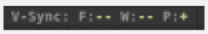
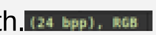
. Currently the only analyzer port is the M42h 96G Video Analyzer/Generator port.

Second Row Items – TMDS and FRL Modes:

Update Cnt – Increments every time the screen contents are updated. 

Type – HDMI for TMDS mode; FRL for Fixed Rate Link (FRL) mode.

Char Rate: – The HDMI character rate.

Real Time Mode – Dashboard Items
TMDS Clock Ratio: – The ratio of the TMDS clock rate to the TMDS bit rate. **Scrambling:** – Whether or not scrambling is enables or not. **HDCP** – Indicates whether HDCP is enabled or disabled. **PassThru** – Indicates if pass through is active. Pass Thru is not currently supported on this. **Scan**: Progressive or Interlaced. **Third Row Items – FRL Mode**: **Active:** – The Active video horizontal and vertical pixels and lines of the format resolution . **Total:** – The Total video horizontal and vertical pixels and lines of the format resolution.  **H-Sync:** – Indicates the horizontal Front Porch sync pulse width. **V-Sync:** – Indicates the vertical Front Porch and vertical sync pulse width and the pulse polarity.  **Fourth Row Items – FRL and TMDS modes**: **Video Identification (format)** – The first item indicates the video identification code (if there is one). This includes the active horizontal and vertical resolution, vertical frame rate and aspect ratio. If the incoming video is not determined to be a CEA format, there will be an indication of CEA VIC 0 and a note: “No Video Identification Code Available.” **Resolution** - The next item is the resolution information. In the first example the active horizontal and vertical resolution is 3840 x 2160. The second example shows an 8K format at 7680 x 4320. **Scan**. The next item is the scan. In this example the field indicates Progressive. The other option is Interlaced. **Bit Depth and Video colorimetry**. The next item is the bit depth and video mode. In this example the field indicates YCbCr with 4:4:4 sampling and 24-bit color depth. The other options are: RGB, YCbCr 4:2:2 and deep color at either 30 or 36-bit color depth. **HDCP Status**. The next item is HDCP status which could either be Encrypted or Not Encrypted. 

7.5.1 Main Control Panel

This subsection describes the main control panel for the Real Time mode. Refer to the table below for a description of these controls.

Real Time Mode – Main Control Panel	Control Button Descriptions
Main Control Panel (two views – Active / Inactive)	The following controls are provided in the main control panel on the right edge of the Real Time mode interface. Each of the buttons have a pull-down menu associated with them. The purpose of each button and their basic control functions are described below: **Start/Stop** –The Start / Stop button / is used to enable and disable the active collection of real time data. **Video** – The video button and associated pull-down menu (not shown) is used to display the Video Info panel which provides timing, resolution, and other basic information about the incoming video.

Real Time Mode – Main Control Panel	**Control Button Descriptions**
	**Scale** – The Scale button and associated pull-down menu (not shown) enables you to control how the video image is displayed in the Real Time mode window. **AVI-IF** - The AVI-IF button and associated pull-down menu (not shown) enables you to show or hide the AVI info panel and pause and resume updates to the panel. It also enables you to control which set of data serves as a “Reference Frame” of data that can be used for comparisons with subsequent frames collected. **VS-IF** - The VS-IF button and associated pull-down menu (not shown) enables you to show or hide the Vendor Specific InfoFrame info panel and pause and resume updates to the panel. It also enables you to control which set of data serves as a “Reference Frame” of data that can be used for comparisons with subsequent frames collected. **GCP** - The GCP button and associated pull-down menu (not shown) enables you to show or hide the General Control Packet panel and pause and resume updates to the panel. It also enables you to control which set of data serves as a “Reference Frame” of data that can be used for comparisons with subsequent frames collected. **ACA** - The ACA button launches the Auxiliary Channel Analyzer (ACA) application for monitoring the DDC transactions. Back - The arrow button enables you to toggle between the current view and the previous view. **Tools** - The Tools button provides access to various tools such as Set EDID management, HP, 5 Volts, SCDC and HDCP management.

7.6 Real Time Mode Data Panels

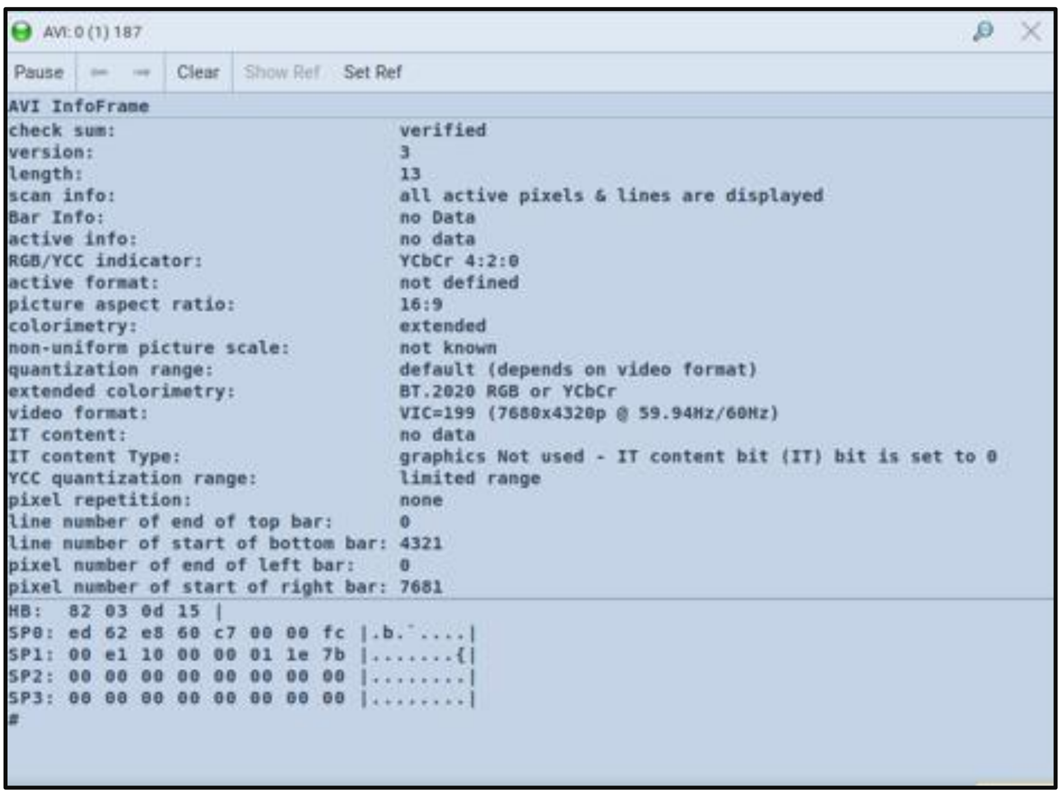
This section describes the **Real Time** controls and data panels. The **Real Time** mode is only available through the embedded GUI. It is not available through the external ATP Manager.

Note: Detailed procedures for operating the M42h 96G Video Analyzer/Generator through the built-in GUI are provided in the M42h Quick Start Guide.

7.6.1 Reference Frames Concept

The M42h 96G Video Analyzer/Generator Real Time feature uses the concept of “Reference Frames” which are sets of data values that you can compare with other collected frames of data of the same type. As you collect data in the **Real Time** mode, the feature will create a distinct view for each change in the source stream for that specific data type. For example, if you have opened the AVI InfoFrame panel, a change in any data that is part of the InfoFrame, such as the video type (RGB, YCbCr), will result in a new distinct view of the data.

By default, the **Real Time** mode establishes the initial data set as the Reference Frame. The initial view is the view of data that occurs when you open a panel or when you initiate a Clear operation. You can change the Reference Frame at any time using a pull-down menu. The data in all other views is compared against the data in the Reference Frame.



7.6.2 Zoom Feature

Because the **Real Time** mode can only be viewed in the embedded M42h GUI where screen real estate is limited, the interface has a zoom feature for setting the viewing size of each dialog box. The zoom feature enables you to set the viewing size of a data panel. The zoom is accessible from the upper right corner of each panel.

7.6.3 Image Scale Dialog Box

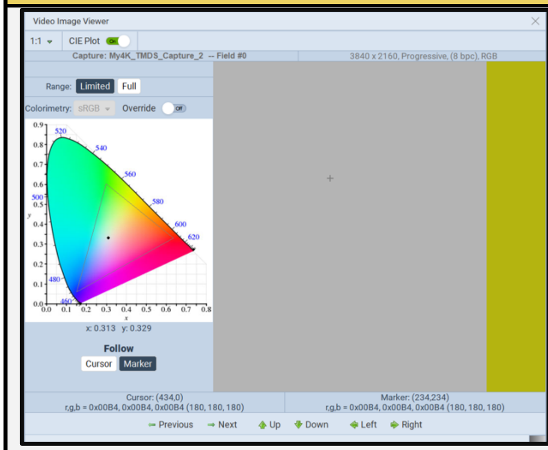
The incoming video content, whether it be full motion video or a basic test pattern, is shown in the window (refer to the screen examples above). You can control the way the incoming video is displayed using **Video** from the control panel on the right. When you select **Scale**, the Image Scale dialog box appears. The control features of the Image Scale dialog box are described in the following table.

Real Time Mode – Image Scale	Controls
Image Scale dialog box	The following controls are provided in the Image Scale dialog box. These controls determine how the incoming video is displayed in the **Real Time** main window. **Mode** – The Mode can be either 1:1 or Full. Use the check box adjacent to each item to select. The 1:1 selection will show the image in its true size; because the **Real Time** window on the built-in front panel display does not support higher resolutions, much of the content will not be viewable in the window when 1:1 is selected. The Full mode enables you to view the entire image. When Full is selected you can also select which Aspect Ratio setting to use. **Quality** – The Quality setting determines the frame rate used to show the incoming video. Selecting Low reduces the frame rate. The High selection will display the video in its native frame rate. **Aspect Ratio** – The Aspect Ratio options can be set only if the Mode is set to Full. The Fit option will cause the image to be scaled such that it occupies the entire window. The H:V option will display the image at its native aspect ratio with letter boxing used to fill in the blank area. The 4:3 option will cause the image to scale to a 4:3 aspect ratio. The 16:9 option will cause the image to be scaled to 16:9.

7.6.4 Video Color Panel

The **Video Color** panel (shown below) enables you to view the pixel values of the incoming video content. The table below describes the information in this panel.

Real Time Mode – Video Color	Information
Video Color panel	The following info is provided in the **Video Color**: **Pixel and pixel values** – The pixel x/y coordinates and the color values for any selected pixel are shown in their format RGB or YCbCr.

<table>
<tr><th>Real Time Mode – Video Color</th><th>Information</th></tr>
<tr><td>
</td><td>There are a series of arrows on the bottom of the Video Info dialog box. These arrows are described below:

Up Arrow – The up arrow Up enables you to move up to an adjacent pixel to view its color components.

Down Arrow – The down arrow Down enables you to move down to an adjacent pixel to view its color components.

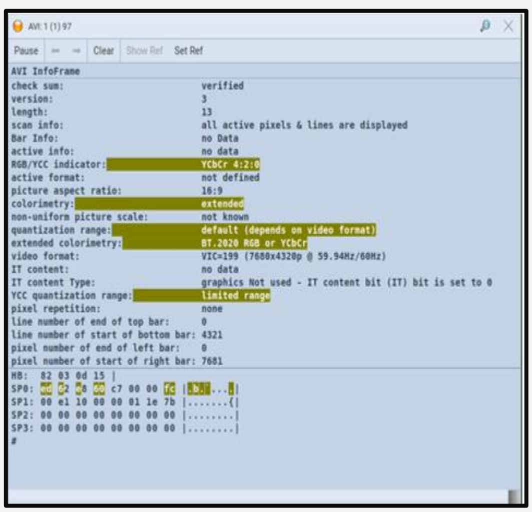
Left Arrow – The left arrow Left enables you to move left to an adjacent pixel to view its color components.

Right Arrow – The right arrow Right enables you to move right to an adjacent pixel to view its color components.</td></tr>
</table>

7.6.5 AVI InfoFrame Panel

The **AVI-IF** button opens the **AVI** panel (shown below). The AVI panel enables you to view the AVI InfoFrame data. There is a control pull-down menu associated with the AVI Info panel. The control menu can be accessed either from the panel itself (the pull-down tab on the upper right corner) or from the AVI-IF button on the main control panel on the right side of the **Real Time** window. The table below describes the information in the AVI Info panel and the associated control menu.

<table>
<tr><th>Real Time – AVI InfoFrame</th><th>Information / Function</th></tr>
<tr><td>AVI InfoFrame


</td><td>The following information is provided in the AVI InfoFrame dialog box:

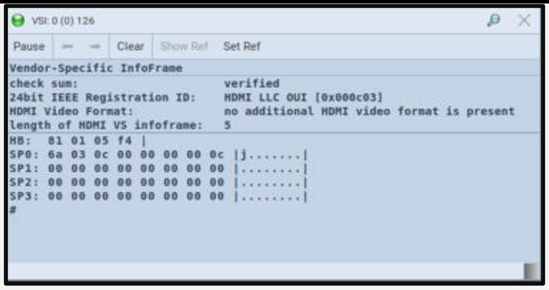
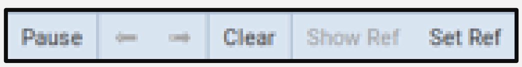
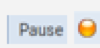
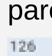
Checksum – Calculation of a checksum to ensure integrity of the data.
Scan Info – Indicates whether there is any underscanning or overscanning applied to the video.
Active info – Indicates whether the Active Format Descriptor information is valid.
RGB/YCC indicator – Indicates whether the incoming video is in the RGB mode or the YCC mode and what sampling mode is used with YCC (YCbCr 4:4:4 or 4:2:2)
Active format – Active format aspect ratio.
Picture aspect ratio – The aspect ratio of the video format transmitted.
Colorimetry – The colorimetry standard used; typically, ITU-601 or ITU-709.
Non-uniform scaling – Indicates if the picture has been scaled vertically and/or horizontally.
Quantization range – Indicates the range of values for defining the data is limited or full.</td></tr>
</table>

Real Time – AVI InfoFrame	Information / Function
	IT content – Indicates when the picture content is composed in accordance with common IT practices. **Video format** – The CEA video identification code (VIC) and the resolution and frame rate. **Pixel repetition** – Indicates to the DTV how many of each pixel are transmitted. Line number at end of top bar. Line number at start of bottom bar. Pixel number at end of left bar. Pixel number at start of right bar.
AVI Pull-down Menu  	There is a pull-down menu associated with the AVI Info panel. You can access either from the main control panel or from the AVI panel. The AVI pull-down menu provides the following functions: **Show/Hide** – Enable or disable the appearance of the AVI InfoFrame panel in the **Real Time** window. **Pause/Start** – Halt the updates of the data to the AVI panel or Start collection. **Clear** – Clear the currently displayed reference frame. **Set Ref** – Set a new reference frame.
Upper Status Bar	The upper status bar shows the following information from left to right: The pause/resume (active) status. AVI: The type of data panel (e.g. AVI). 1 The number of changes defined since you set the reference frame. (1) The number of distinct data views in parentheses. 97 The total number of frames captured since the panel was opened or since the last clear.

7.6.6 VS-IF InfoFrame Panel

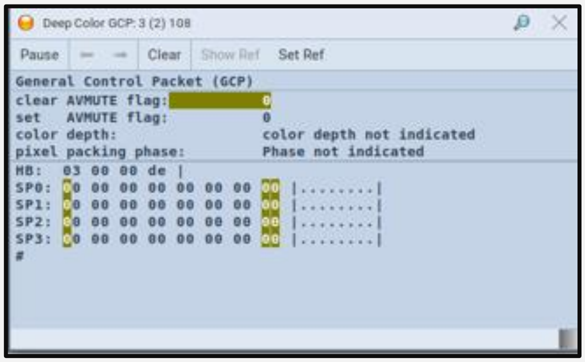
The **VS-IF** button opens the **VS-IF** panel (shown below). The **VS-IF** panel enables you to view the Vendor Specific InfoFrame data. There is a control pull-down menu associated with the **VS-IF** panel. The control menu can be accessed either from the panel itself (the pull-down tab on the upper right corner) or from the **VS-IF** button on the main control panel on the right side of the **Real Time** window. The table below describes the information in the AVI Info panel and the associated control menu.

Real Time – VS-IF	Information / Function
Vendor Specific InfoFrame	The following information is provided in the Vendor Specific InfoFrame:

Real Time – VS-IF	Information / Function
	**Length** – The length in hex of the Vendor Specific InfoFrame. **Checksum** – A checksum to verify the integrity of the InfoFrame. **Registration ID** – IEEE Registration ID **HDMI Video Format** – Provides additional information such as 4K by 2K or 3D format structure. **3D Structure** – This is the 3D format structure used. This could be one of: Frame Packing, Field Alternative, Line Alternative, Side-by-Side (Full), L + depth, L + depth + Graphics-Depth, Side-by-Side (half) **3D Extra Data** – Applies when the 3D structure is Side-by-Side (half). Indicates the horizontal sub-sampling and Quincunx matrix. **3D Meta Data** – Indicates whether 3D metadata is present or not.
VS-IF Pull-down Menu 	There is a pull-down menu associated with the VS-IF Info panel. You can access either from the main control panel or from the VS-IF panel. The AV-IF pull-down menu provides the following functions: **Show/Hide** – Enable or disable the appearance of the VS-IF InfoFrame panel in the **Real Time** window. **Pause** – Halt the updates of the data to the VS IF panel. **Clear** – Clear the currently displayed reference frame. **Set Ref** – Set a new reference frame.
Upper Status Bar	The upper status bar shows the following information from left to right:  The pause/resume (active) status. The type of data panel (e.g. VS-IF). The number of changes defined since you set the reference frame.  The number of distinct data views in parentheses.  The total number of frames captured since the panel was opened or since the last clear.

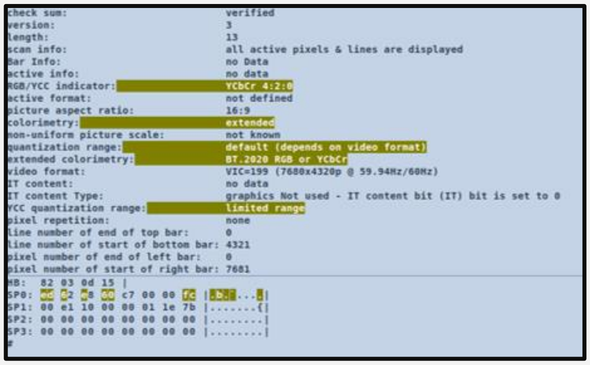
7.6.7 General Control Packet Data Panel

The **GCP** (General Control Packet) button opens the **GCP** panel (shown below). The **GCP** panel enables you to view the General Control Packet data. There is a control pull-down menu associated with the **GCP** panel. The control menu can be accessed either from the panel itself (the pull-down tab on the upper right corner) or from the **GCP** button on the main control panel on the right side of the **Real Time** window. The table below describes the information in the GCP Info panel and the associated control menu.

Real Time – General Control Packet	Information / Function
General Control Packet  	The following information is provided in the General Control Packet data island: **AVmute flag** (clear/set) – Identifies whether the AVmute is set or cleared. **Color depth** – Indicates the color depth in bits per pixel. **Pixel packing phase** – Indicates the pixel packing phase of the last pixel character sent prior to the GCP when the source is transmitting deep color.
GCP Pull-down Menu  	There is a pull-down menu associated with the GCP Info panel. You can access either from the main control panel or from the GCP panel. The GCP pull-down menu provides the following functions: **Show/Hide** – Enable or disable the appearance of the GCP panel in the **Real Time** window. **Pause** – Halt the updates of the data to the GCP panel. **Clear** – Clear the currently displayed reference frame. **Set Ref** – Set a new reference frame.
Upper Status Bar	The upper status bar shows the following information from left to right:  The pause/resume (active) status. The type of data panel (e.g. GCP). 3 The number of changes defined since you set the reference frame. (2) The number of distinct data views in parentheses. 108 The total number of frames captured since the panel was opened or since the last clear.

7.6.8 HDR InfoFrame Panel

The **HDR IF** (InfoFrame) button opens the **HDR IF** panel (shown below). The **HDR IF** panel enables you to view the HDR InfoFrame Packet data. The table below describes the information in the GCP Info panel and the associated control menu.

Real Time – HDR InfoFrame Packet	Information / Function
HDR InfoFrame Packet  	The following information is provided in the HDR InfoFrame Packet: **InfoFrame Version** – Identifies the version of the HDR **InfoFrame.** **Length of HDR Metadata** – Indicates the number of bytes of data in the HDR InfoFrame. **EOTF** – Electro Optical Transfer Function industry standard used. **Static Metadata Descriptor ID** – The Static Metadata Type used. **Static Metadata Descriptor** – The Static Metadata parameters used for the display primaries, white point, display luminance, light level, and frame average light level.
HDR IF Pull-down Menu  	There is a pull-down menu associated with the HDR IF Info panel. You can access from the main control panel. The pull-down menu provides the following functions: **Show/Hide** – Enable or disable the appearance of the GCP panel in the **Real Time** window. **Pause** – Halt the updates of the data to the GCP panel. **Clear** – Clear the currently displayed reference frame. **Set Ref** – Set a new reference frame.
Upper Status Bar	The upper status bar shows the following information from left to right: Pause The pause/resume (active) status. Deep Color GCP: 3 (2) 108 The type of data panel (e.g. GCP). 3 The number of changes defined since you set the reference frame. (2) The number of distinct data views in parentheses. 108 The total number of frames captured since the panel was opened or since the last clear.

7.6.9 Testing QMS on a Source Device

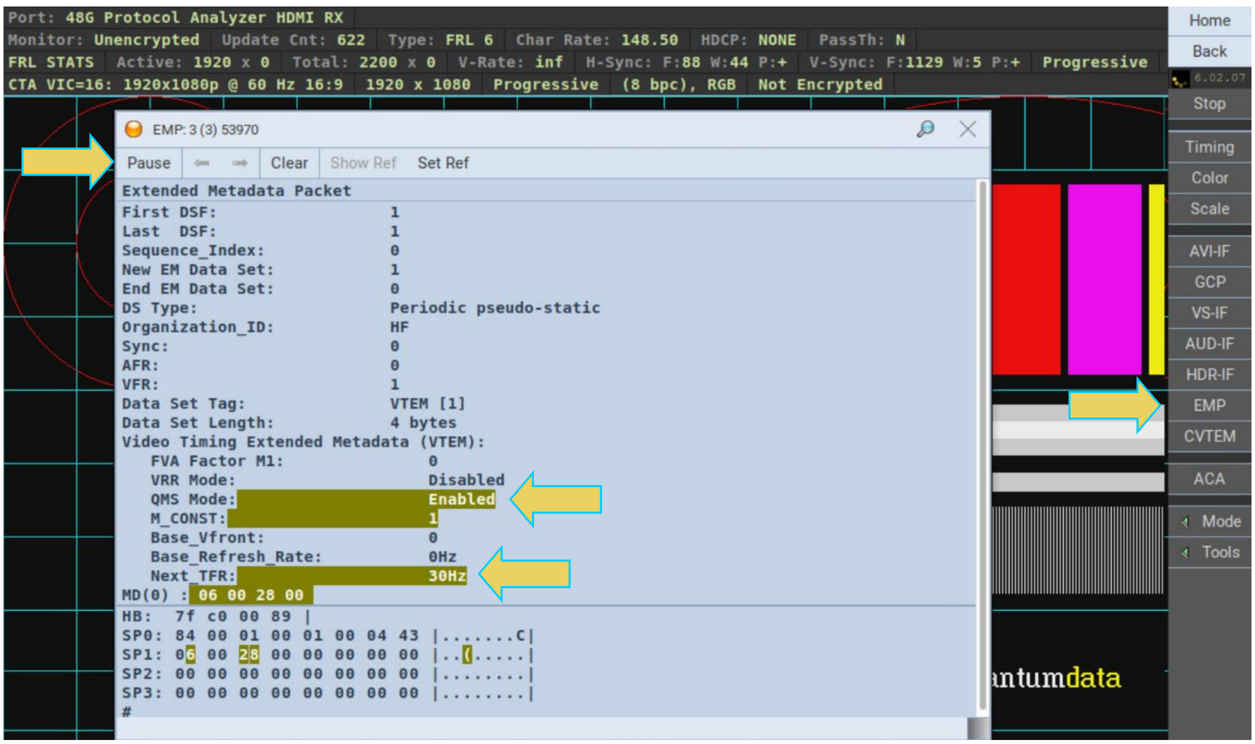
Use the following procedure to test Quick Media Switching on a source device.

Ensure that QMS has been enabled on the source DUT and navigate to the 96G Protocol Analyzer HDMI RX within the embedded ATP Manager GUI of the M42h.

Access the **Extended Metadata Packet** tool by clicking the **EMP** button on the righthand sidebar.

Press the **Start** button at the top left if necessary. You may **Pause** or **Clear** the data at any time as well using the top tool bar.

The EMP tool will indicate whether QMS is enabled, as well as the next target frame rate within the **Next_TFR** field, as shown in the example below. In this example, the Source DUT is generating a 60 Hz signal with QMS Target Frame Rate at 30 Hz

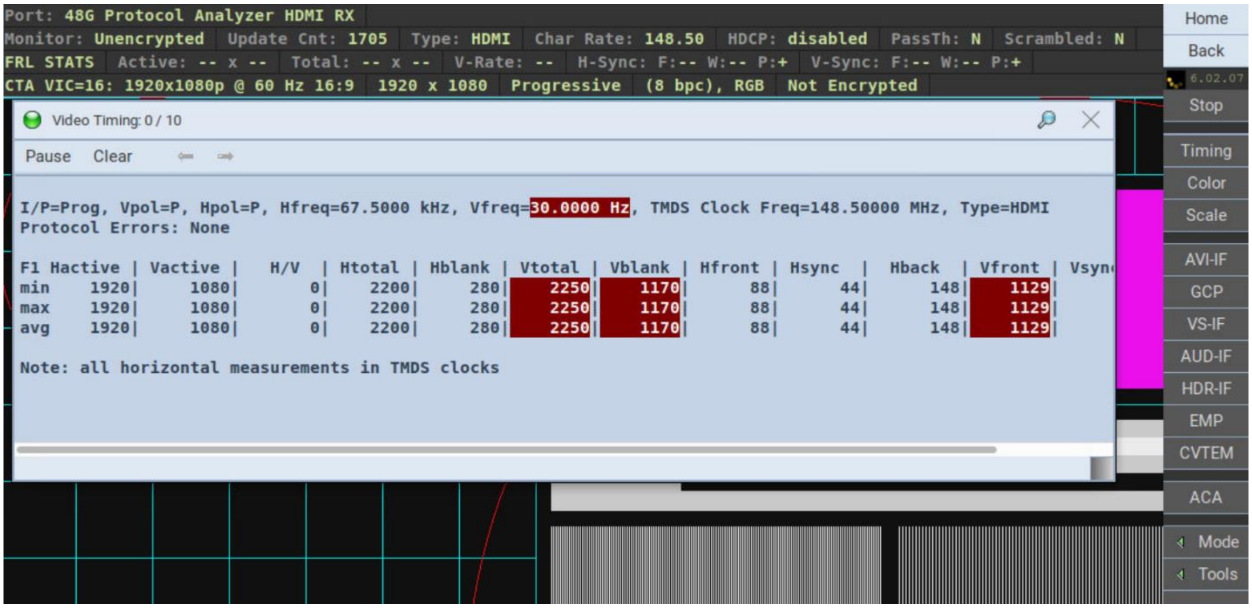


The above example is with a source signal trainer in FRL mode. QMS is also available in TMDS mode, demonstrated on the next page.

In addition to the Extended Metadata Packets tool, when the source DUT and M42h RX Analyzer are trained in TMDS mode, you can view the video timing data as well.

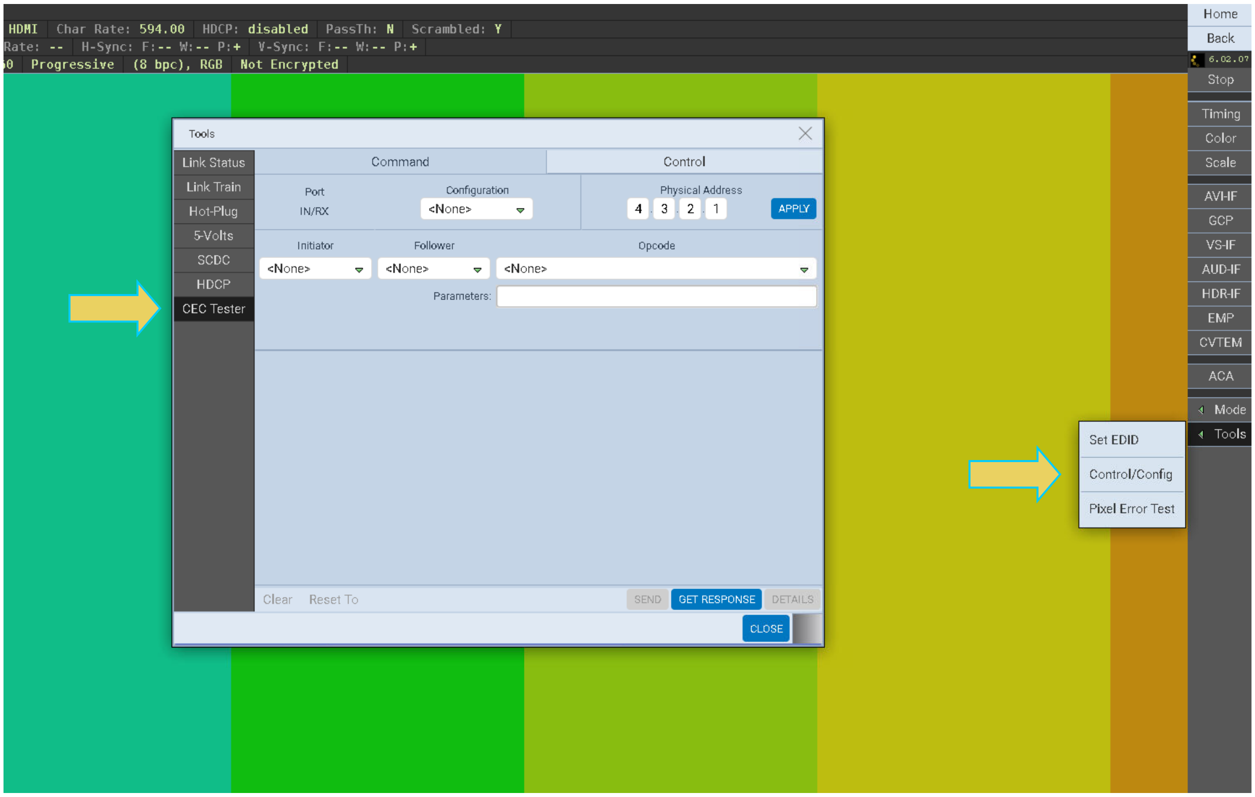
Access the **Video Timing** tool using the **Timing** button on the righthand side of the RX Analyzer, as shown below.

Following the previous example of 60 Hz frame rate switching to 30 Hz using QMS, the screen below demonstrates the video timing data for this configuration.



7.6.10 Rx CEC Tester

The M42h provides CEC (Consumer Electronics Control) functional testing within the RX Analyzer. Access the CEC Tester via the Tools flyout button on the righthand side bar. Select the CEC Tester within the pop up window, as shown below.



The CEC Tester tool allows you to edit the register entries on the emulated receiver within the RX Analyzer. See below tables for configurable options:

Configuration Options Dropdown Menu	
Register	**Entry**
0x00	TV
0x01	REC1
0x02	REC2
0x03	TUNE1
0x04	PLAY1
0x05	AUDIO
0x06	TUNE2
0x07	TUNE3
0x08	PLAY2
0x09	REC3
0x0A	TUNE4
0x0B	PLAY3
0x0C	RSVD
0x0D	RSVD
0x0E	SPEC
0x0F	*ALL*

Initiator Dropdown Menu	
Register	**Entry**
0x00	TV
0x01	REC1
0x02	REC2
0x03	TUNE1
0x04	PLAY1
0x05	AUDIO
0x06	TUNE2
0x07	TUNE3
0x08	PLAY2
0x09	REC3
0x0A	TUNE4
0x0B	PLAY3
0x0C	RSVD
0x0D	RSVD
0x0E	SPEC
0x0F	*ALL*

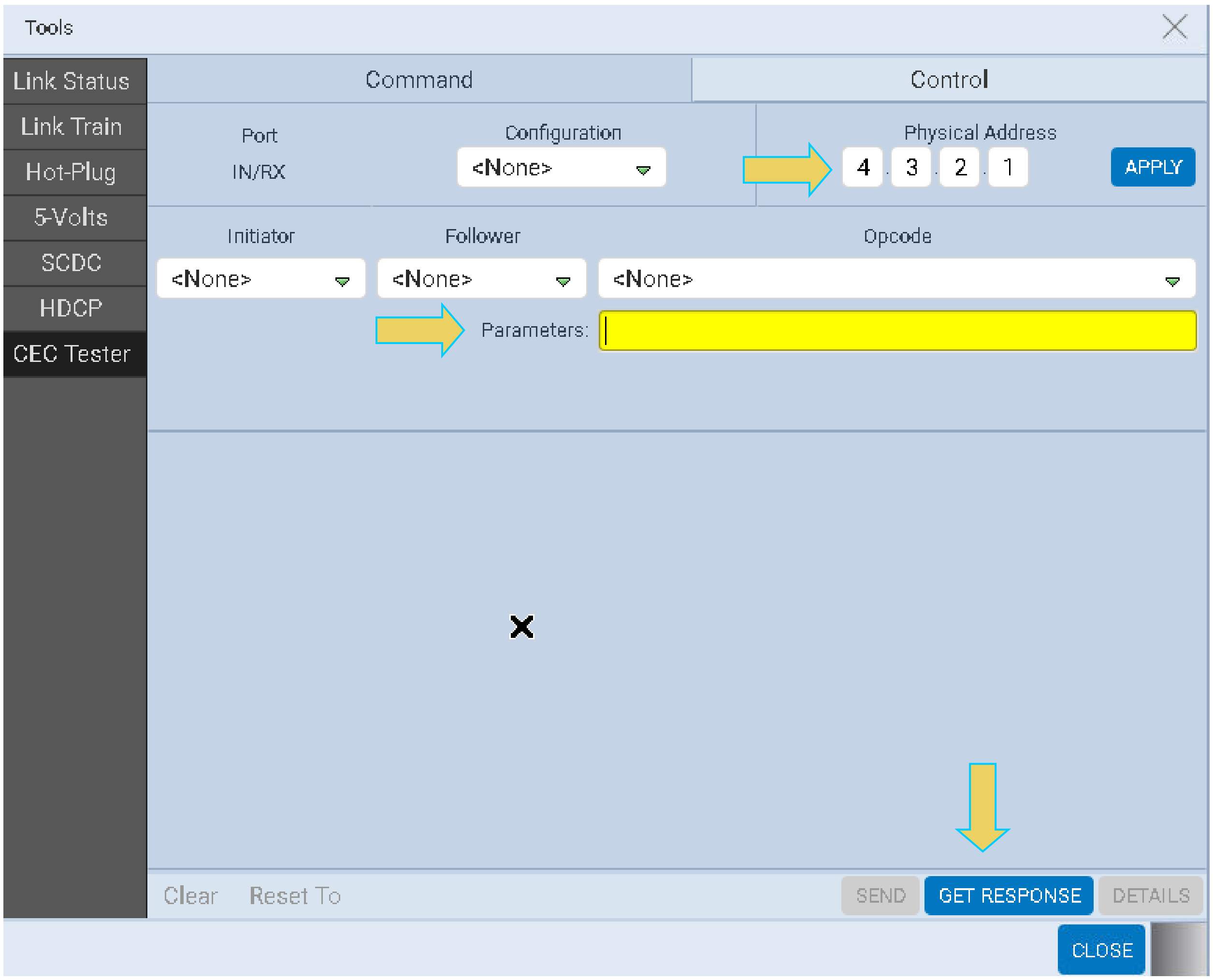
Follower Options Dropdown Menu	
Register	**Entry**
0x00	TV
0x01	REC1
0x02	REC2
0x03	TUNE1
0x04	PLAY1
0x05	AUDIO
0x06	TUNE2
0x07	TUNE3
0x08	PLAY2
0x09	REC3
0x0A	TUNE4
0x0B	PLAY3
0x0C	RSVD
0x0D	RSVD
0x0E	SPEC
0x0F	*ALL*

Opcode Options Dropdown Menu	
Register	**Entry**
0x00	Feature Abort
0x04	Image View On
0x05	Tuner Step Increment
0x06	Tuner Step Decrement
0x07	Tuner Device Status
0x08	Give Tuner Device Status
0x09	Record On
0x0A	Record Status
0x0B	Record Off

Opcode Options Dropdown Menu	
Register	**Entry**
0x0D	Text View On

The following procedure allows you to operate the CEC Tester:

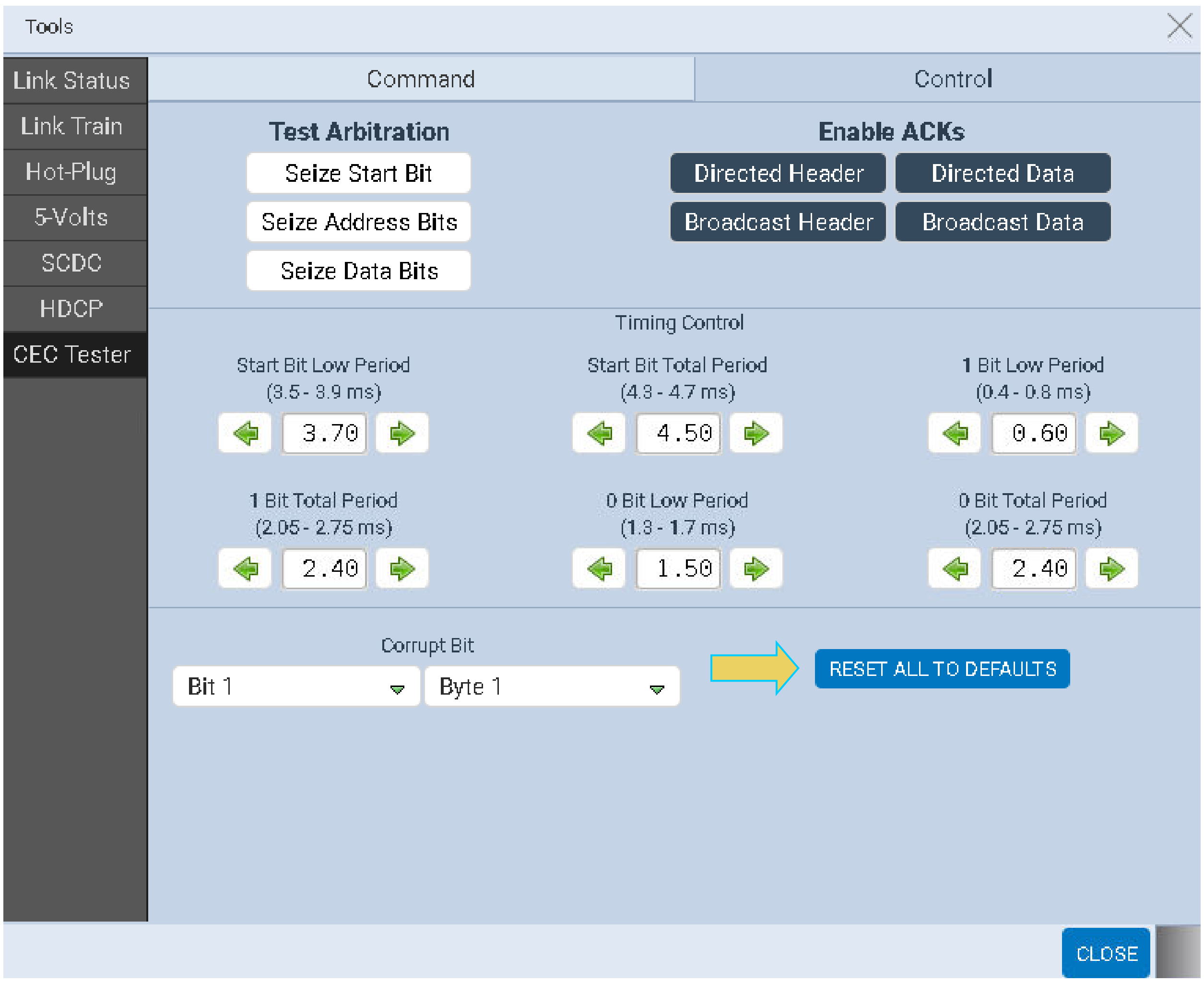
1. Specify the physical address and click **APPLY**.
2. Optionally, enter testing **Parameters**.
3. Once all settings have been configured, click the **GET RESPONSE** button, as demonstrated below.



4. Within the Control tab of the CEC Tester, you can configure settings for the functional tests as shown in the following table:

Control Tab Settings for Functional Tests	
Setting	**Options**
Test Arbitration	- Seize Start Bit - Seize Address Bits - Seize Data Bits
Enable ACKs	- Directed Header - Directed Data

Control Tab Settings for Functional Tests	
Setting	**Options**
	- Broadcast Header - Broadcast Data
Start Bit Low Period (ms)	3.5 – 3.9 ms
Start Bit Total Period (ms)	4.3 – 4.7 ms
1 Bit Low Period (ms)	0.4 – 0.8 ms
1 Bit Total Period (ms)	2.05 – 2.75 ms
0 Bit Low Period (ms)	1.8 – 1.7 ms
0 Bit Total Period (ms)	2.05 – 2.75 ms
Corrupt Bit	- Choose from bits 1–8 to emulate as corrupted - Choose from bytes 1–16 within the selected bit



5. To start over, you may reset all configurations to their default values using the **RESET ALL TO DEFAULTS** button, as shown above.

7.7 Enabling HDCP Authentication and Encryption

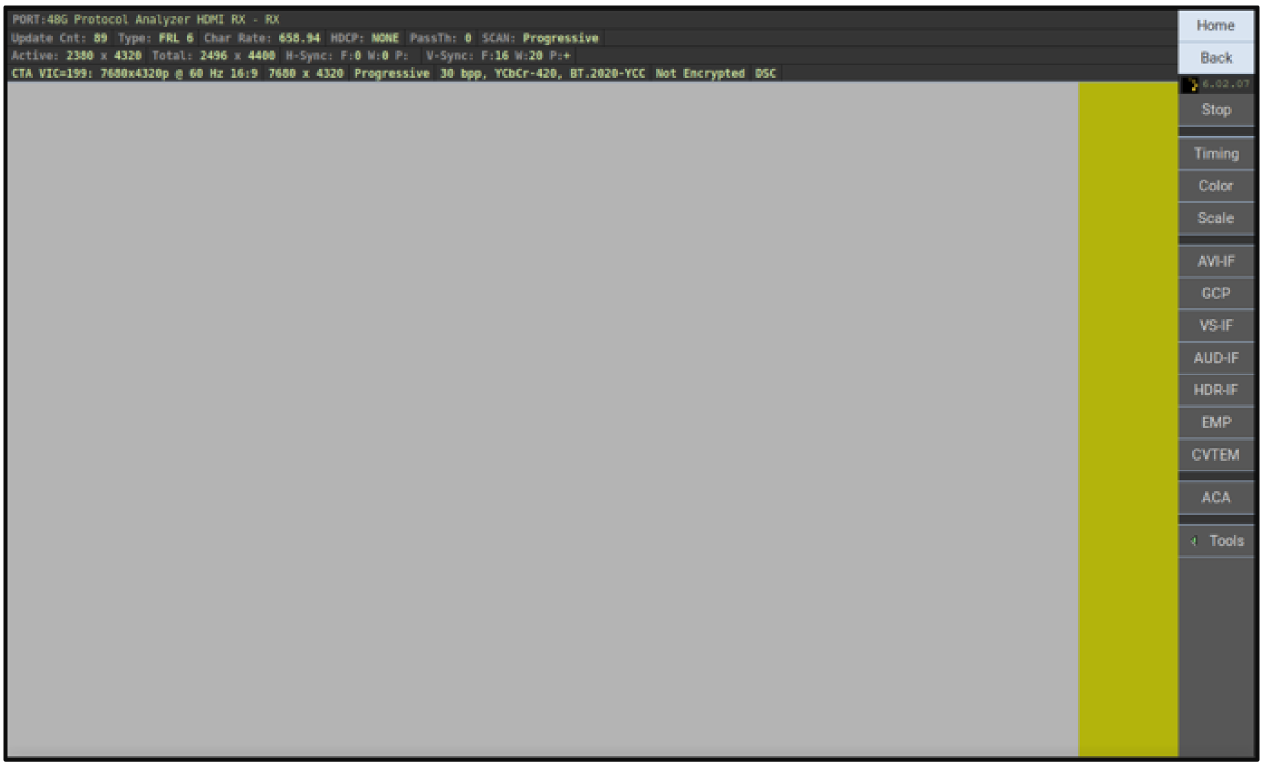
Important Note: HDCP is not currently supported.

This section describes the procedure for enabling HDCP authentication and encryption within the Basic Analyzer to test a source HDCP functionality.

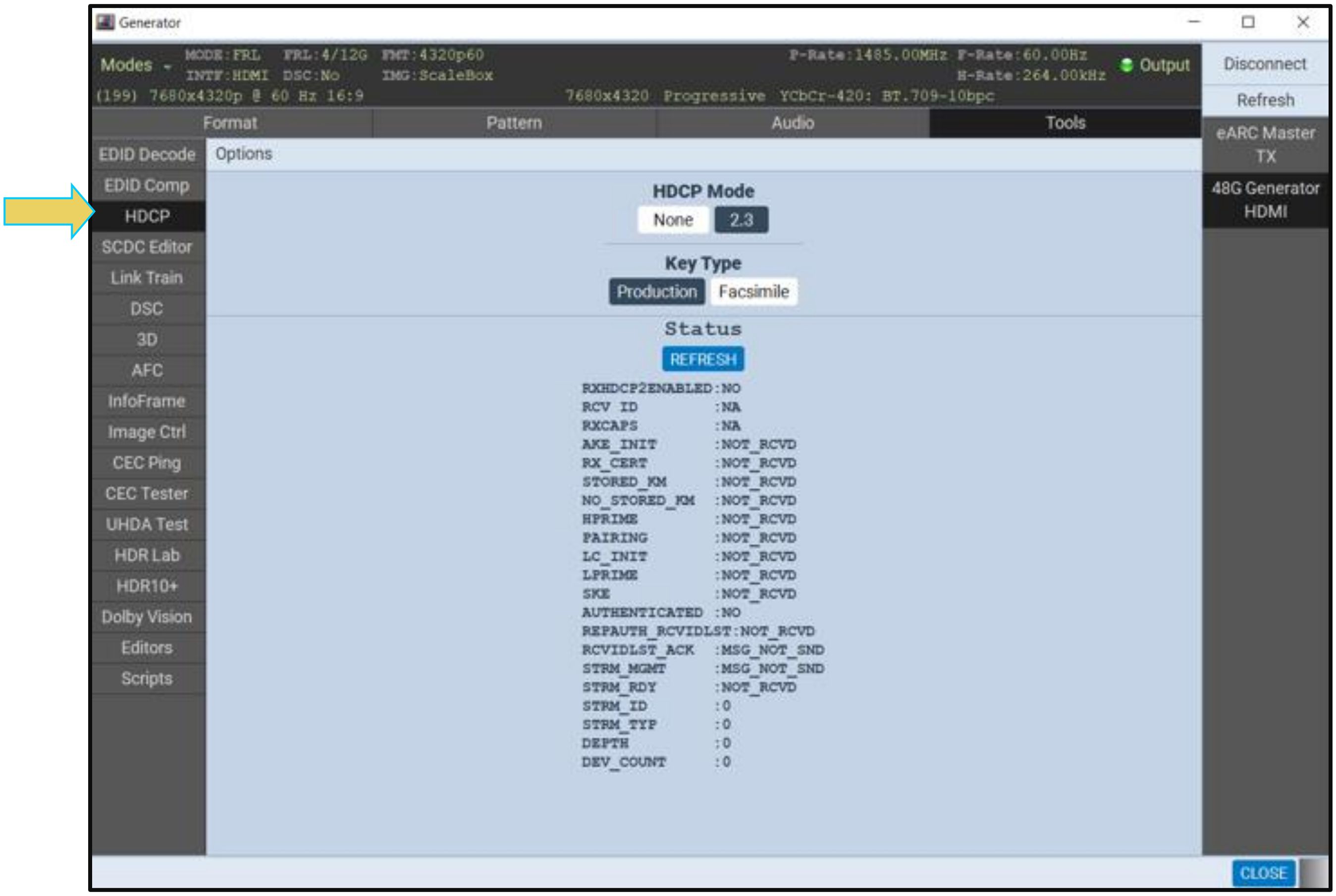
Setting the HDCP 2.3 mode

The M42h enables you to enable and disable HDCP on the Rx sink emulation port. This enables you to test how your source DUT responds to a sink that may or may not support HDCP. Use the following procedures to set the HDCP mode and registers.

1. Select Rx HDCP Settings from the Instrument pull-down menu on the built-in front panel as shown below.



The **RX HDCP 2.3 Settings** dialog box appears as shown below.



2. Select the RX Control and Configuration dialog box using the check boxes.

Enabled – In the Enabled mode, the M42h 96G Video Analyzer/Generator sink emulator will respond to HDCP 2.3 authentication request from a source device under test.

Disabled – In the Disabled mode, the M42h 96G Video Analyzer/Generator sink emulator will not respond to HDCP 2.3 authentication from a source device under test.

Repeater – This check box enables you to indicate whether the M42h 96G Video Analyzer/Generator emulates an HDCP 2.3 repeater device.

Depth – This indicates the depth count if M42h 96G Video Analyzer/Generator is emulating an HDCP 2.3 repeater device.

Device Count – This indicates the Device count if the M42h 96G Video Analyzer/Generator is emulating an HDCP 2.3 repeater device.

Refresh – This activation button refreshes the HDCP 2.3 status area of the dialog box.

NOTE: HDCP 2.3 Compliance Tests will only pass when executed in standard definition format (480p or 576p). Executing an HDCP 2.3 Compliance Test in 1080p or above will result in a failed test.

8 Analyzing HDMI Data with the M42h 96G Video Analyzer/Generator Capture Analysis Utility

Important Note: Not all functions described in this Chapter are currently implemented on the M42h.

This chapter describes how to use the M42h 96G Video Analyzer/Generator to view HDMI protocol data from the HDMI source device under test in the M42h 96G Video Analyzer/Generator Capture Utility. Analysis of TMDS and FRL incoming streams are supported.

8.1 Overview

These procedures assume that you have powered up the M42h system, connected your HDMI 2.1 source device, connected the Ethernet cable, and established an IP connection from the ATP Manager running on your PC to the M42h system that the M42h 96G Video Analyzer/Generator resides in. You should now have the ATP Manager open on your PC.

8.1.1 Operational Workflow for Capturing Data with your M42h 96G Video Analyzer/Generator

This subsection describes how to use the M42h 96G Video Analyzer/Generator to capture and analyze HDMI source devices. Testing an HDMI 2.1 source device involves the following high-level steps:

- Configure the M42h 96G Video Analyzer/Generator in the proper mode HDMI.
- Set the +5V threshold level.
- Configure the M42h 96G Video Analyzer/Generator's Rx port with the proper EDID.
- Specify a trigger method (There is only one default trigger condition currently supported which is the first instance of a Scrambler Reset character sequence in a Super Block).
- Specify the data that you want to capture and how much data you want to capture. Currently all data is captured; there is no pre-capture filtering supported.
- Initiate the capturing of the data.

Examine the test data through the ATP Manager at the high-level view on the **Event Plot** panel or the **Video Analysis** panel.

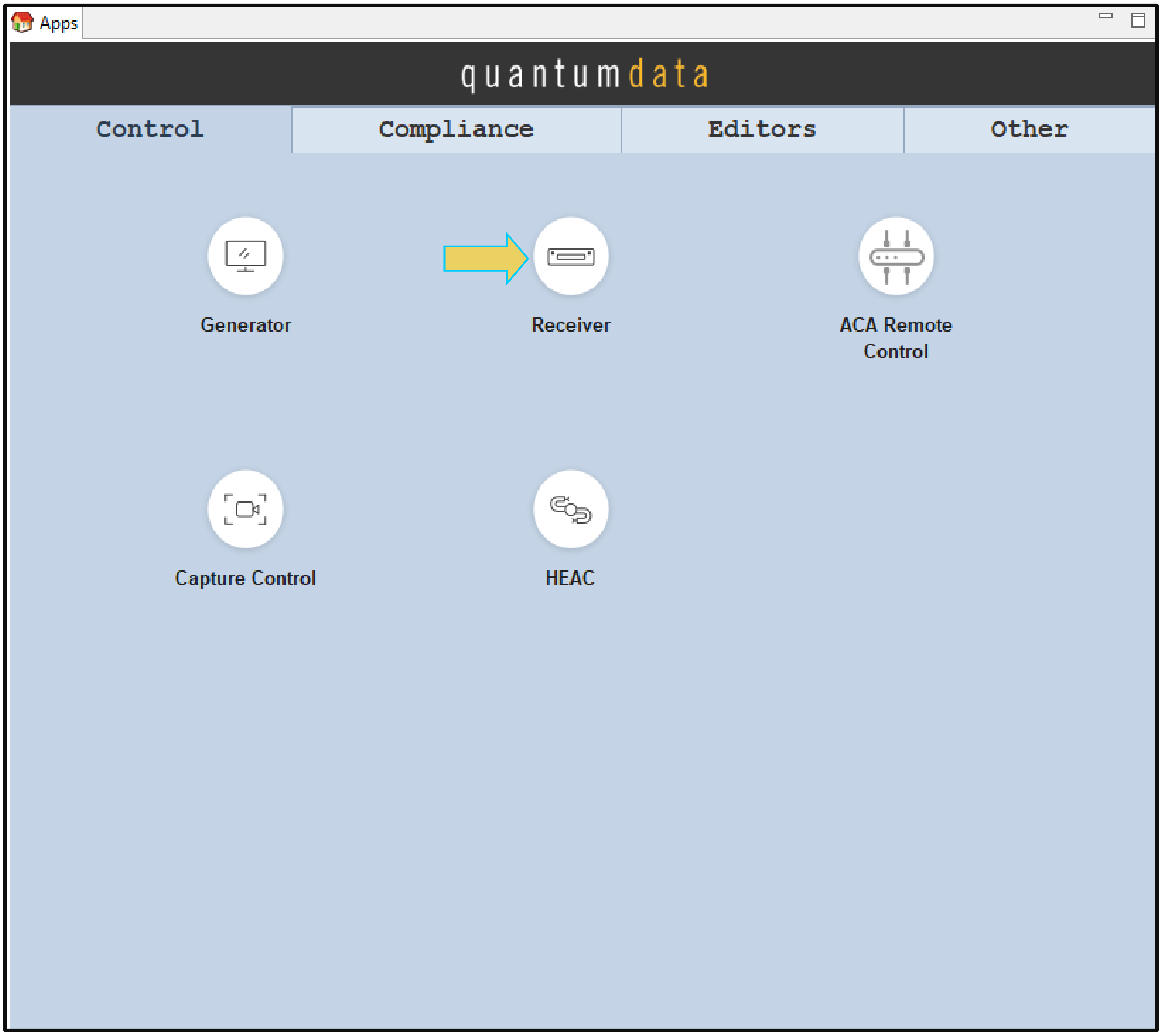
Drill down to examine the data at the lower level through the details of the **Decode** panel view.

Examine the data through the capture viewer.

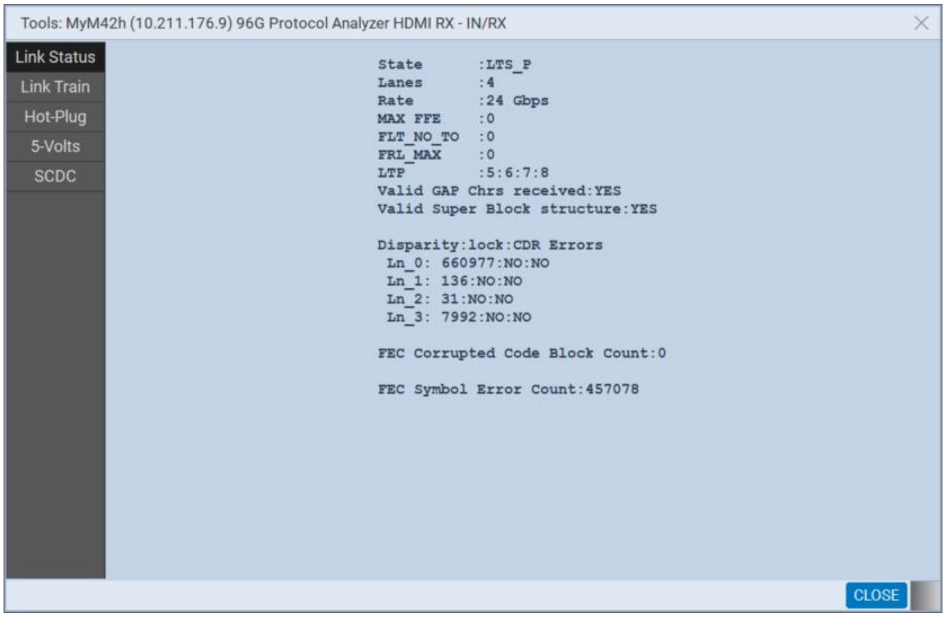
8.2 Configuring the M42h 96G Video Analyzer/Generator Rx Interface

Use the procedures below to provision the M42h 96G Video Analyzer/Generator's Rx port through a **Tools** dialog box. You can configure the Rx port with an EDID, the +5V load, generated hot plug. Through this dialog box you can also view the SCDC registers and the status of the FRL lanes.

1. Access the **Tools** dialog box from **Card Control** page of Apps menu as shown below.



The **Tools** dialog box appears as shown below. By default the **Tools** dialog box shows the **Status** of the FRL lanes if FRL is active. The following is an example. In this example the interface is trained at 24Gbps on 4 FRL lanes. The lanes are aligned and FRL lanes in the locked state with no pattern errors.

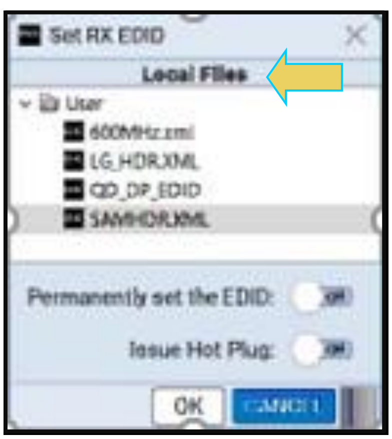


To provision the EDID:

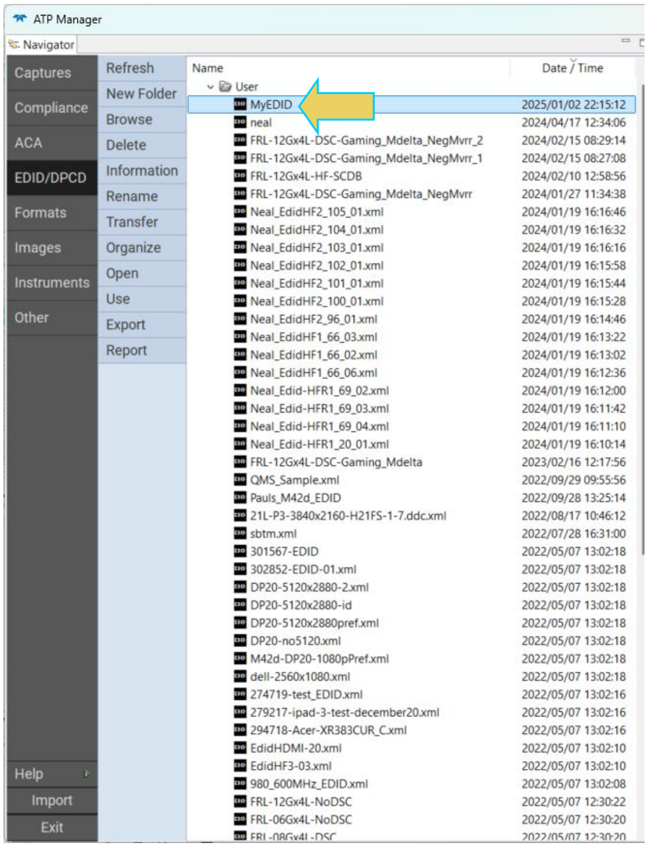
There are two ways to provision the M42h 96G Video Analyzer/Generator's Rx port with an EDID of your choosing. Not that the EDID must support FRL. The default EDID does support FRL.

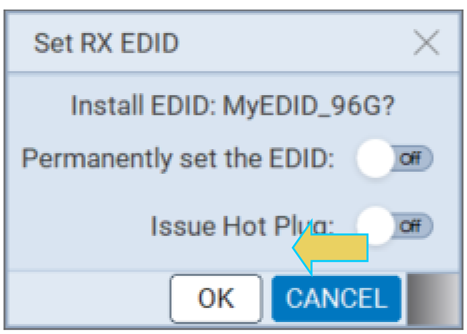
1. (optional) Load the EDID to use in the M42h 96G Video Analyzer/Generator. This is the EDID that the M42h 96G Video Analyzer/Generator will be emulating.

The default EDID in the M42h 96G Video Analyzer/Generator has a preferred timing of 4Kp60 and supports FRL. You can provision the M42h 96G Video Analyzer/Generator with a different EDID. Sample EDIDs are available from the Quantum Data website on the downloads page (http://www.quantumdata.com/support/M42hreadme.asp#edid). You can download these EDIDs to the host PC where the ATP Manager is running. Select an EDID file by activating the **Set M42h Rx EDID** (shown on the screen below).



Alternatively, you can use the EDID/DPCD tab to select and EDID as shown below. Select the EDID and then right-click to access a pull-down menu. Select Use to set the Rx port with the selected EDID as shown below.





1. Select the EDID that you wish to provision the Rx port with. The example above shows 5AMHDRXML EDID being selected. Select the desired EDID and then click on the OK button. Select Issue **Hot Plug** check box if you want to issue a hot plug once the selection is made. Select the **Permanently set the EDID** if you want this EDID to be the new default EDID.

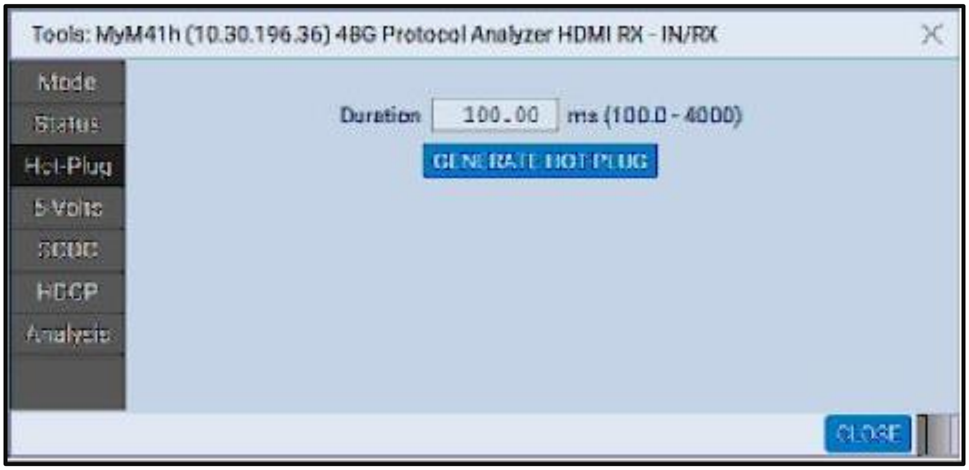
Note that there are two check box options on the dialog box. The following is a description of each:

Permanently set the EDID M42h HDMI 2.1 Protocol Analyzer's EDID – This means that the EDID that you provision will persist through a reboot of the M42h. Otherwise the default M42h EDID will be reprovisioned when a reboot occurs.

Issue Hot Plug – This means that the M42h 96G Video Analyzer/Generator will issue a hot plug when you click the OK activation button on this dialog box.

To Set the Hot Plug duration:

1. (optional) Set the Hot Plug duration and generate a hot plug as shown on the screen below. Select the **Hot-Plug** access button on the **Tools** menu as shown below. Specify the duration of the hot plug using milliseconds.

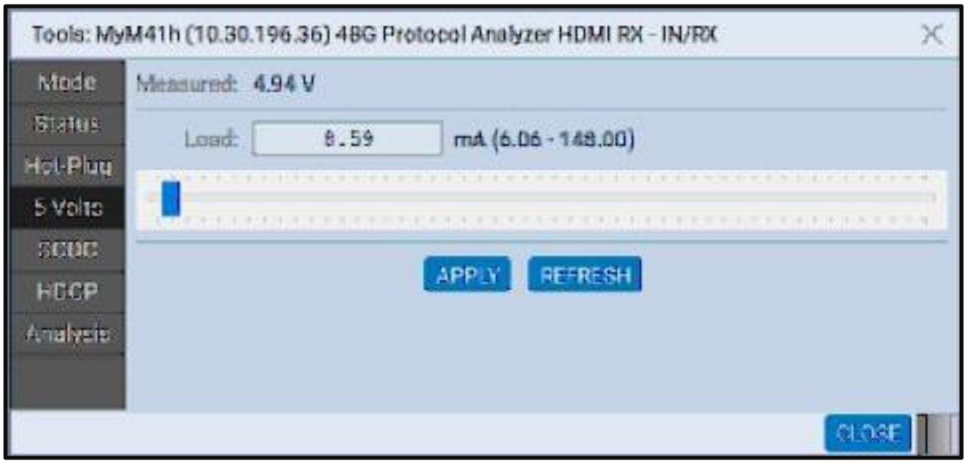


To Set the +5V load:

1. (optional) Set the Rx port's +5V load via the 5 Volts access button through the Tools menu as shown below.
2. Specify the current load in milliamps. Use the slider or enter the value in the field provided.

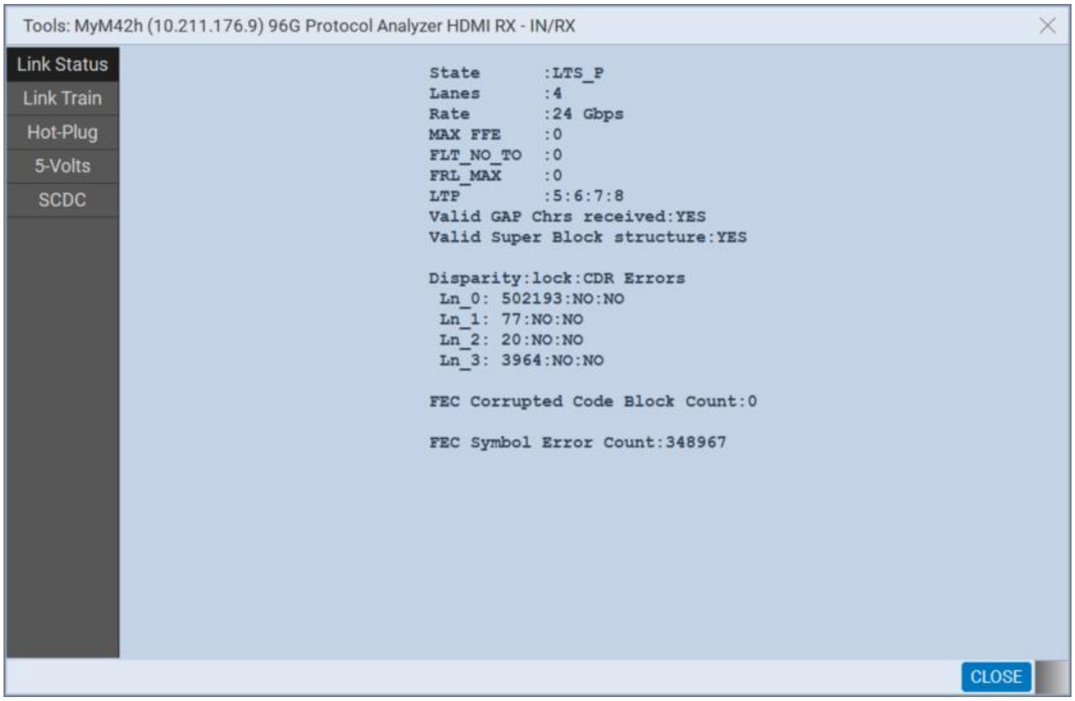
   The **Measured** value of the +5V is shown (4.97 V in the example below).

3. Hit the Apply button when you have set the desired load. Use Refresh to view the new measured value of the +5V.



To View the SCDC Registers:

1. (optional) View the SCDC registers using the SCDC access button. The values of various status and configuration registers are shown. Use Refresh to update the values displayed.

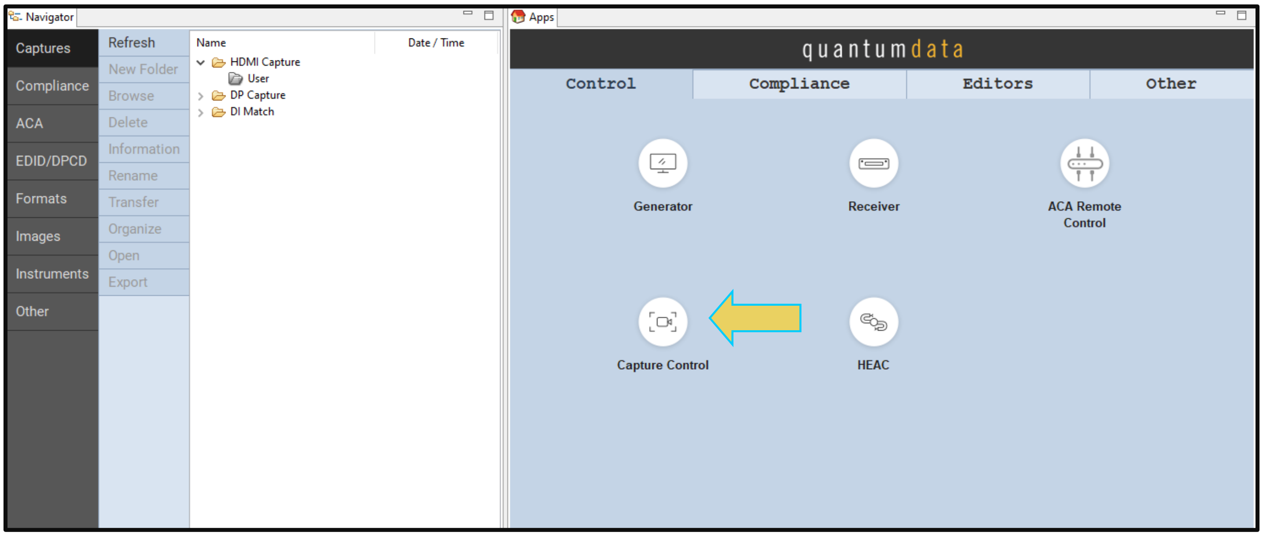

Tools: MyM42h (10.211.176.9) 96G Protocol Analyzer HDMI RX - IN/RX
Link Status
Link Train
Hot-Plug
5-Volts
SCDC
State :LTS_P
Lanes :4
Rate :24 Gbps
MAX FFE :0
FLT_NO_TO :0
FRL_MAX :0
LTP :5:6:7:8
Valid GAP Chrs received:YES
Valid Super Block structure:YES
Disparity:lock:CDR Errors
Ln_0: 502193:NO:NO
Ln_1: 77:NO:NO
Ln_2: 20:NO:NO
Ln_3: 3964:NO:NO
FEC Corrupted Code Block Count:0
FEC Symbol Error Count:348967
CLOSE

8.3 Capturing HDMI FRL Incoming Streams

The M42h 96G Video Analyzer/Generator supports the capturing of both HDMI TMDS incoming streams and Fixed Rate Link (FRL) incoming streams. This subsection describes the procedures for capturing FRL streams. The following subsection provides procedures for capturing TMDS incoming streams.

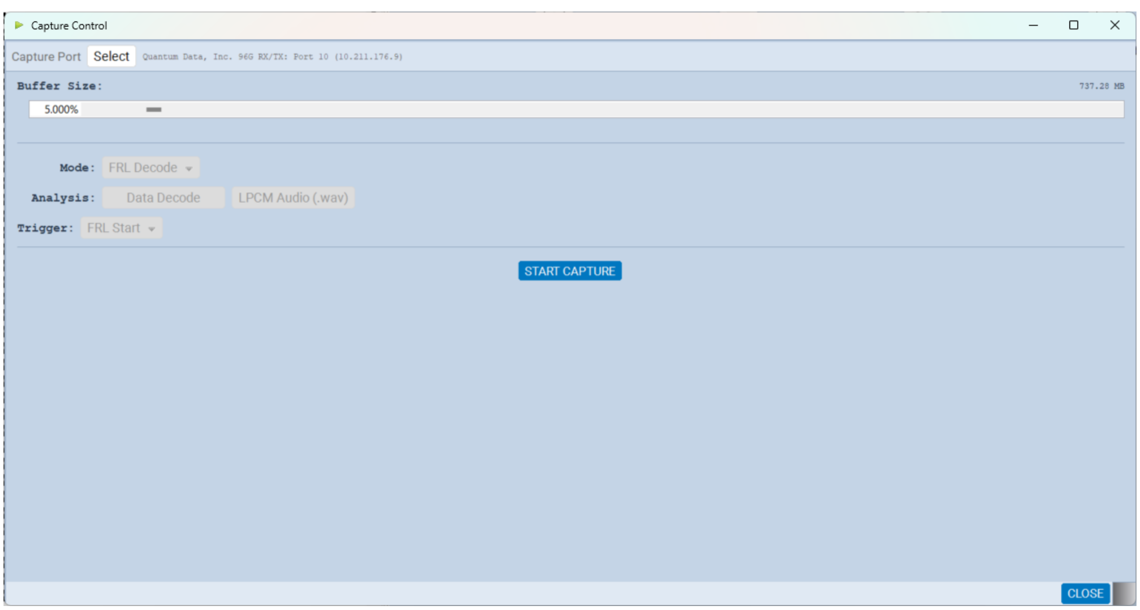
To capture FRL streams:

1. Select the **Capture Control** application from the **Control Page** of the Main screen.

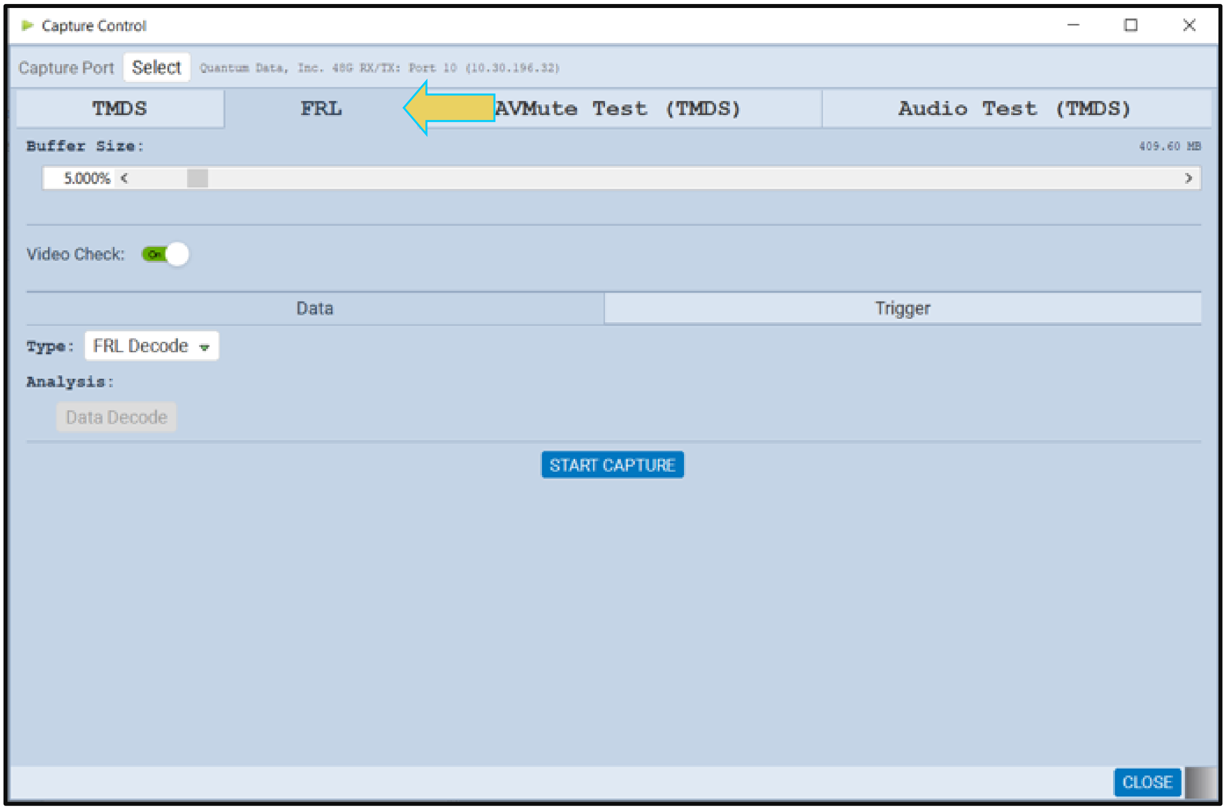


2. Select the FRL tab from the **Capture Control** window.

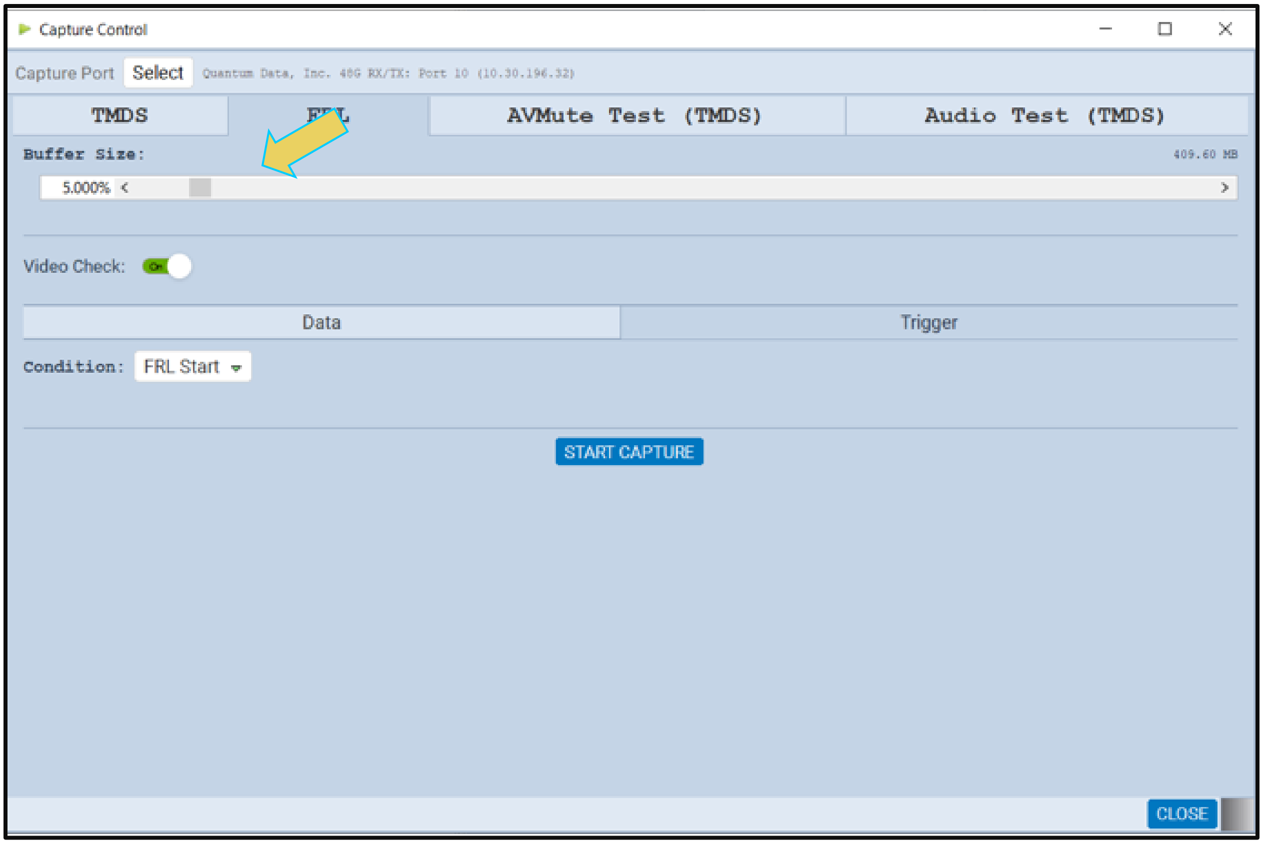
Important Note: At this time not all Capture functions are supported in the M42h.



Important Note: The following screen shots depict the full support that the M42h will provide in future releases.

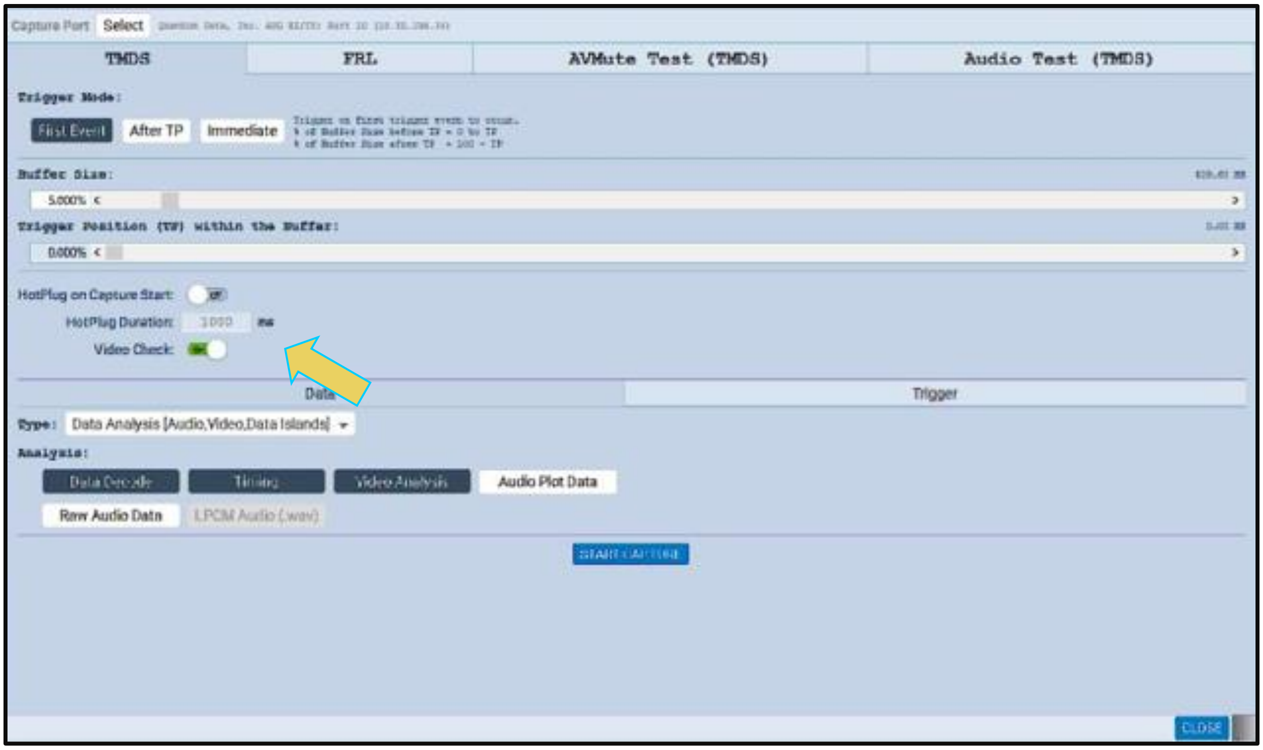


3. Set the **Buffer Size** slider to a percent value to meet your requirements. You can capture up to about 8GB of data.



4. Check the **Hot Plug** on **Start Capture** button if you want the M42h 96G Video Analyzer/Generator to issue a hot plug to initiate HDCP authentication. You also need to specify the duration of hot plug pulse in milliseconds.

   Note: If you are going to be taking some action on the device under test that will halt video, such as unseating and reseating the HDMI cable, you will need to slide the **Video Check** to on in the Capture Configuration section of the **Capture Control** dialog box.

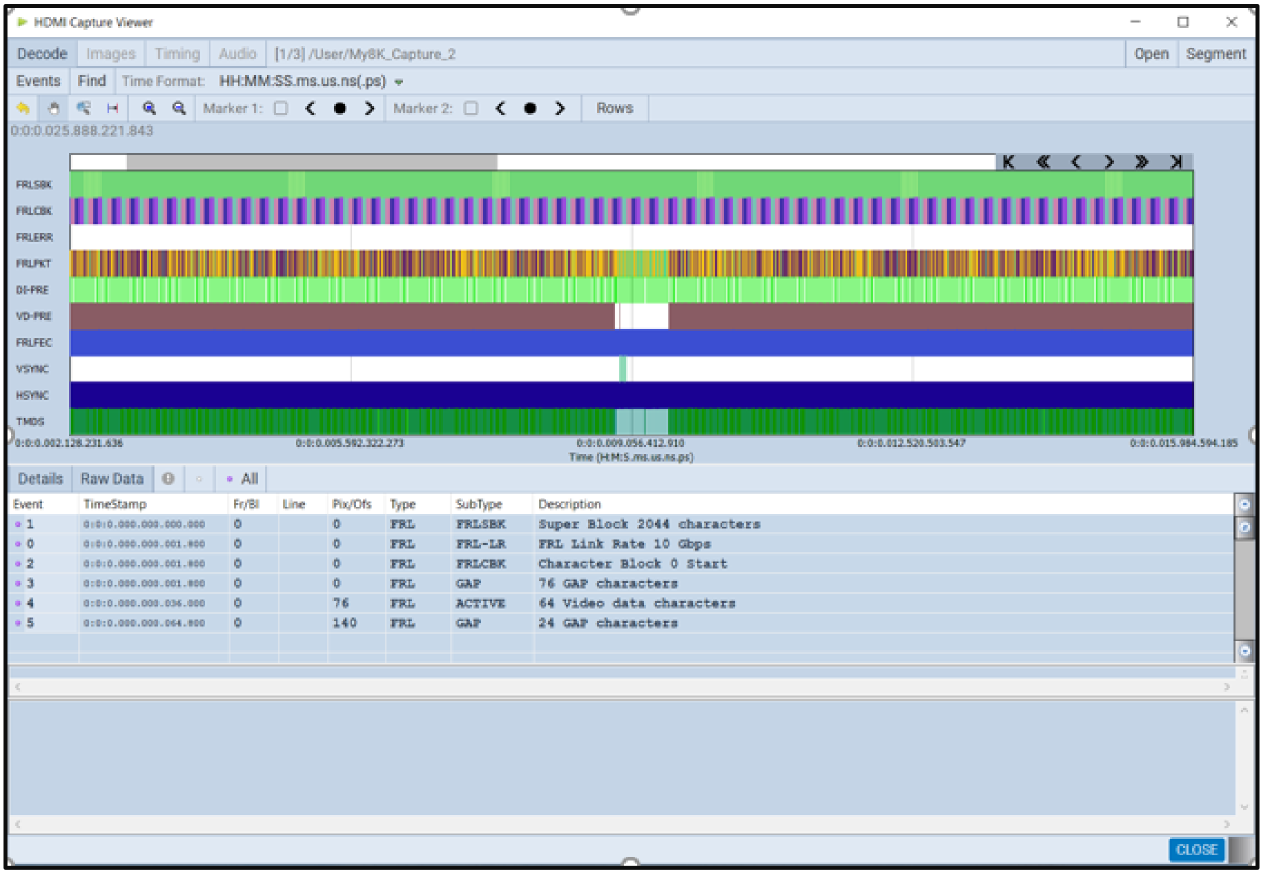


5. Click on the **Start Capture** button.

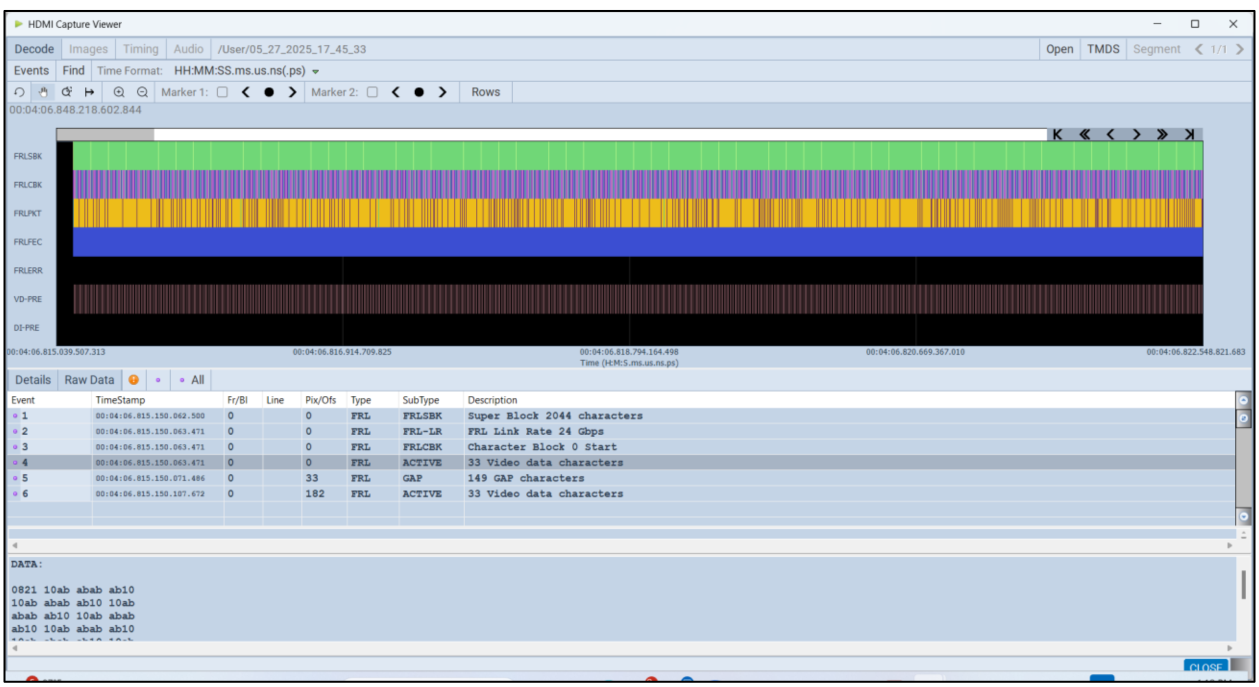
   The M42h 96G Video Analyzer/Generator will capture the data. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

   Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will state "**Waiting for capture trigger to occur…**"

When the M42h Protocol Analyzer is finished capturing the data a decode file is shown in the **Event Plot** panel and the **Decode** panel.



The following is a sample capture of a stream at 24Gb/s per lane (96G aggregate).



Note: The null packets may be present in the capture. These null packets assure proper FRL flow metering. Therefore, the product does not offer an option to disable them; however, you can filter them out with the filter function.

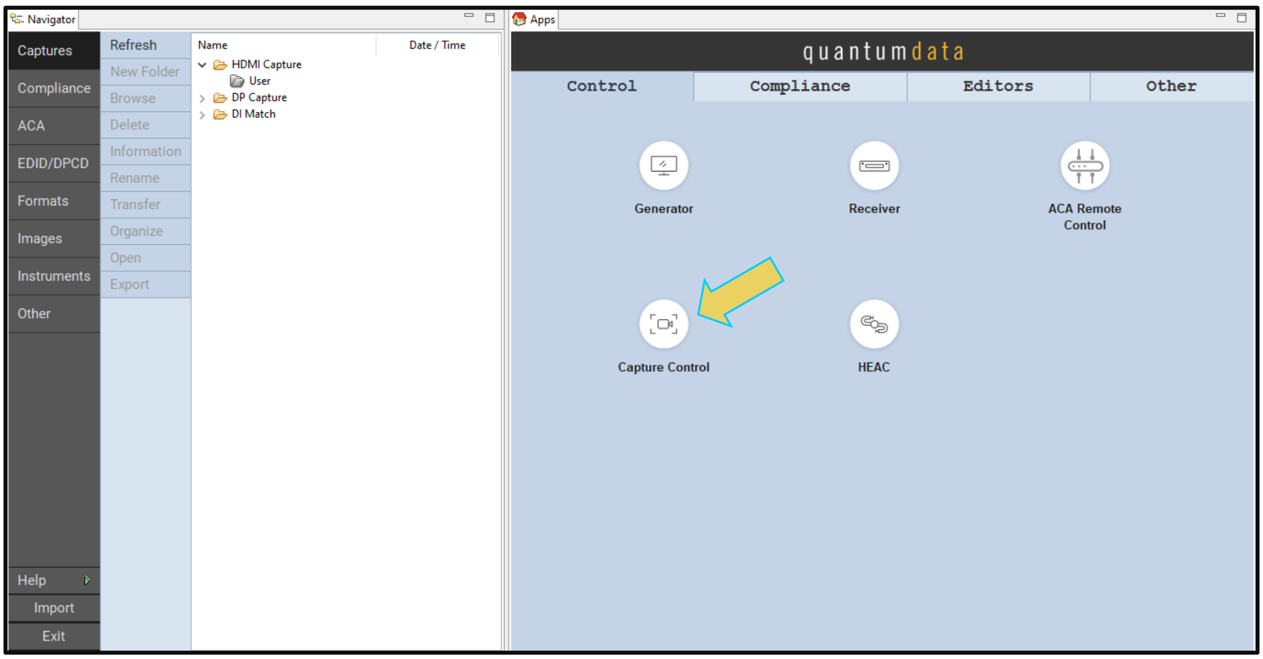
8.4 Capturing HDMI TMDS Incoming Streams

The M42h 96G Video Analyzer/Generator supports the capturing of both HDMI TMDS incoming streams and Fixed Rate Link (FRL) incoming streams. This subsection describes the procedures for capturing TMDS streams. The previous subsection provides procedures for capturing FRL incoming streams.

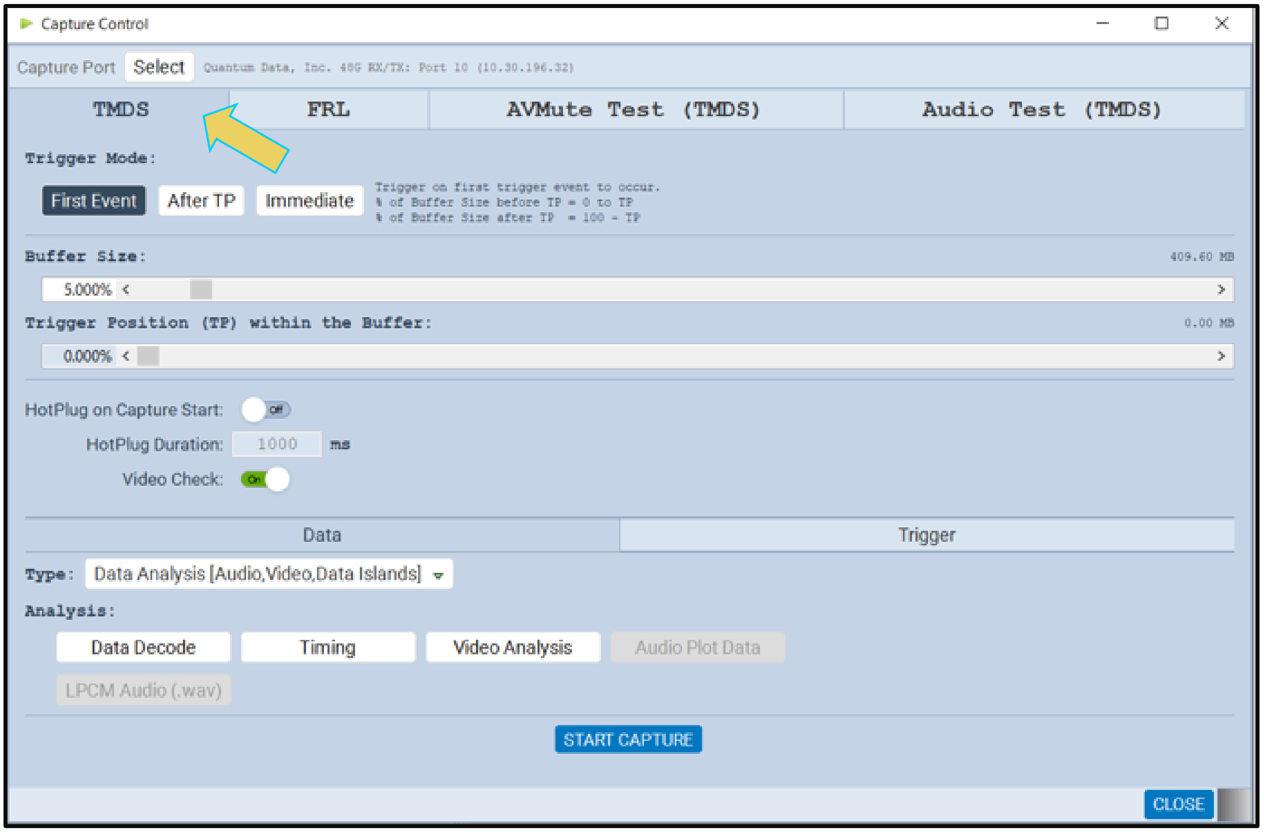
To capture TMDS streams:

Use the procedures below to initiate a new capture.

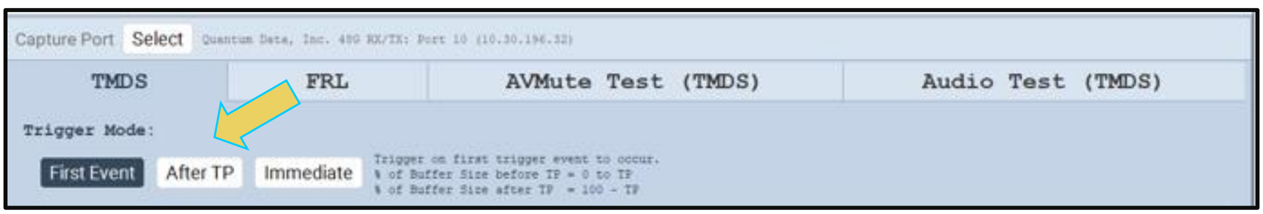
1. Select the **Capture Control** application from the **Control Page** of the Main screen.



2. Select the TMDS tab at the top of the Capture Control window.



3. Set the Video Trigger mode using the information described below:

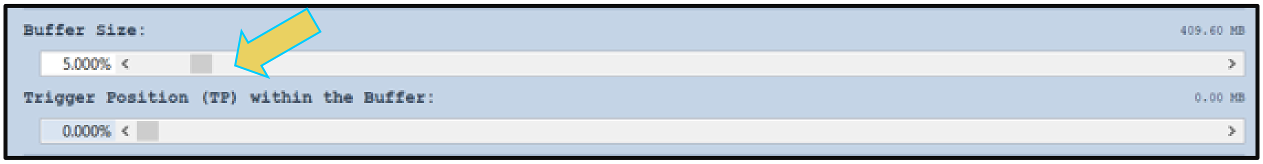


First Event – The trigger occurs on the first event—first occurrence—of the trigger condition defined in the Trigger Type pull-down menu (Vsync, encryption Enabled, Encryption Disabled, External Trigger, Manual Trigger, TMDS Clock Change). Depending on the setting of the Trigger Position slider, you may have some of the captured data in the buffer that accumulated prior to the trigger condition and some of the captured data in the buffer that accumulated after the trigger condition. At the left most position there will be no data in the capture buffer that occurred prior to the trigger event. At the right most position, all the data in the capture buffer will be data that accumulated prior to the trigger event. Because the trigger condition could be met quite quickly, the capture buffer may not be filled to the amount specified in Buffer Size.

After TP (Trigger Position) – In this setting the trigger condition specified in the Trigger Type pull-down menu will be ignored until data has accumulated in the capture buffer up to the point where the Trigger Position slider is set. Once the data has accumulated to the setting of the Trigger Position, any event matching the Trigger Type specified will cause a trigger condition and data accumulation will begin. Some of the data in the capture buffer will be data that has accumulated prior to the trigger condition being met and some of the data in the capture buffer will be data that has accumulated after the trigger condition was met. This setting will ensure that the capture buffer is filled to the Buffer Size setting.

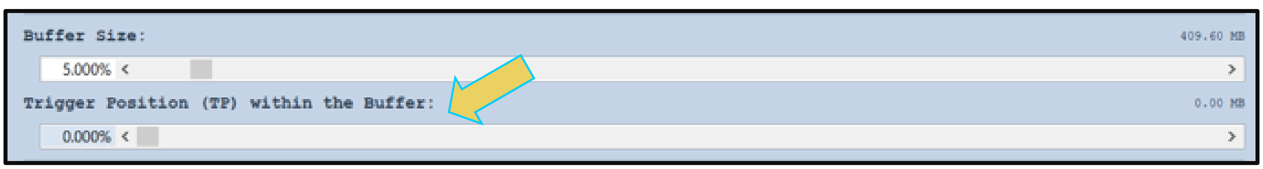
Immediate – Data capture begins accumulating immediately when the Start Capture button is activated. Data capture halts when buffer is filled. This setting will not provide any capture history, i.e. none of the captured data accumulated in the capture buffer will be data that occurred prior to the capture trigger event (activating the Start Capture button).

4. Set the Buffer Size slider to a percent value to meet your requirements. You can capture up to about 4GB of data which is about 1150 frames at 576p/480p and about 204 frames at 1080p which includes the video. If you do not want to capture the video and only capture the metadata, you can store well over 200,000 frames of data with the 4GByte storage capabilities.



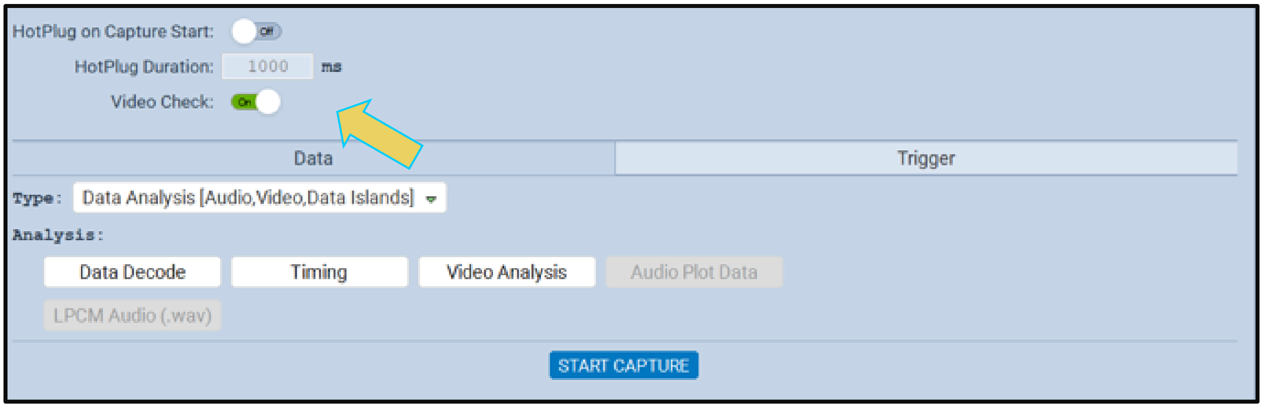
5. Set the Trigger **Position** within the **Buffer** slider to a percent value to meet your requirements. This slider enables you to set the position of the trigger event within the captured data. This is a slider that provides an indication (on the left) of the location within the captured data, expressed as a percent with 0% indicating that the trigger event occurs at the beginning of the captured data and 100% indicating that the trigger event occurs at the end of the captured data.

Note: When using **Manual** trigger, it is important to set the Trigger Position to ensure that there is some captured data prior to the manual trigger start point. The manual trigger is particularly useful when you are observing the behavior of a connected sink and then manually initiating the trigger when a particular symptom exhibits itself. Typically, you should move the trigger position to the right nearest the 100% mark. This way you ensure that there is data prior to the trigger event by accounting for reaction time between the time the symptom occurs and the time you initiate the trigger. Refer to the settings below which are typical.

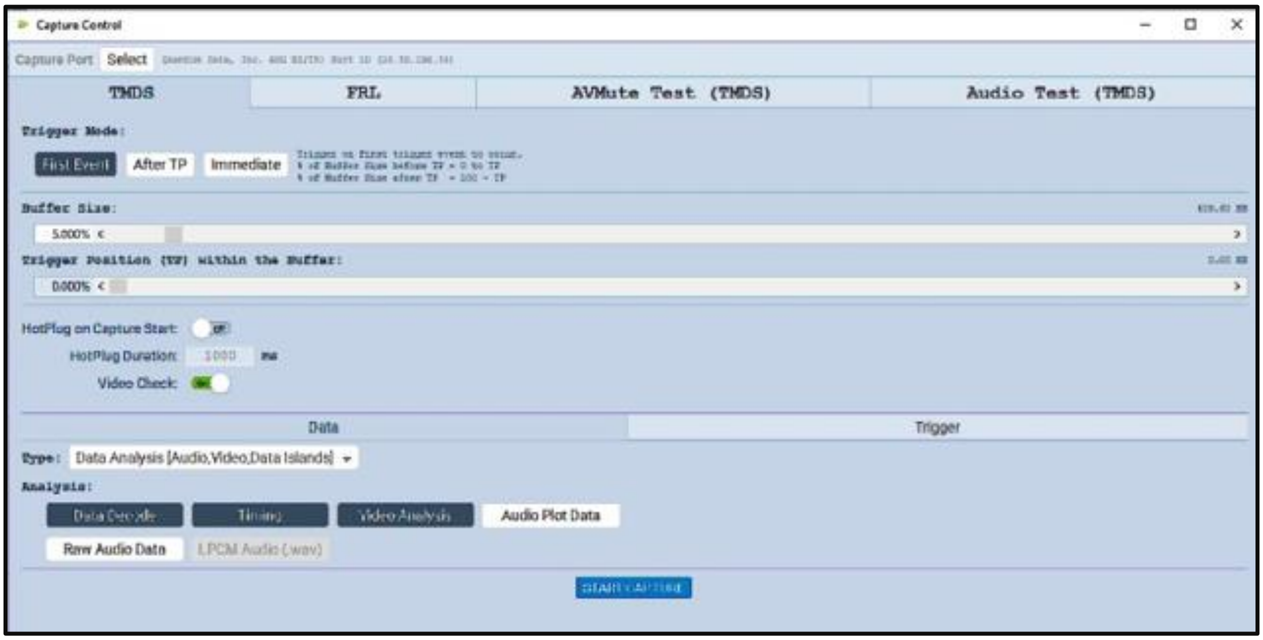


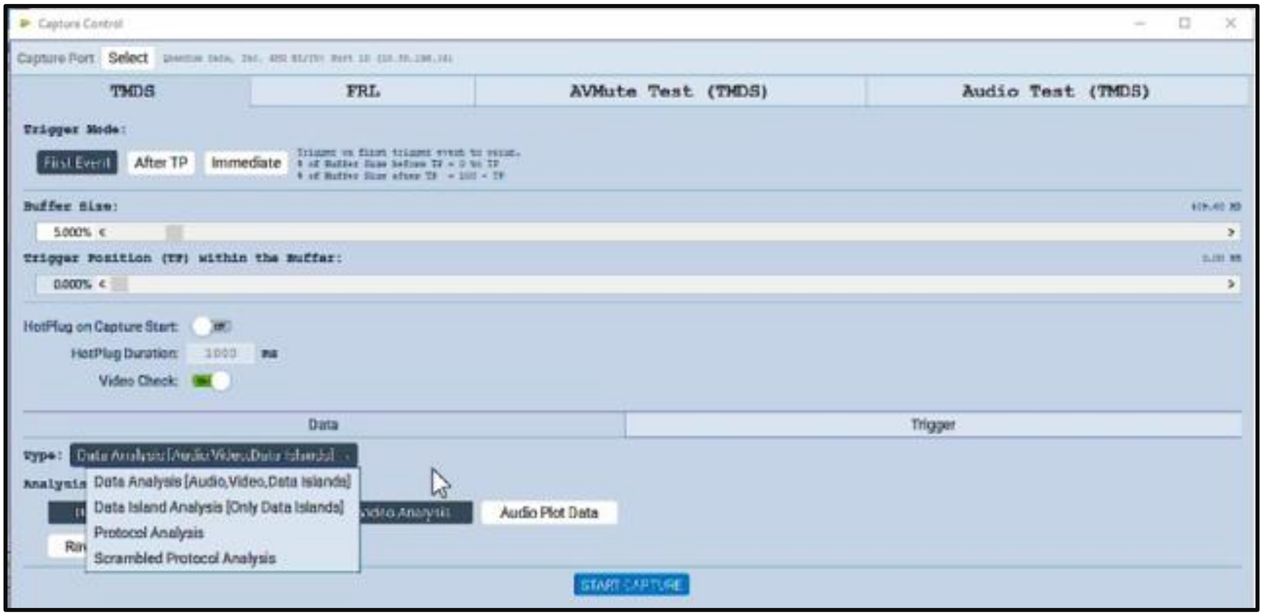
6. Select **Hot Plug** on **Start Capture** button if you want the M42h 96G Video Analyzer/Generator to issue a hot plug to initiate HDCP authentication. You also need to specify the duration of hot plug pulse in milliseconds.

Note: If you are going to be taking some action on the device under test that will halt video, such as unseating and reseating the HDMI cable, you will need to turn on the **Video Check** radio button in the Capture Configuration section of the **Capture Control** dialog box.

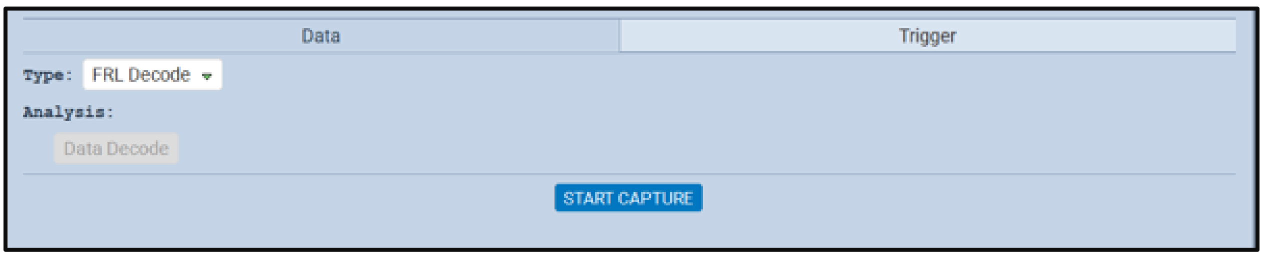


7. Select the **Capture** tab.
8. Select the **Data Selection** Type from the pull-down menu provided.

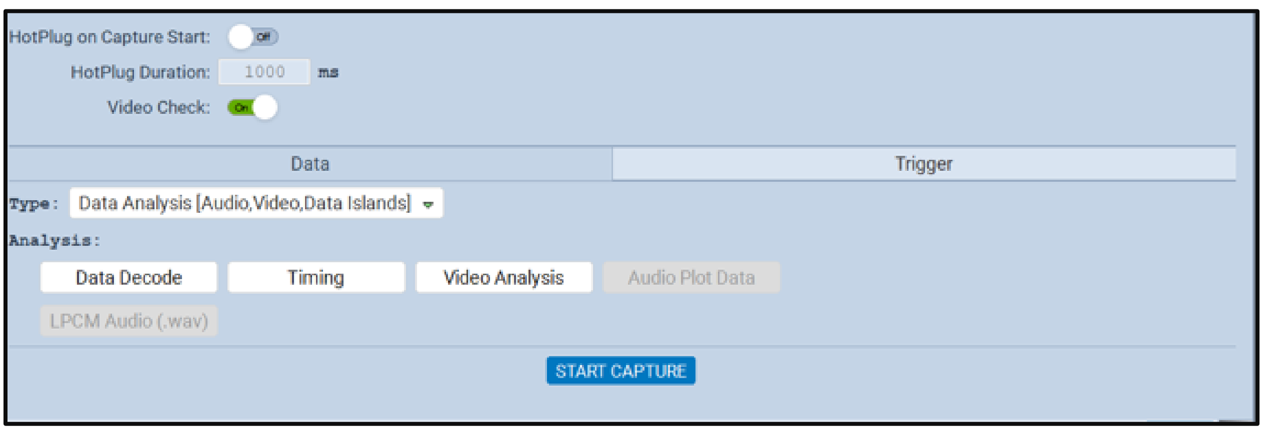




9. Select the Trigger selection **Condition**.

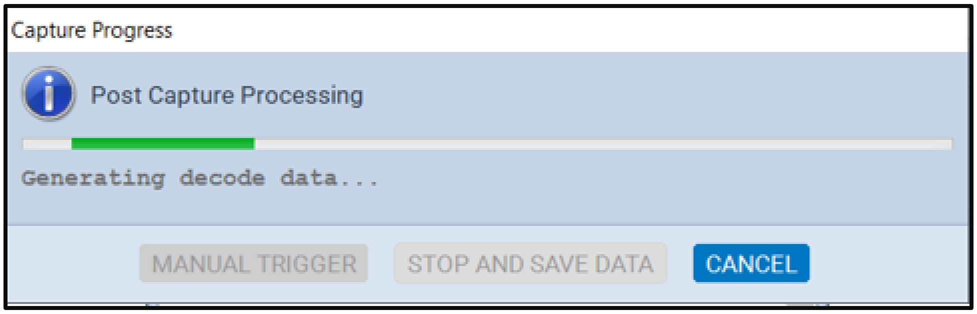


10. Click on the **Start Capture** button.

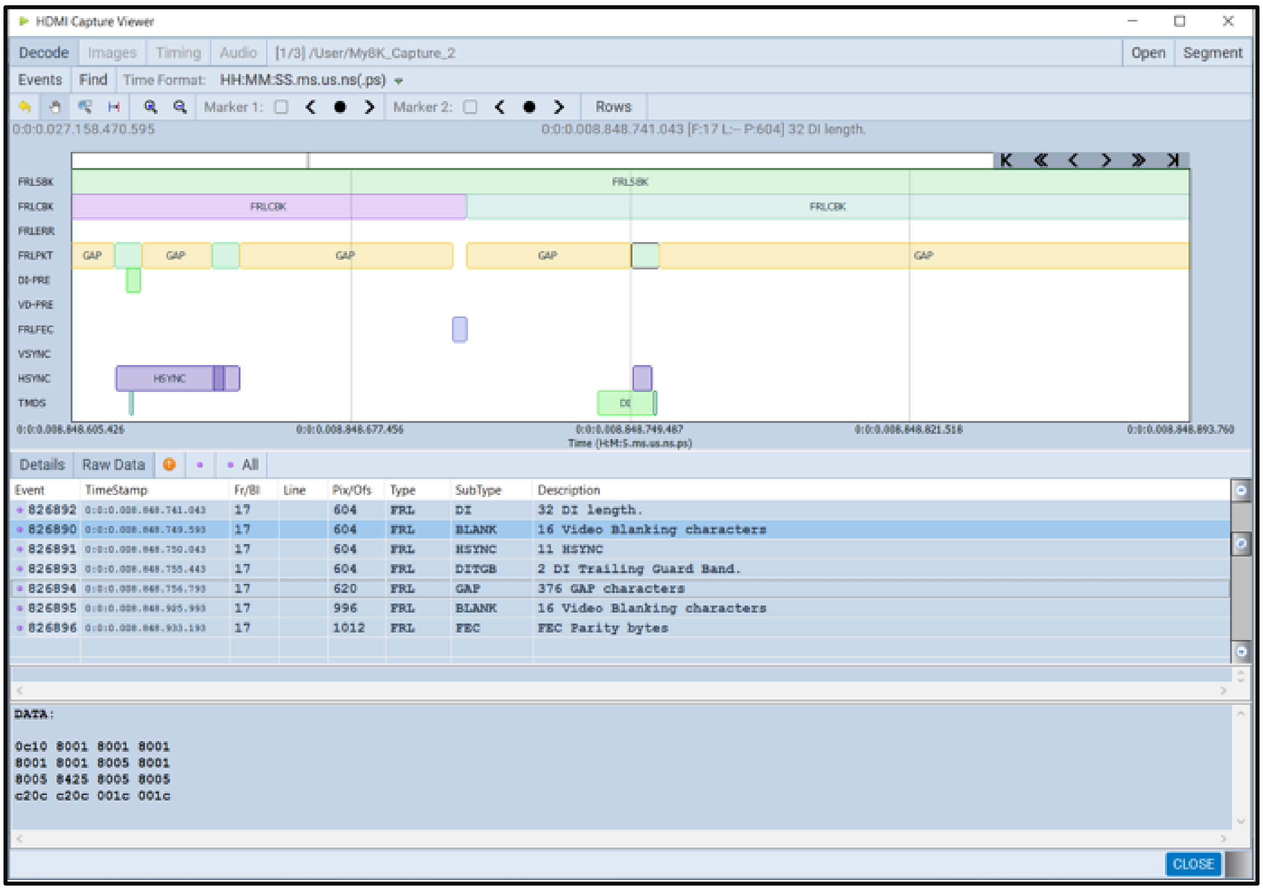


The M42h 96G Video Analyzer/Generator will capture the data. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

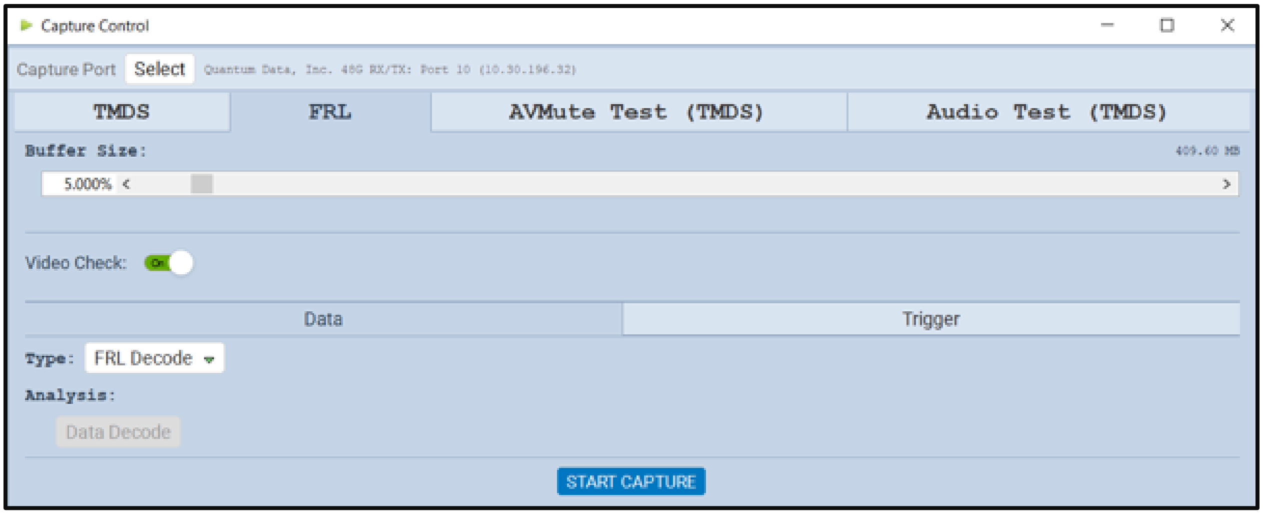
Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will state "**Waiting for capture trigger to occur…**"



When the M42h 96G Video Analyzer/Generator is finished capturing data a decode file is shown in the **Event Plot** panel and the **Decode** panel.



Note: This feature is not currently supported. The External Trigger Input enables you to initiate a capture trigger event from an external source. You select the external trigger from the Trigger pull-down menu as shown below:

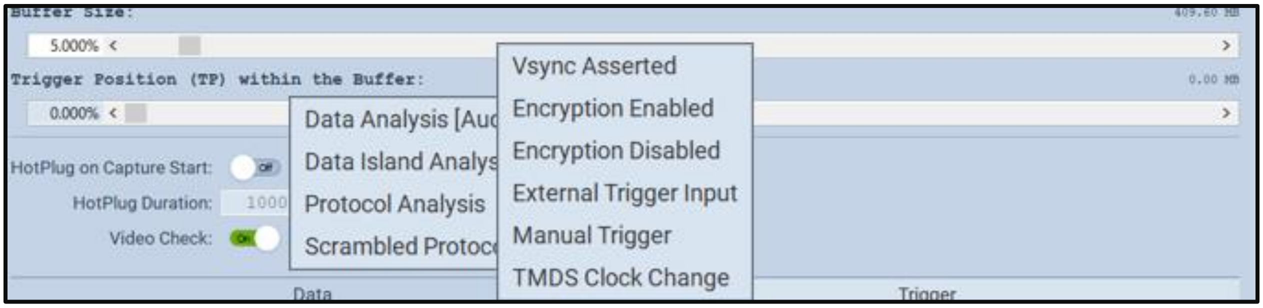


The minimum voltage required to activate the external trigger is 2.1 volts and will accept up to 5V. The pulse duration of the External Trigger must be greater than 1 TMDS pulse clock period. The Trigger Input is on the rear of the M42h. It is the topmost BNC connector. There are a few M42h configurations; the most common are shown below.

M42h Advanced Test Platform – Trigger IN (Not Currently Supported)

8.5 Initiating a Capture with Manual Triggering

In addition to the triggers provided in the pull-down menu, you can select to manually trigger on an event. Refer to the screen shot below:



Typically, manual triggers are used in the Pass-through mode. In these modes there is a display connected to the M42h HDMI Protocol Analyzer Tx port. A common application would be to observe the connected display and when it exhibits the behavior you are looking for you can initiate the manual trigger.

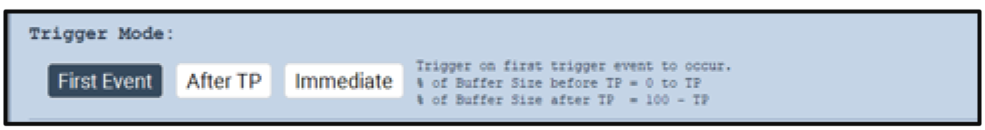
8.5.1 Initiating a Capture with Manual Triggering

With the manual capture, you can monitor the downstream HDMI sink device for behavior or symptoms that could be an issue and then initiate a capture when the condition exhibits itself. This ensures that the relevant data—data related to interoperability—is captured.

To capture data using manual triggering:

Use the procedures below to initiate a new capture.

1. Set the Video Trigger mode using the information described below:

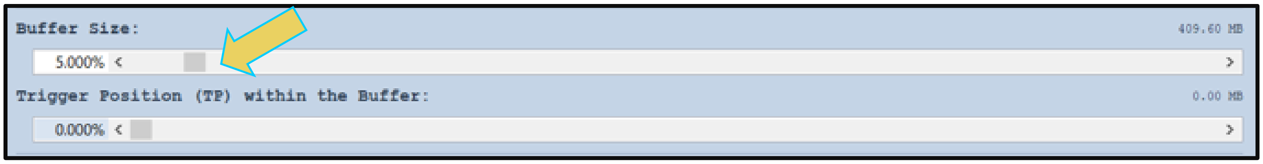


First Event – The trigger occurs on the first event—first occurrence—of the trigger condition defined in the Trigger Type pull-down menu (Vsync, encryption Enabled, Encryption Disabled, External Trigger, Manual Trigger, TMDS Clock Change). Depending on the setting of the Trigger Position slider, you may have some of the captured data in the buffer that accumulated prior to the trigger condition and some of the captured data in the buffer that accumulated after the trigger condition. At the left most position there will be no data in the capture buffer that occurred prior to the trigger event. At the right most position, all the data in the capture buffer will be data that accumulated prior to the trigger event. Because the trigger condition could be met quite quickly, the capture buffer may not be filled to the amount specified in Buffer Size.

After TP (Trigger Position) – In this setting the trigger condition specified in the Trigger Type pull-down menu will be ignored until data has accumulated in the capture buffer up to the point where the Trigger Position slider is set. Once the data has accumulated to the setting of the Trigger Position, any event matching the Trigger Type specified will cause a trigger condition and data accumulation will begin. Some of the data in the capture buffer will be data that has accumulated prior to the trigger condition being met and some of the data in the capture buffer will be data that has accumulated after the trigger condition was met. This setting will ensure that the capture buffer is filled to the Buffer Size setting.

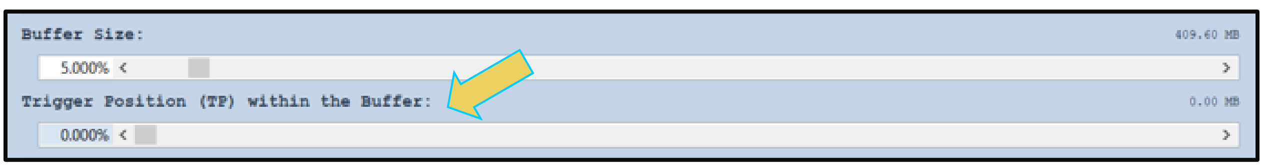
Immediate – Data capture begins accumulating immediately when the Start Capture button is activated. Data capture halts when buffer is filled. This setting will not provide any capture history, i.e. none of the captured data accumulated in the capture buffer will be data that occurred prior to the capture trigger event (activating the Start Capture button).

2. Set the **Buffer Size** slider to a percent value to meet your requirements. You can capture up to about 4GB of data which is about 1150 frames at 576p/480p and about 204 frames at 1080p which includes the video. If you do not want to capture the video and only capture the metadata, you can store well over 200,000 frames of data with the 4GByte storage capabilities.



3. Set the **Trigger Position** within the Buffer slider to a percent value to meet your requirements. This slider enables you to set the position of the trigger event within the captured data. This is a slider that provides an indication (on the left) of the location within the captured data, expressed as a percent with 0% indicating that the trigger event occurs at the beginning of the captured data and 100% indicating that the trigger event occurs at the end of the captured data.

Note: When using a **Manual** trigger, it is important to set the Trigger Position to ensure that there is some captured data prior to the manual trigger start point. The manual trigger is particularly useful when you are observing the behavior of a connected sink and then manually initiating the trigger when a particular symptom exhibits itself. Typically, you should move the trigger position to the right nearer the 100% mark. This way you ensure that there is data prior to the trigger event by accounting for reaction time between the time the symptom occurs and when you initiate the trigger. Refer to the settings below which are typical.

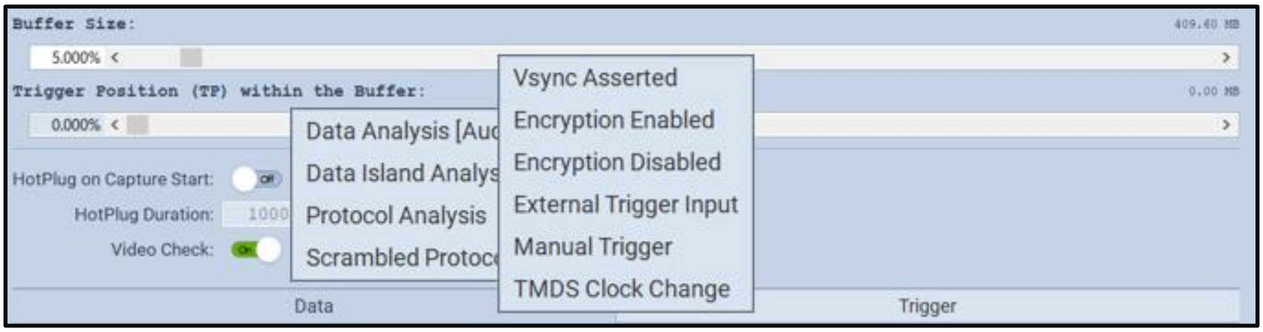


4. Check the **Hot Plug on Start Capture** button if you want the M42h HDMI 2.0 Protocol Analyzer to issue a hot plug to initiate HDCP authentication. You also need to specify the duration of hot plug pulse in milliseconds.

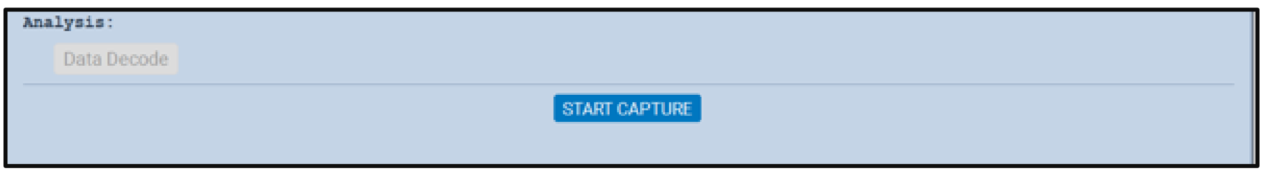
Note: If you are going to be taking some action on the device under test that will halt video, such as unseating and reseating the HDMI cable, you will need to turn on the **Video Check** radio button in the Capture Configuration section of the **Capture Control** dialog box.

5. Select the **Capture** tab.
6. Select the Data Selection Type from the pull-down menu provided.

7. Select the Manual Trigger selection **Condition**.

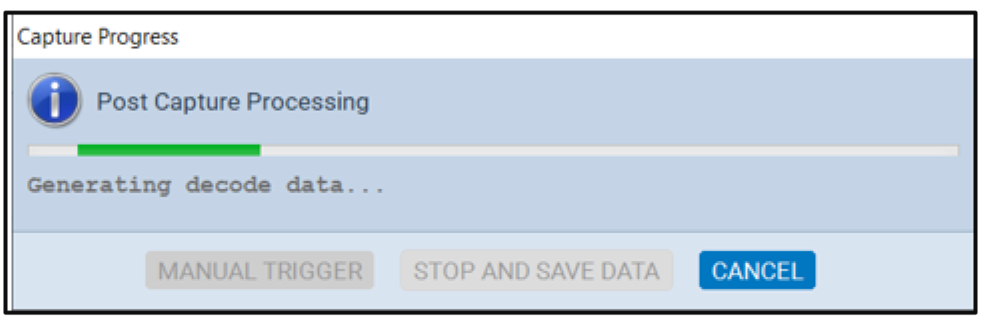


8. Click on the **Start Capture** button.

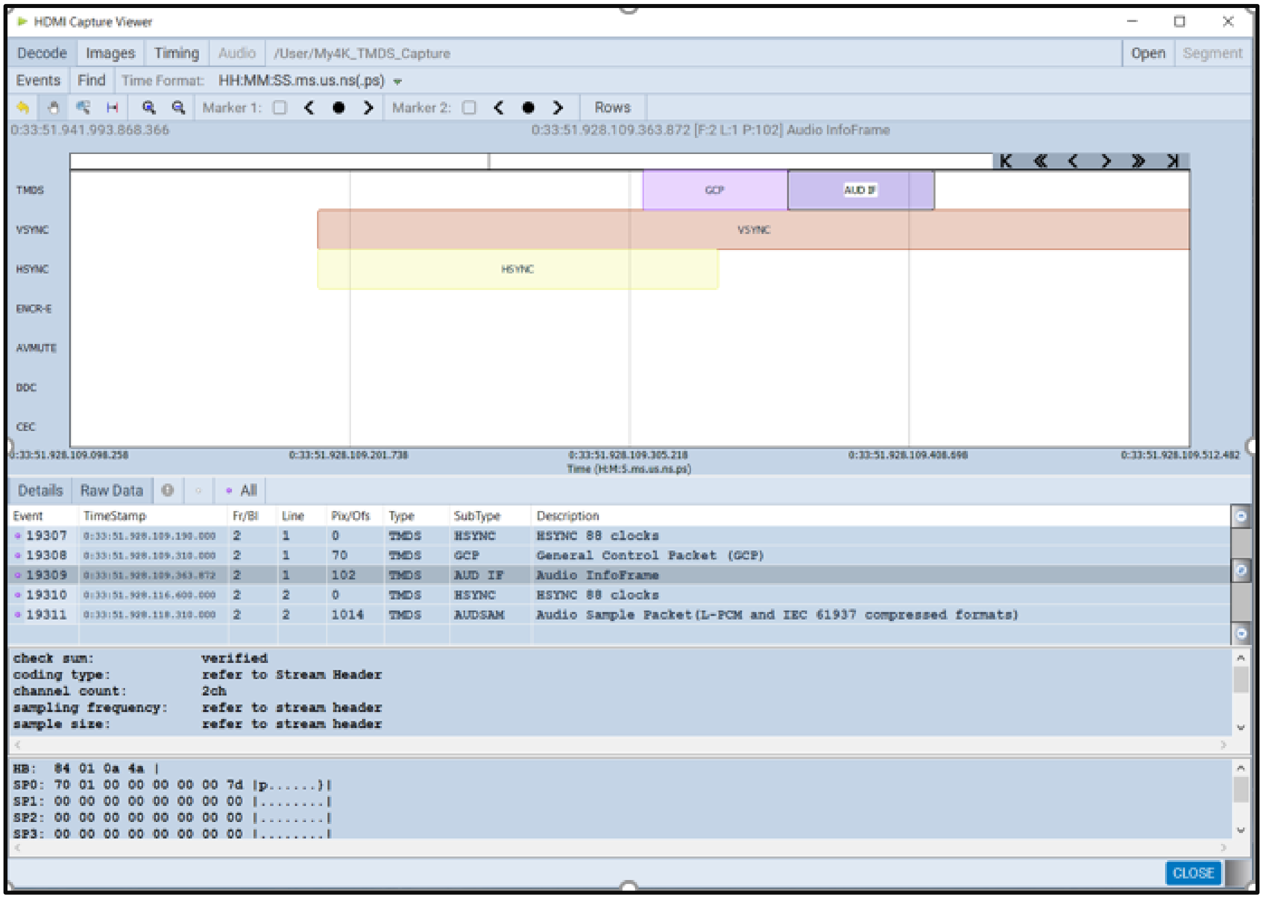


The M42h 96G Video Analyzer/Generator will capture the data. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

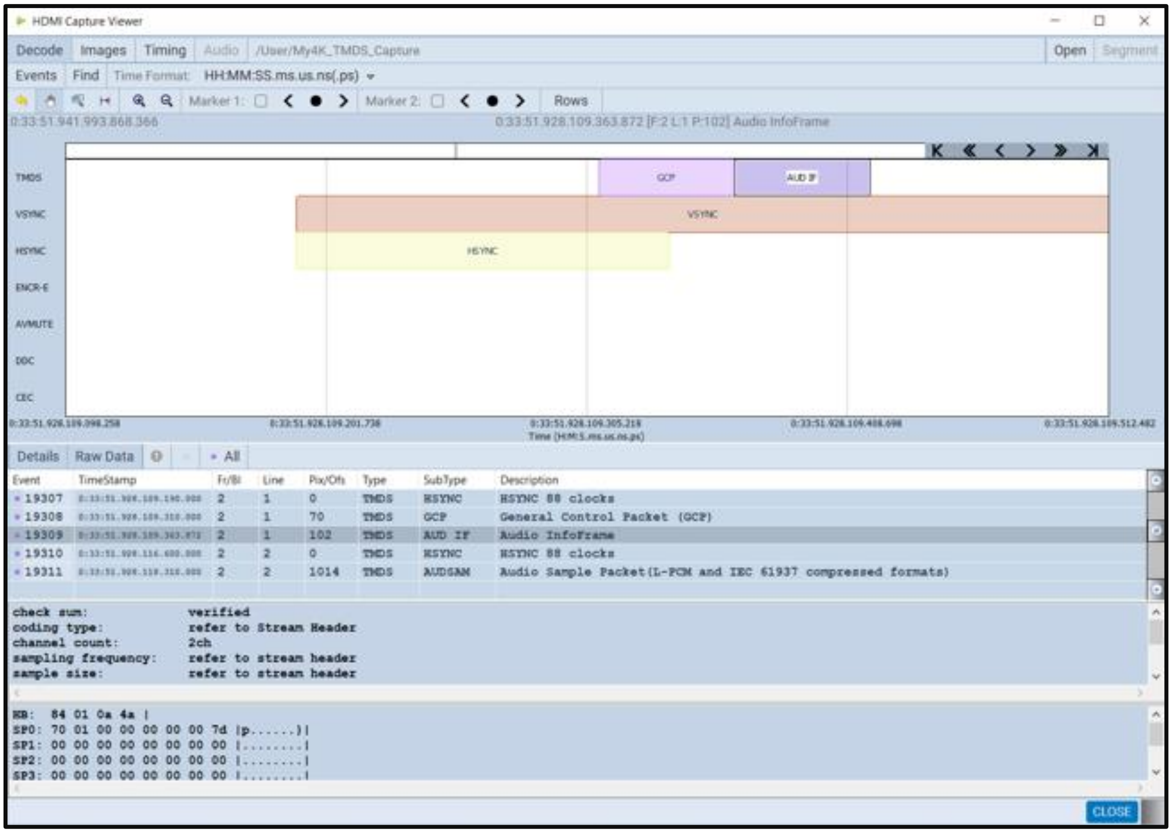
Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will state "**Waiting for capture trigger to occur…**"

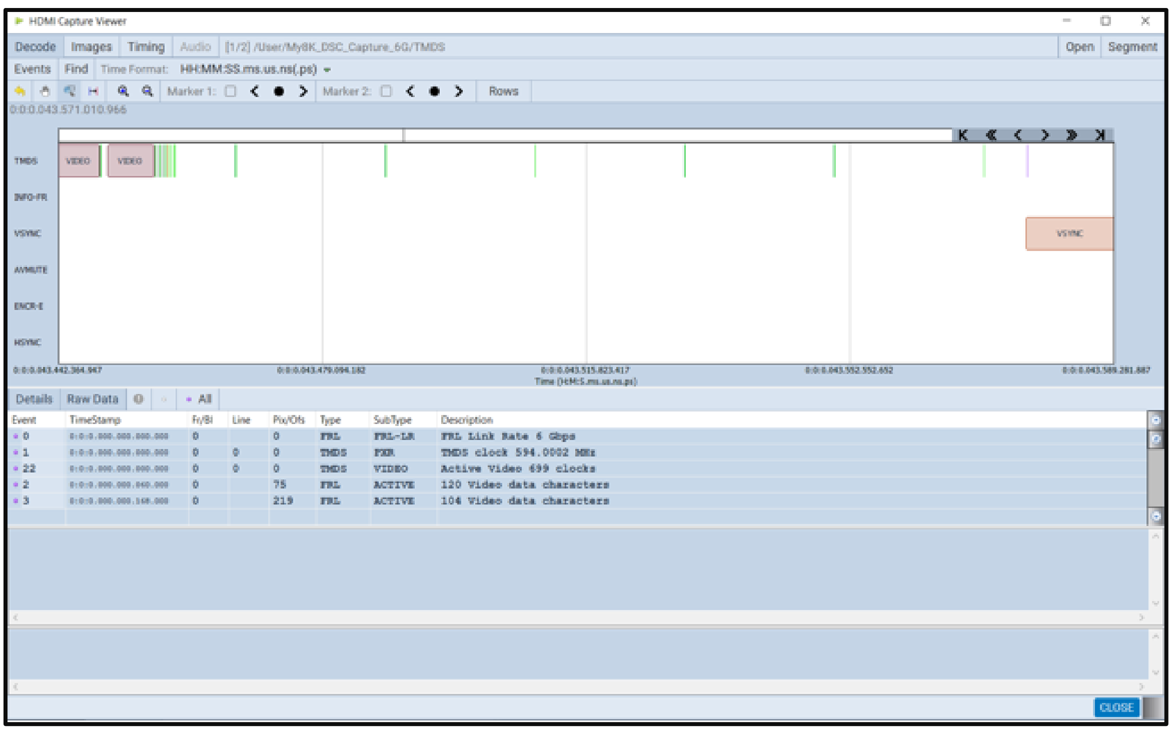


When the M42h 96G Video Analyzer/Generator is done capturing data a decode file is shown in the **Event Plot** panel and the **Decode** panel. The following screen shots show examples of captures.

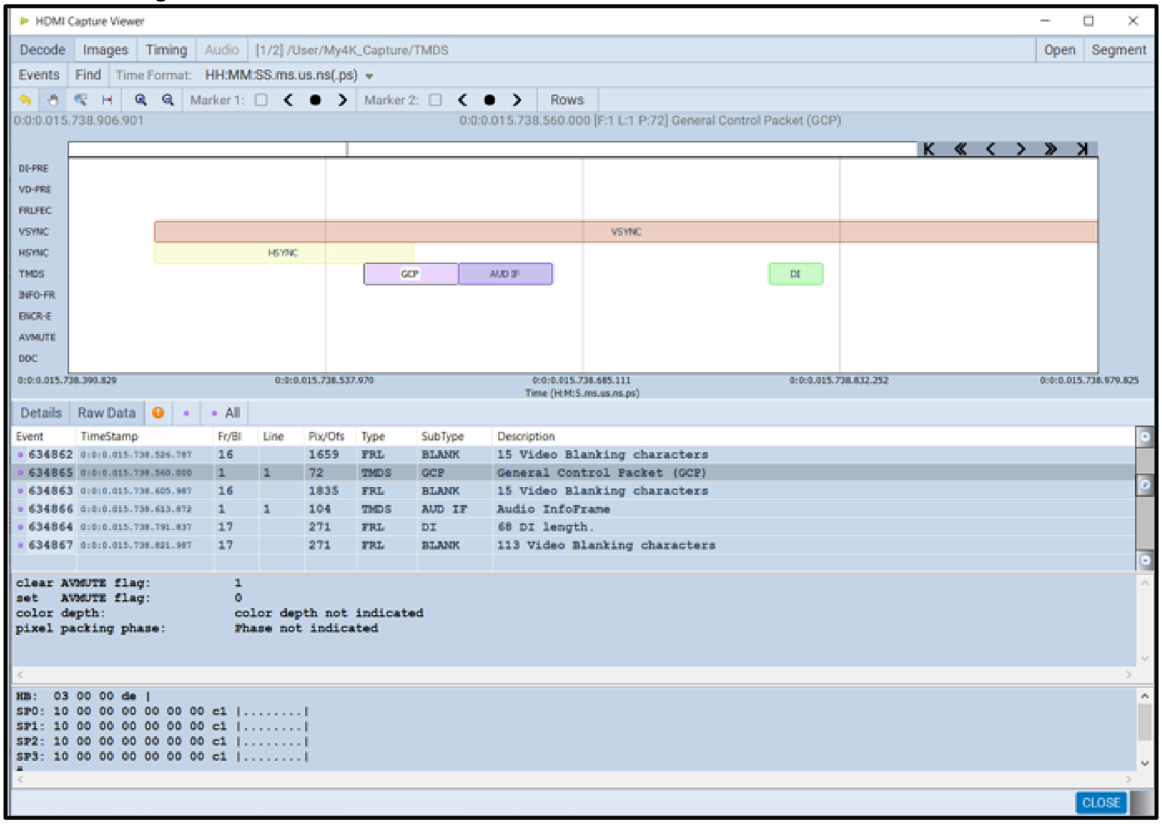

HDMI Capture Viewer
Decode Images Timing Audio /User/My4K_TMDS_Capture Open Segment
Events Find Time Format: HH:MM:SS.ms.us.ns(.ps)
Marker 1: Marker 2: Rows
0:33:51.941.993.868.366
0:33:51.928.109.363.872 [F:2 L:1 P:102] Audio InfoFrame
TMDS
VSYNC
HSYNC
ENCR-E
AVMUTE
DDC
CEC
GCP
AUD IF
Details Raw Data All
Event TimeStamp Fr/Bl Line Pix/Ofs Type SubType Description
19307 2 1 0 TMDS HSYNC HSYNC 88 clocks
19308 2 1 70 TMDS GCP General Control Packet (GCP)
19309 2 1 102 TMDS AUD IF Audio InfoFrame
19310 2 2 0 TMDS HSYNC HSYNC 88 clocks
19311 2 2 1014 TMDS AUDSAM Audio Sample Packet(L-PCM and IEC 61937 compressed formats)
check sum: verified
coding type: refer to Stream Header
channel count: 2ch
sampling frequency: refer to stream header
sample size: refer to stream header
HB: 84 01 0a 4a |
SP0: 70 01 00 00 00 00 00 7d |p......}|
SP1: 00 00 00 00 00 00 00 00 |........|
SP2: 00 00 00 00 00 00 00 00 |........|
SP3: 00 00 00 00 00 00 00 00 |........|
CLOSE

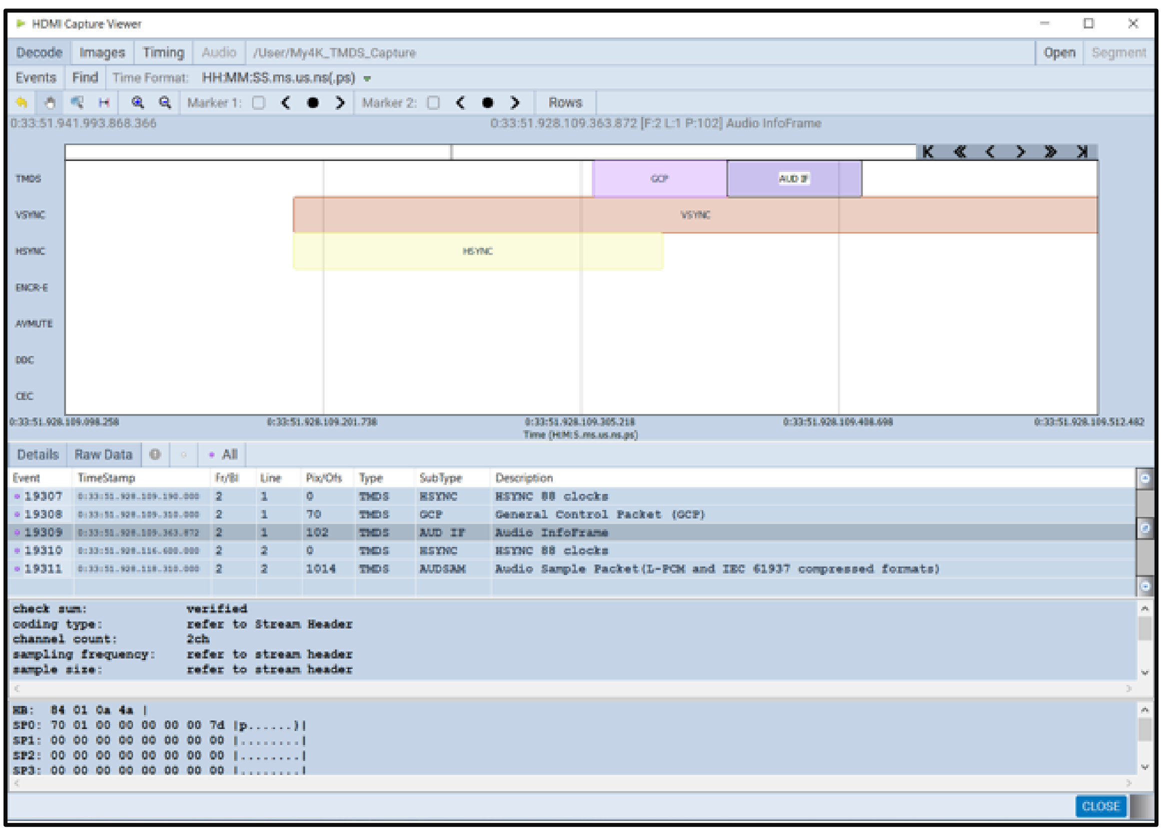
The following screen shots show zoomed in views on the InfoFrame.



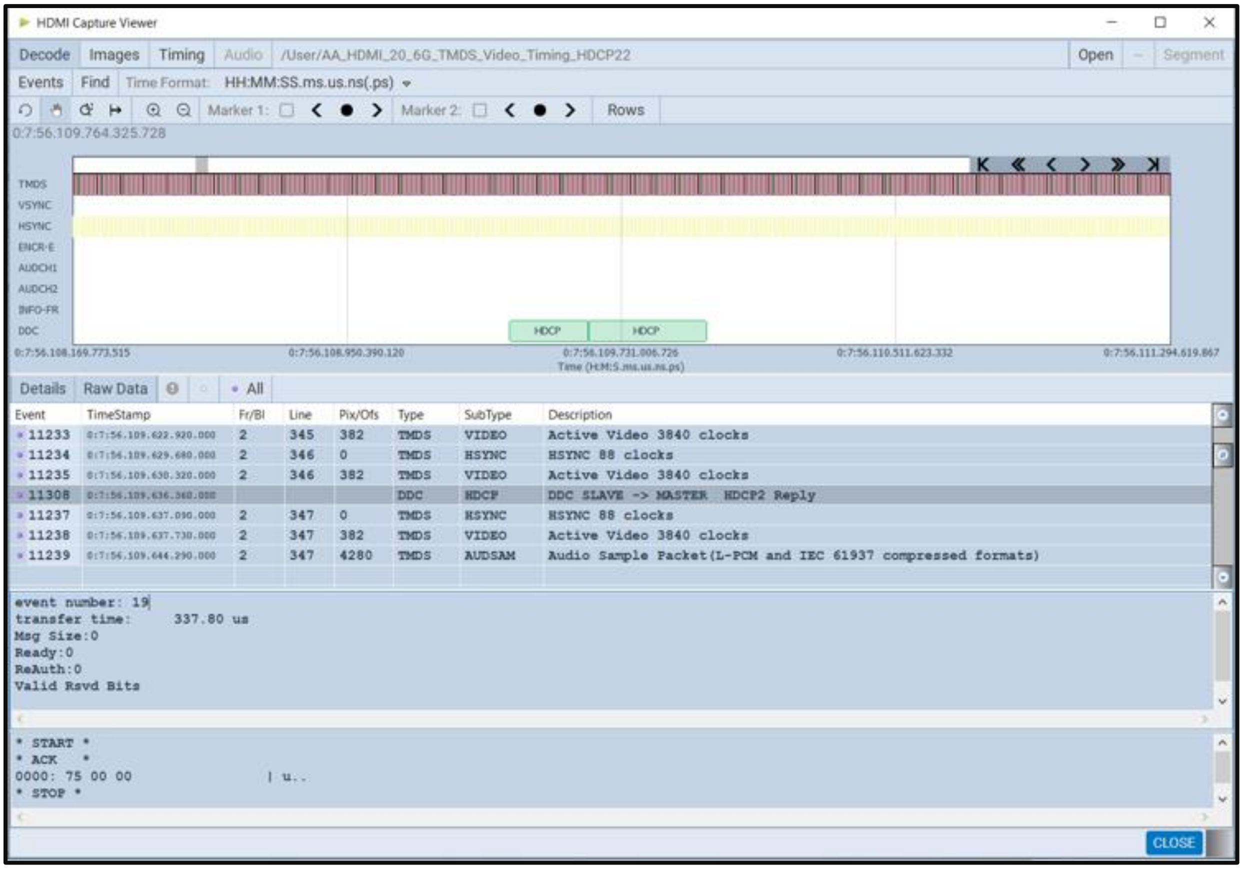


The following screen shots show zoomed in views on the GCP and AUD InfoFrame.



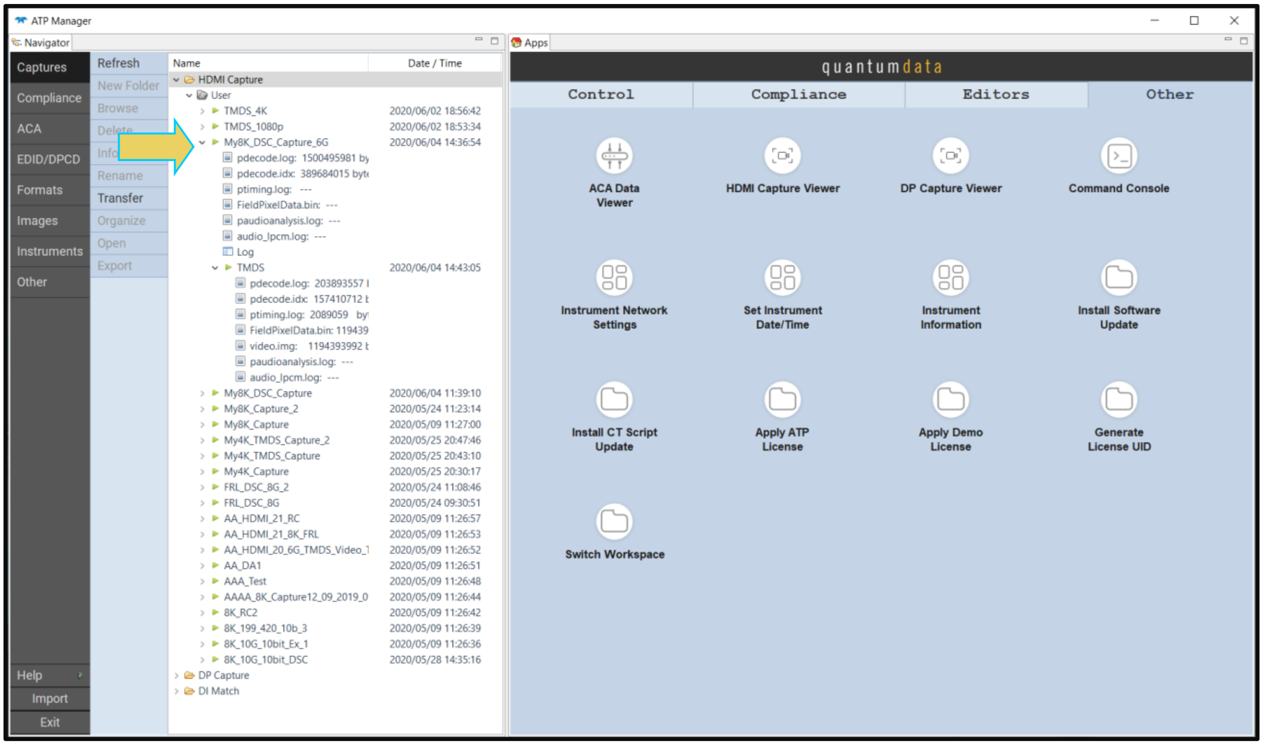


The following screen shot example shows a capture with HDCP 2.3 active.

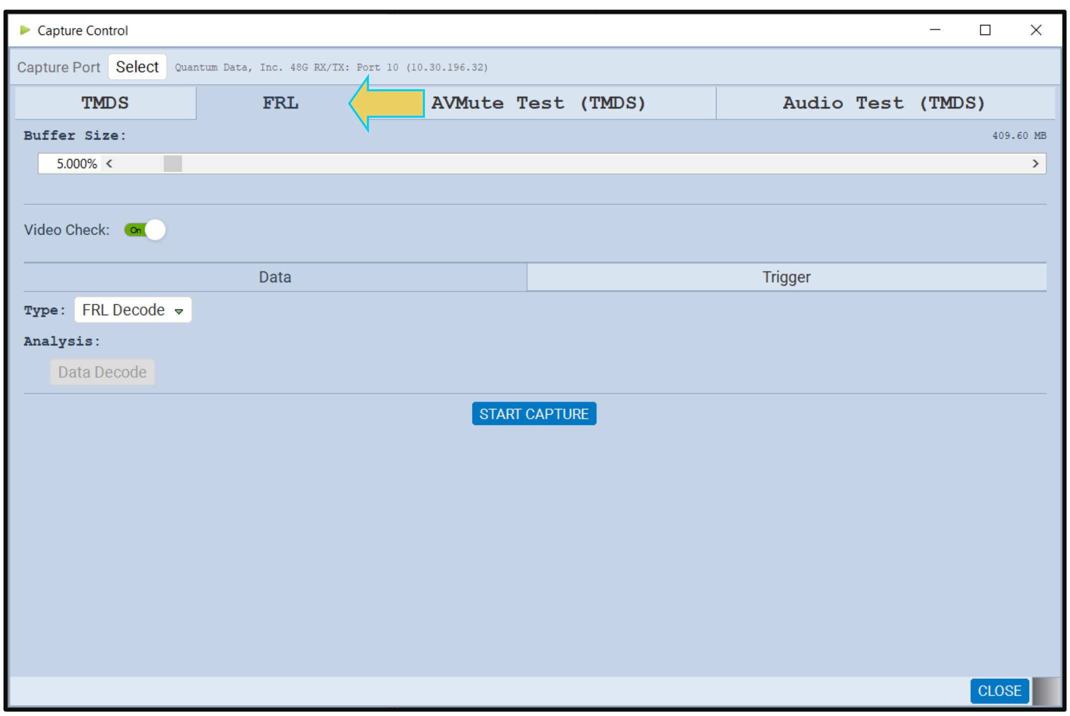


8.6 Viewing the Display Stream Compression (DSC) Capture

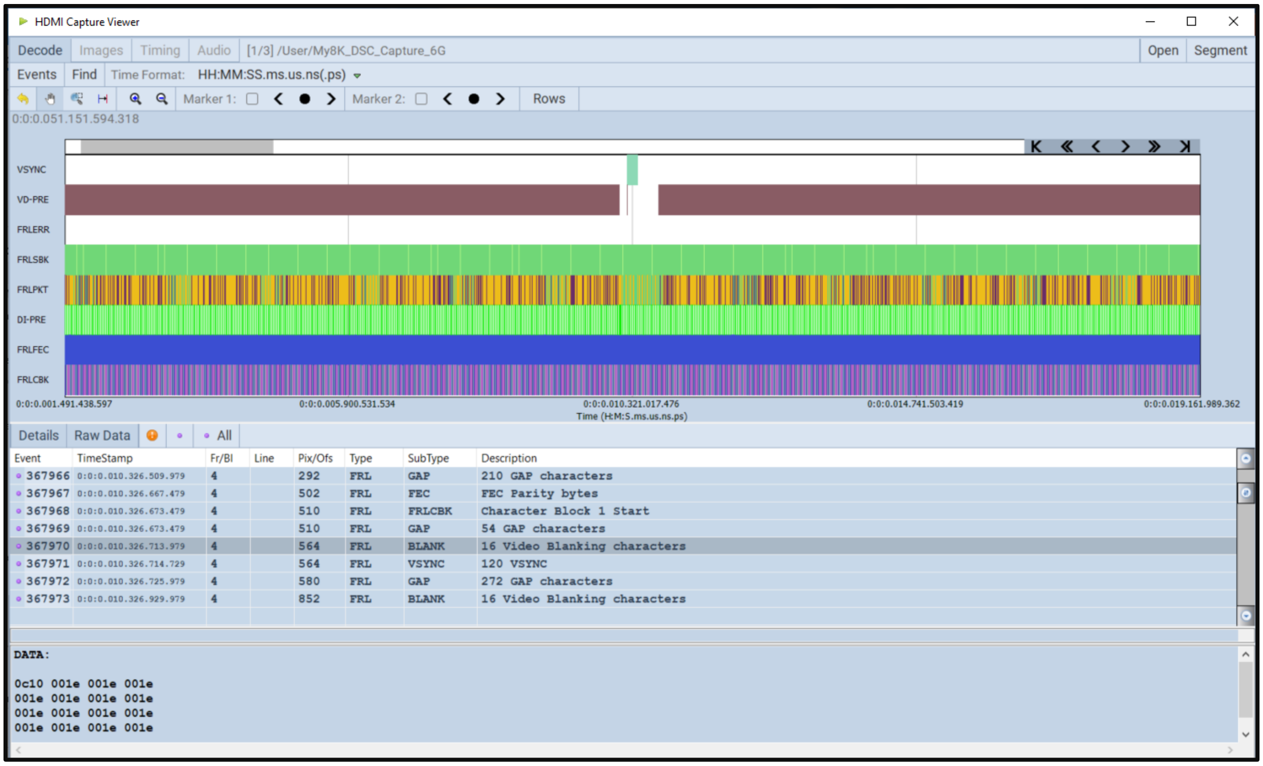
You can view the data of an FRL Display Stream Compression (DSC) stream through the Capture Viewer. You can view these FRL/DSC captures under in the Navigator as shown below.



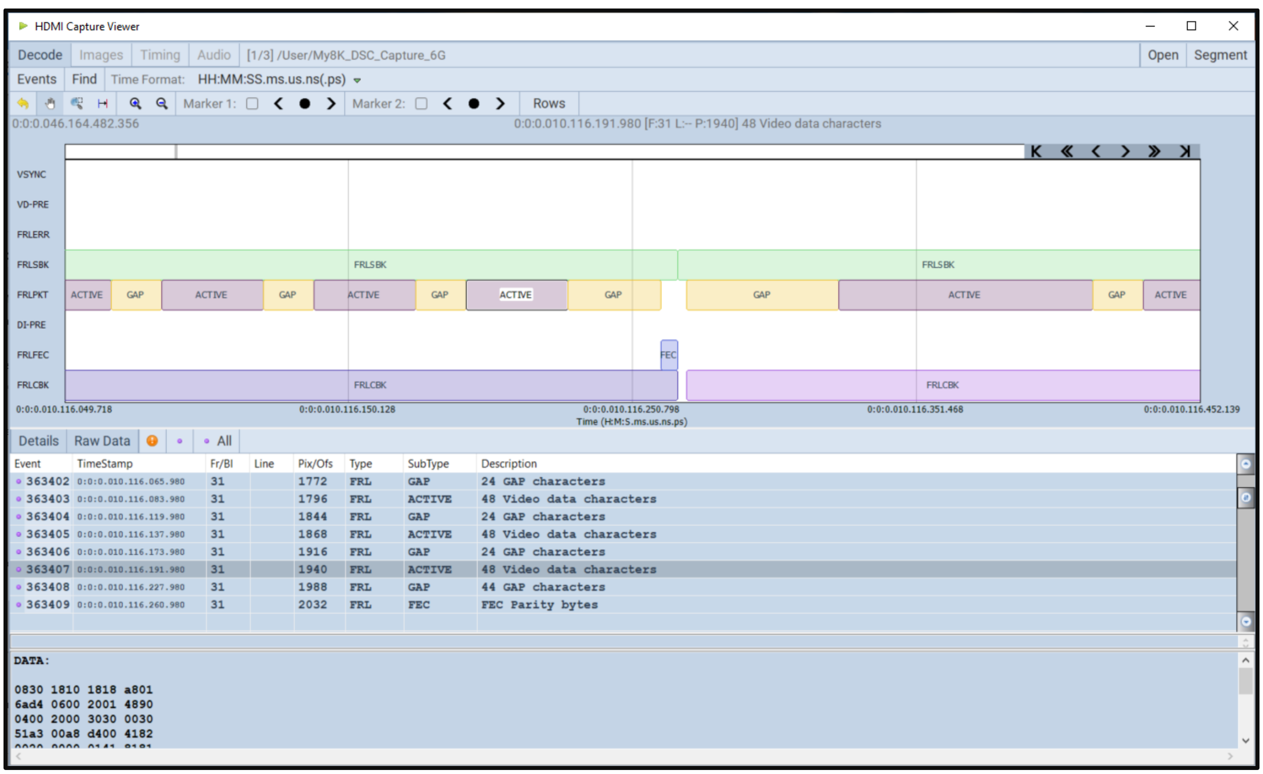
To capture an incoming Display Stream Compression (DSC) stream you must capture in the FRL mode as shown below.



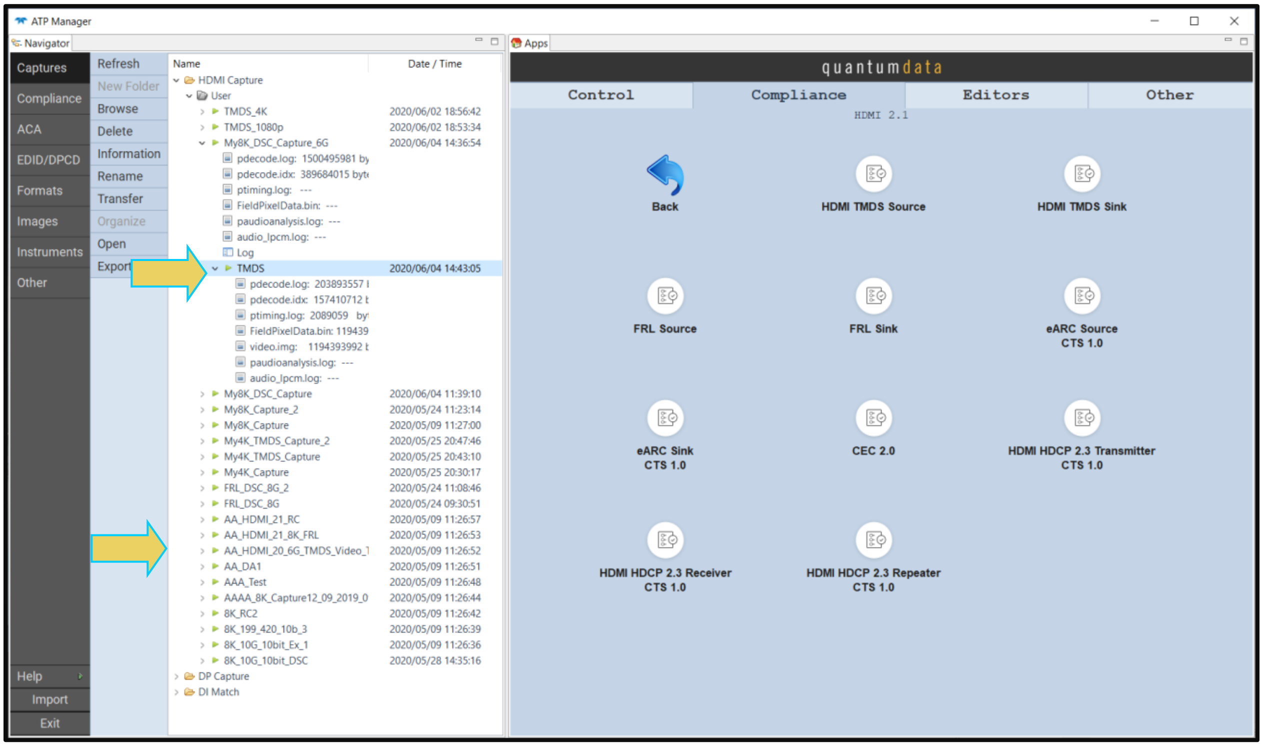
Hit the **Start Capture** button to initiate the capture. When the capture is ready it will appear in the **Capture Viewer**.



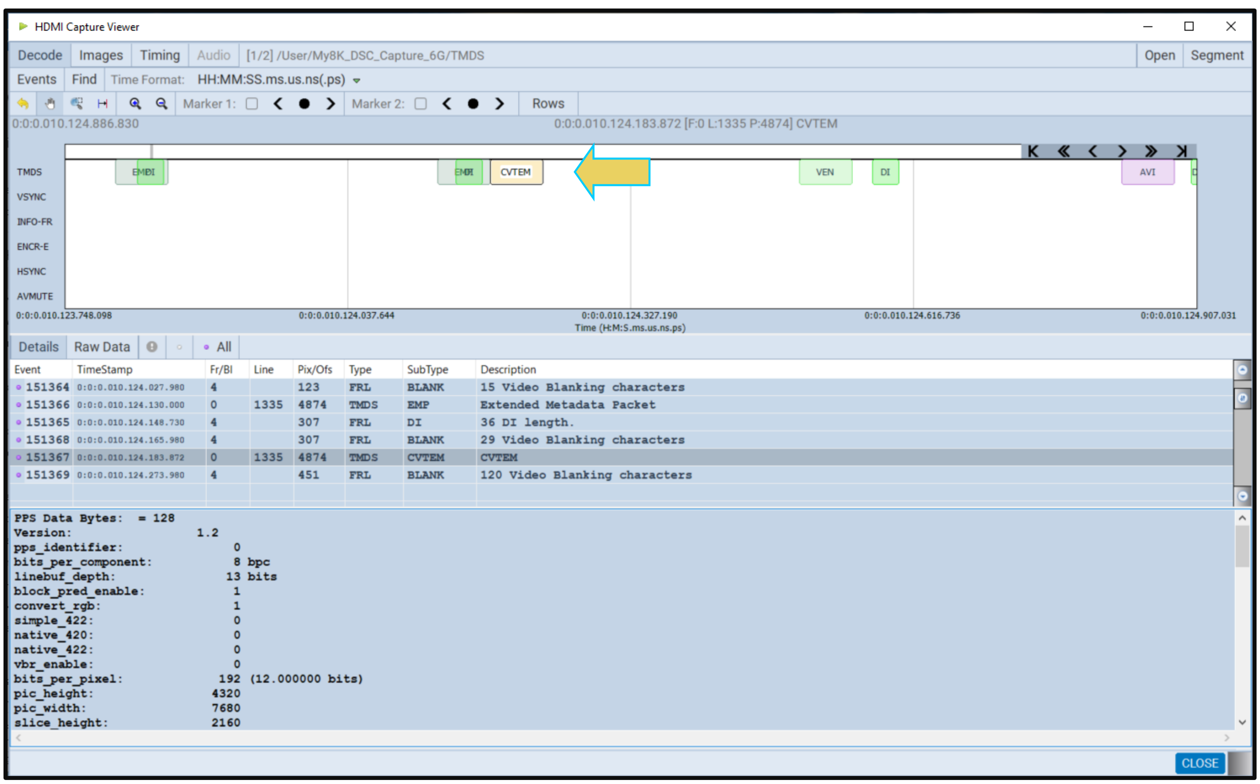
The following is a zoomed in view of the capture.



You can view the underlying Tri-Byte data which is indicated as “TMDS” in the example below.



You can view the Compressed Video Transport extended metatdata (CVTEM) packet in the TMDS capture as shown below. The CVTEM shows the DSC Picture Parameter Set (PPS) data that is used to indicate the DSC parameters to a DSC-capable sink device.



8.7 Examining HDMI 2.1 FRL Captured Data

The procedures below describe how to view various types of captured data through the **Decode** and **Event Plot** panels. This procedure assumes that you have captured the data or have opened a previously captured data file.

8.7.1 Viewing Data Analysis Captures through the Decode panel

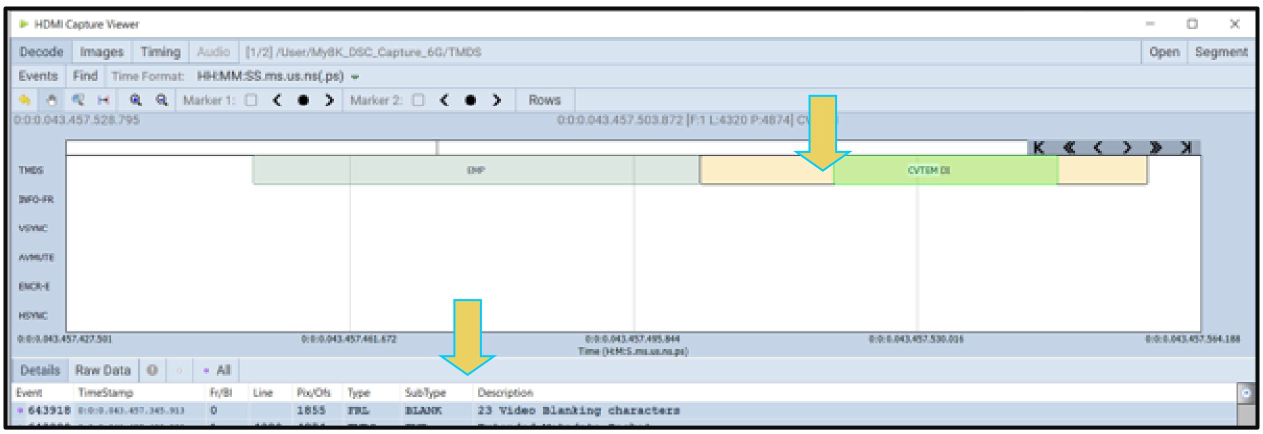
This subsection provides procedures for viewing the captured data taken using one of the Data Analysis capture modes through the **Decode** panel in the ATP Manager.

To view captured data through the Decode panel:

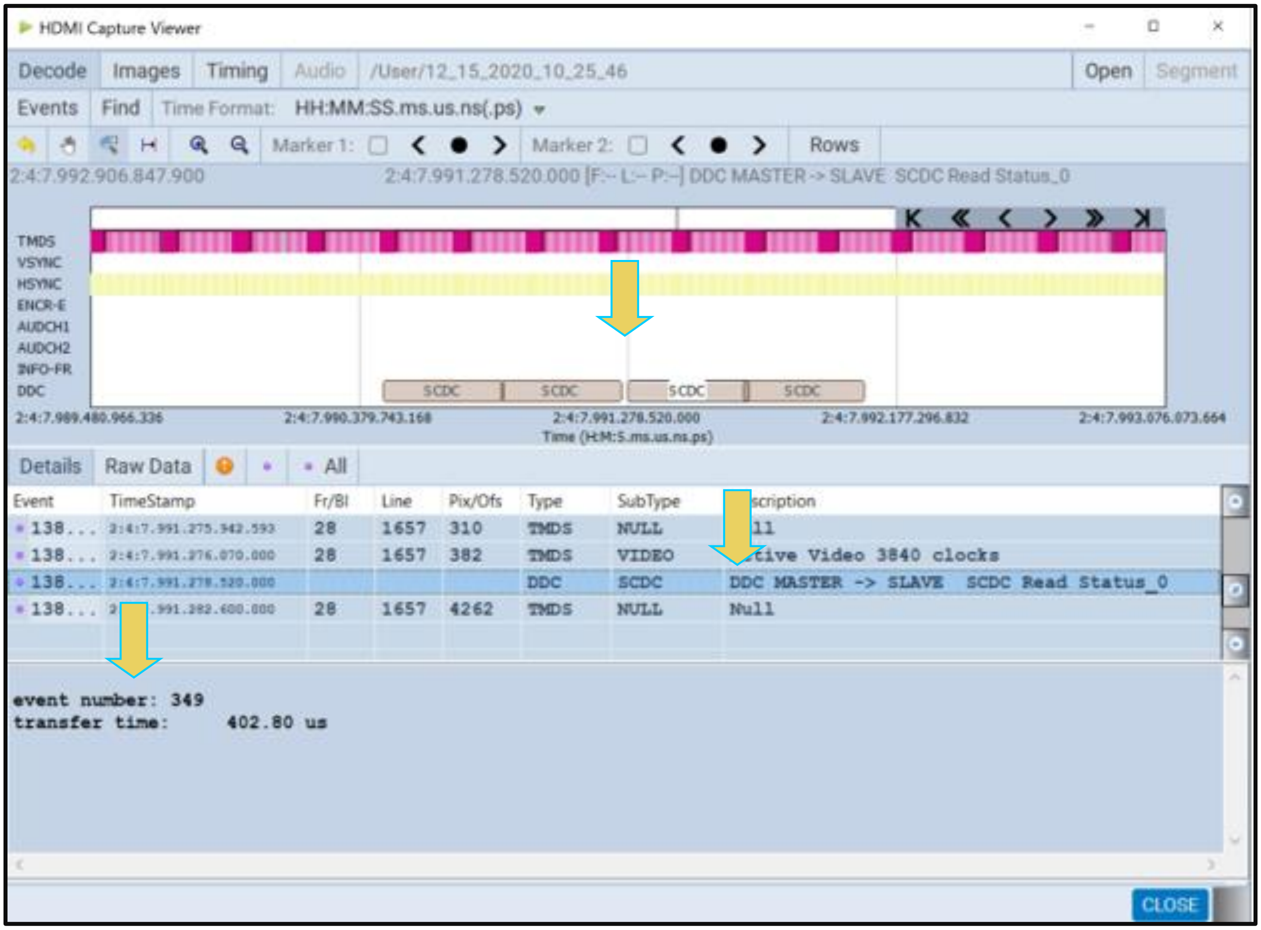
1. To view the protocol data transactions on the **Decode** panel, activate the **Decode** tab.

The **Decode** window shows the protocol data in a report. Highlight an AVI InfoFrame record to view its contents as shown below. The **Decode** window above shows the AVI InfoFrame data record selected. The AVI InfoFrame contents are parsed out in human readable text on the upper panel. The hex representation of the contents is presented in the lower panel.

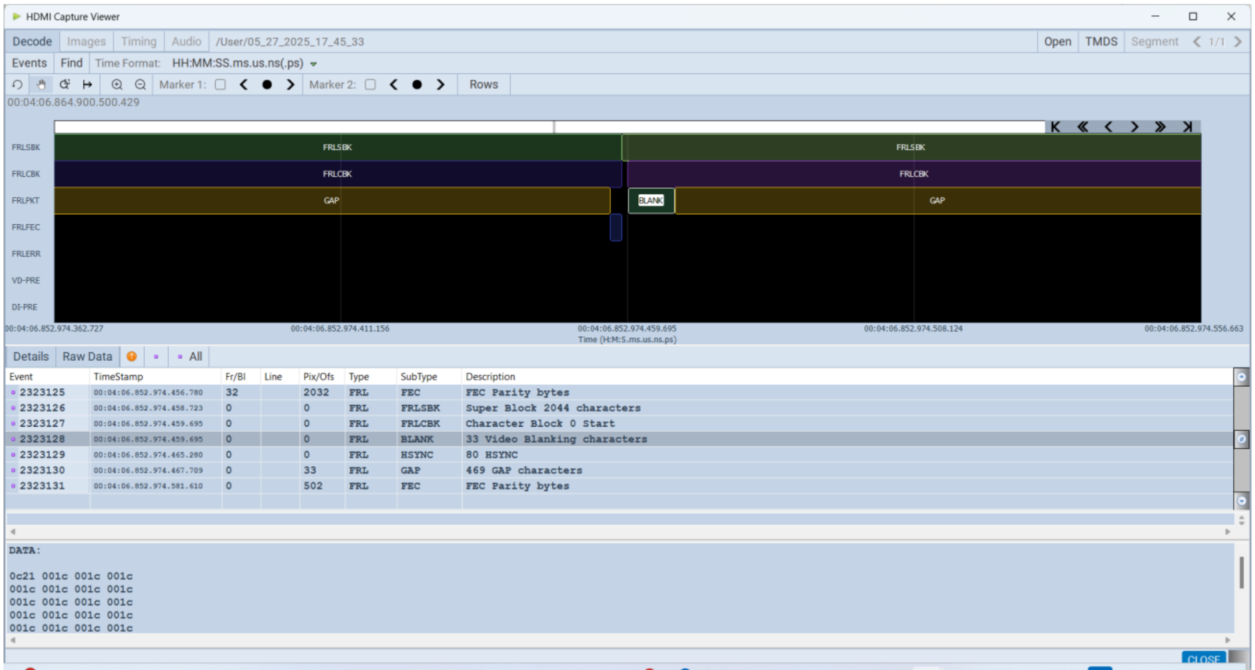
Note: In the screen capture below the 4-lane data is depicted in columns under DATA in the Raw Data window. This is indicated below.



2. Highlight a SCDC transaction to view its contents as shown below. The example below shows a register read.



Here is an FRL sample capture showing a 24G capture.

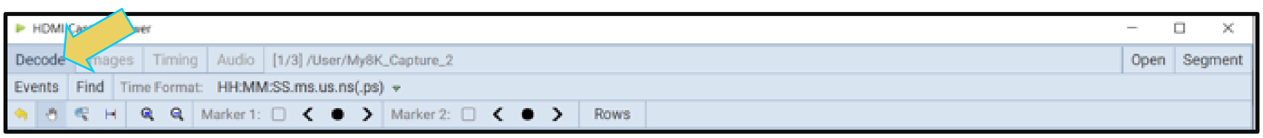


8.7.2 Filtering the Data in the Decode panel

The procedures below describe how to filter the data in the **Decode** panel. You use the panel on the right that is adjacent to the **Decode** panel to apply filtering on the data displayed on the **Decode** panel.

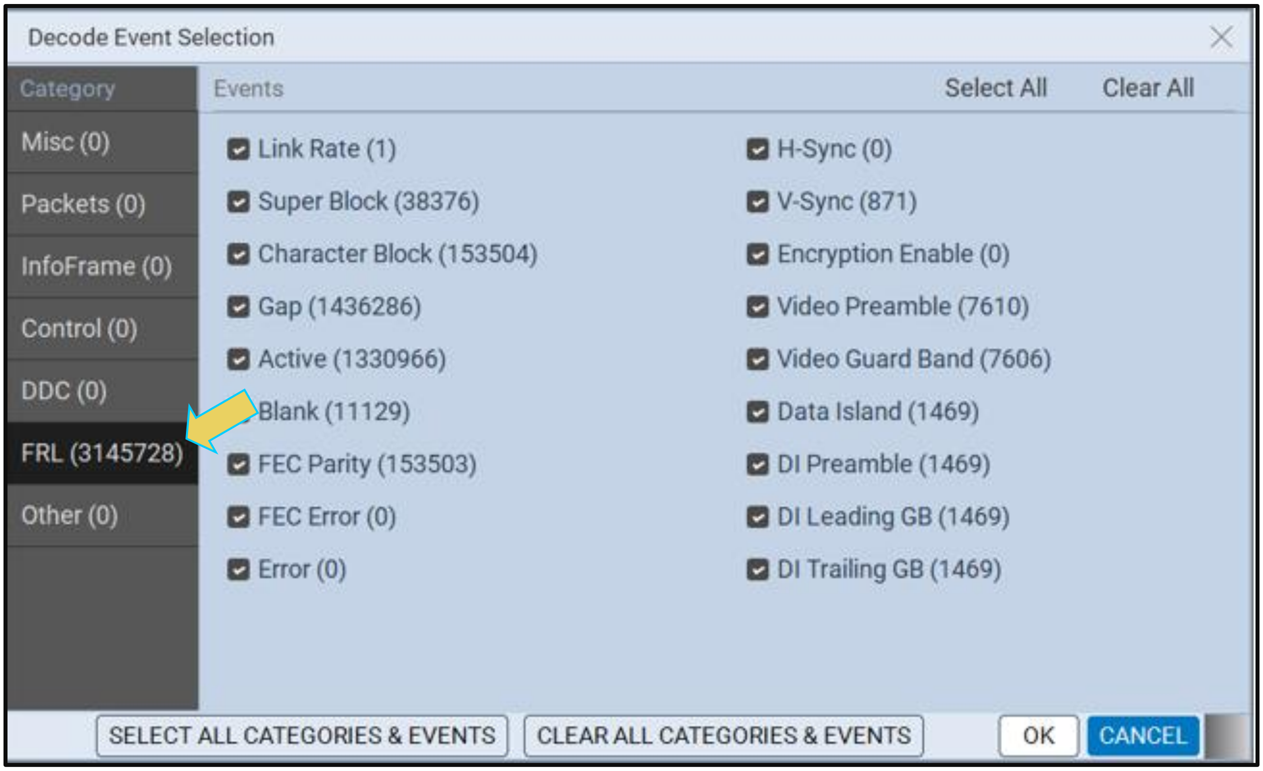
To apply filters to the data:

1. From the **Decode** panel, select the Events activation button to access the Decode Event Selection dialog box.

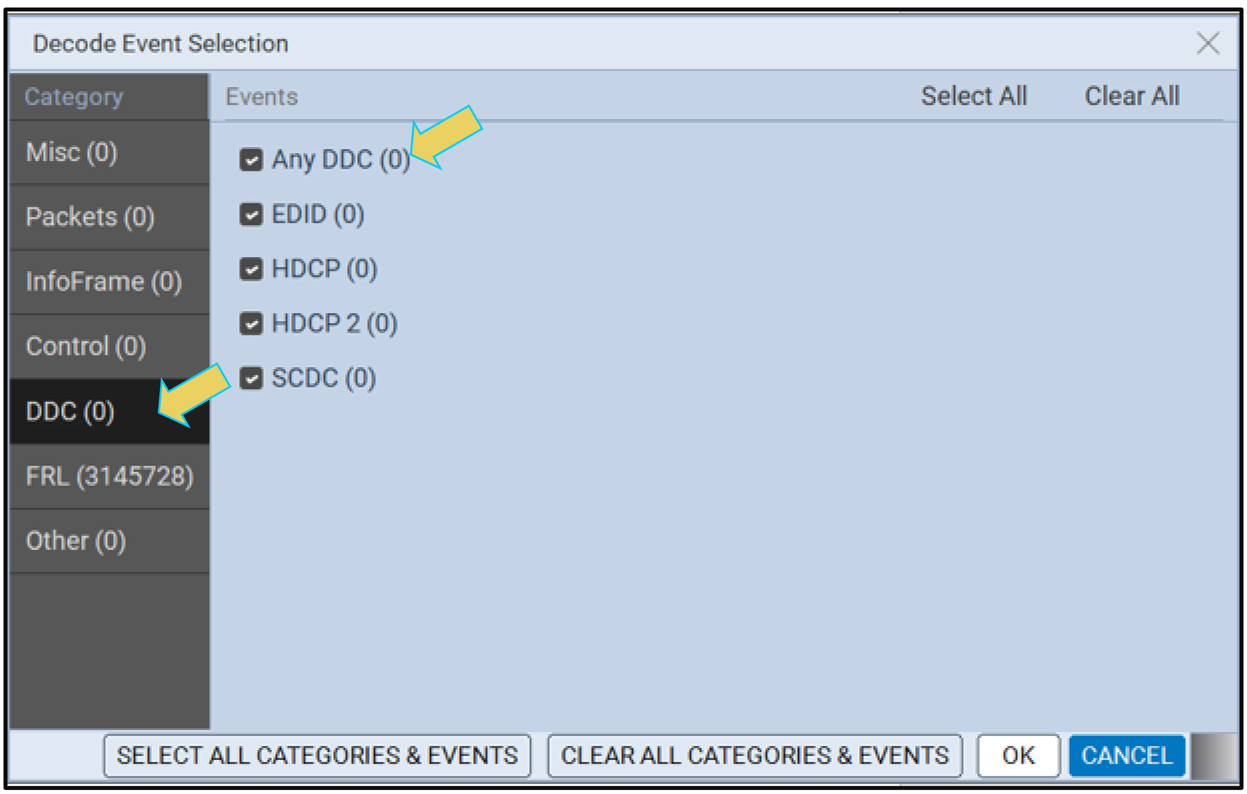


The **Decode Event Selection** dialog box is shown below.

In the example below, only some of the data islands are selected.

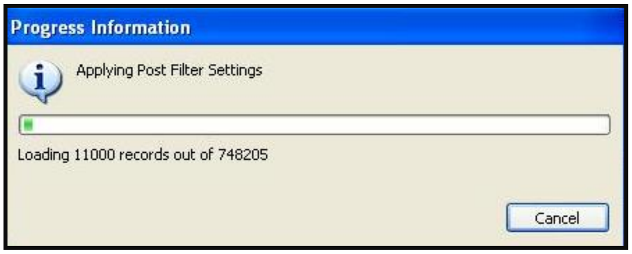


The following is a screen example of the **DDC** page.



2. Select the data items you want to appear in the **Decode** panel. The filtering you apply in this series of dialog boxes also applies to the **Event Plot** panel.

3. Click the **OK** button on the bottom right to set your selections or click on the **Cancel** button to exit without saving the changes.



Note that you can clear all the selections on all pages with the Clear All activation button on the top left. You can also select all items on all pages with the Select All activation button.

You can also apply the same Select and Clear operations to each tab of the **Decode Event Selection** dialog box.

8.7.3 Searching Through the Data in the Decode Panel

The procedures below describe how to search through the data in the **Decode** panel.

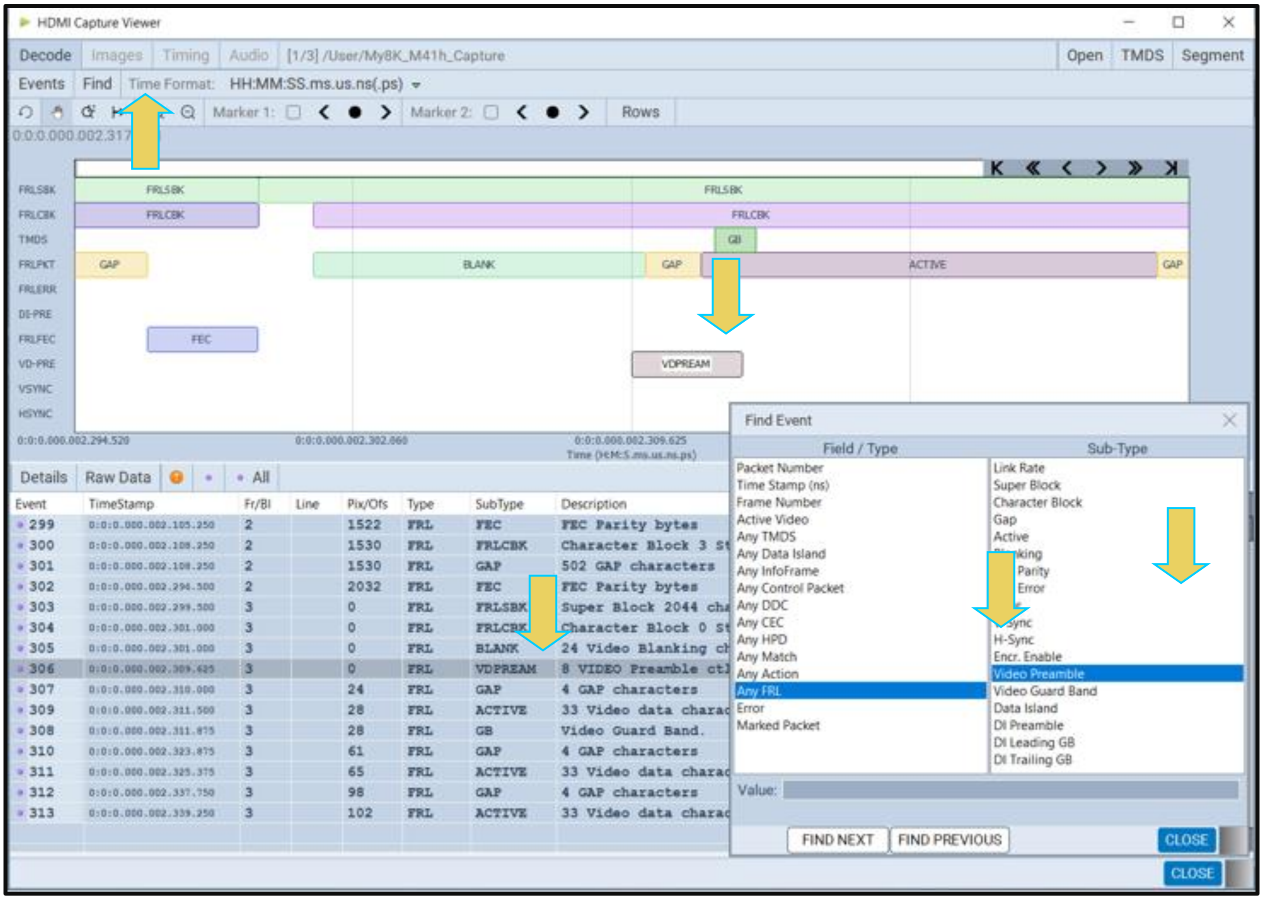
To search through the data:

1. Click on Find.

You can search on a variety of packet types and some of the fields in the **Decode** panel such as Packet, Timestamp, Frame, Line, and Pixel. You can also search for a variety of control events such as the occurrence of Avmute in an ACR packet or a Vsync/Hsync.

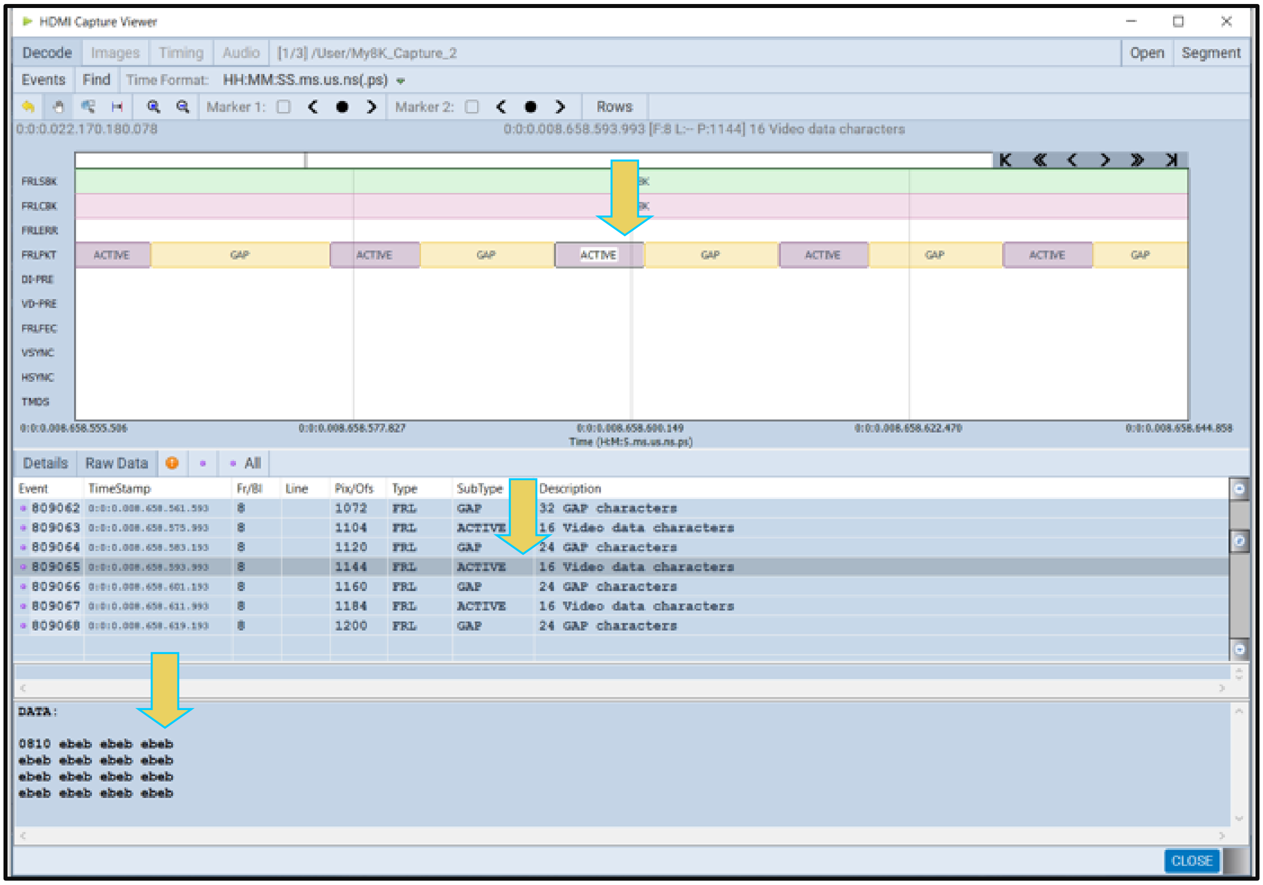
The default is to search Forward which is a search for events that occur later in time. You can change that to search backward by selecting the associated radio button.

A dialog box appears that enables you to enter search criteria. In this example we will search for an Audio Clock Regeneration packet. The **Decode** panel will then show the next General Control Packet (GCP) packet. If you are searching for a specific packet number, timestamp or frame you will have to enter the value in the Find/Goto field.

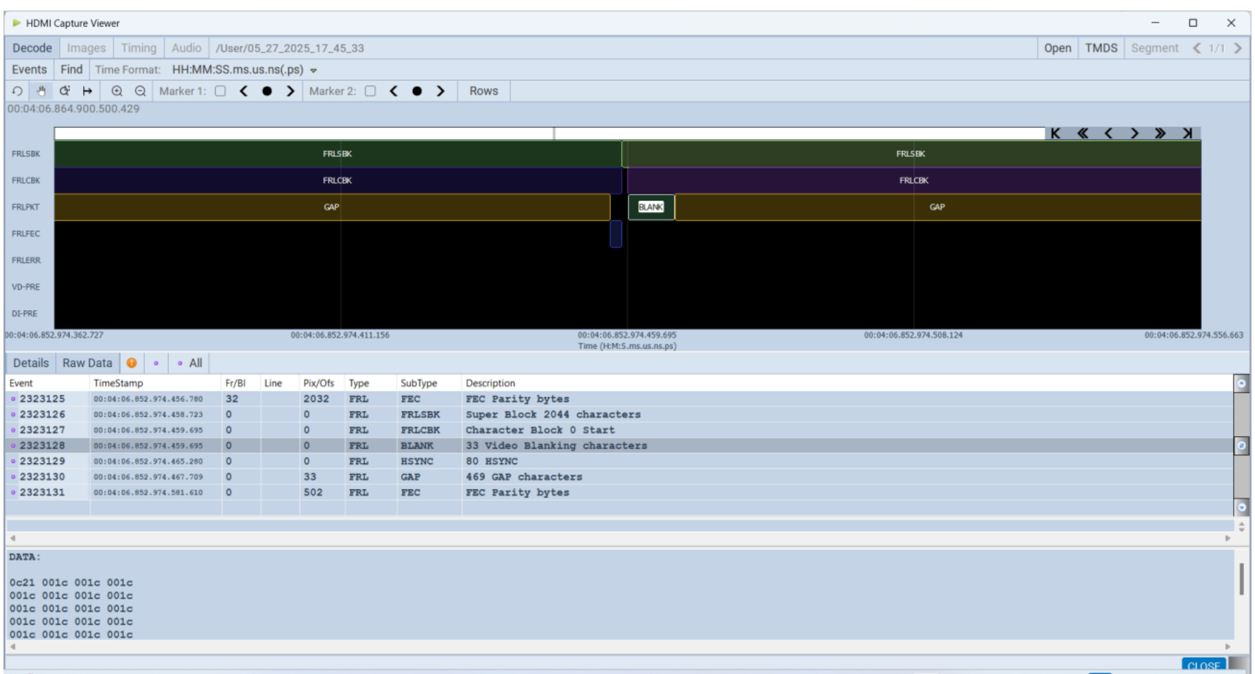


This example shows a search for Active video.

Note: In the screen capture below the 4-lane data is depicted in columns under DATA in the Raw Data window. This is indicated below.



Here is a sample capture showing a 24Gb/s capture per lane showing FRL blanking packets selected.

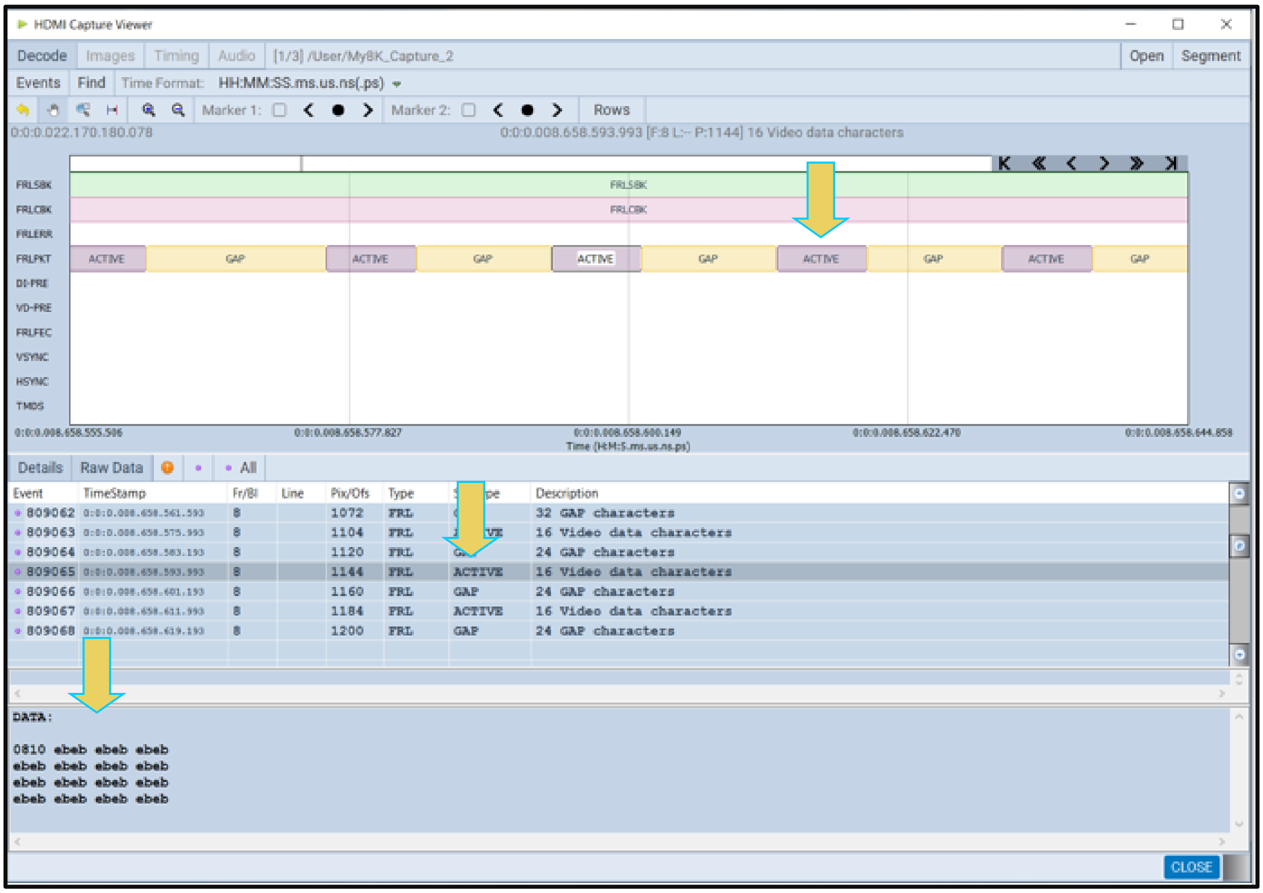


8.7.4 Viewing Data Through the Event Plot Panel

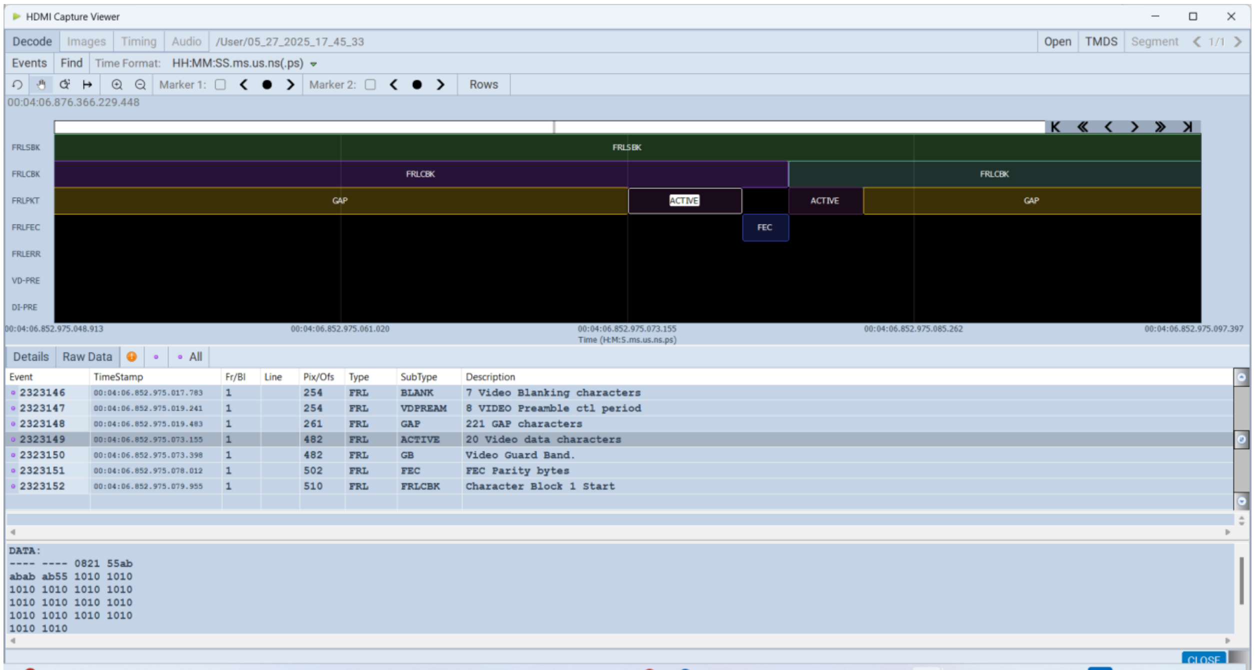
The Event Plot panel provides you with a graphical view of the data. It enables you to see relationships between the various data types on a timeline. A sample screen of the **Event Plot** is shown below. The operation of the **Event Plot** is described at: [Event Plot Panel.]

The following example shows active video, video guard band, FRL packets and the FEC block packet.

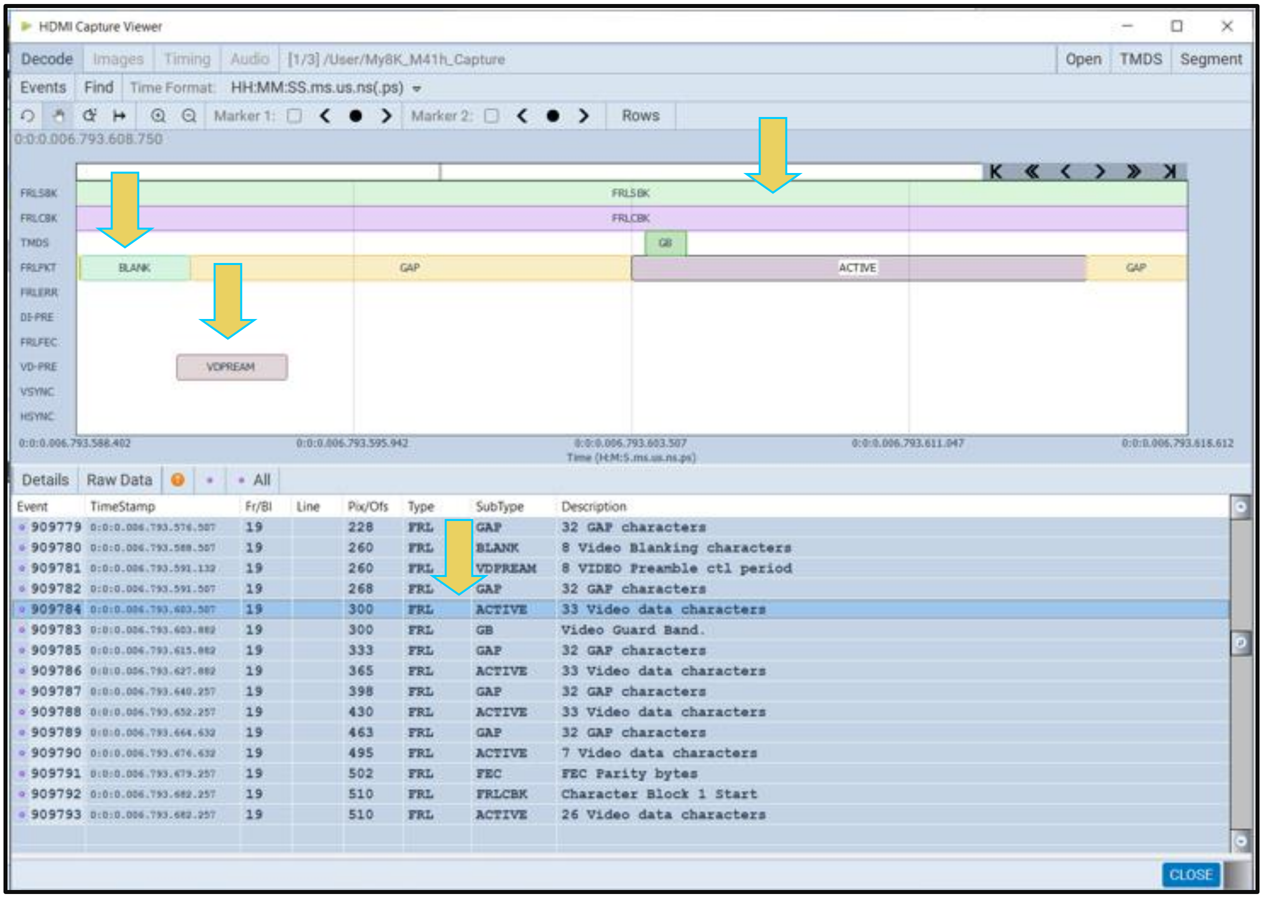
Note: In the screen capture below the 4-lane data is depicted in columns under DATA in the Raw Data window. This is indicated below.



Here is a sample capture showing a 24Gb/s capture per lane showing FRL Active video packets selected.

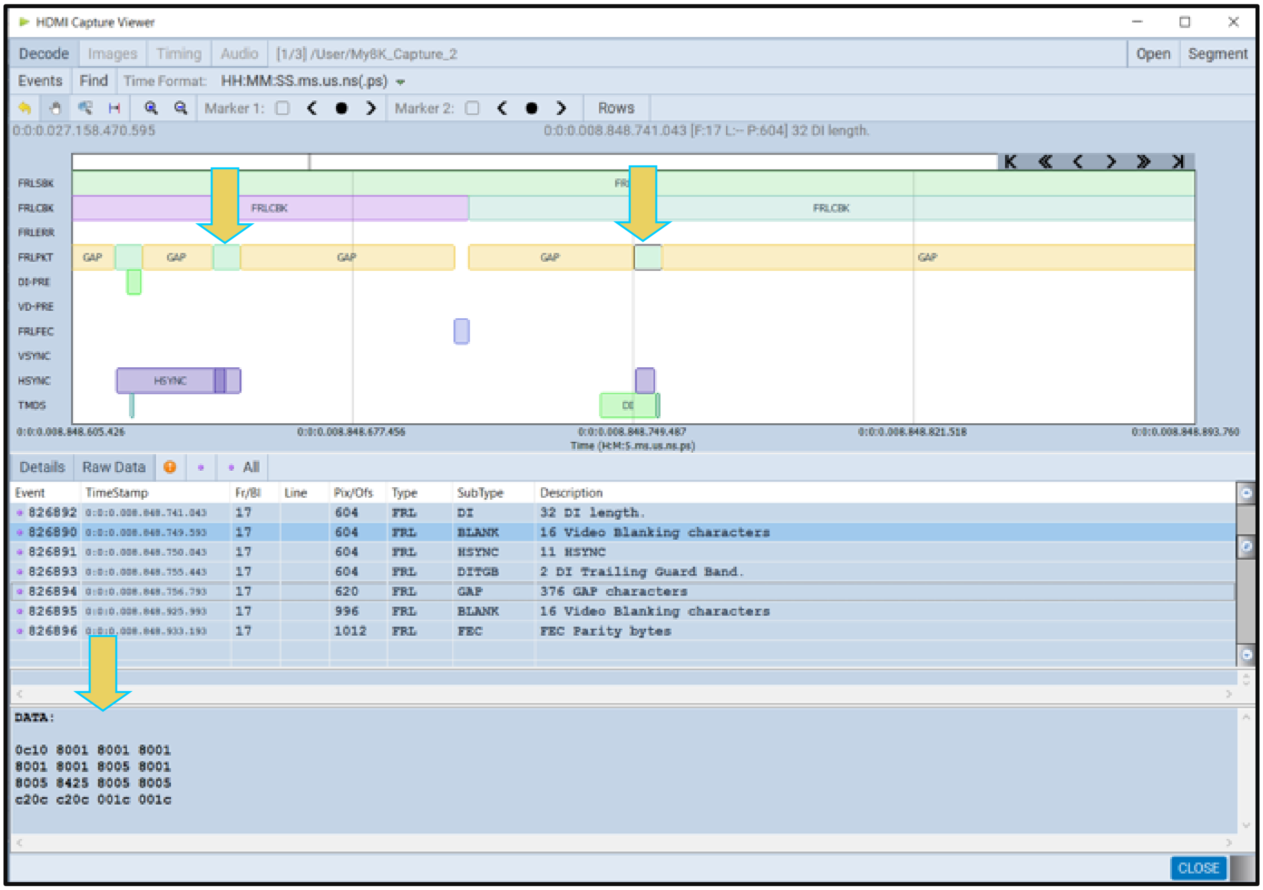


The following example shows a blanking period with the video preamble, data island preamble, data island guard band, etc.


HDMI Capture Viewer
Decode
Images
Timing
Audio
[1/3] /User/My8K_M41h_Capture
Open
TMDS
Segment
Events
Find
Time Format:
HH:MM:SS.ms.us.ns(.ps)
Marker 1:
Marker 2:
Rows
FRLSBK
FRLCBK
TMDS
FRLPKT
FRLERR
DI-PRE
FRLFEC
VD-PRE
VSYNC
HSYNC
GB
BLANK
GAP
ACTIVE
VDPREAM
Details
Raw Data
All
Event
TimeStamp
Fr/Bl
Line
Pix/Ofs
Type
SubType
Description
909779 19 228 FRL GAP 32 GAP characters
909780 19 260 FRL BLANK 8 Video Blanking characters
909781 19 260 FRL VDPREAM 8 VIDEO Preamble ctl period
909782 19 268 FRL GAP 32 GAP characters
909784 19 300 FRL ACTIVE 33 Video data characters
909783 19 300 FRL GB Video Guard Band.
909785 19 333 FRL GAP 32 GAP characters
909786 19 365 FRL ACTIVE 33 Video data characters
909787 19 398 FRL GAP 32 GAP characters
909788 19 430 FRL ACTIVE 33 Video data characters
909789 19 463 FRL GAP 32 GAP characters
909790 19 495 FRL ACTIVE 7 Video data characters
909791 19 502 FRL FEC FEC Parity bytes
909792 19 510 FRL FRLCBK Character Block 1 Start
909793 19 510 FRL ACTIVE 26 Video data characters
CLOSE

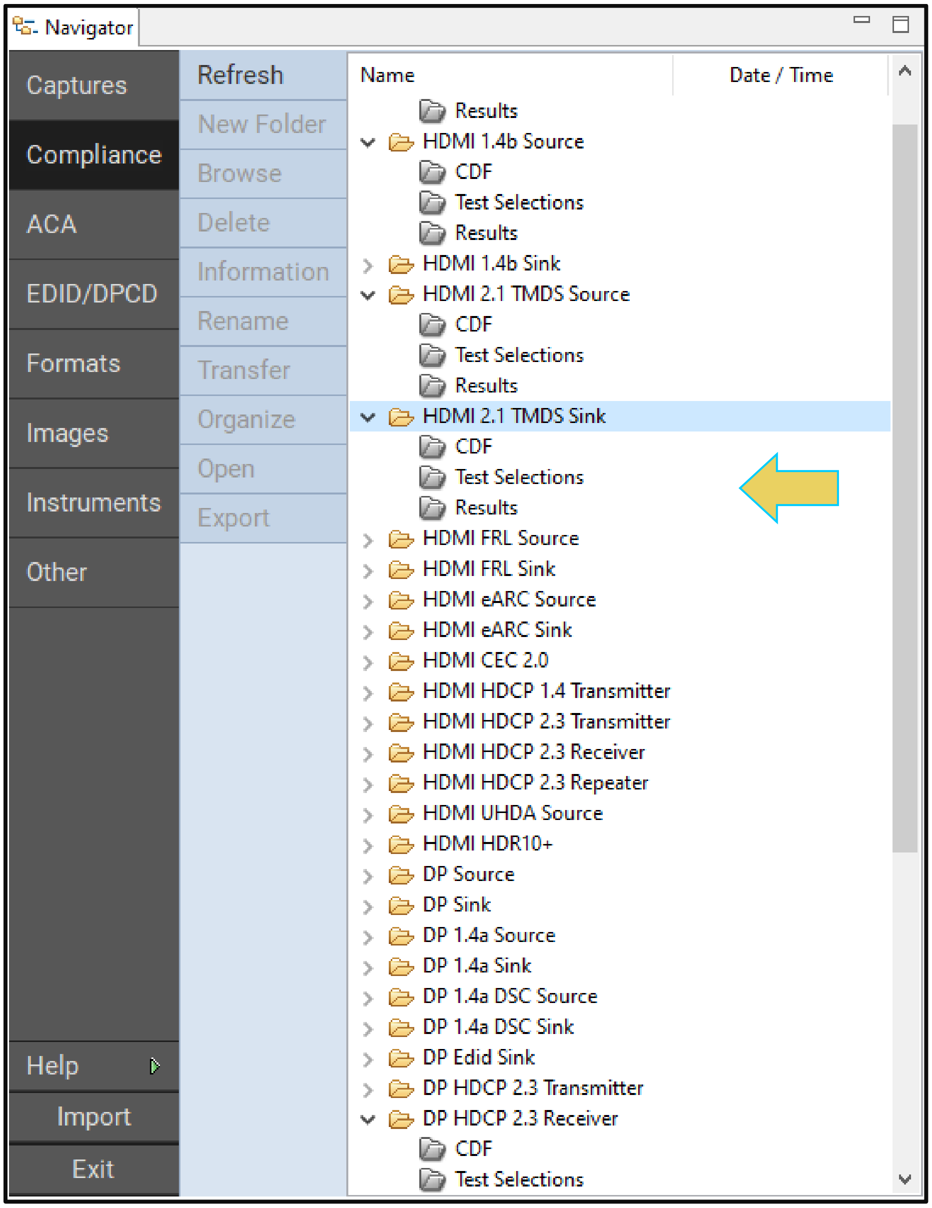
The following example shows a couple of blanking periods, vsync and hsync elements and the FRL packet structure.

Note: In the screen capture below the 4-lane data is depicted in columns under DATA in the Raw Data window. This is indicated below.

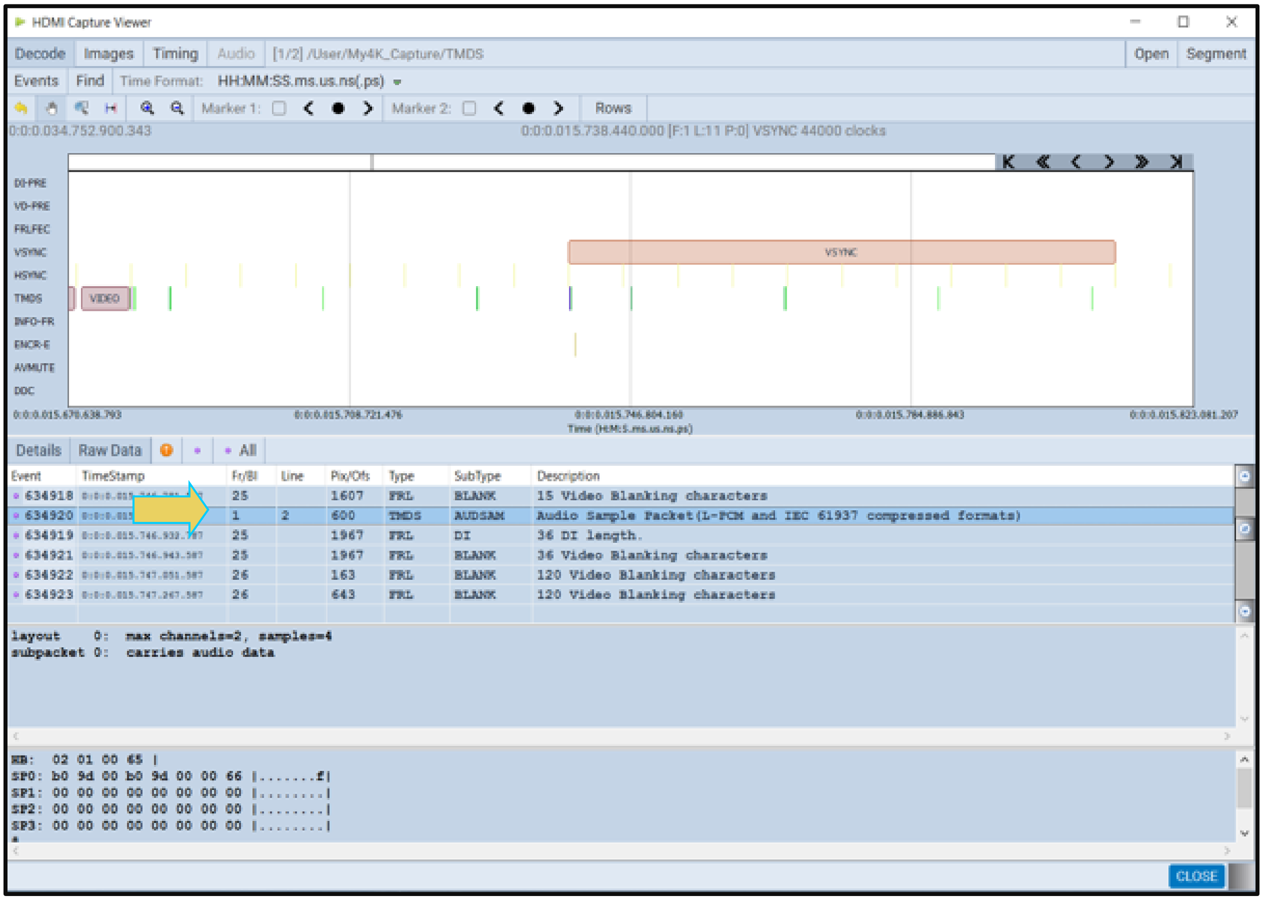


8.7.5 Viewing the Embedded TMDS Capture

You can view the underlying TMDS capture of an FRL capture. You can view these TMDS captures under in the Navigator as shown below.



1. Double-click on the embedded TMDS capture to view the TMDS capture as shown below.



8.8 Examining TMDS Captured Data

Important Note: TMDS captures are not currently supported on the M42h.

The procedures below describe how to view various types of TMDS captured data through the **Decode** and **Event Plot** panels. This procedure assumes that you have captured the data or have opened a previously captured data file.

8.8.1 Viewing Data Analysis Captures Through the Decode panel

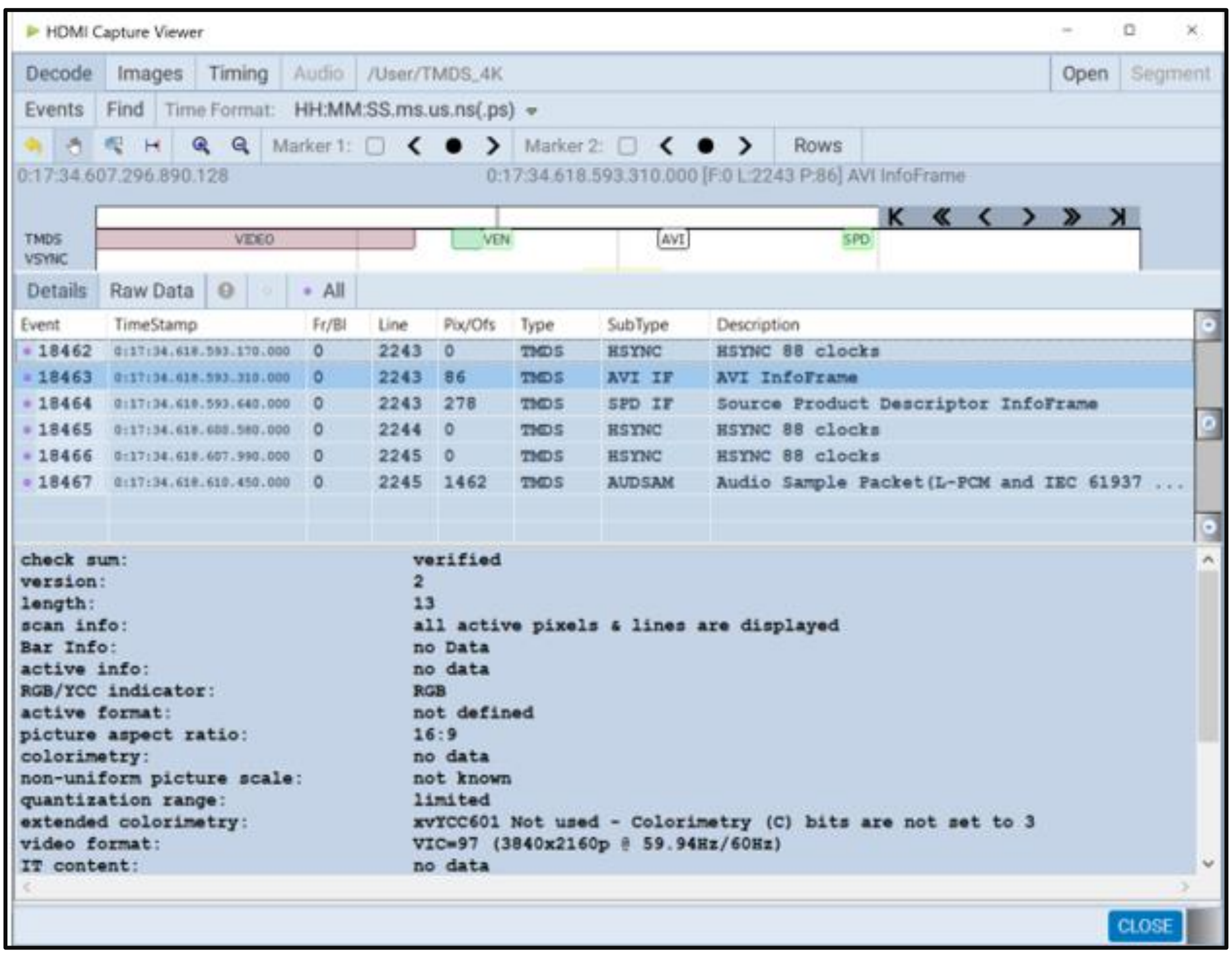
This subsection provides procedures for viewing the captured data taken using one of the Data Analysis capture modes through the **Decode** panel in the ATP Manager.

To view captured data through the Decode panel:

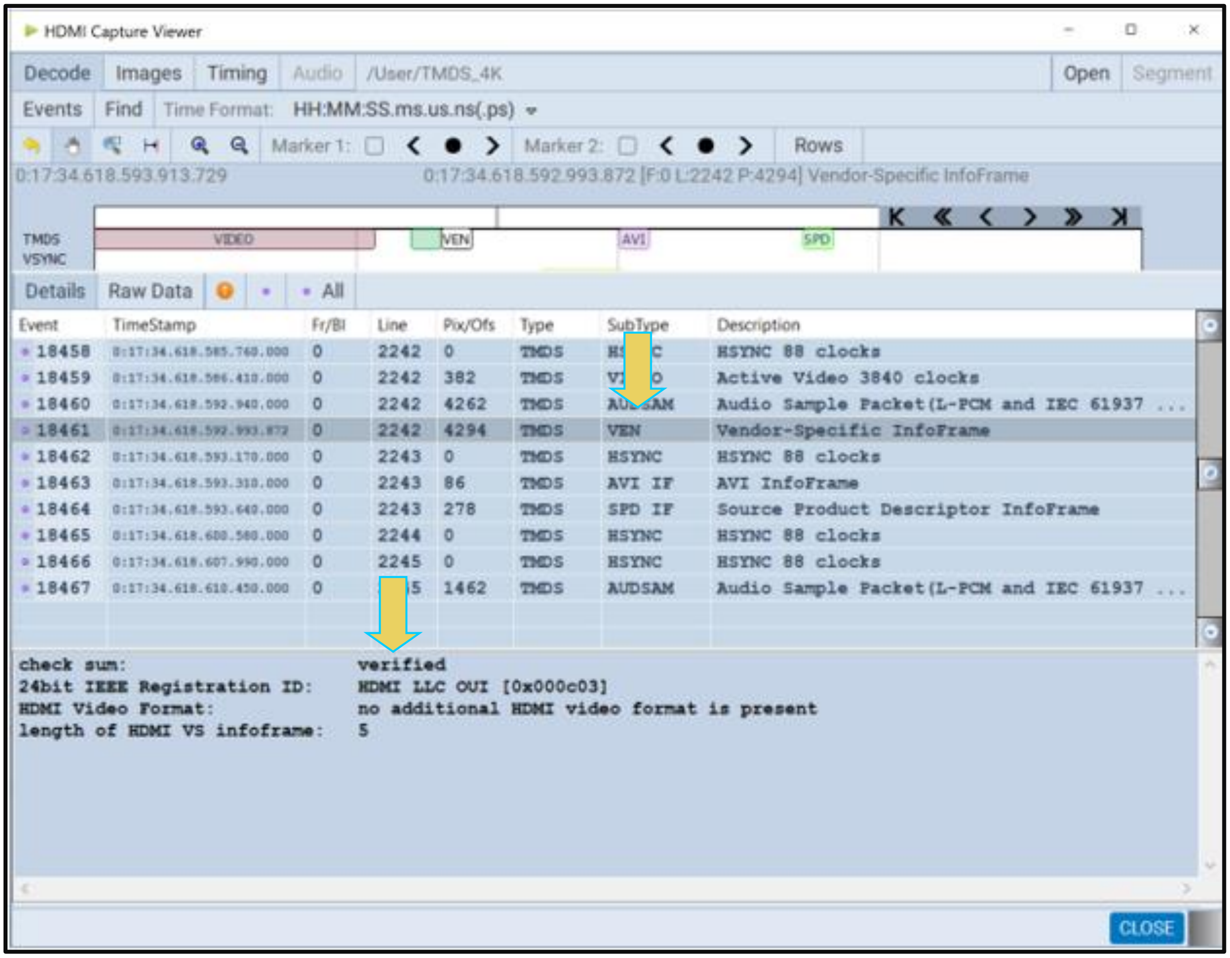
1. To view the protocol data transactions on the **Decode** panel, activate the **Decode** tab.

The **Decode** window shows the protocol data in a report.

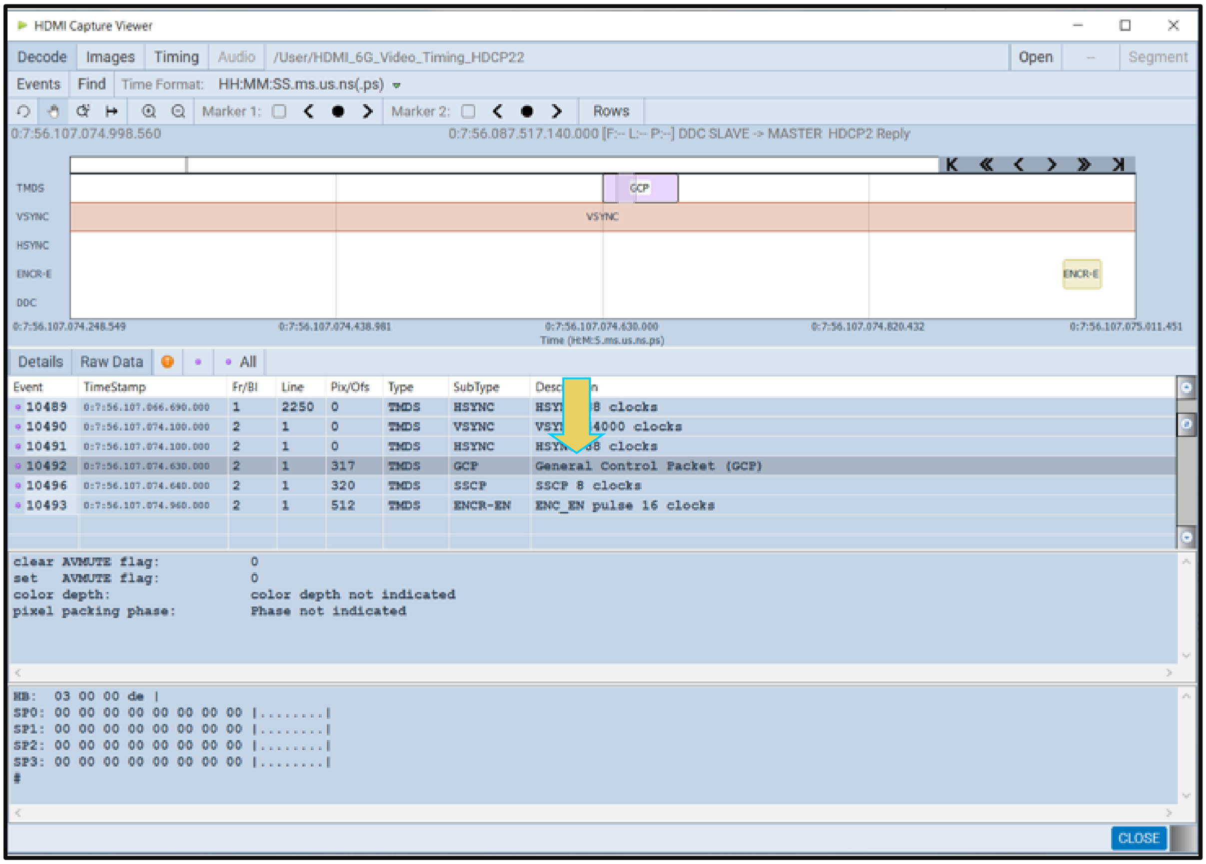
2. Highlight an AVI InfoFrame record to view its contents as shown below. The Decode window above shows the AVI InfoFrame data record selected. The AVI InfoFrame contents are parsed out in human readable text on the upper panel. The hex representation of the contents is presented in the lower panel.



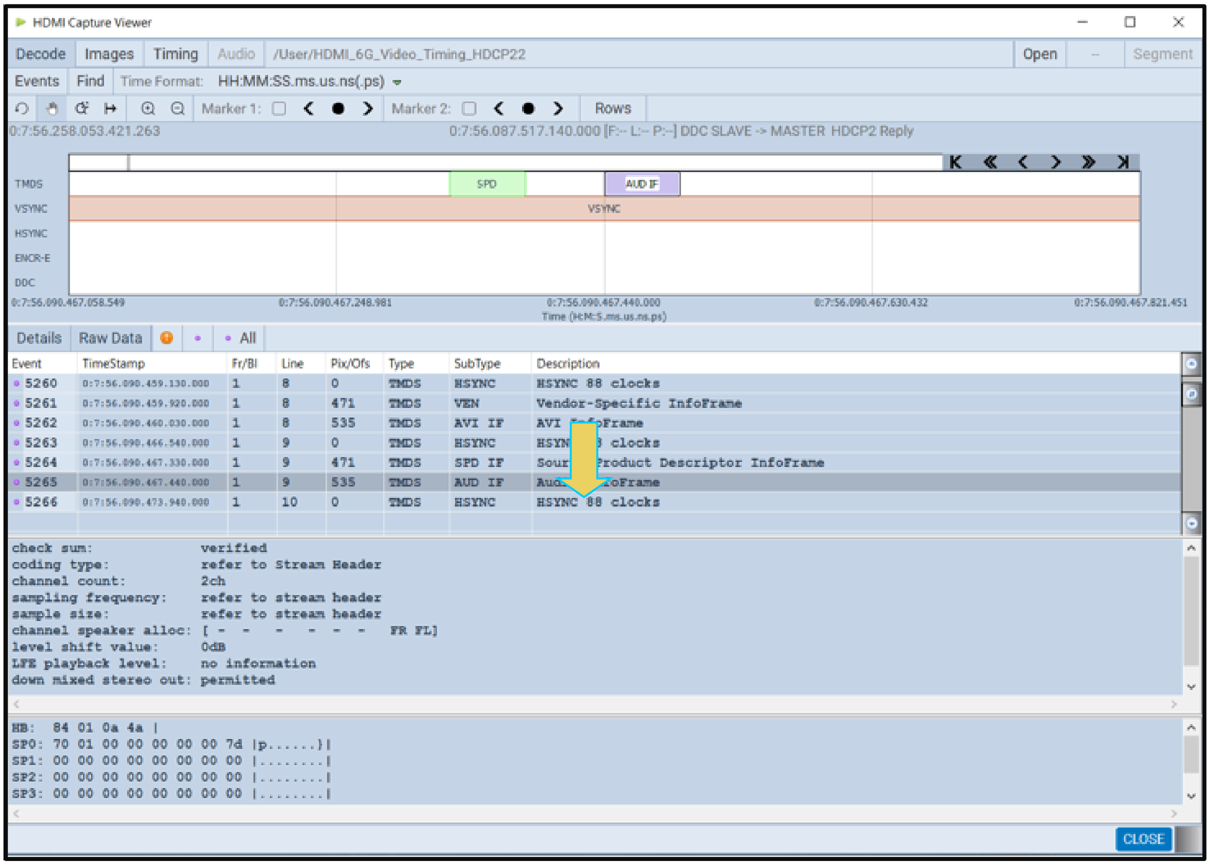
3. Highlight a Vendor Specific InfoFrame record to view its contents. The example below shows a Vendor Specific InfoFrame where the HDMI source is transmitting 3D content in Frame Packing.



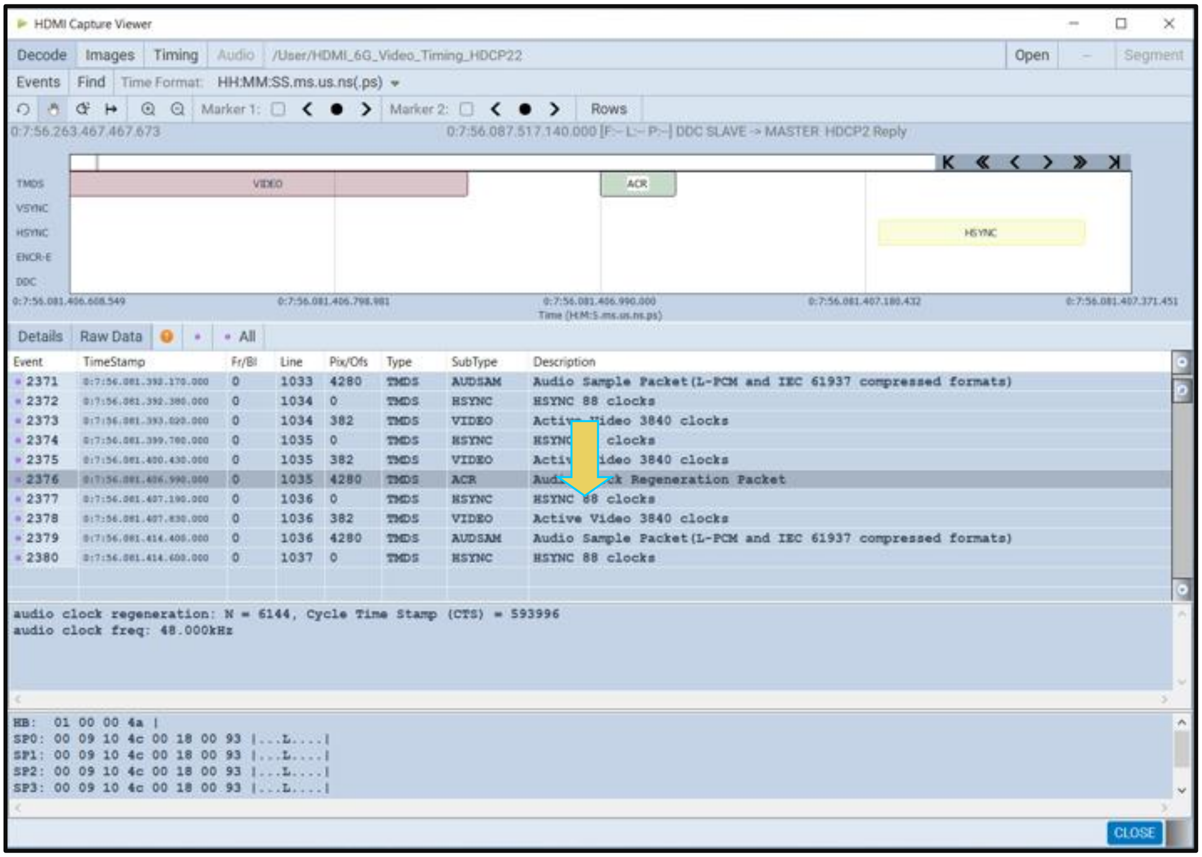
4. Highlight a General Control Packet record to view its contents as shown below.



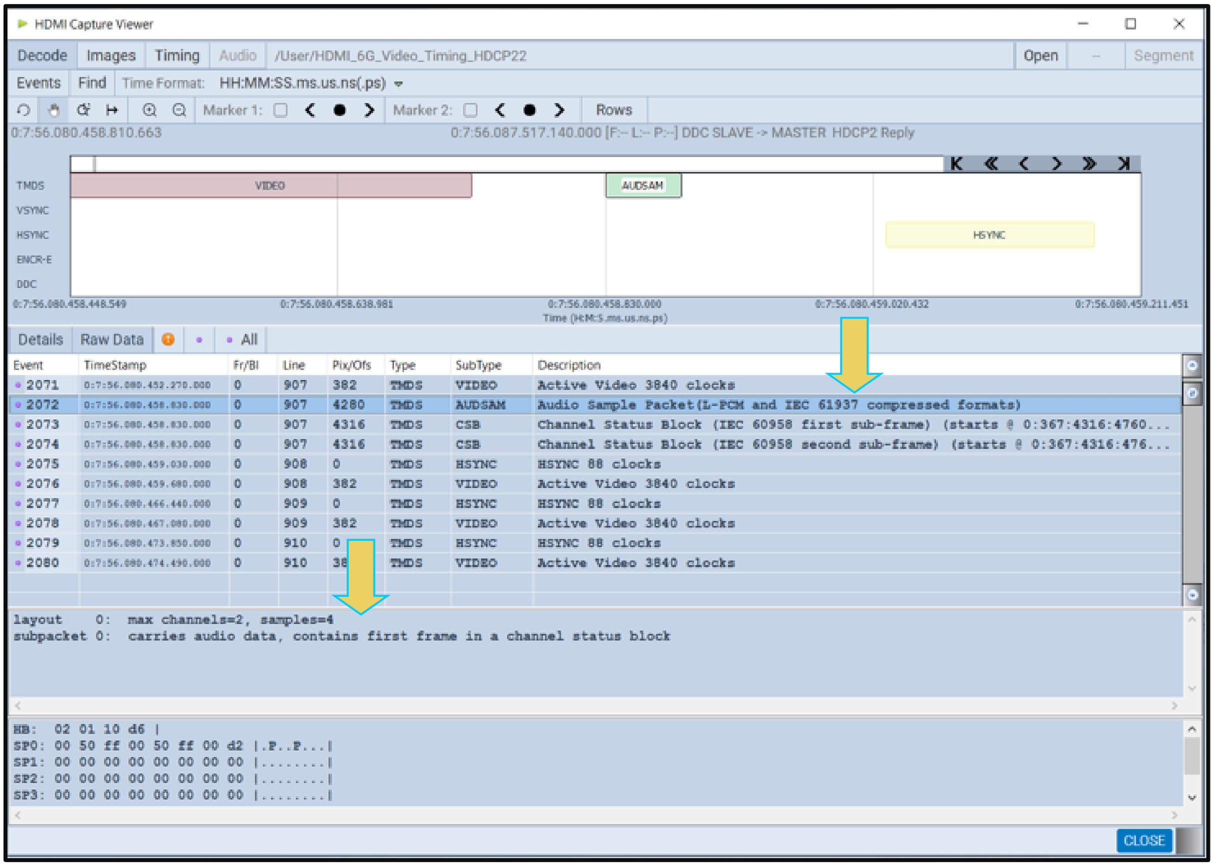
5. Highlight an audio InfoFrame record to view its contents as shown below.



6. Highlight an Audio Clock Regeneration packet record to view its contents as shown below.



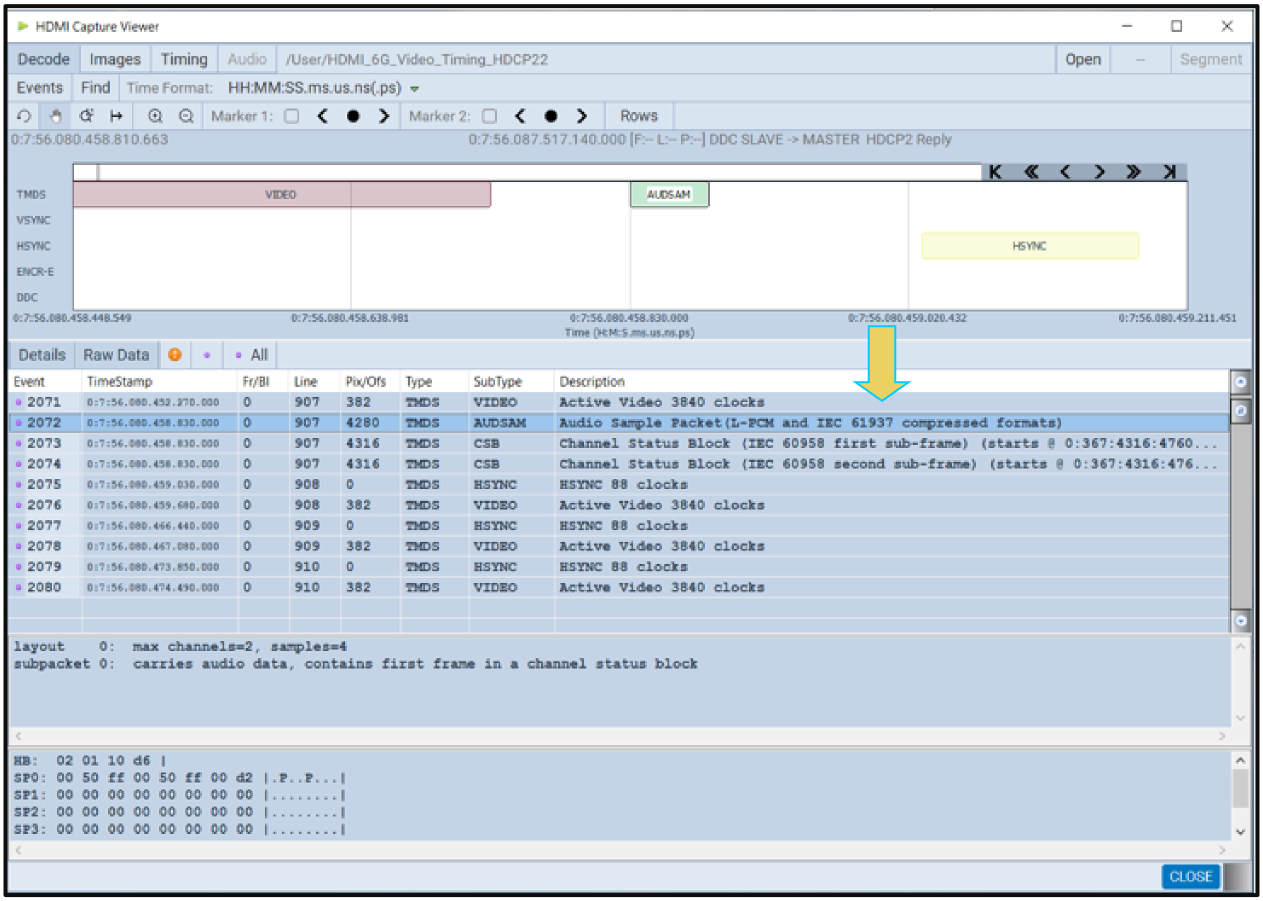
7. Highlight an audio sample packet record to view its contents as shown below. The number of channels and samples provided as well as the content of the samples is shown in the lower panel.



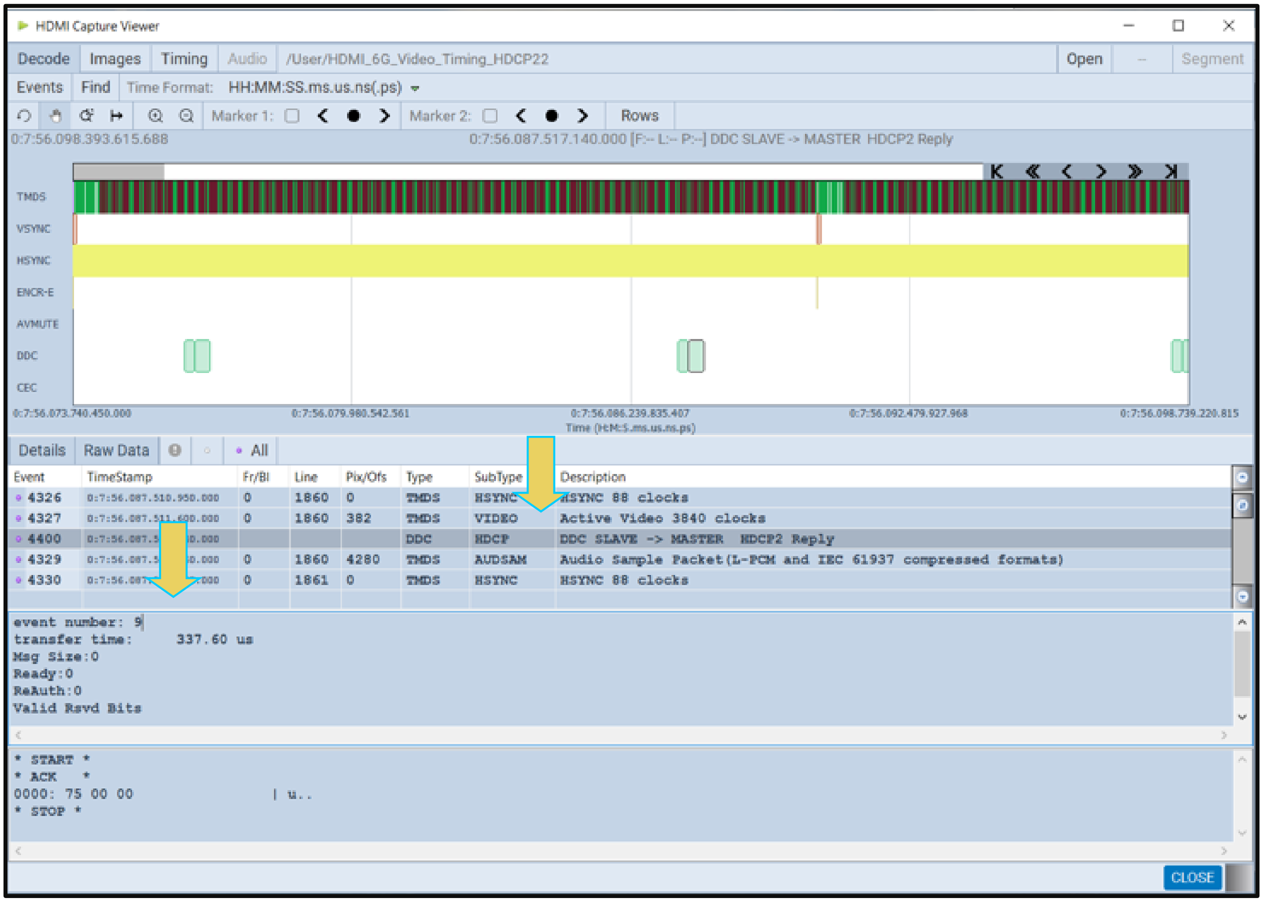
8. Highlight an audio sample packet channel status block record to view its contents as shown below.

The channel status block is shown in the detailed data window when it is fully acquired, i.e. after the 192 frames are all captured. There are two blocks, one for each subframe A and B. The first subframe (A) corresponds to the Left channel and the second subframe (B) corresponds to the Right channel.

You can determine when the channel status bits begin to be acquired by looking at the top section of the Details panel (not shown below).



9. Highlight a DDC transaction to view its contents as shown below. The example below shows a register read.



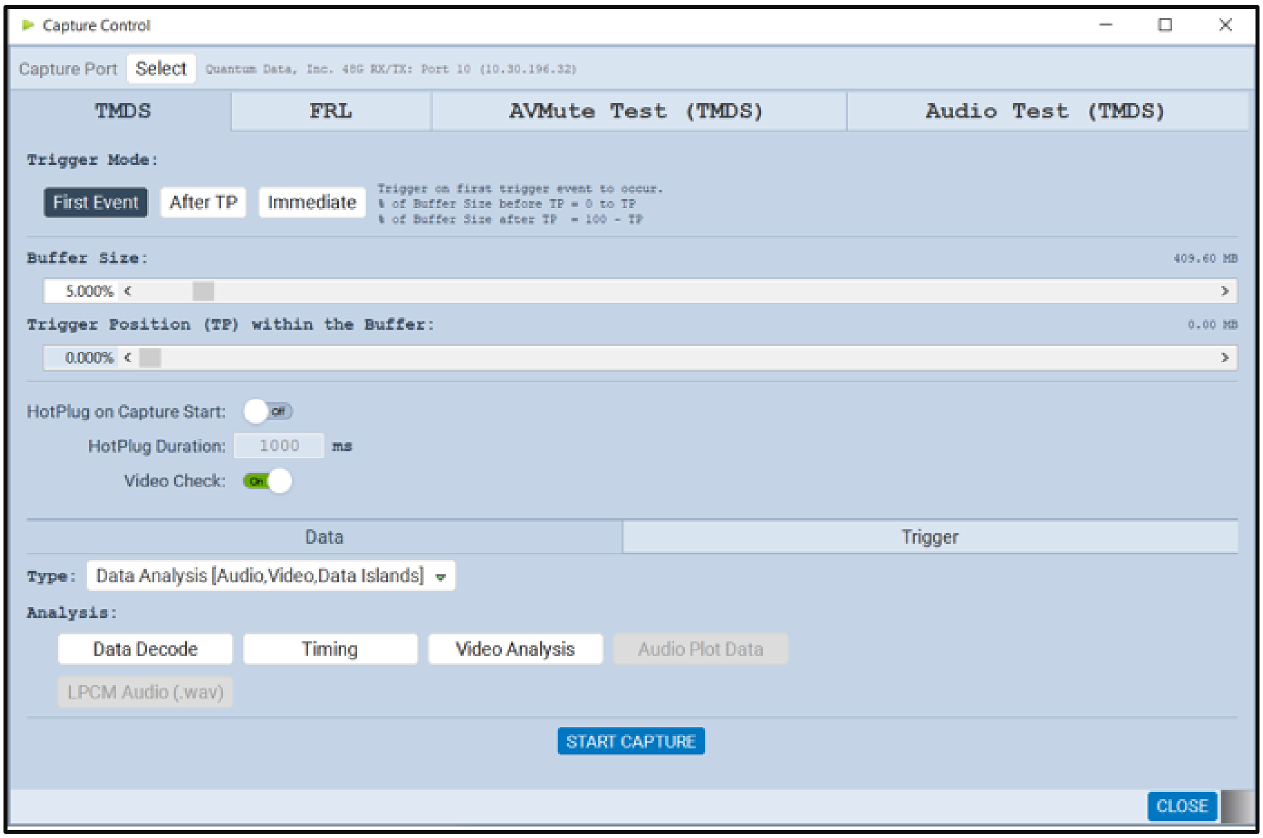
8.8.2 Viewing Protocol Analysis Captures Through the Decode Panel

This subsection provides procedures for viewing the captured data taken using the Protocol Analysis capture mode through the **Decode** and **Event Plot** panels in the ATP Manager.

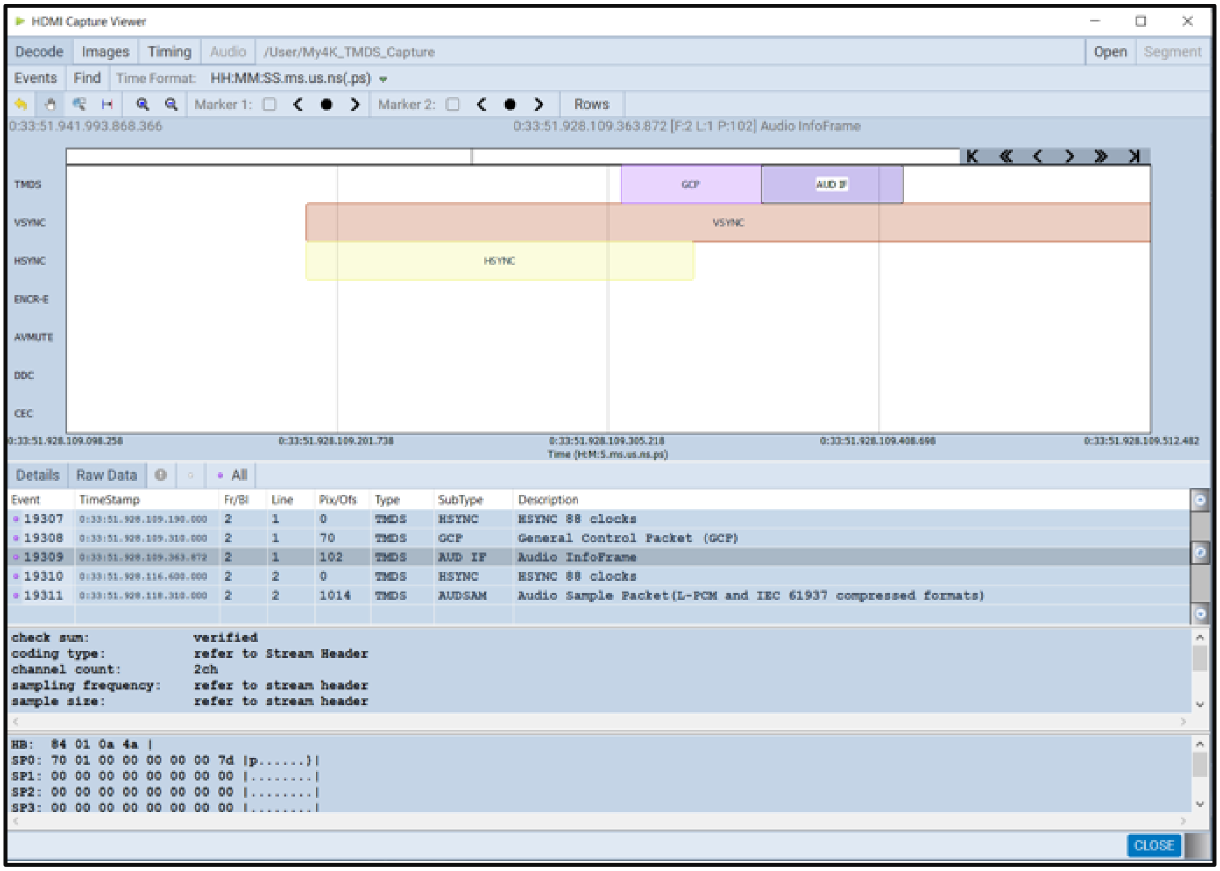
To view captured data through the Decode panel:

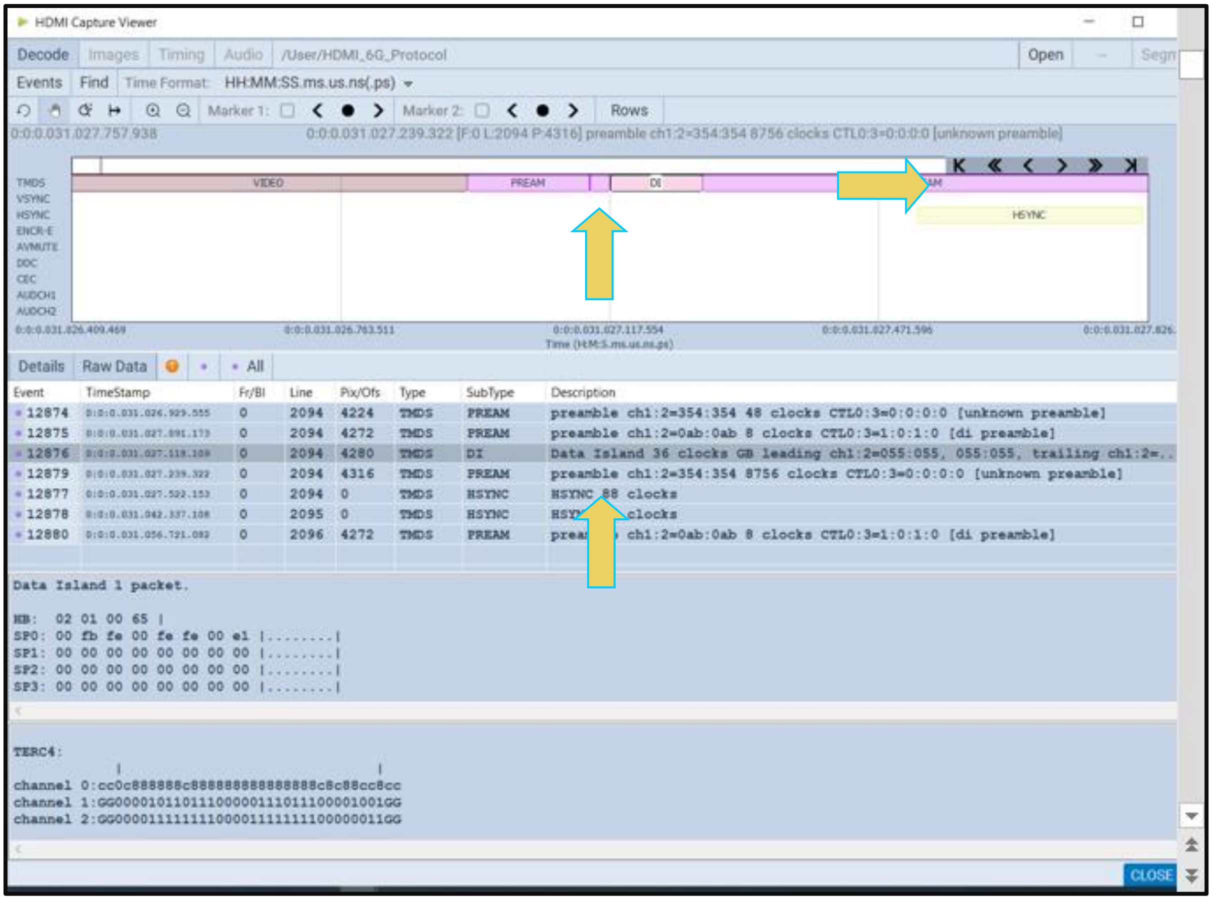
1. To view the Protocol Analysis data transactions on the **Decode** and **Event Plot** panels, activate the **Decode** and **Event Plot** tabs.

The screen example below shows data captured using the Protocol Analysis mode. The preamble data is shown as a distinct data type in both the **Event Plot** and the **Decode**. The guard band data is shown as part of the Video data period in the example.



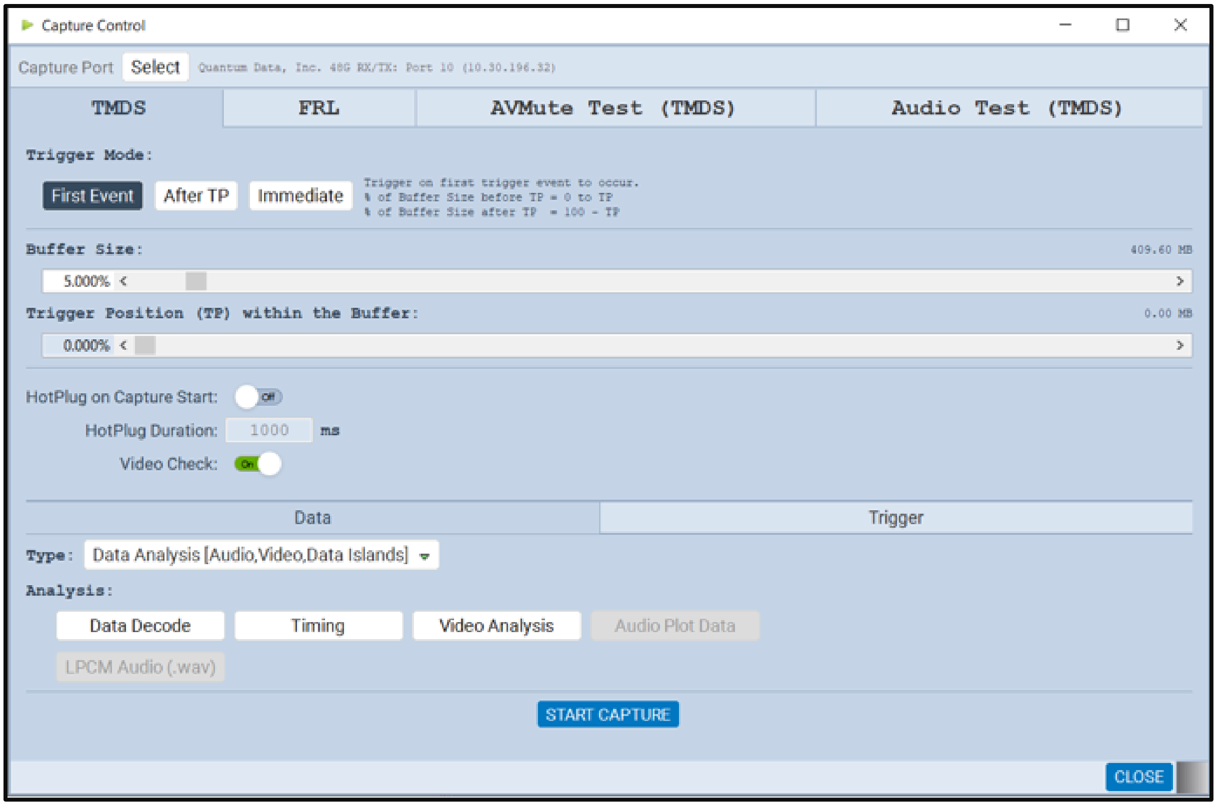
The following screen shots show examples of the protocol captured data showing the guard bands and preambles.



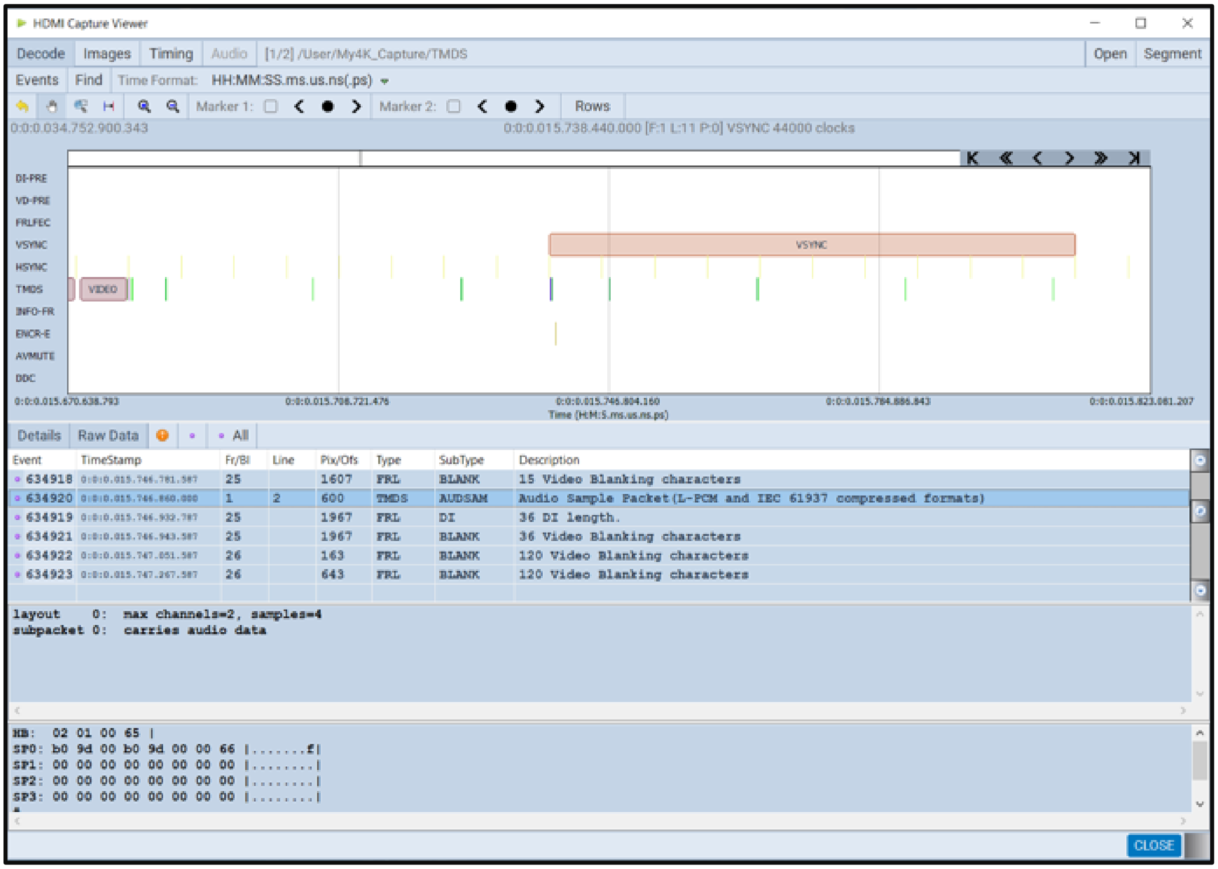


8.8.3 Viewing Scrambled Protocol Analysis Captures Through the Decode Panel

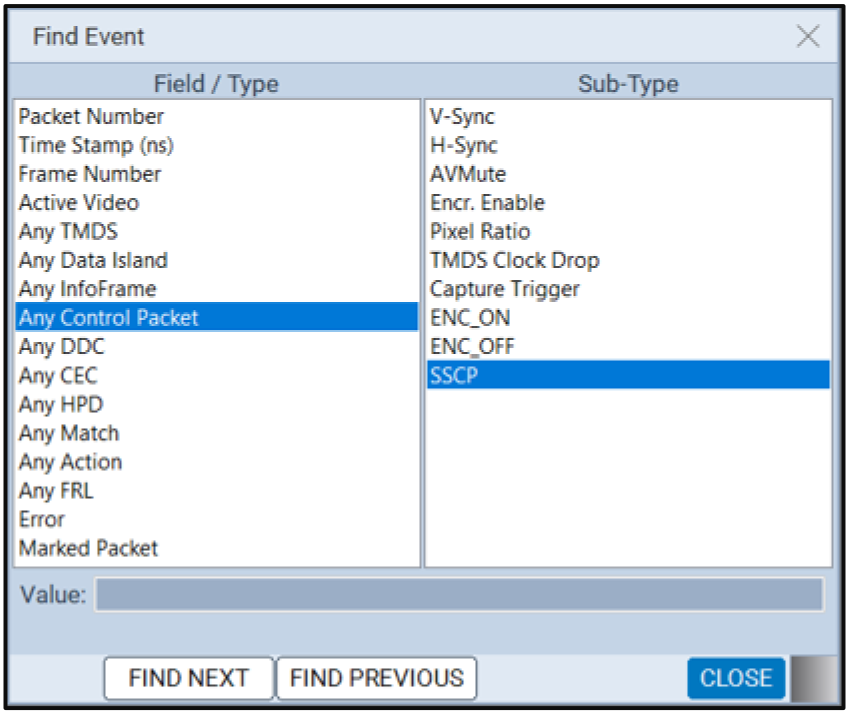
This subsection provides procedures for viewing the captured data taken using the Scrambled Protocol Analysis capture mode through the **Decode** and **Event Plot** panels in the ATP Manager.


Capture Control
Capture Port
Select
Quantum Data, Inc. 48G RX/TX: Port 10 (10.30.196.32)
TMDS
FRL
AVMute Test (TMDS)
Audio Test (TMDS)
Trigger Mode:
First Event
After TP
Immediate
Trigger on first trigger event to occur.
% of Buffer Size before TP = 0 to TP
% of Buffer Size after TP = 100 - TP
Buffer Size:
409.60 MB
5.000%
Trigger Position (TP) within the Buffer:
0.00 MB
0.000%
HotPlug on Capture Start:
Off
HotPlug Duration:
1000
ms
Video Check:
On
Data
Trigger
Type:
Data Analysis [Audio,Video,Data Islands]
Analysis:
Data Decode
Timing
Video Analysis
Audio Plot Data
LPCM Audio (.wav)
START CAPTURE
CLOSE

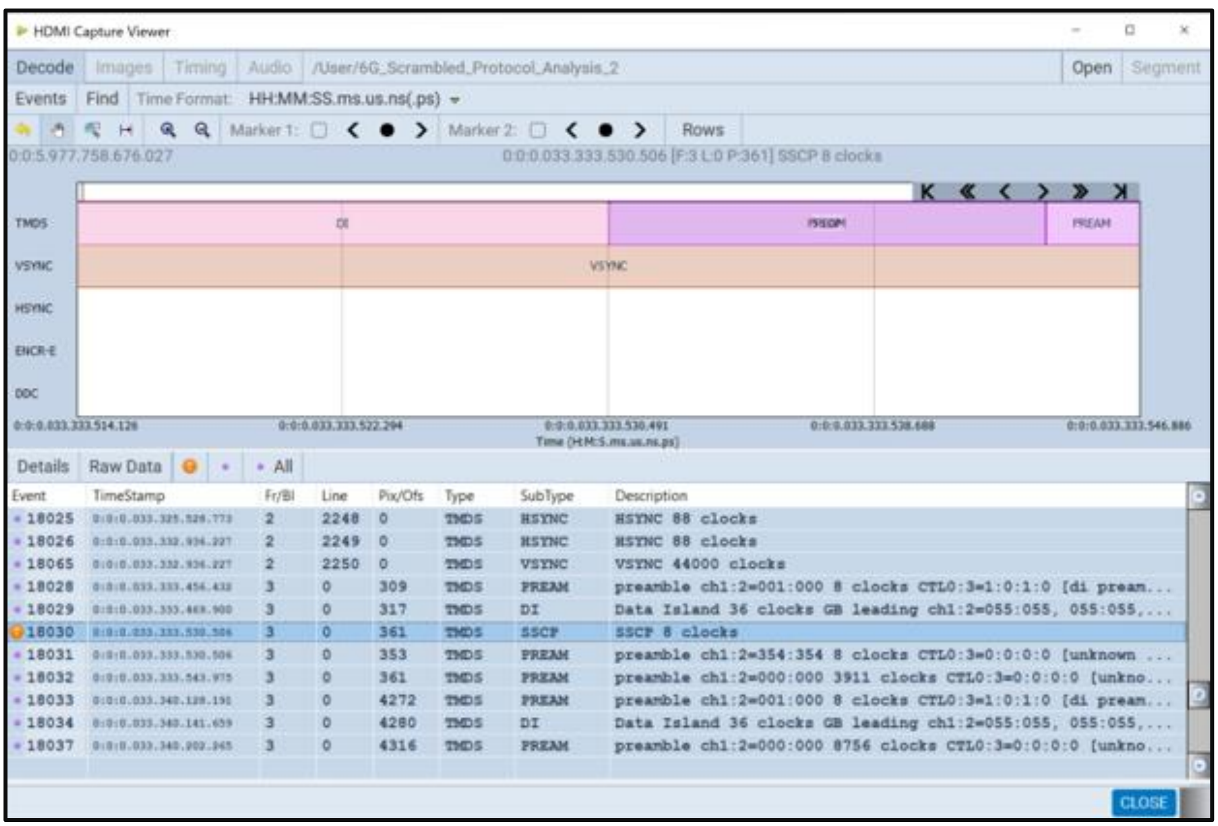
The following screen shot shows an example of the protocol data capture with scrambling enabled.



You can search for the Scrambler Synchronization Control Period (SSCP) bytes.



The following screen shot shows an example of the protocol data with the SSCP byte.

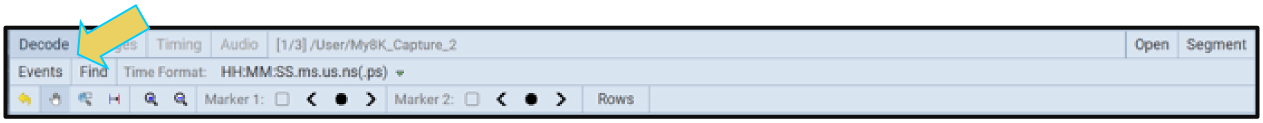


8.8.4 Filtering the Data in the Decode Panel

The procedures below describe how to filter the data in the **Decode** panel. You use the panel on the right that is adjacent to the **Decode** panel to apply filtering on the data displayed on the **Decode** panel.

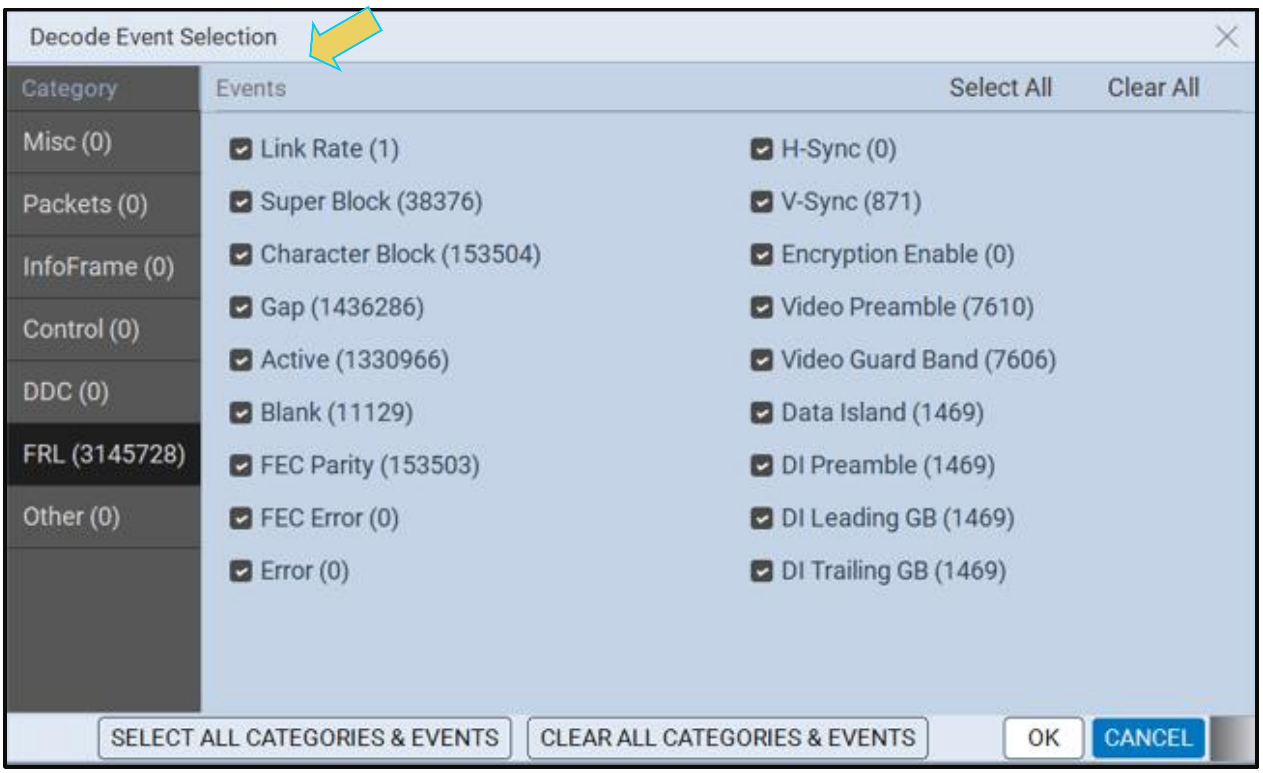
To apply filters to the data:

1. From the **Decode** panel, select the **Events** activation button to access the **Decode Event Selection** dialog box

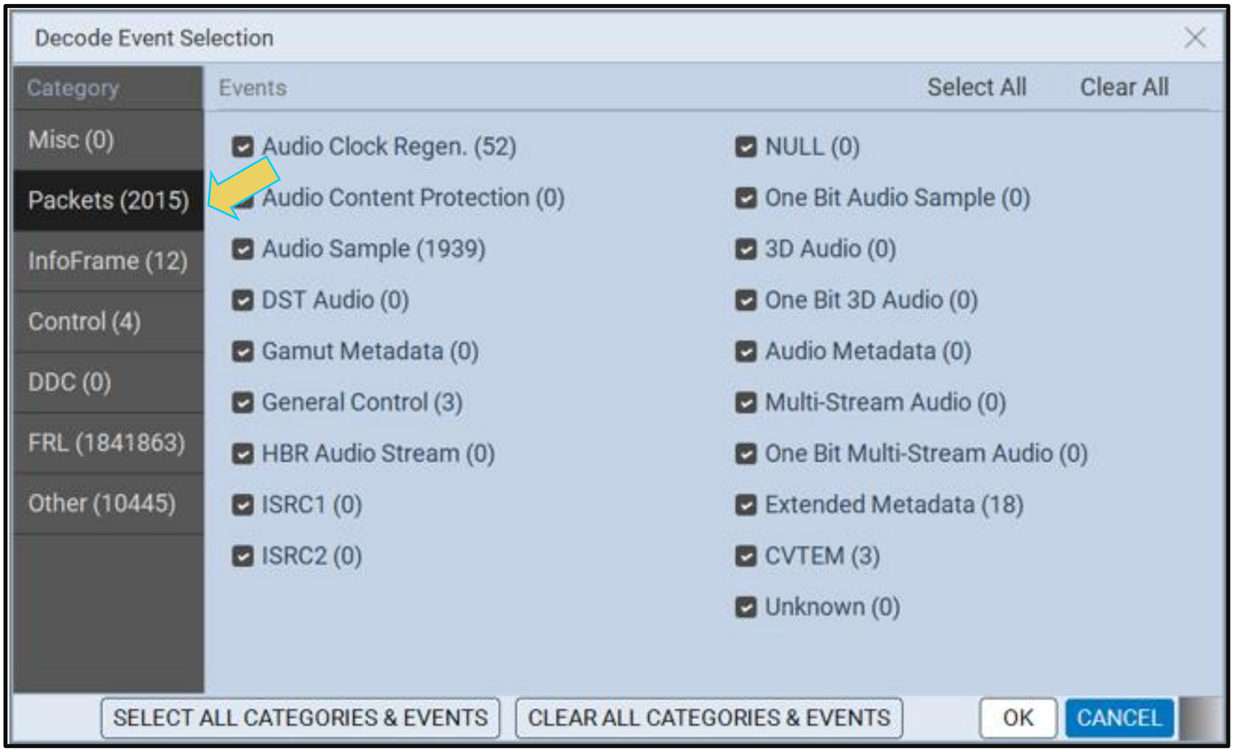


The **Decode Event Selection** dialog box is shown below.

In the example below, only some of the data islands are selected.



The following is a screen example of the **Control Packets** page.

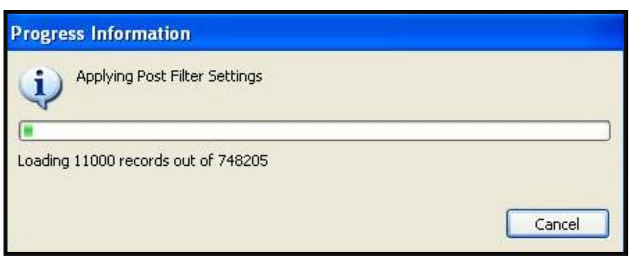


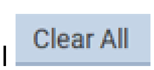
2. Select the data items you want to appear in the **Decode** panel. The filtering you apply in this series of dialog boxes also applies to the **Event Plot** panel.

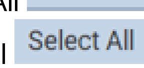
3. Click the **OK** 

button on the bottom right to set your selections or click on the **Cancel** 

button to exit without saving the changes.



Note that you can clear all the selections on all pages with the Clear All 

activation button on the top left. You can select all items on all pages with the Select All 

activation button.

You can also apply the same Select and Clear operations to each tab of the **Decode Event Selection** dialog box.

8.8.5 Searching Through the Data in the Decode Panel

The procedures below describe how to search through the data in the **Decode** panel.

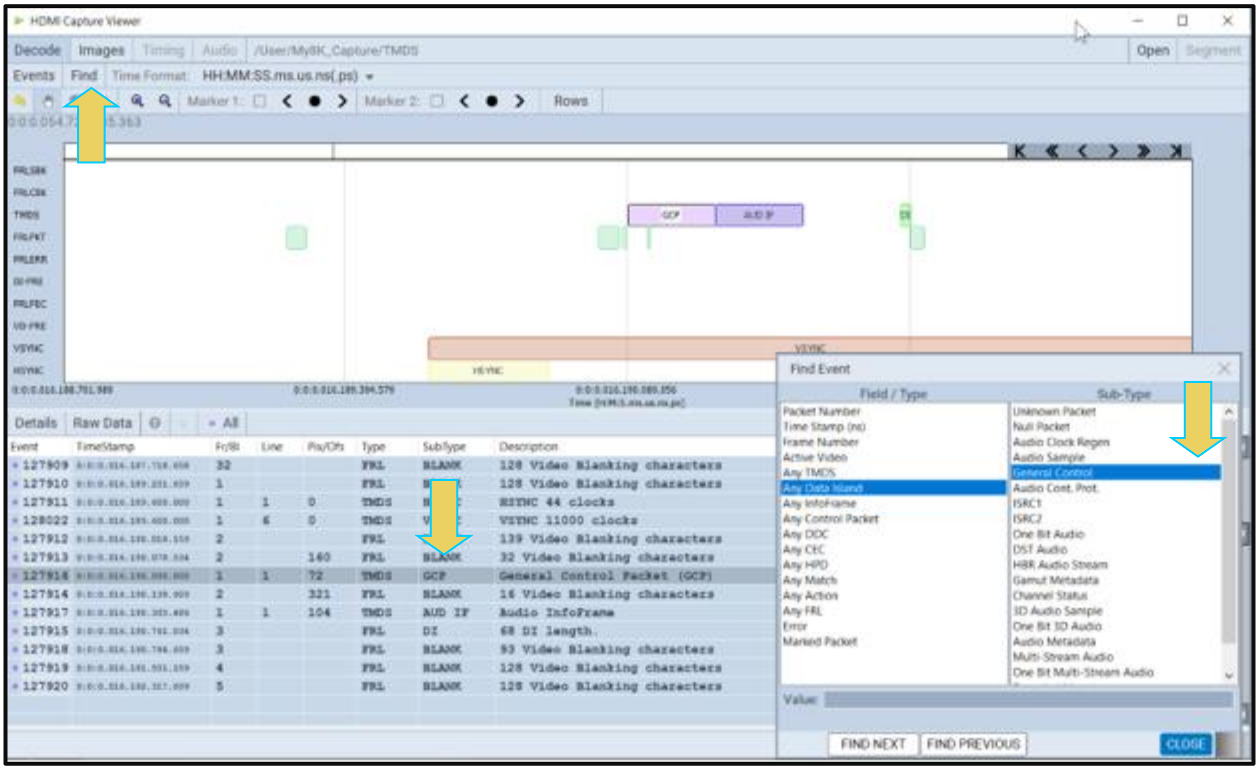
To search through the data:

1. Click on Find. 

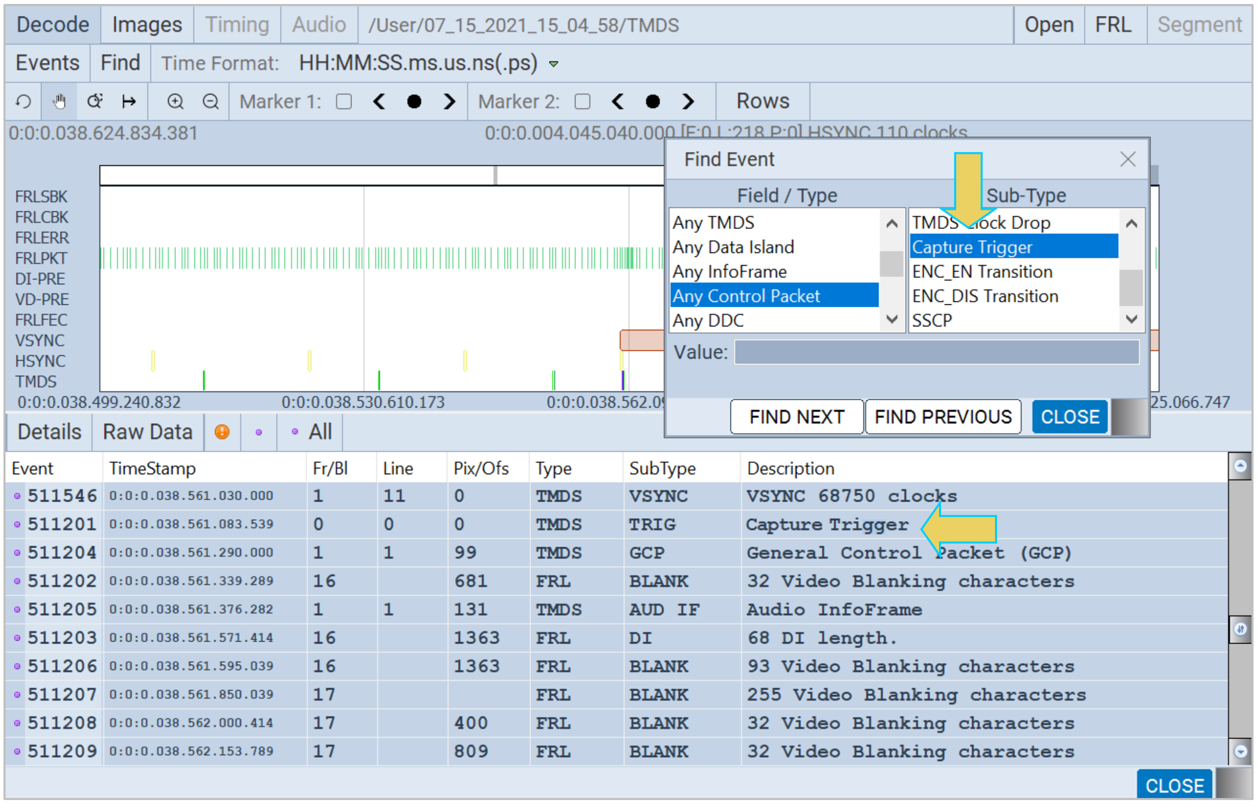
You can search on a variety of packet types and some of the fields in the **Decode** panel such as Packet, Timestamp, Frame, Line and Pixel. You can also search for a variety of control events such as the occurrence of Avmute in an ACR packet or a Vsync/Hsync.

The default is to search Forward which is a search for events that occur later in time. You can change that to search backward by selecting the associated radio button.

A dialog box appears that enables you to enter search criteria. In this example we will search for an Audio Clock Regeneration packet. The **Decode** panel will then show the next General Control Packet (GCP) packet. If you are searching for a specific packet number, timestamp or frame you will have to enter the value in the Find/Goto field.



Sometimes you may wish to search for the trigger event. In this case you select Any Control Packet under Field / Type and then select Capture Trigger under Sub-Type as shown below.

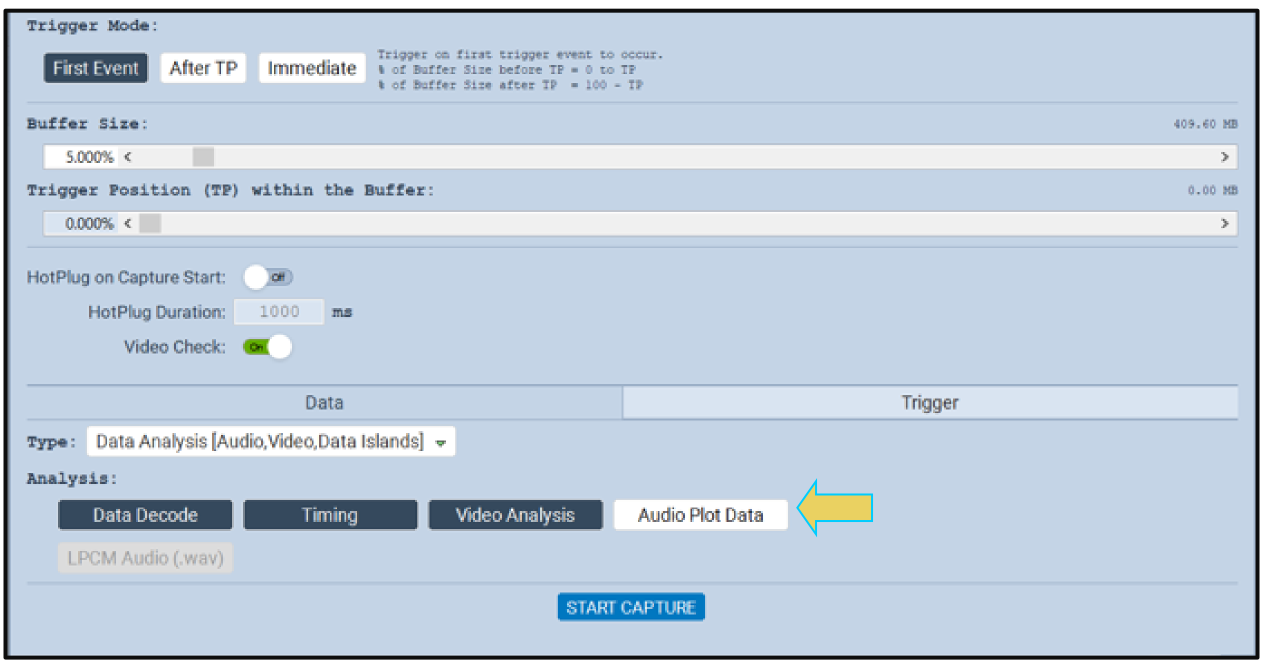


8.8.6 Viewing Data Through the Event Plot Panel

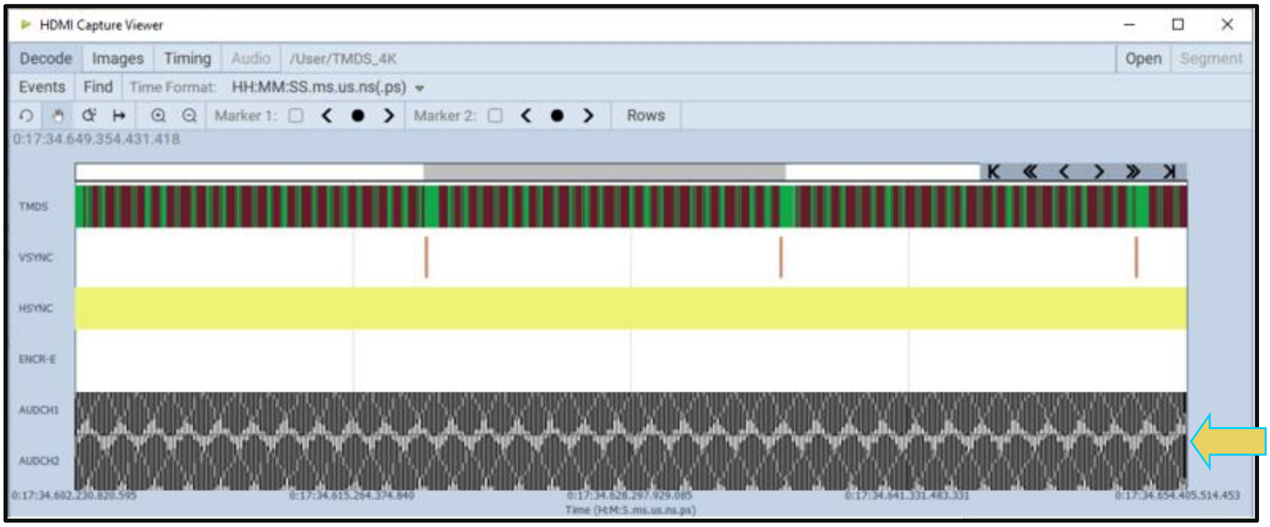
The Event Plot panel provides you with a graphical view of the data. It enables you to see relationships between the various data types on a timeline. A sample screen of the **Event Plot** is shown below. The operation of the **Event Plot** is described at: Event Plot Panel.

8.8.7 Viewing Audio Plot Data Through the Event Plot Panel

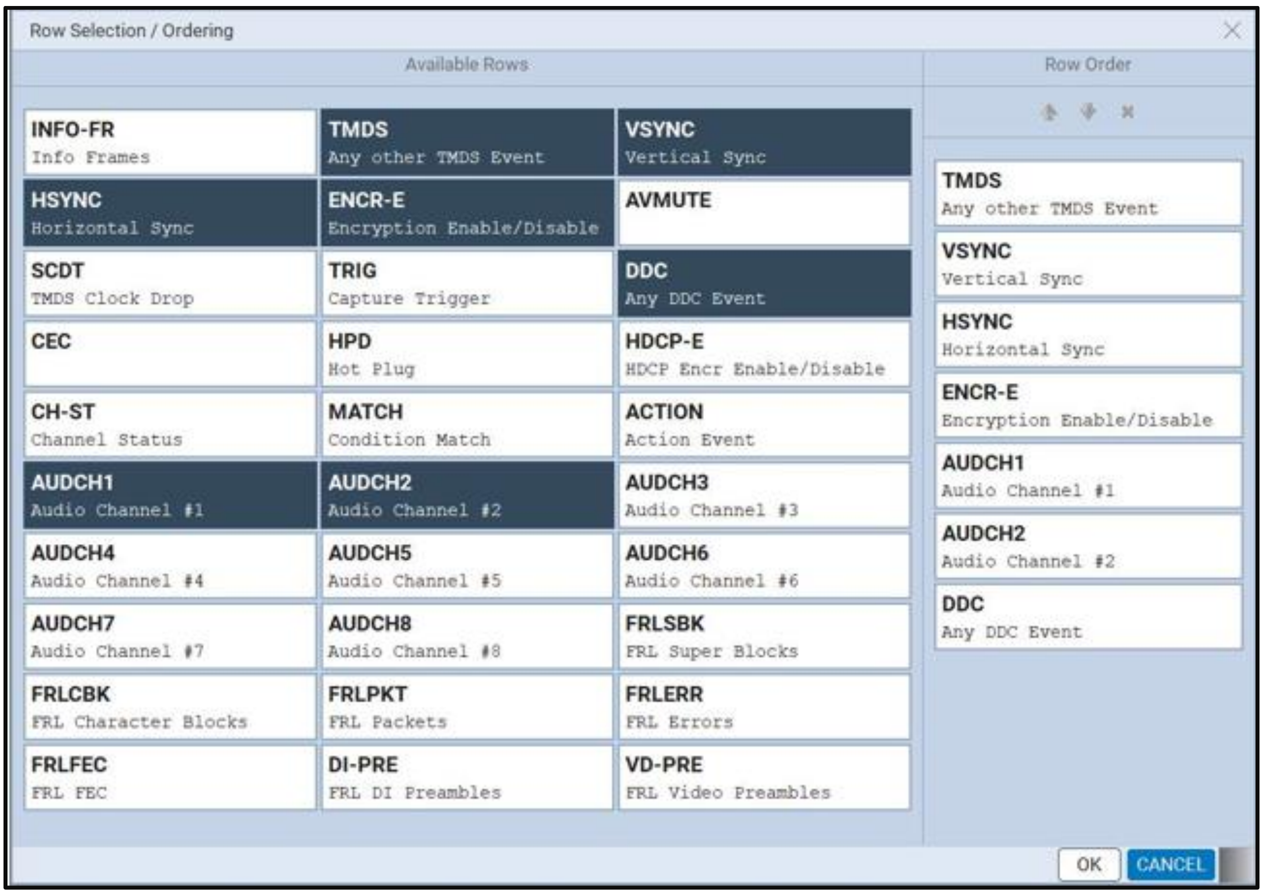
This subsection provides procedures for viewing the Audio Plot data on the **Event Plot** panels in the ATP Manager. You must have Audio Plot Data selected as indicated below. You can only view LPCM data. You cannot view compressed audio formats.



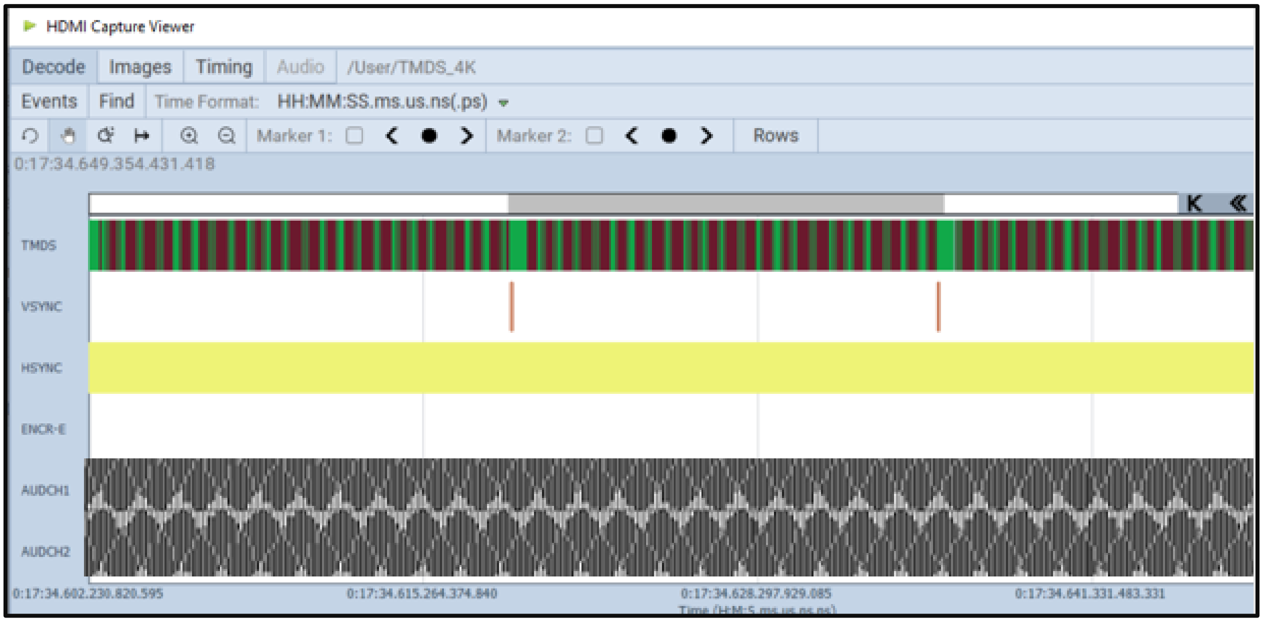
The following screen shot shows an example of the Audio Plot data for 2 channel LPCM.



Note: You must be sure to have selected the audio channels using the Rows button on the Event Plot panel (below).



The following screen example shows the same data zoomed in.



9 Running Standard Tests

Important Note: Many of the functions described in this section have been implemented on the M42h.

This chapter describes how to use the M42h 96G Video Analyzer/Generator special tests. The M42h 96G Video Analyzer/Generator supports the following special tests:

Video timing analysis – Verifies that the timing parameters from an HDMI® source device including all horizontal and vertical parameters.

Video analysis – Enables you to check the video parameters and pixel values from the HDMI source device.

Audio analysis - Identify audio inconsistencies in metadata related to sampling rate and audio clock recover that could result in interoperability problems.

Note: These tests are currently only available in the TMDS mode.

AV mute – Verifies that an HDMI source has implemented Avmute properly.

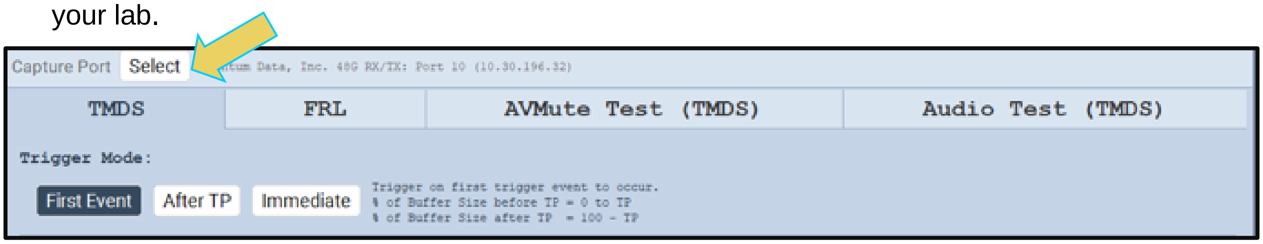
9.1.1 Running a Video Timing Test

The procedures below describe how to run the video timing test on an HDMI source device through the ATP Manager. This subsection describes how to use the M42h 96G Video Analyzer/Generator to run a timing test on an HDMI source device. The setup procedures described above in the section: Analyzing HDMI Data with your M42h Protocol Analyzer should be followed for the timing tests. These setup procedures are listed below:

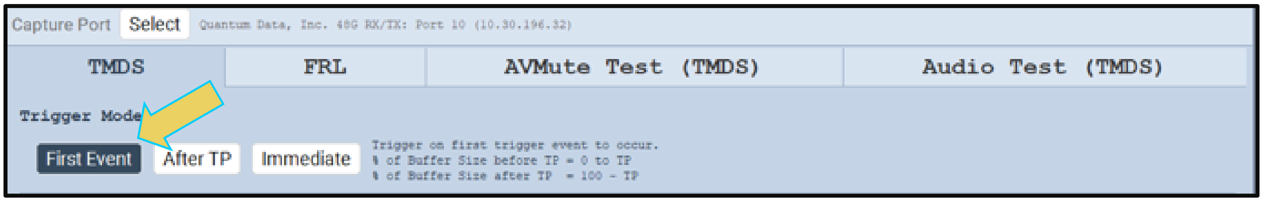
- Set the threshold of the +5V.
- Configure the M42h 96G Video Analyzer/Generator Rx port with the proper EDID.

To run the video timing analysis test:

1. Select the M42h 96G Video Analyzer/Generator that you are using to capture the data from your HDMI source device under test by clicking on the **Select** button and selecting the proper instrument from the list (not shown). Typically, you would only have one M42h Test System in your lab.



2. Set the Video Trigger mode using the information provided below. Note that typically for a Video Timing test you would select either Immediate or First Event.

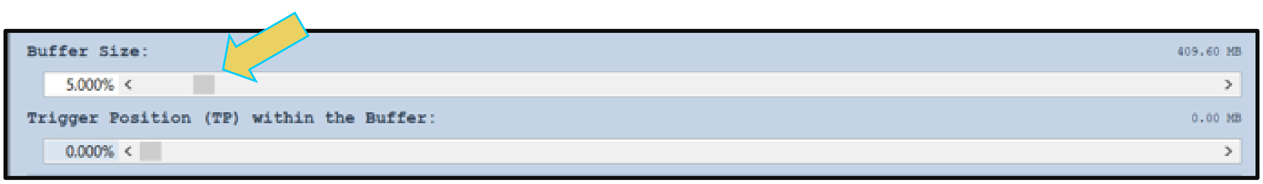


First Event – The trigger occurs on the first event—first occurrence—of the trigger condition defined in the Trigger Type pull-down menu (Vsync, Encryption Enabled, Encryption Disabled, External Trigger, Manual Trigger, TMDS Clock Change). Depending on the setting of the Trigger Position slider, you may have some of the captured data in the buffer that accumulated prior to the trigger condition and some of the captured data in the buffer that accumulated after the trigger condition. At the left most position there will be no data in the capture buffer that occurred prior to the trigger event. At the right most position, all the data in the capture buffer will be data that accumulated prior to the trigger event. Because the trigger condition could be met quite quickly, the capture buffer may not be filled to the amount specified in Buffer Size.

After TP (Trigger Position) – In this setting the trigger condition specified in the Trigger Type pull-down menu will be ignored until data has accumulated in the capture buffer up to the point where the Trigger Position slider is set. Once the data has accumulated to the setting of the Trigger Position, any event matching the Trigger Type specified will cause a trigger condition and data accumulation will begin. Some of the data in the capture buffer will be data that has accumulated prior to the trigger condition being met and some of the data in the capture buffer will be data that has accumulated after the trigger condition was met. This setting will ensure that the capture buffer is filled to the Buffer Size setting.

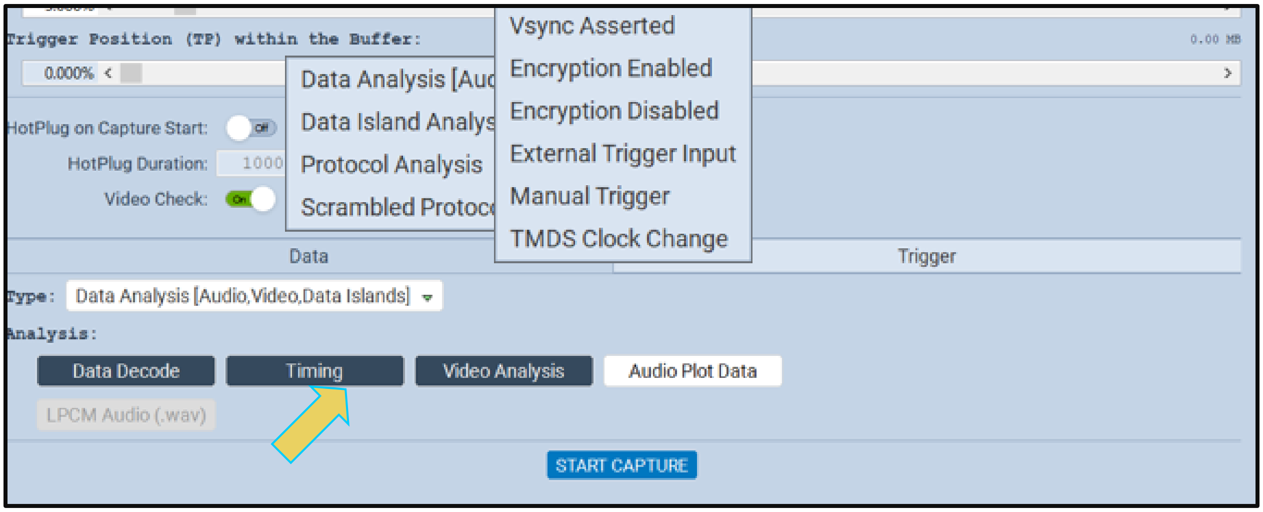
Immediate – Data capture begins accumulating immediately when the Start Capture button is activated. Data capture halts when buffer is filled. This setting will not provide any capture history, i.e. none of the captured data accumulated in the capture buffer will be data that occurred prior to the capture trigger event (activating the Start Capture button).

3. Set the **Buffer Size** slider to a percent value to meet your requirements. You can capture up to about 4GB of data which is about 2300 frames at 576p/480p and about 400 frames at 1080p which includes the video. If you do not want to capture the video and only capture the metadata, you can store well over 200,000 frames of data.

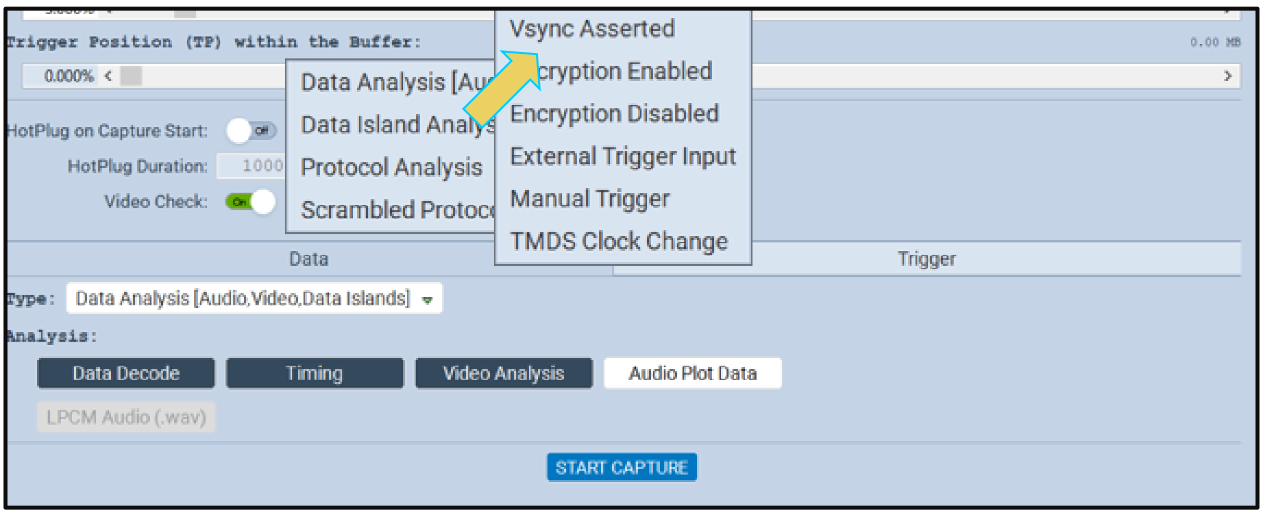


4. Set the **Capture Buffer Position** slider to a percent value to meet your requirements. This slider enables you to set the position of the trigger event within the captured data. This is a slider that provides an indication (on the right) of the location within the captured data, expressed as a percent with 0% indicating that the trigger event occurs at the beginning of the captured data and 100% indicating that the trigger event occurs at the end of the captured data.
5. Select the **Capture** tab in the **Capture Control** panel.

6. Select **Data Analysis** (Audio, Video, Data Islands) in the **Data Selection** Type pull-down menu provided as shown below. Then make sure you check the **Timing** check box.



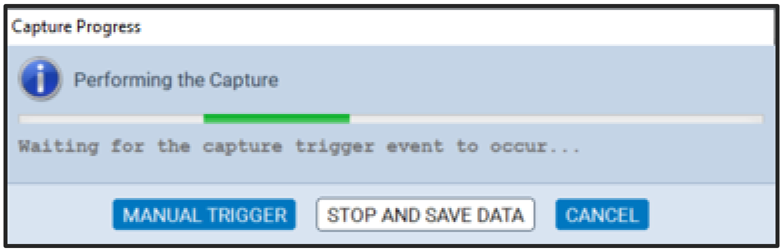
7. Select Vsync Asserted for the **Trigger Selection** condition.



8. Click on the **Start Capture** button to initiate the test.

The M42h 96G Video Analyzer/Generator will capture the data including the timing data. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

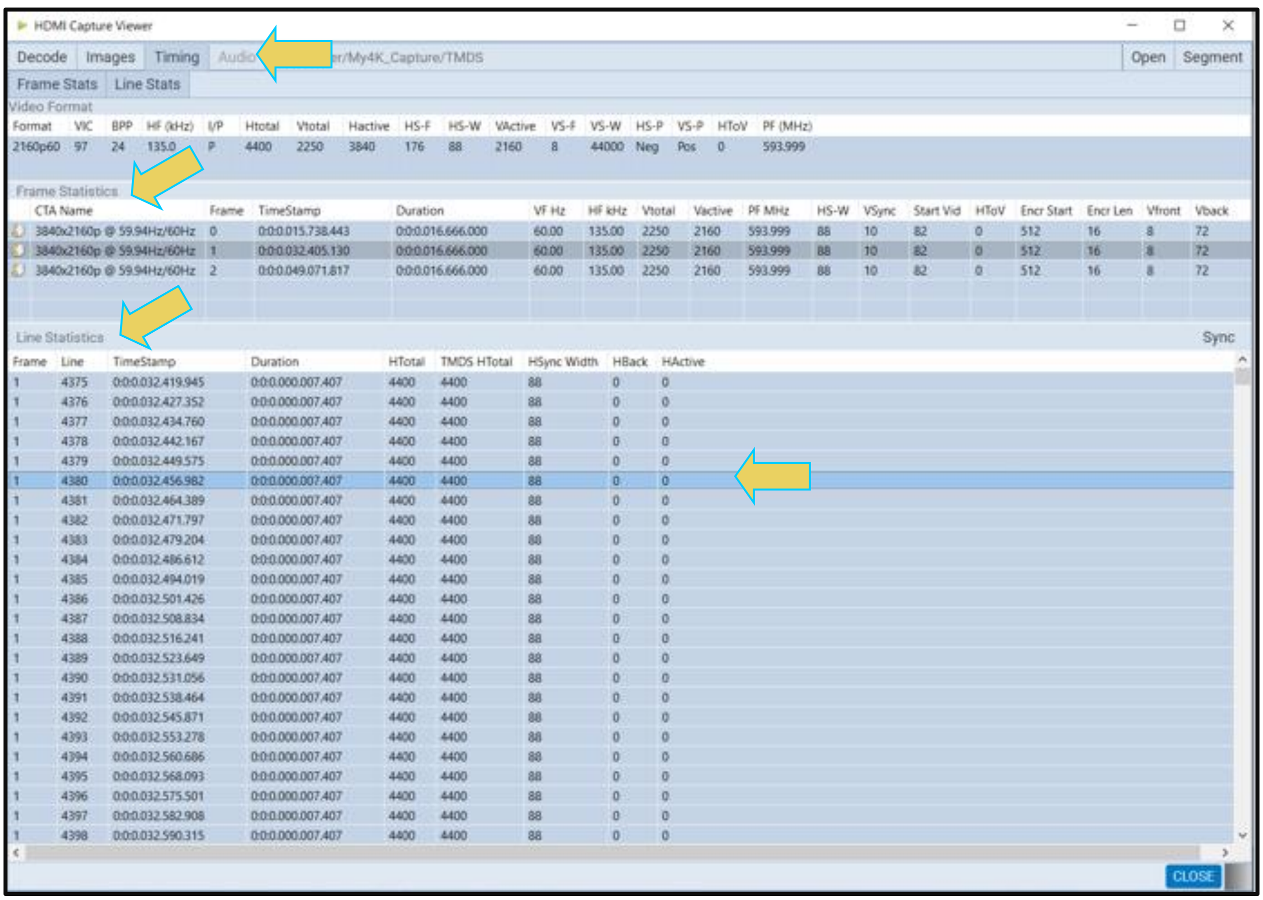
Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will indicate that. This is shown in the following screen shot.



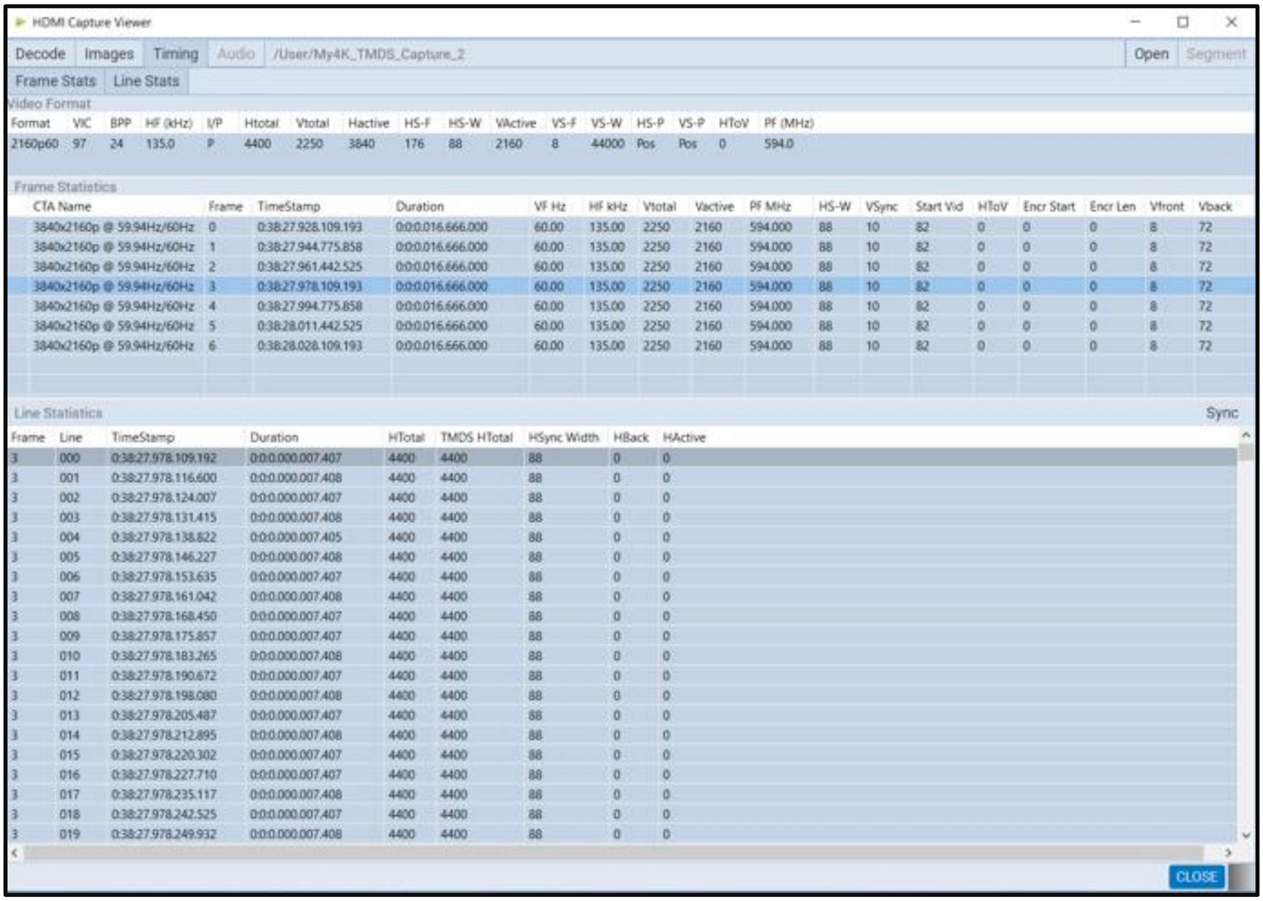
When the M42h 96G Video Analyzer/Generator is finished capturing data you can view the timing parameters in the **Timing Analyzer** panel. The **Timing Analysis** panel has three subpanels: 1) **Video Format**, 2) **Frame Statistics** 3) **Line Statistics**. The **Video Format** panel shows a summary of the key parameters and indicates the standard format timing that the timing parameters detected from the source match. If there is not a precise match between the timing parameters of a format in the M42h 96G Video Analyzer/Generator format library and the measured values, the M42h will select the format nearest to the values measured and indicate any parameters that deviate from that standard timing.

The **Frame Statistics** panel shows the frame or vertical parameters. When you highlight a particular frame, the parameters for each of the lines in that frame are listed in the **Line Statistics** panel.

The **Frame Statistics** panel also indicates whether the frame is encrypted or not. If the frame is encrypted a key icon will be shown on the left side of each frame. Refer to the screen example below.



The screen shot of the Timing Analysis panel shown below.


HDMI Capture Viewer

Decode | Images | Timing | Audio | /User/My4K_TMDS_Capture_2 | Open | Segment

Frame Stats | Line Stats

Video Format

Format	VIC	BPP	HF (kHz)	I/P	Htotal	Vtotal	Hactive	HS-F	HS-W	VActive	VS-F	VS-W	HS-P	VS-P	HToV	PF (MHz)
2160p60	97	24	135.0	P	4400	2250	3840	176	88	2160	8	44000	Pos	Pos	0	594.0

Frame Statistics

CTA Name	Frame	TimeStamp	Duration	VF Hz	HF kHz	Vtotal	Vactive	PF MHz	HS-W	VSync	Start Vid	HToV	Encr Start	Encr Len	Vfront	Vback
3840x2160p @ 59.94Hz/60Hz	0	0:38:27.928.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	1	0:38:27.944.775.858	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	2	0:38:27.961.442.525	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	3	0:38:27.978.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	4	0:38:27.994.775.858	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	5	0:38:28.011.442.525	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	6	0:38:28.028.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72

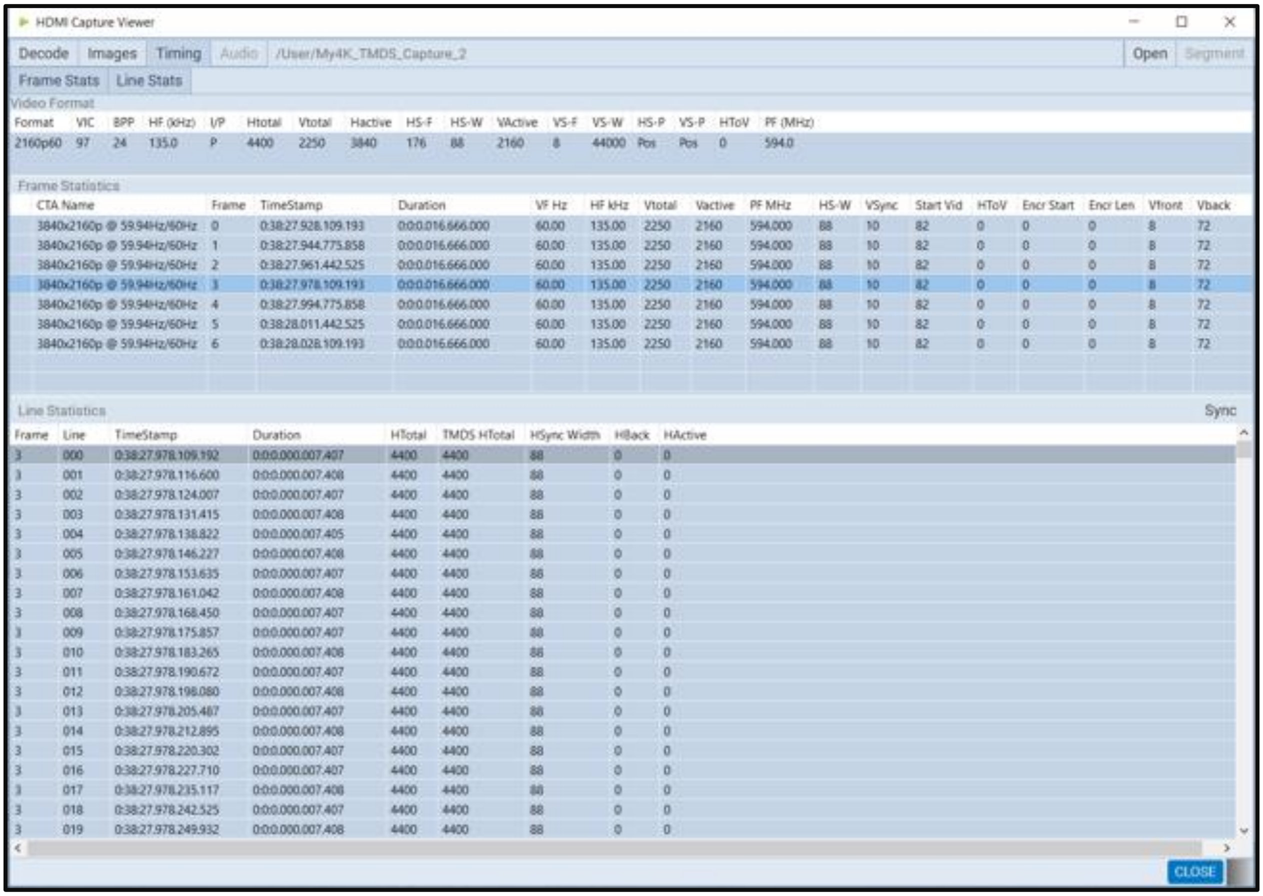
Line Statistics

Sync

Frame	Line	TimeStamp	Duration	HTotal	TMDS HTotal	HSync Width	HBack	HActive
3	000	0:38:27.978.109.192	0:0:0.000.007.407	4400	4400	88	0	0
3	001	0:38:27.978.116.600	0:0:0.000.007.408	4400	4400	88	0	0
3	002	0:38:27.978.124.007	0:0:0.000.007.407	4400	4400	88	0	0
3	003	0:38:27.978.131.415	0:0:0.000.007.408	4400	4400	88	0	0
3	004	0:38:27.978.138.822	0:0:0.000.007.405	4400	4400	88	0	0
3	005	0:38:27.978.146.227	0:0:0.000.007.408	4400	4400	88	0	0
3	006	0:38:27.978.153.635	0:0:0.000.007.407	4400	4400	88	0	0
3	007	0:38:27.978.161.042	0:0:0.000.007.408	4400	4400	88	0	0
3	008	0:38:27.978.168.450	0:0:0.000.007.407	4400	4400	88	0	0
3	009	0:38:27.978.175.857	0:0:0.000.007.407	4400	4400	88	0	0
3	010	0:38:27.978.183.265	0:0:0.000.007.408	4400	4400	88	0	0
3	011	0:38:27.978.190.672	0:0:0.000.007.407	4400	4400	88	0	0
3	012	0:38:27.978.198.080	0:0:0.000.007.408	4400	4400	88	0	0
3	013	0:38:27.978.205.487	0:0:0.000.007.407	4400	4400	88	0	0
3	014	0:38:27.978.212.895	0:0:0.000.007.408	4400	4400	88	0	0
3	015	0:38:27.978.220.302	0:0:0.000.007.407	4400	4400	88	0	0
3	016	0:38:27.978.227.710	0:0:0.000.007.407	4400	4400	88	0	0
3	017	0:38:27.978.235.117	0:0:0.000.007.408	4400	4400	88	0	0
3	018	0:38:27.978.242.525	0:0:0.000.007.407	4400	4400	88	0	0
3	019	0:38:27.978.249.932	0:0:0.000.007.408	4400	4400	88	0	0

CLOSE

You can view 4K by 2K timing data on the M42h 96G Video Analyzer/Generator.



Format	VIC	BPP	HF (kHz)	I/P	Htotal	Vtotal	Hactive	HS-F	HS-W	VActive	VS-F	VS-W	HS-P	VS-P	HToV	PF (MHz)
2160p60	97	24	135.0	P	4400	2250	3840	176	88	2160	8	44000	Pos	Pos	0	594.0

CTA Name	Frame	TimeStamp	Duration	VF Hz	HF kHz	Vtotal	Vactive	PF MHz	HS-W	VSync	Start Vid	HToV	Encr Start	Encr Len	Vfront	Vback
3840x2160p @ 59.94Hz/60Hz	0	0:38:27.928.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	1	0:38:27.944.775.858	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	2	0:38:27.961.442.525	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	3	0:38:27.978.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	4	0:38:27.994.775.858	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	5	0:38:28.011.442.525	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72
3840x2160p @ 59.94Hz/60Hz	6	0:38:28.028.109.193	0:0:0.016.666.000	60.00	135.00	2250	2160	594.000	88	10	82	0	0	0	8	72

Frame	Line	TimeStamp	Duration	HTotal	TMDS HTotal	HSync Width	HBack	HActive
3	000	0:38:27.978.109.192	0:0:0.000.007.407	4400	4400	88	0	0
3	001	0:38:27.978.116.600	0:0:0.000.007.408	4400	4400	88	0	0
3	002	0:38:27.978.124.007	0:0:0.000.007.407	4400	4400	88	0	0
3	003	0:38:27.978.131.415	0:0:0.000.007.408	4400	4400	88	0	0
3	004	0:38:27.978.138.822	0:0:0.000.007.405	4400	4400	88	0	0
3	005	0:38:27.978.146.227	0:0:0.000.007.408	4400	4400	88	0	0
3	006	0:38:27.978.153.635	0:0:0.000.007.407	4400	4400	88	0	0
3	007	0:38:27.978.161.042	0:0:0.000.007.408	4400	4400	88	0	0
3	008	0:38:27.978.168.450	0:0:0.000.007.407	4400	4400	88	0	0
3	009	0:38:27.978.175.857	0:0:0.000.007.407	4400	4400	88	0	0
3	010	0:38:27.978.183.265	0:0:0.000.007.408	4400	4400	88	0	0
3	011	0:38:27.978.190.672	0:0:0.000.007.407	4400	4400	88	0	0
3	012	0:38:27.978.198.080	0:0:0.000.007.408	4400	4400	88	0	0
3	013	0:38:27.978.205.487	0:0:0.000.007.407	4400	4400	88	0	0
3	014	0:38:27.978.212.895	0:0:0.000.007.408	4400	4400	88	0	0
3	015	0:38:27.978.220.302	0:0:0.000.007.407	4400	4400	88	0	0
3	016	0:38:27.978.227.710	0:0:0.000.007.407	4400	4400	88	0	0
3	017	0:38:27.978.235.117	0:0:0.000.007.408	4400	4400	88	0	0
3	018	0:38:27.978.242.525	0:0:0.000.007.407	4400	4400	88	0	0
3	019	0:38:27.978.249.932	0:0:0.000.007.408	4400	4400	88	0	0

9.2 Running a Video Analysis Test

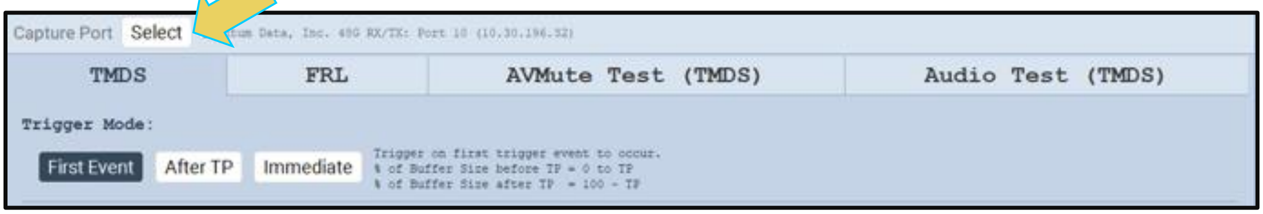
The procedures below describe how to run the video analysis test on an HDMI source device through the M42h Manager. The **Video Analysis** panel enables you to view the captured video images. It provides thumbnails of each captured frame. It also enables you to navigate to the **Decode** panel to view the transactions for that frame. The **Video Analysis** panel can synchronize with the **Decode** panel by pressing the ALT key and clicking on a frame. Once you synchronize the **Decode** panel to a frame you can view the transactions for that frame in the **Decode** panel.

The setup procedures described above in the section: Analyzing HDMI Data with your M42h Protocol Analyzer should be followed for the video analysis tests. These setup procedures are listed below:

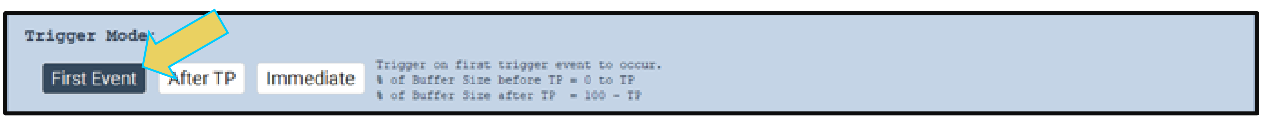
- Set the threshold of the +5V.
- Configure the M42h Rx port with the proper EDID.

To run the video analysis test:

1. Select the M42h 96G Video Analyzer/Generator that you are using to capture the data from your HDMI source device under test from the pull-down menu.



2. Set the Video Trigger mode using the information provided below. Note that typically for a Video Timing test you would select either Immediate or First Event.



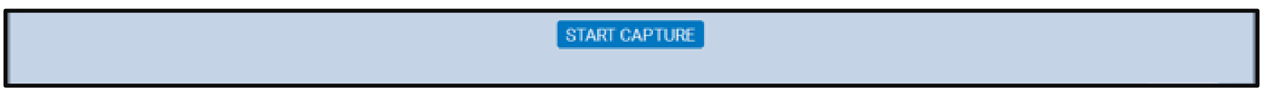
First Event – The trigger occurs on the first event—first occurrence—of the trigger condition defined in the Trigger Type pull-down menu (Vsync, Encryption Enabled, Encryption Disabled, External Trigger, Manual Trigger, TMDS Clock Change). Depending on the setting of the Trigger Position slider, you may have some of the captured data in the buffer that accumulated prior to the trigger condition and some of the captured data in the buffer that accumulated after the trigger condition. At the left most position there will be no data in the capture buffer that occurred prior to the trigger event. At the right most position, all the data in the capture buffer will be data that accumulated prior to the trigger event. Because the trigger condition could be met quite quickly, the capture buffer may not be filled to the amount specified in Buffer Size.

After TP (Trigger Position) – In this setting the trigger condition specified in the Trigger Type pull-down menu will be ignored until data has accumulated in the capture buffer up to the point where the Trigger Position slider is set. Once the data has accumulated to the setting of the Trigger Position, any event matching the Trigger Type specified will cause a trigger condition and data accumulation will begin. Some of the data in the capture buffer will be data that has accumulated prior to the trigger condition being met and some of the data in the capture buffer will be data that has accumulated after the trigger condition was met. This setting will ensure that the capture buffer is filled to the Buffer Size setting.

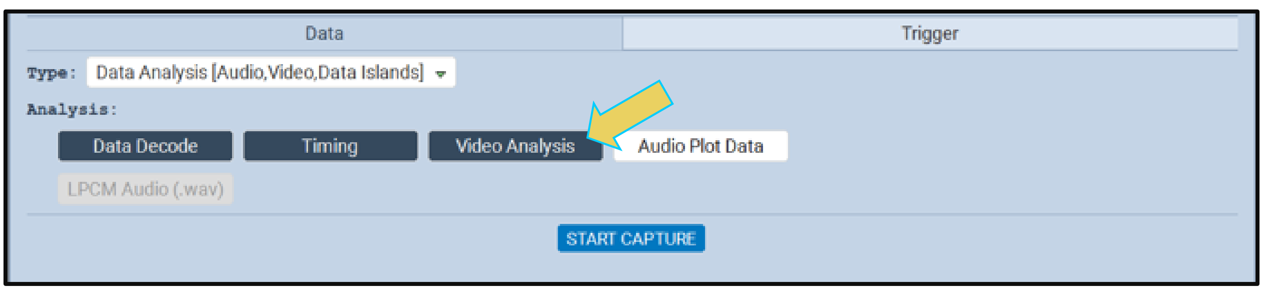
Immediate – Data capture begins accumulating immediately when the Start Capture button is activated. Data capture halts when buffer is filled. This setting will not provide any capture history, i.e. none of the captured data accumulated in the capture buffer will be data that occurred prior to the capture trigger event (activating the Start Capture button).

3. Set the **Buffer Size** slider to a percent value to meet your requirements. You can capture up to about 4GB of data which is about 2300 frames at 576p/480p and about 400 frames at 1080p which includes the video. If you do not want to capture the video and only capture the metadata, you can store well over 200,000 frames of data.

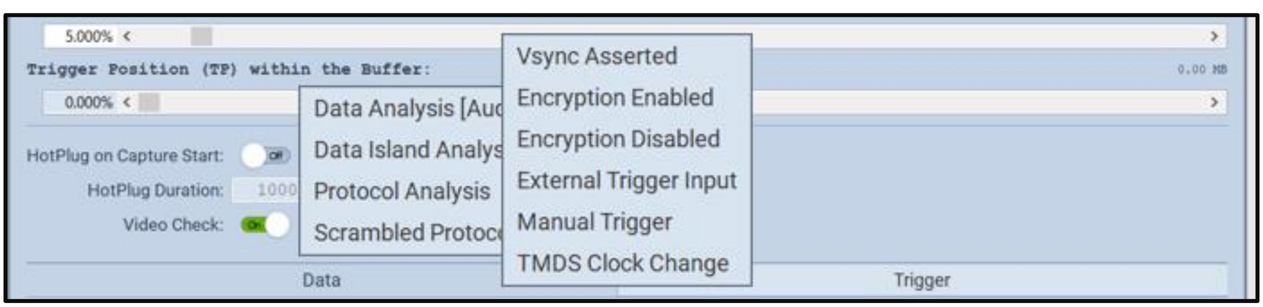
4. Set the **Capture Buffer Position** slider to a percent value to meet your requirements. This slider enables you to set the position of the trigger event within the captured data. This is a slider that provides an indication (on the right) of the location within the captured data, expressed as a percent with 0% indicating that the trigger event occurs at the beginning of the captured data and 100% indicating that the trigger event occurs at the end of the captured data.
5. Select the **Capture** tab under the **Options** section of the **Capture Control** panel.



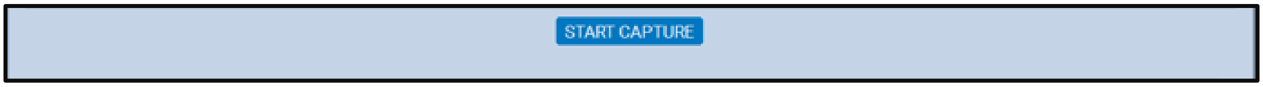
6. Select Data Analysis (Audio, Video, Data Islands) in the **Data Selection** Type pull-down menu provided as shown below. Then make sure you select **Video Analysis**.



7. Select Vsync Asserted for the **Trigger Selection** condition.

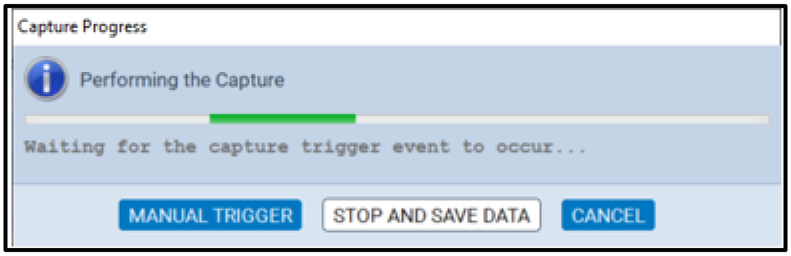


8. Click on the **Start Capture** button to initiate the test.

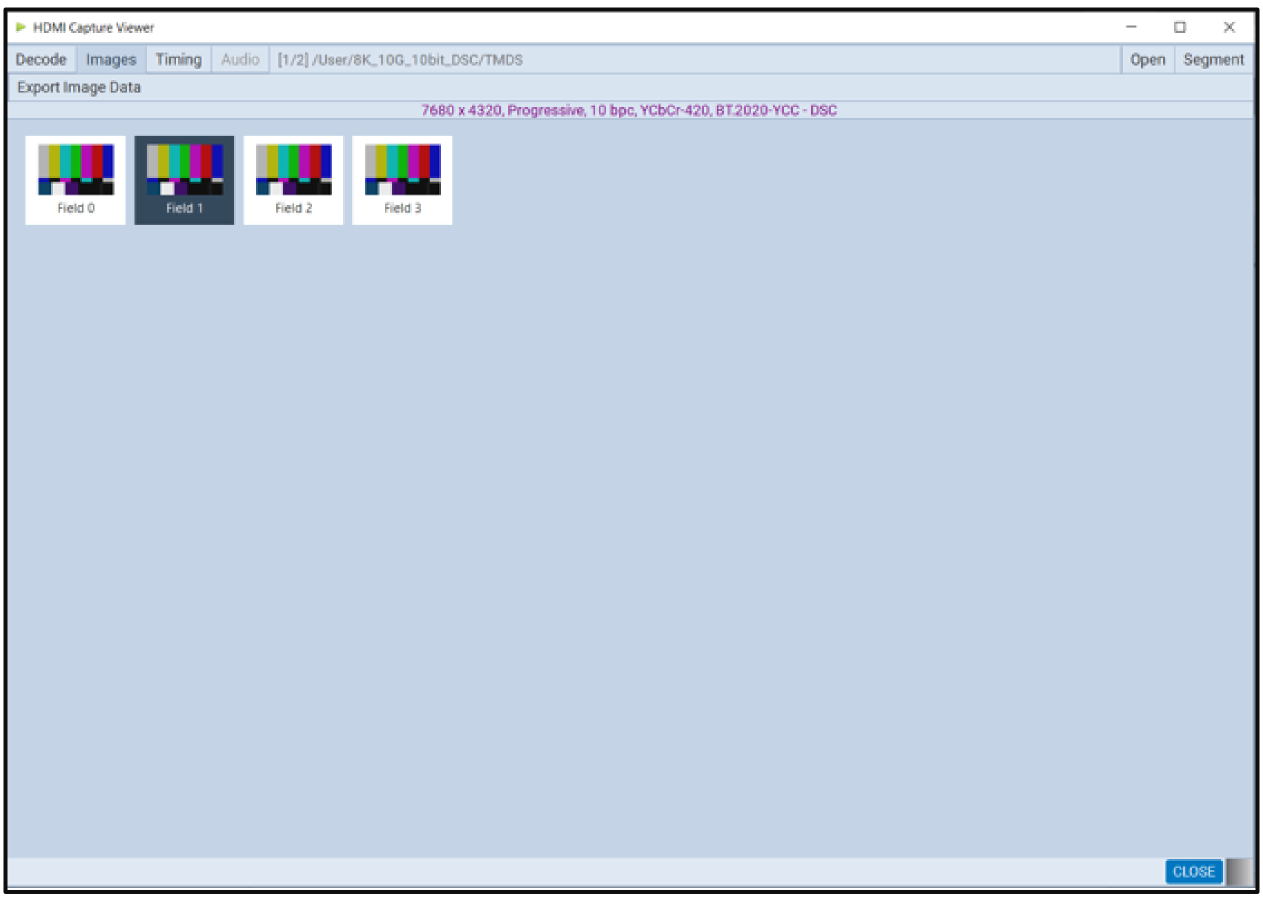


The M42h 96G Video Analyzer/Generator will capture the data including the video data. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

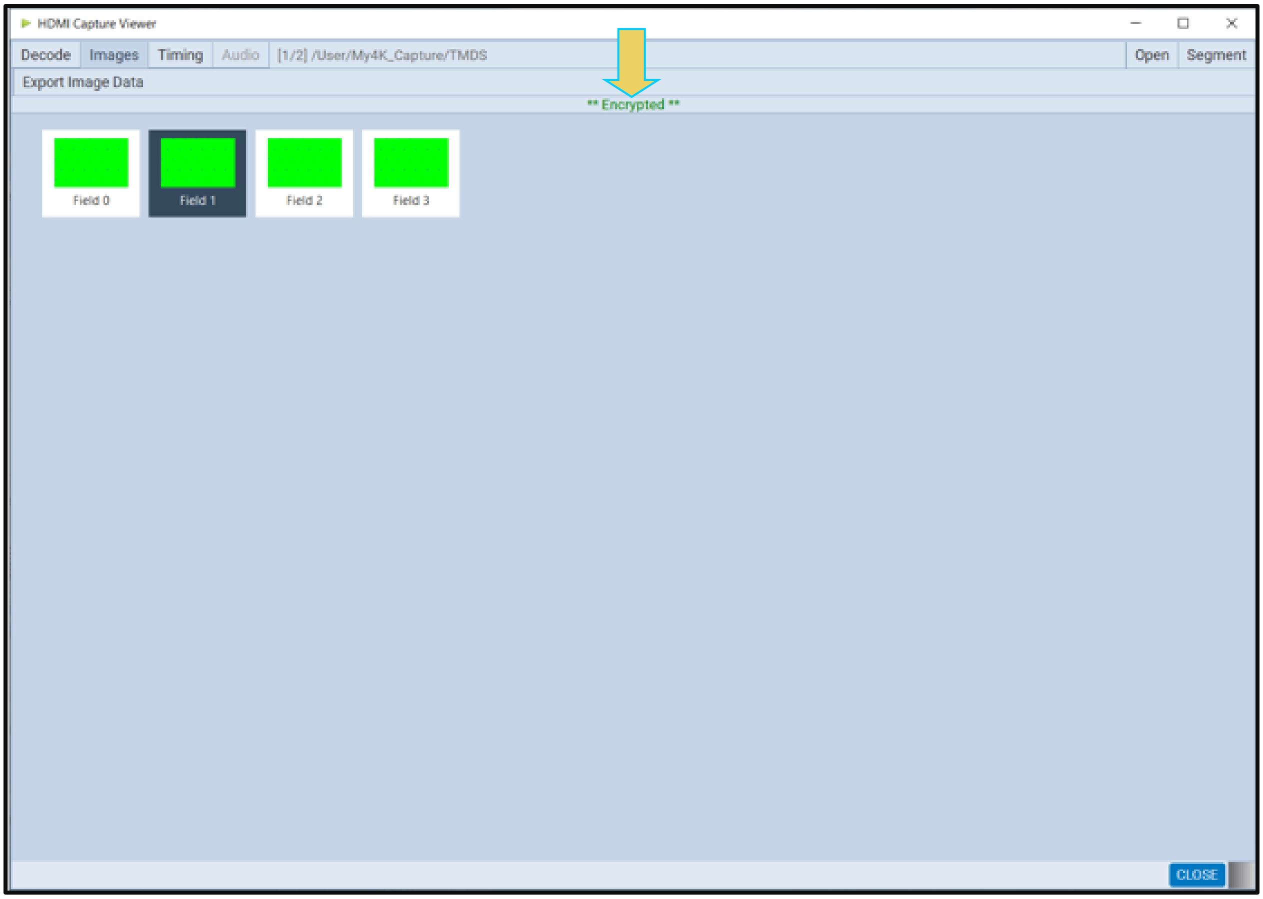
Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will indicate that. This is shown in the following screen shot.



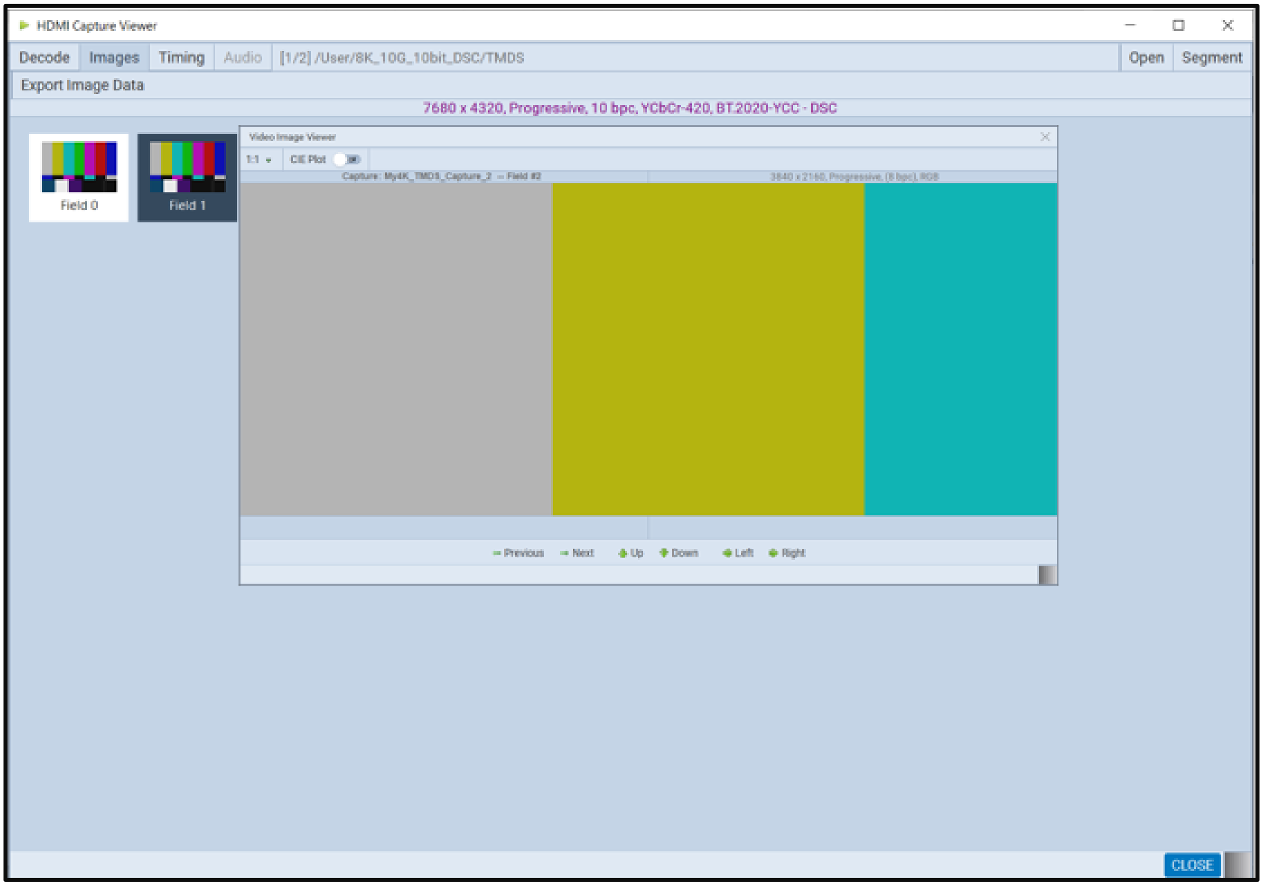
When the M42h 96G Video Analyzer/Generator is finished capturing data you can view the video thumbnails in the **Video Analysis** panel. The **Video Analysis** panel enables you to view the captured video images. It provides thumbnails of each captured frame.



Note: You cannot view video frames of video that is encrypted with HDCP. The **Video Analysis** will show green thumbnails and the word "Encrypted" will be shown on the panel as shown below.

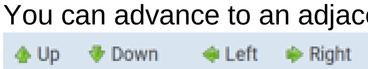

HDMI Capture Viewer
Decode
Images
Timing
Audio
[1/2] /User/My4K_Capture/TMDS
Open
Segment
Export Image Data
** Encrypted **
Field 0
Field 1
Field 2
Field 3
CLOSE

9. View the pixel values of any frame by double-clicking on any frame to open the **Video Image Viewer** panel (shown below).

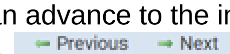


The **Video Analysis** panel enables you to view the video pattern or content for a frame in full size by simply double-clicking on a frame. Once you have activated the full view of a frame in the **Video Image Viewer** panel you can view the pixel values for any pixel by moving your mouse over the pattern.

You can view the pixel value by clicking on an area on the image (Marker) and/or by moving the mouse cursor over the image (Cursor). In the example below the Cursor is over pixel (x=684, y=223) and the Marker is set on pixel (x=380, y=198). If the color space is YCbCr the Video Image Viewer will show these values and indicate the color space. Deep color values are also shown in either YCbCr or RGB color space.

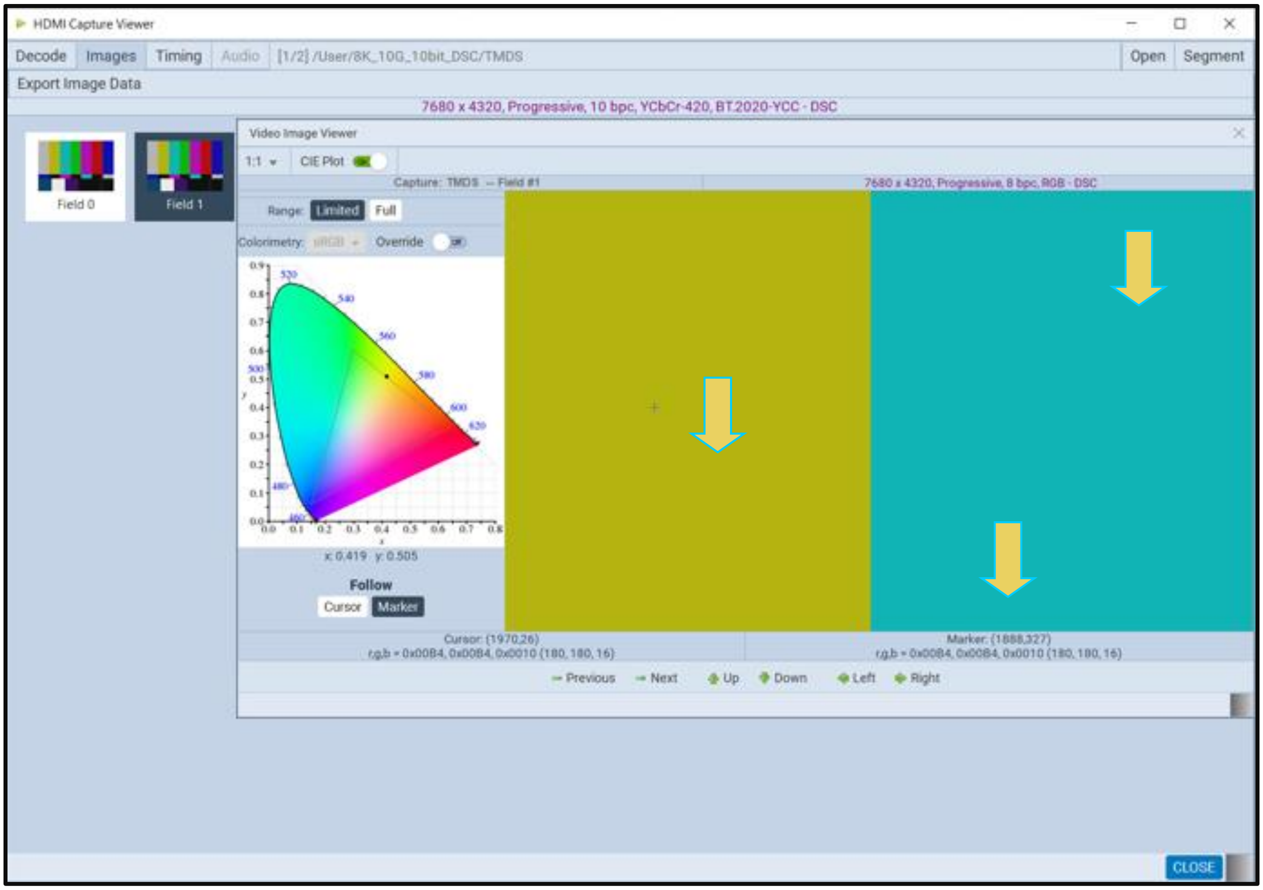
You can advance to an adjacent pixel (up/down or left/right) using the green arrow buttons on 

the bottom of the **Video Image Viewer** panel.

You can advance to the image of an adjacent frame (previous or next) using the thin green arrow buttons 

on the bottom of the **Video Image Viewer** panel.

These are shown in the screen image below.


HDMI Capture Viewer
Decode
Images
Timing
Audio
[1/2] /User/8K_10G_10bit_DSC/TMDS
Open
Segment
Export Image Data
7680 x 4320, Progressive, 10 bpc, YCbCr-420, BT.2020-YCC - DSC
Field 0
Field 1
Video Image Viewer
1:1
CIE Plot
Capture: TMDS -- Field #1
7680 x 4320, Progressive, 8 bpc, RGB - DSC
Range:
Limited
Full
Colorimetry:
Override
x: 0.419 y: 0.505
Follow
Cursor
Marker
Cursor: (1970,26)
r,g,b = 0x00B4, 0x00B4, 0x0010 (180, 180, 16)
Marker: (1888,327)
r,g,b = 0x00B4, 0x00B4, 0x0010 (180, 180, 16)
Previous
Next
Up
Down
Left
Right
CLOSE

1. Navigate to the **Decode** panel by first synchronizing the **Decode Panel** to the **Video Analysis** panel and then activating the **Decode** panel. The **Video Analysis** panel is shown in the screen image below.

The **Video Analysis** panel can synchronize with the **Decode** panel by pressing the ALT key and clicking on a frame.

9.3 Audio Analysis

The **Audio (Data) Analysis** feature enables you to detect inconsistencies in the metadata relating to the sampling rate and the audio clock regeneration values. The following items are listed and/or verified during the test:

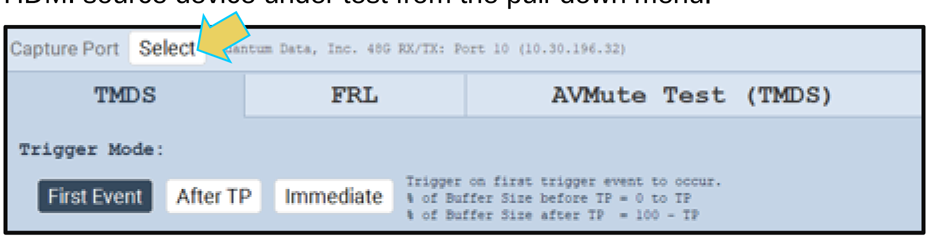
- Sampling rate shown in the Audio InfoFrame.
- Sampling size (bit depth) in the Audio InfoFrame.
- Channel count in the Audio InfoFrame.
- N and CTS values in the Audio Clock Regeneration packets.
- Audio type listed in the Channel Status Blocks.
- Sampling frequency in the Channel Status Blocks.
- Original sampling frequency listed in the Channel Status Blocks.
- Channel count listed in the Channel Status Blocks.
- Sampling rate calculated from the audio samples.
- Rate that the ACR packets are transmitted.

The setup procedures described above in the section: Analyzing HDMI Data with your M42h Protocol Analyzer should be followed for the audio analysis tests. These setup procedures are listed below:

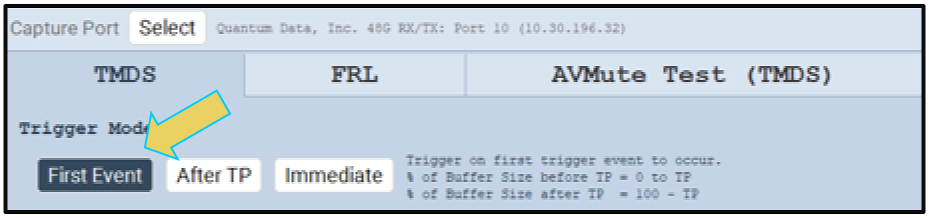
- Set the threshold of the +5V.
- Configure the M42h 96G Video Analyzer/Generator Rx port with the proper EDID.

To run the audio analysis test:

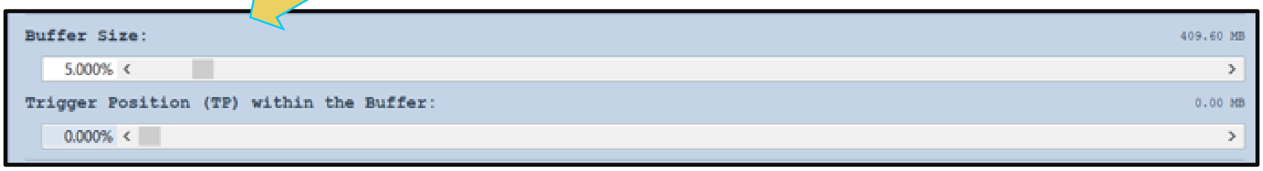
1. Select the M42h 96G Video Analyzer/Generator that you are using to capture the data from your HDMI source device under test from the pull-down menu.



2. Set the Video Trigger mode using the information provided below. Note that typically for the Audio test you would select First Event.

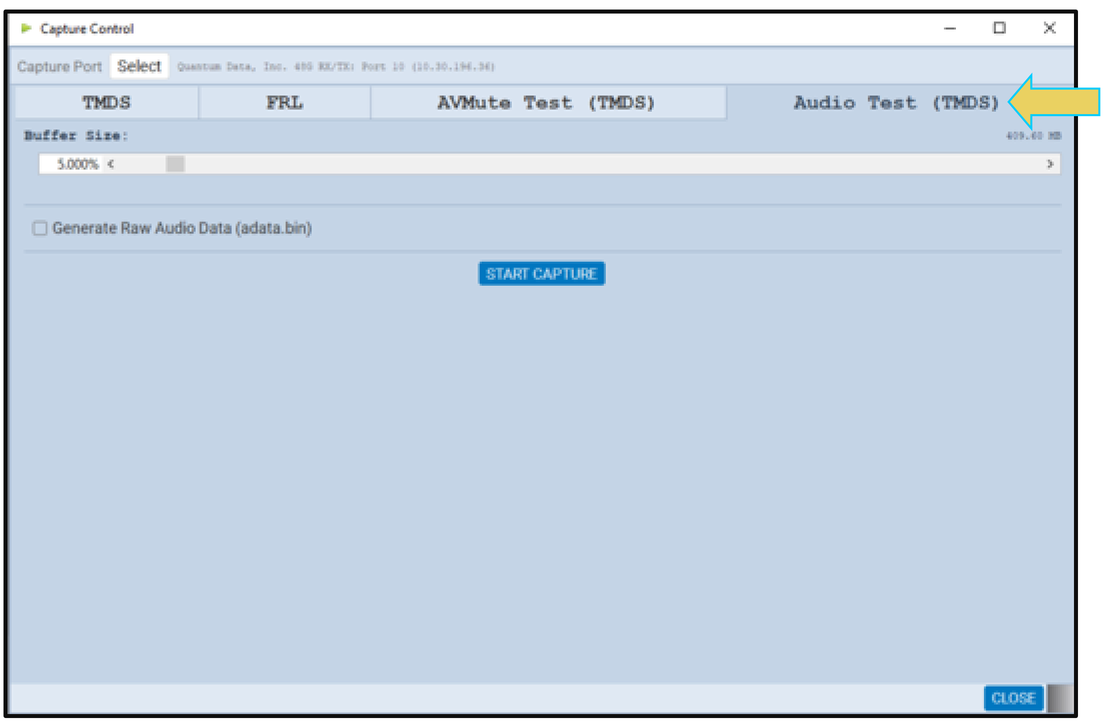


3. Set the **Buffer Size** slider to a percent value to meet your requirements. You can capture up to 4GB of data which is about 2300 frames at 576p/480p and about 400 frames at 1080p which includes the video. If you do not want to capture the video and only capture the metadata, you can store well over 200,000 frames of data.



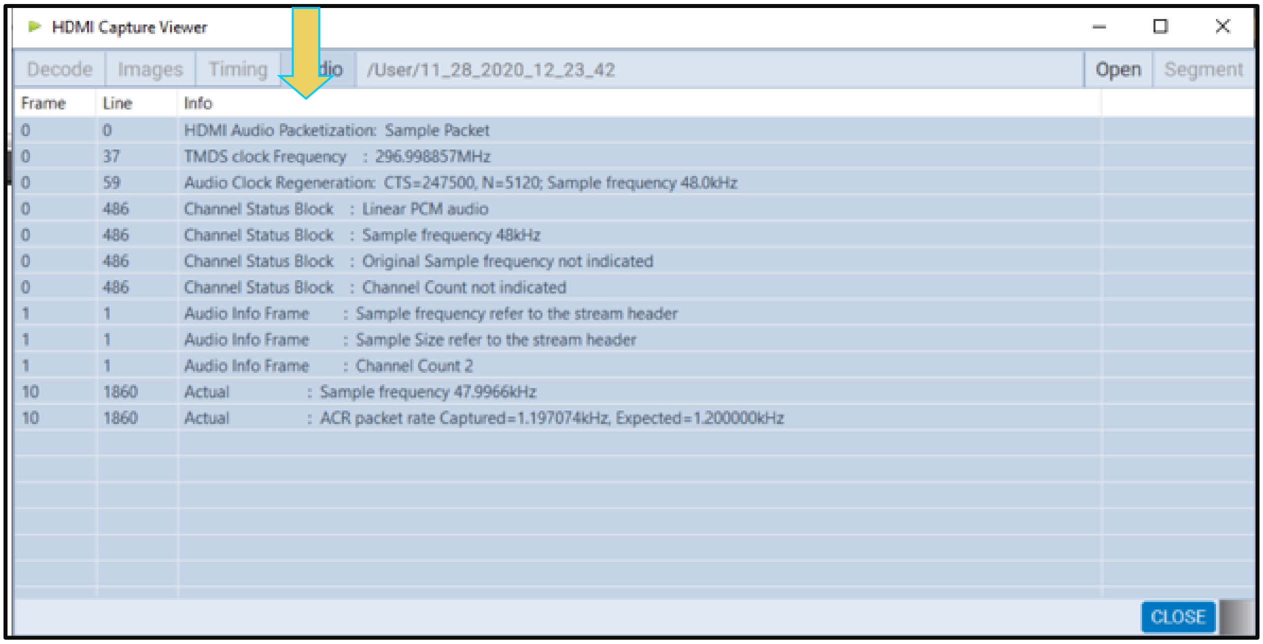
Note: You do not need to set the **Trigger Position** or the **Trigger Selection** when running the **Audio Analysis** test. The Trigger Position is always reset to 0% and the **Trigger Selection** is set to Vsync. These settings occur as part of the test when you initiate the test.

4. Select the **Std Tests** tab under the **Options** section of the **Capture Control** panel (below).



5. Click on the Audio Test to initiate the Audio Analysis test.

The results are shown in the **Data Analysis** panel in the main window of the M42h Manager. A sample is shown below.


HDMI Capture Viewer
Decode
Images
Timing
dio
/User/11_28_2020_12_23_42
Open
Segment
Frame
Line
Info
0 0 HDMI Audio Packetization: Sample Packet
0 37 TMDS clock Frequency : 296.998857MHz
0 59 Audio Clock Regeneration: CTS=247500, N=5120; Sample frequency 48.0kHz
0 486 Channel Status Block : Linear PCM audio
0 486 Channel Status Block : Sample frequency 48kHz
0 486 Channel Status Block : Original Sample frequency not indicated
0 486 Channel Status Block : Channel Count not indicated
1 1 Audio Info Frame : Sample frequency refer to the stream header
1 1 Audio Info Frame : Sample Size refer to the stream header
1 1 Audio Info Frame : Channel Count 2
10 1860 Actual : Sample frequency 47.9966kHz
10 1860 Actual : ACR packet rate Captured=1.197074kHz, Expected=1.200000kHz
CLOSE

10 Enhanced Audio Return Channel (eARC) Functional Testing

This Section provides information and procedures about testing eARC Tx and eARC Rx devices. This Section does not provide procedures for running eARC compliance tests. Compliance tests are provided in the HDMI® Forum MOIs.

10.1 EARC Tx Functional Testing

This subsection provides procedures on testing eARC Tx devices. The M42h 96G Video Analyzer/Generator provides eARC Rx emulation and diagnostic testing to run functional verification tests on eARC Tx devices such as eARC capable UHD TVs. You can monitor the Common mode transactions and view the audio metadata status. You can also extract the 2 Channel LPCM or

Digital audio out the SPDIF port on the M42h for audible monitoring.

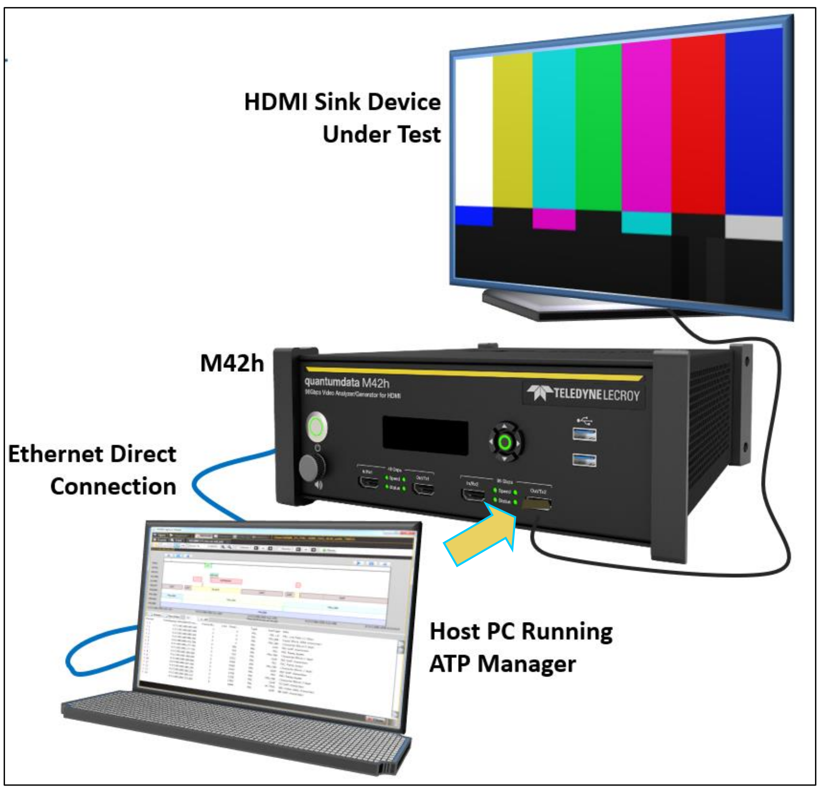
To view the incoming audio metadata over the eARC channel:

1. Establish the physical connection from the eARC Rx DUT to the M42h 96G Video Analyzer/Generator's HDMI Output port.

Prior to making the physical connection, you can initiate the Aux Channel Analyzer utility to monitor the eARC Common mode transactions. See the subsection below.

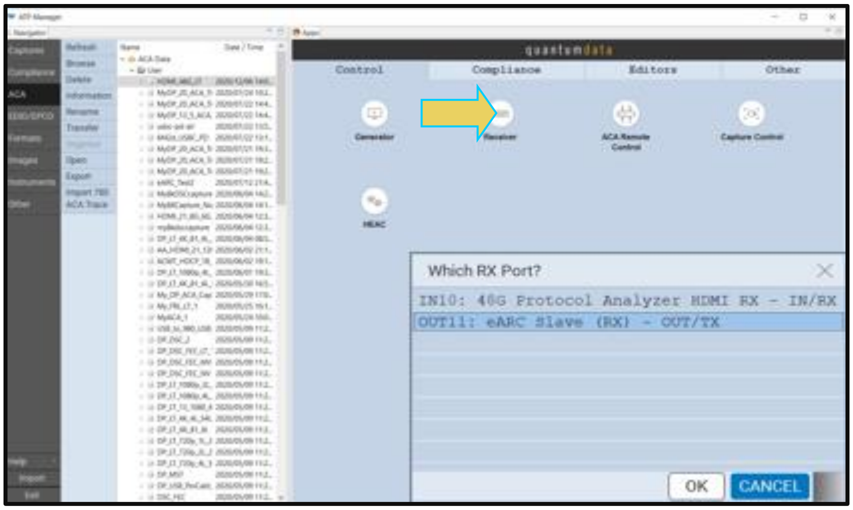
The test setup is shown below. The eARC Tx device is connected via a suitable eARC capable HDMI cable to the M42h 96G's Output port as shown below.

The test setup is depicted below.



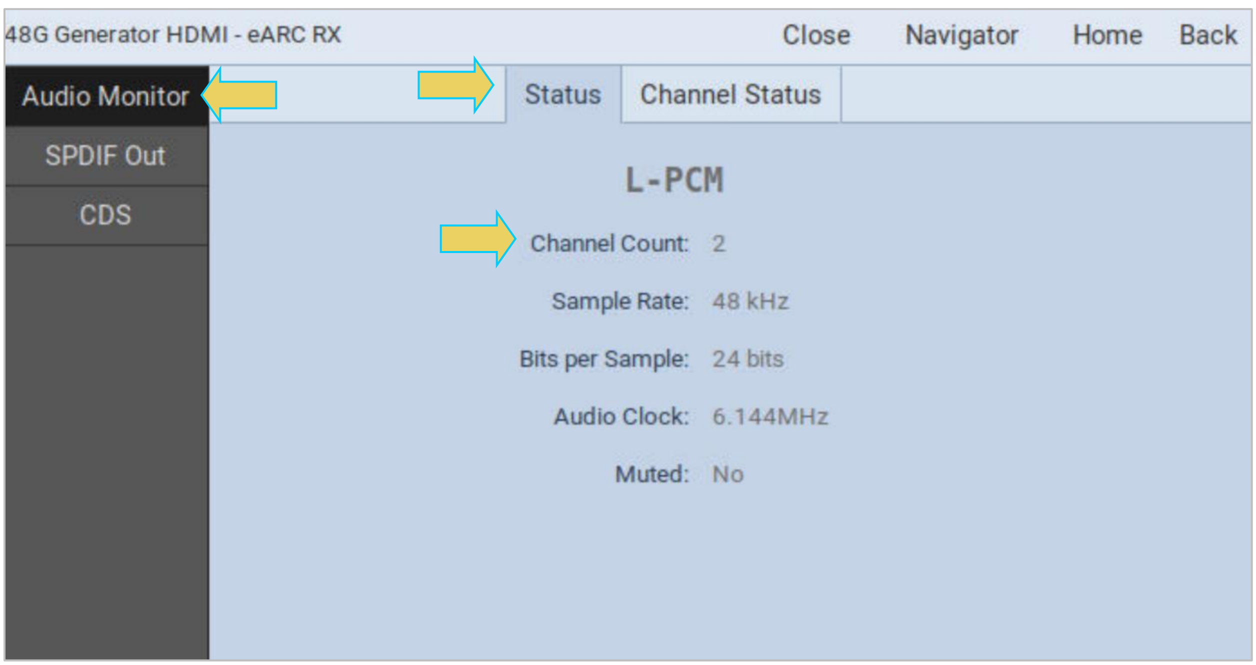
Setup for Testing eARC Tx devices

1. Access **Receiver** from the **Card Control** panel as shown below.



The **Which RX Port** dialog will appear as shown above.

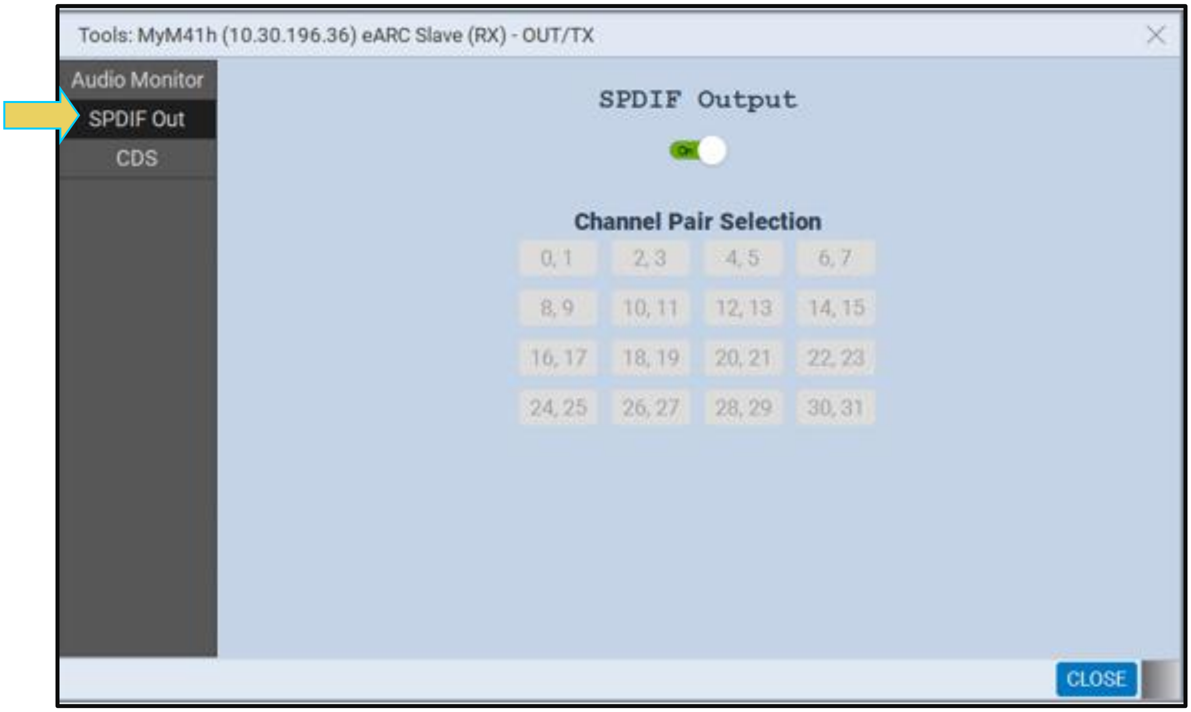
2. Select the **Audio Monitor** button and view the Status of incoming audio metadata.



To eject the LPCM or Dolby Digital eARC audio out the SPDIF out port on the M42h. You can use a SPDIF analyzer to verify the LPCM audio. Use the setup below.

The SPDIF port is on the back of the M42h and identified in the illustration below.

Then select the SPDIF Out button on the eARC Slave Control panel as shown below.



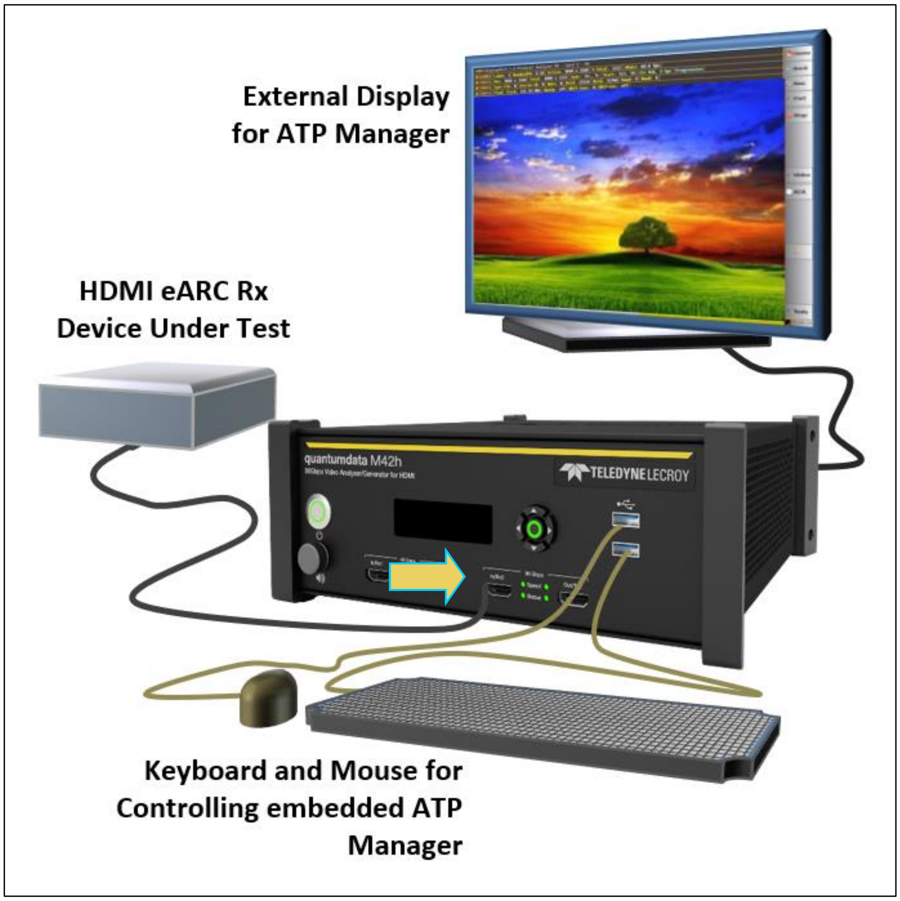
10.2 EARC Rx Functional Testing

This subsection provides procedures on testing eARC Rx devices. The M42h 96G Video Analyzer/Generator emulates an eARC Tx device. The function will invoke the Common mode commands to establish an eARC connection. You can monitor the Common mode channel transactions using the Aux Channel Analyzer (ACA) utility. Procedures for this are provided in the next subsection. You can then select from LPCM or compressed audio formats for transmission over the Differential mode channel. You can select between the Multi-Channel or 2 channel audio layout and mute the audio stream.

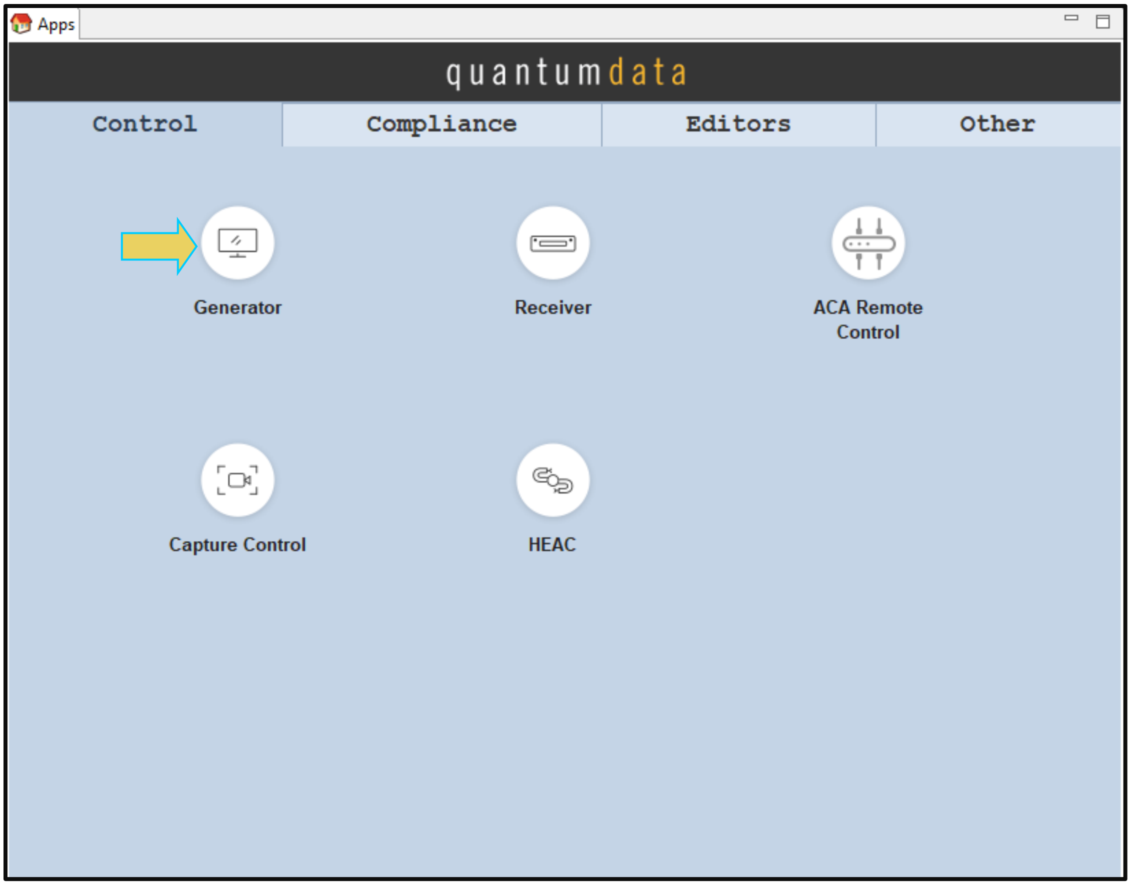
Use the procedures below to transmit eARC audio to test an eARC Rx device.

1. Establish the physical connection from the eARC Rx DUT to the M42h 96G Video Analyzer/Generator’s HDMI Input port.
2. Prior to making the physical connection, you can initiate the Aux Channel Analyzer utility to monitor the eARC Common mode transactions. See the subsection below.

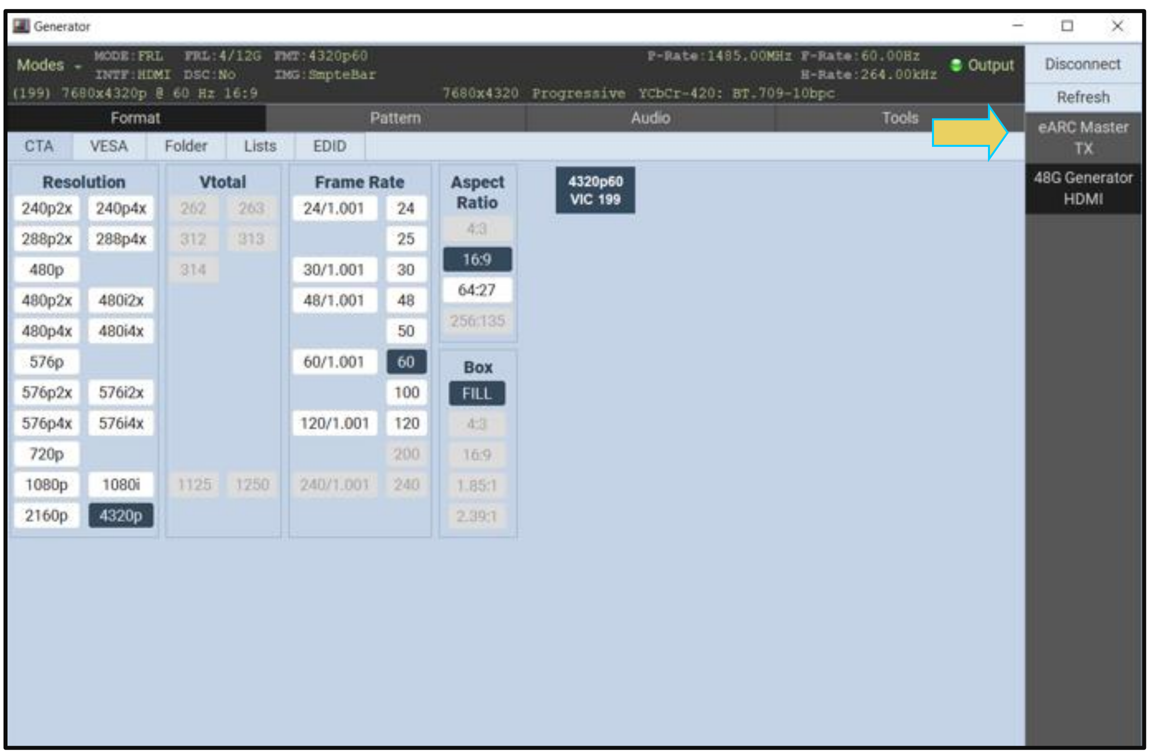
The test setup is shown below. The eARC Rx device is connected via a suitable eARC capable HDMI cable to the M42h 96G's Input port as shown below.



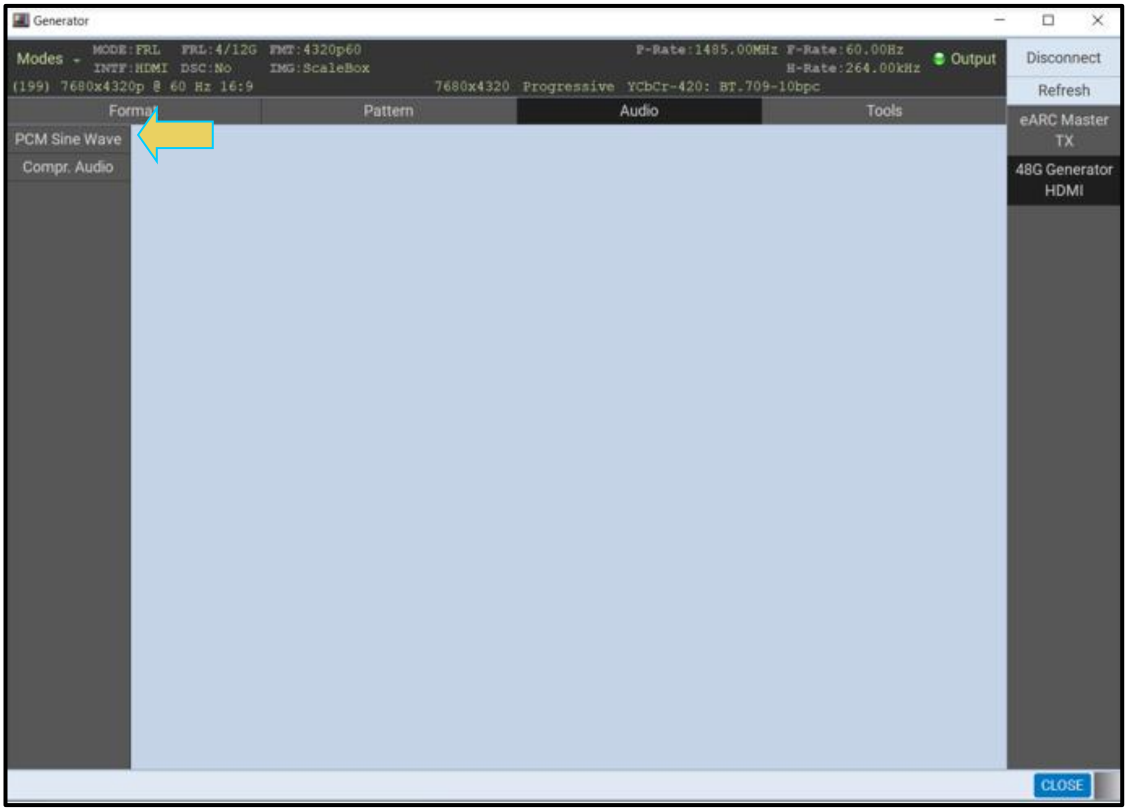
Setup for Testing eARC Rx devices



3. Click on the Generator and select eARC Tx Master as shown below.

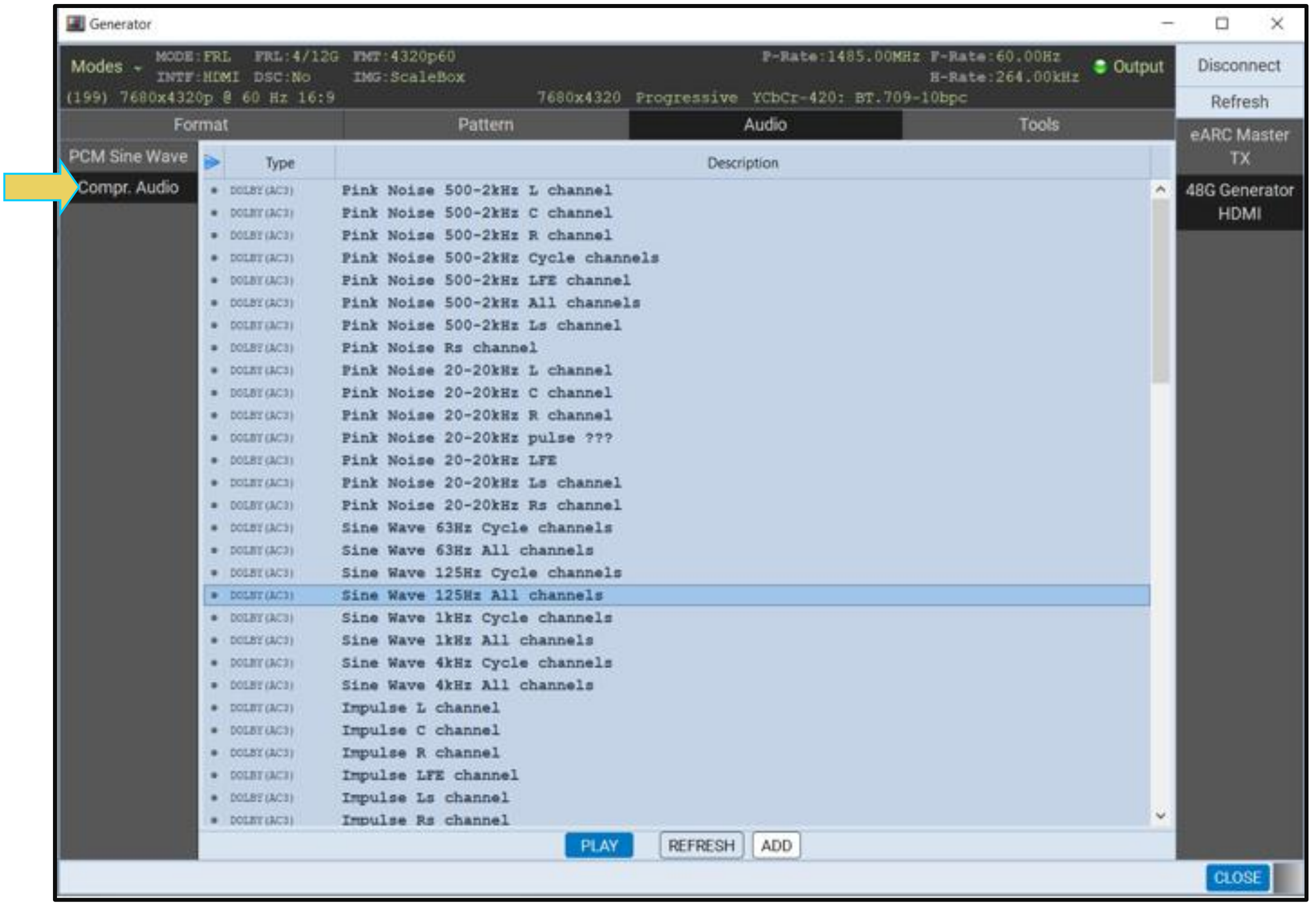


4. Click on the PCM Sine Wave button to select the LPCM audio to transmit out the eARC Differential mode channel.

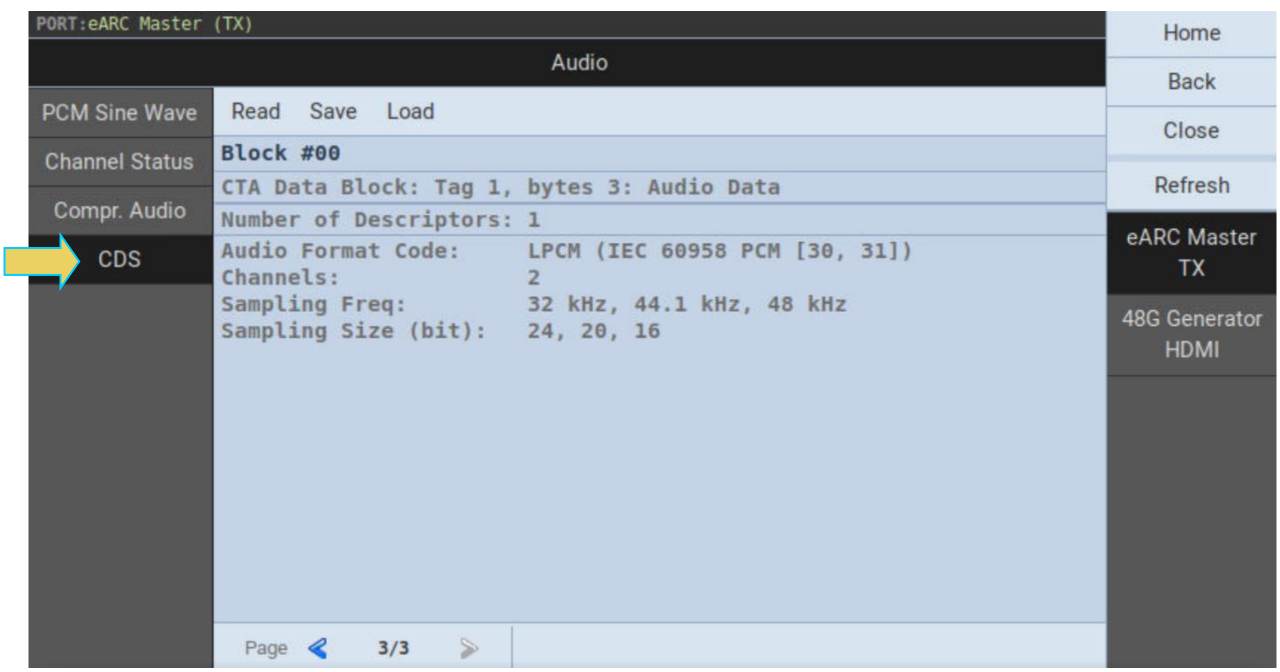


You can select the number of channels, sampling rate, bits per sample from the pull-down menus. You can also mute selected channels and set their amplitude. Refer to the screen examples below.

You can also transmit compressed audio files, but Dolby and DTS formats, out the eARC channel.



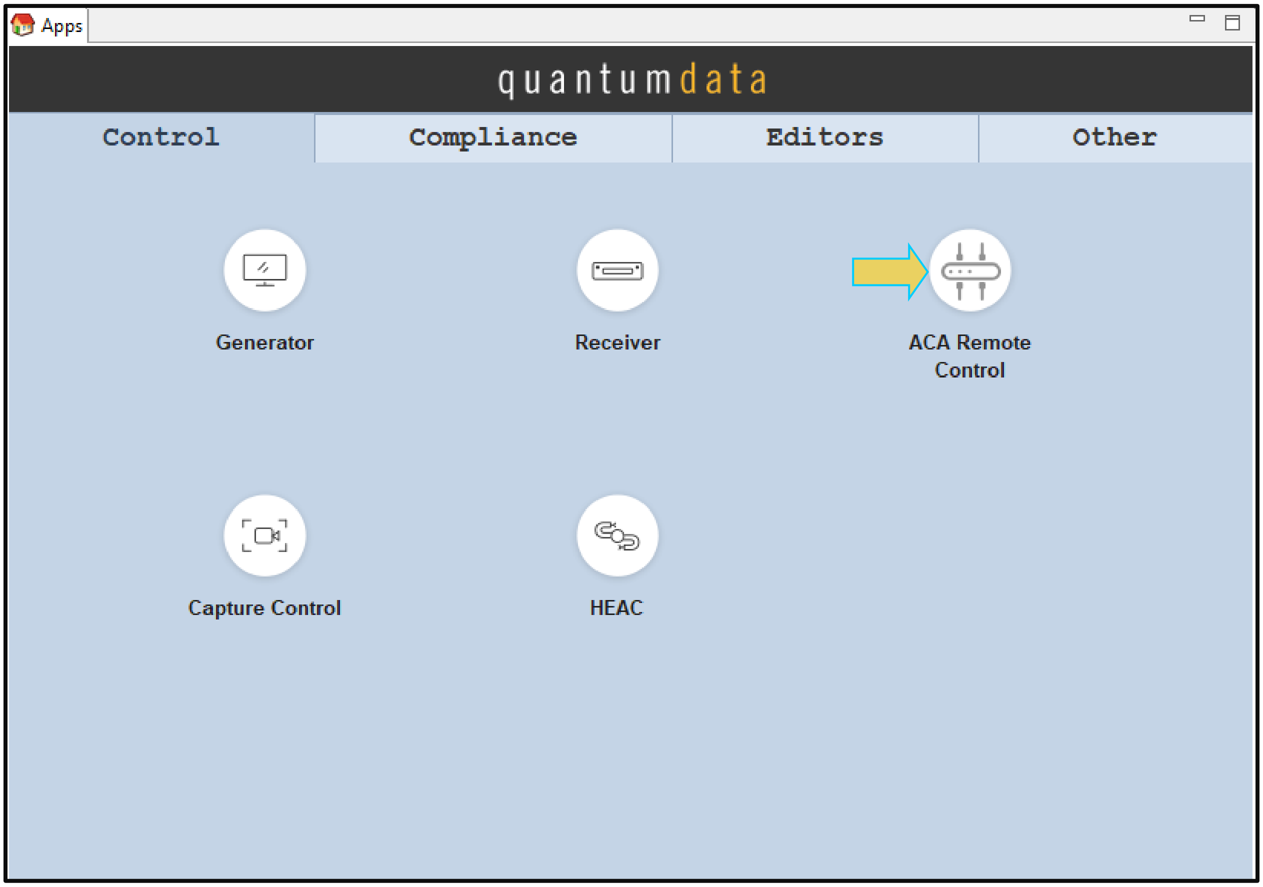
5. View the Capabilities Data Structure (CDS) of the connected eARC Rx device. The CDS shows the audio capabilities of the eARC Rx device.



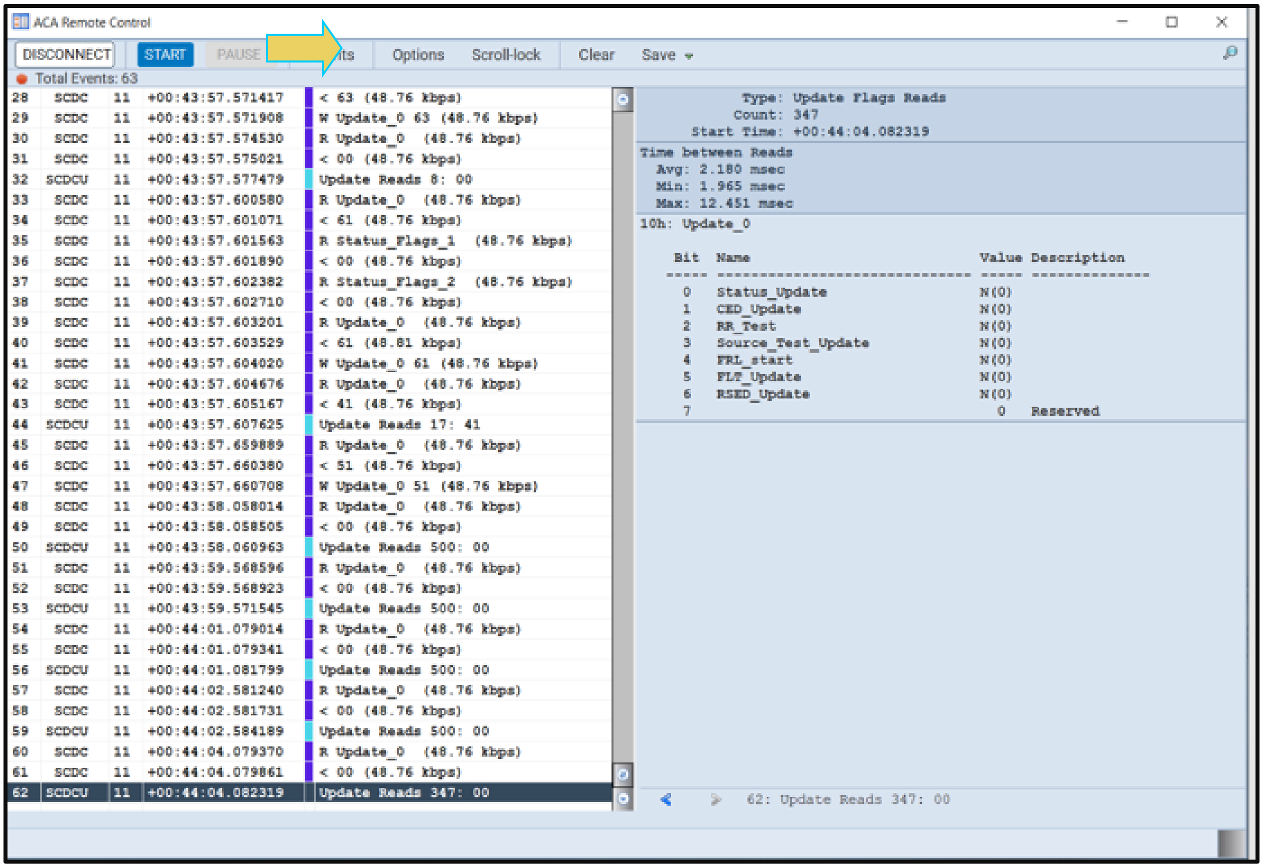
10.3 Monitoring the EARC Common Mode Transactions

The eARC common mode transactions can monitor using the Aux Channel Analyzer (ACA) utility. The procedures for using the Aux Channel Analyzer are provided in the Section that follows. The screen shows an example of the Common mode transactions viewed in the Aux Channel Analyzer.

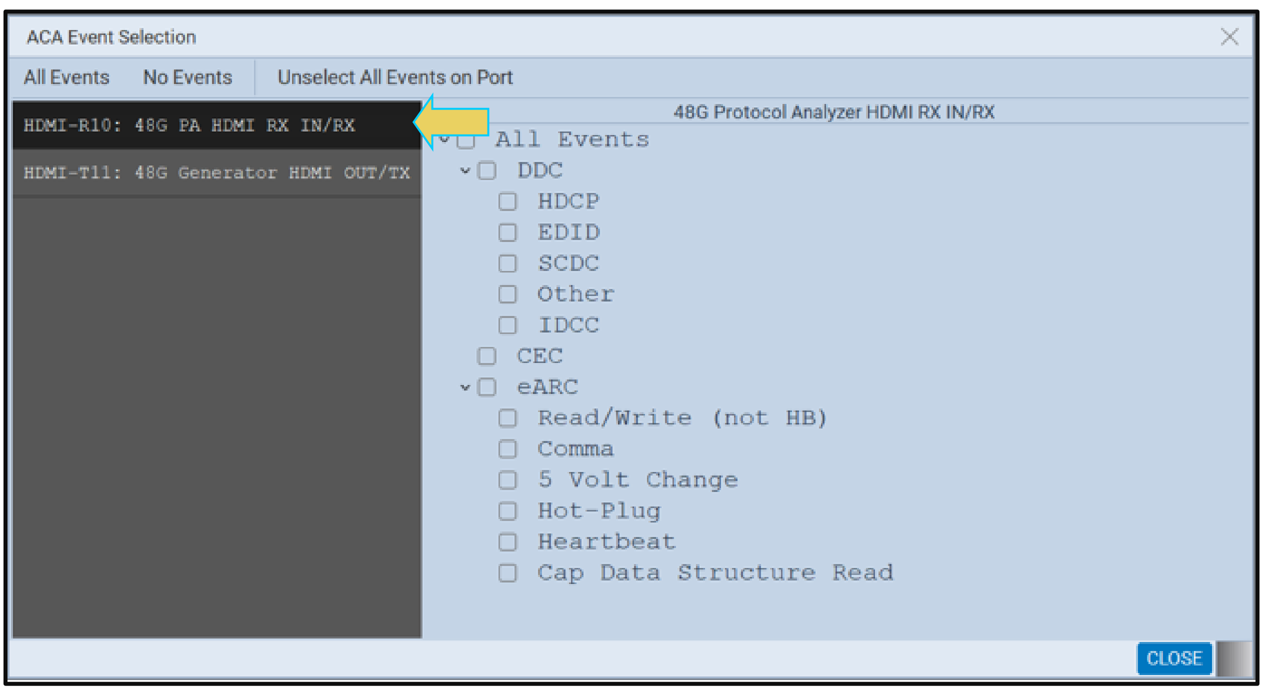
1. Access the ACA utility either through the embedded GUI or the remote GUI (shown below).

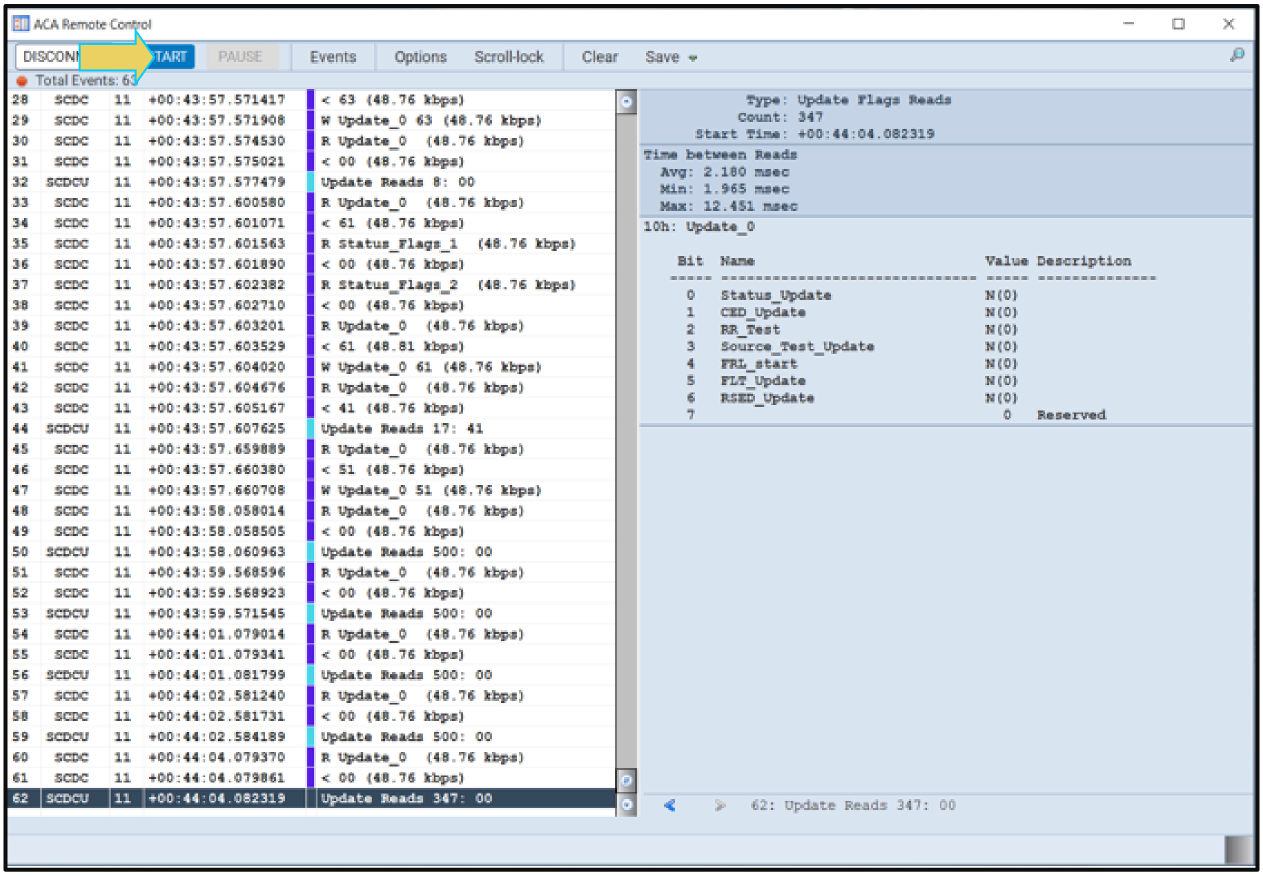


2. Access the **Event Selection** panel.

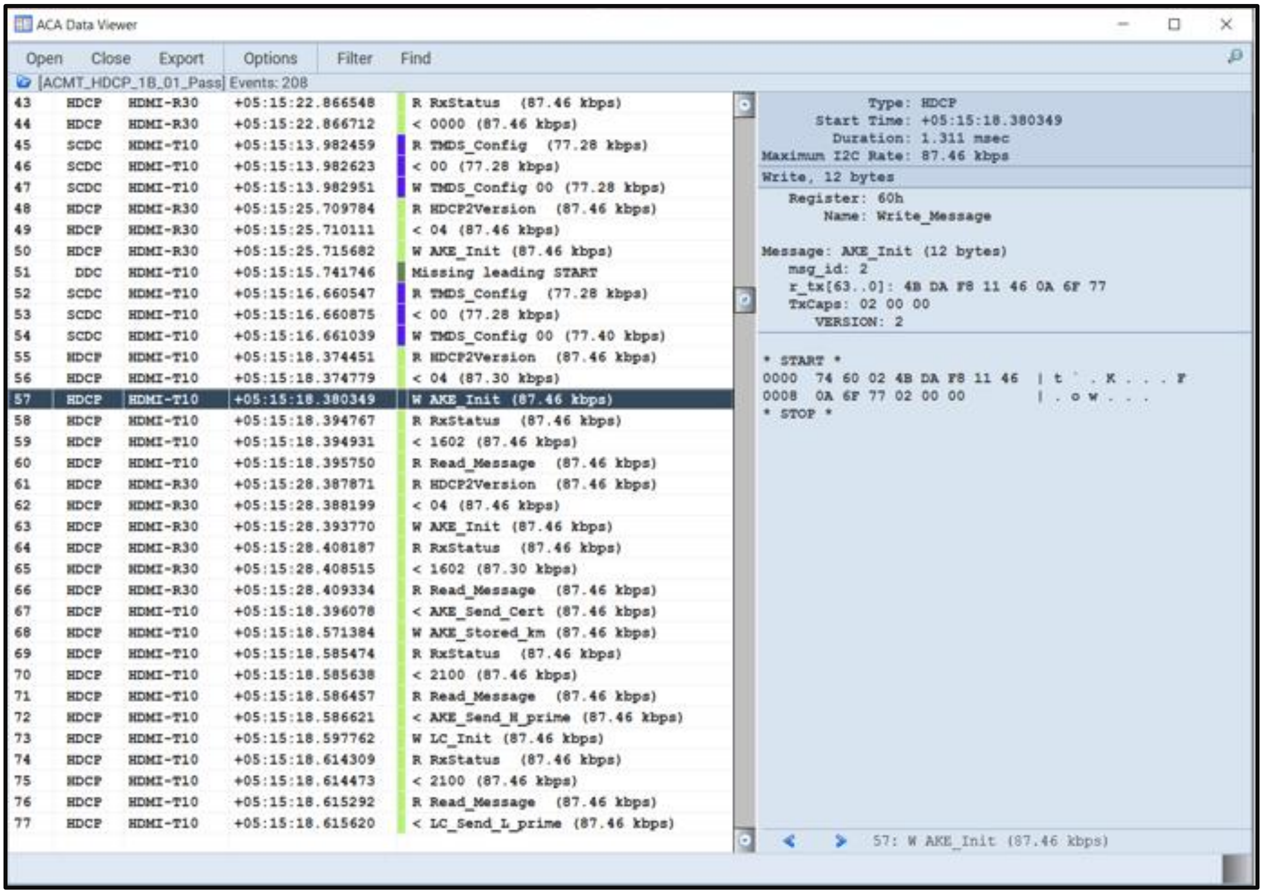


3. Select the eARC elements from the **Event Selection** panel.





You will then see the eARC Common mode transactions in the ACA window.



Refer to the ACA Section below for more details on using the ACA utility.

11 Auxiliary Channel Analyzer (ACA)

The Auxiliary Channel Analyzer **(ACA)** utilities enable you to view the DDC channel traffic for HDMI® streams in real time or from stored real time log files. You can view the HDCP authentication transactions, EDID exchanges, SCDC transactions for FRL link training and CEC messages in real time with the ACA either through the embedded M42h GUI or the external ATP Manager application running on a host PC. You can view the transactions between the M42h 96G Video Analyzer/Generator receiver port and a connected HDMI source device or you can monitor the auxiliary channel passively between an HDMI source and sink device.

There are three (3) Auxiliary Channel Analyzer utilities:

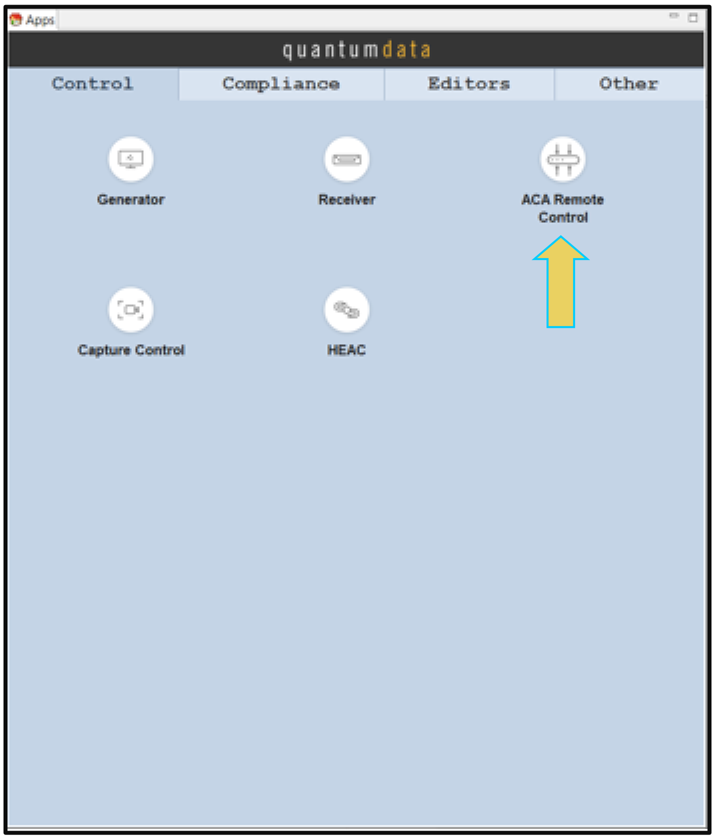
- Auxiliary Channel Analyzer ("ACA") – Used for real time viewing auxiliary channel HDMI DDC channel data through the *embedded* ATP Manager. You can also open existing ACA trace files stored on the M42h Instrument.
- ACA Remote Control - Used for viewing auxiliary channel HDMI DDC channel data through the *external* ATP Manager. This application operates in sync with the Aux Channel Analyzer on the embedded display.
- ACA Data Viewer - Used for viewing previously captured auxiliary channel data. You can view these saved ACA traces and disseminate them to colleagues at other locations. These colleagues can then use the ACA Data Viewer utility off-line without an M42h test instrument to view these transactions.

11.1 Aux Channel Analyzer (ACA) – For Real Time Viewing of Auxiliary Channel Data

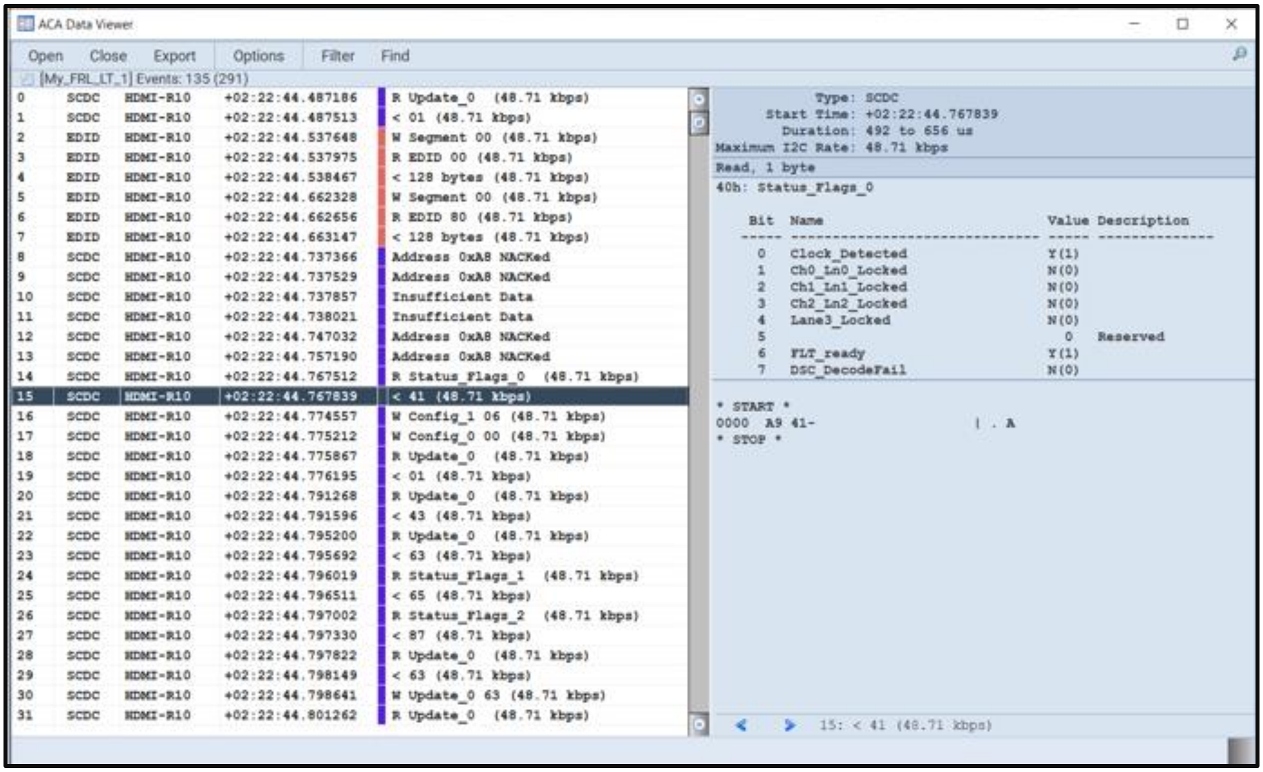
This subsection describes the **Aux Channel Analyzer** utility used for viewing the real time auxiliary channel data through the *embedded* ATP Manager.

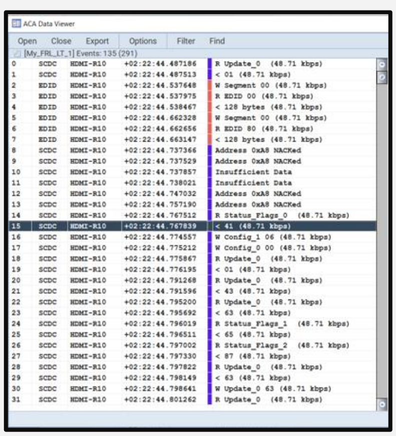
11.1.1 Aux Channel Analyzer (ACA) – Panel Description

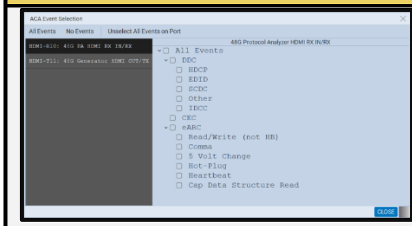
The Aux Channel Analyzer panel is described in the table below. There is a control menu panel on the right side. The control menu and elements of the ACA panel are described in the following table.

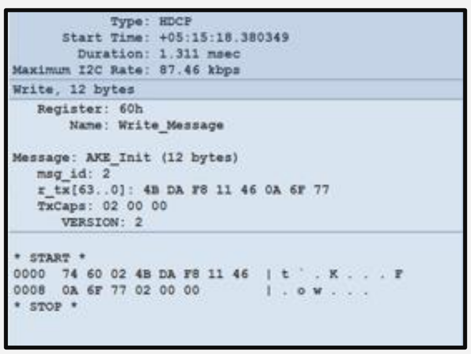


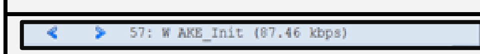
The following is an example of a populated ACA window.



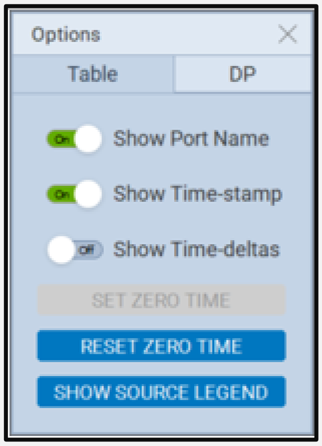
Real Time – ACA	Information / Function
Aux Channel Analyzer (ACA) **ACA Trace Panel** FRL Link Training Transaction Example 	The following information is provided in the ACA data dialog box for each Event: **Item number** – This is a unique sequence number of the transaction. **Type** – There are various types of data that can be monitored on the HDMI interfaces: EDID, HDCP and CEC messaging. **M42h Port number, slot number**. **Time stamp** (optional viewing field) – Shows the timestamp of each transaction. Can either be absolute time based (shown) on the M42h system clock or relative time (Time -deltas) referenced from the initial transaction in the trace. **Transaction Description** – A description of the transaction.
ACA Control Menu **ACA Event Selection**	There is a menu associated with the ACA Info panel. It is location on the right side of the panel. The ACA pull-down menu provides the following functions: **Home** – Navigates you back to the Home menu screen of the embedded ATP Manager.

<table>
<tr><th>Real Time – ACA</th><th>Information / Function</th></tr>
<tr><td>


</td><td>
Back – Navigates back to the previous screen in the Real Time mode.
Nav – Takes you to the Navigation window.
Close – Closes out the ACA application.
Start/Stop – Starts and Stops the collection of DDC data.
Resume/Pause – Halts the updates of the data to the ACA panel to view traces and allows you to resume.
Events – Opens up the ACA Event Selection window (below left) enabling you to specify the port that you wish to collect trace data from. Also selects which events you wish to collect. Use the check boxes to select which event you wish to collect or collect All Events.
Options – Opens up a flyout menu described below-left.
Data – Opens up flyout menu with the following options (described below).
Clear – Clears the ACA Trace Panel.
Open – Opens an existing trace file stored on the M42h.
Save – Saves a current trace file to the M42h file system.
</td></tr>
<tr><td>


</td><td>
The following information is provided in the ACA Event Details dialog box. Two examples are shown on the left. One for HDCP transactions and another for Link Training transactions:
Type – There are various types of data that can be monitored on the HDMI interfaces: EDID, HDCP and CEC messages.
Start Time – This start time of the transaction in microseconds from a reference time determined when the capture of real time data began.
Note: The information in the Details panel will vary depending on the type of log record that is selected.
Duration – The duration in milliseconds of the transaction.
Direction – The direction of the transaction either a request or a reply.
Maximum I2C Rate – The rate that the I2C channel clock is operating.
Details (text) – The contents of the transaction in human readable text.
Details (hex) – The contents of the transaction in hex data.
</td></tr>
<tr><td>


</td><td>
There are some control arrows and a status panel on the bottom of the ACA Event Details panel. These are as follows:
Left arrow – The left arrow allows you to see the details of the next transaction.
</td></tr>
</table>

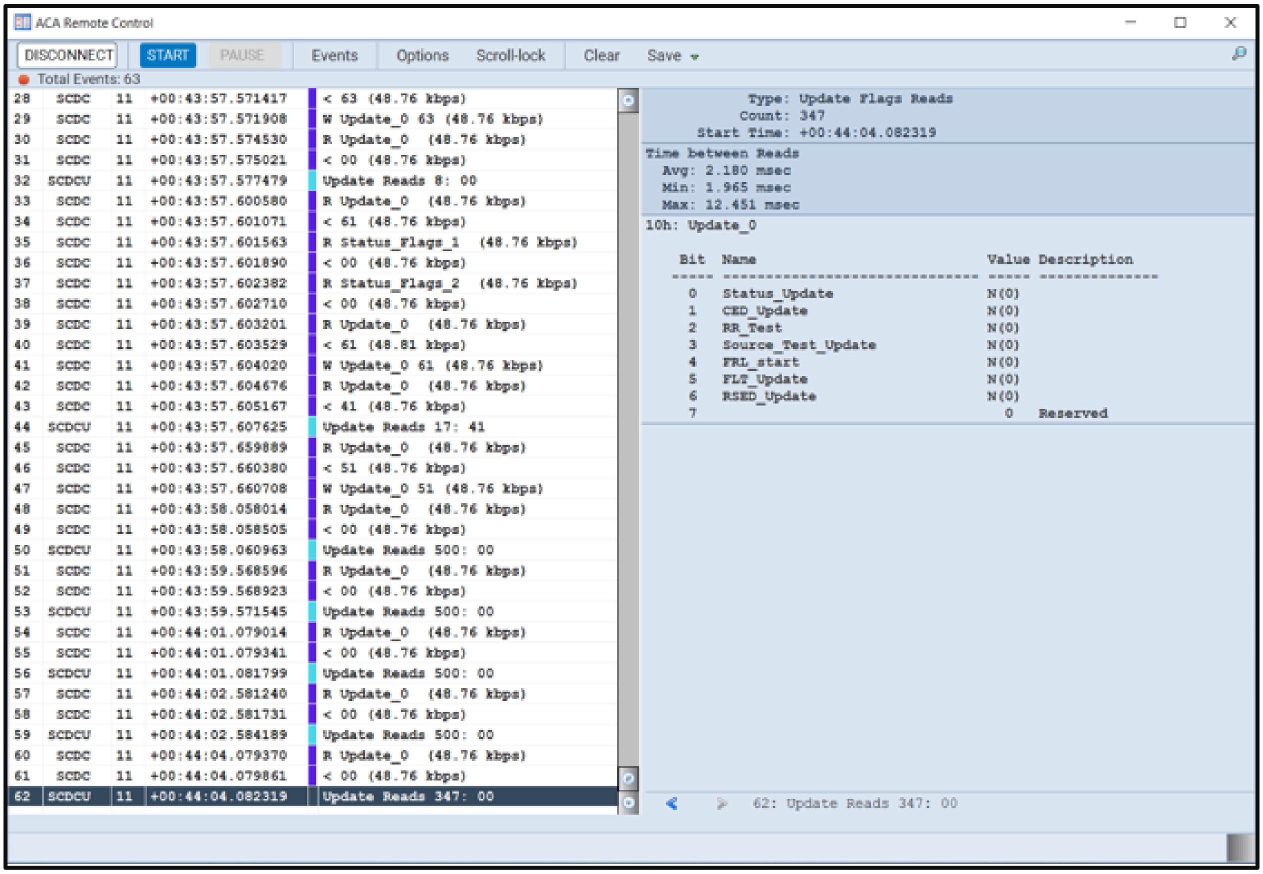
Real Time – ACA	Information / Function
	Right arrow – The right arrow allows you to see the details of the previous transaction. **Status field** – Shows the sequence number and the description of the selected transaction.
Options Flyout Menu 	The **Options** flyout menu items are described below. These options are only available on the Real Time ACA when the trace logging is stopped. **Scroll Lock** – The left arrow allows you to see the details of the next transaction. **Source Legend** – Displays a dialog box listing the interface cards on the M42h Instrument and their slot and port numbers, e.g. 32 is Slot 3, Port 2. **Show Port Name** – Enables you to display or not display the Port number. **Show Time-stamp** – Enables you to show or not show the time stamps for each transaction. **Show Time-deltas** – Enables you to show the time stamps relative to the previous transaction. Only available when time stamps are shown (see above). **Set Zero Time** – Enables you to set a log record to zero. Subsequent log records are relative to this new zero record. **Reset to Zero Time** – Resets the initial record in the active log in the ACA Trace window to zero.

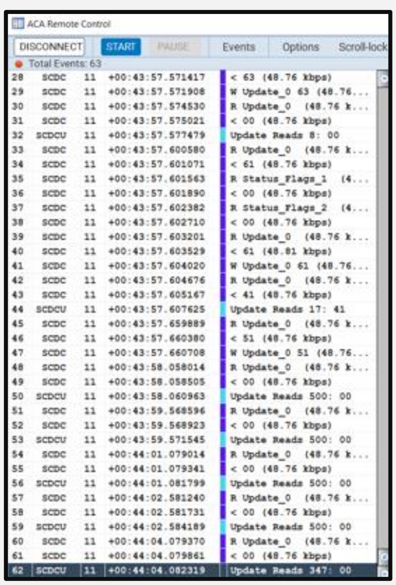
11.2 ACA Remote Control – For Real Time Viewing of HDMI Aux Channel Data

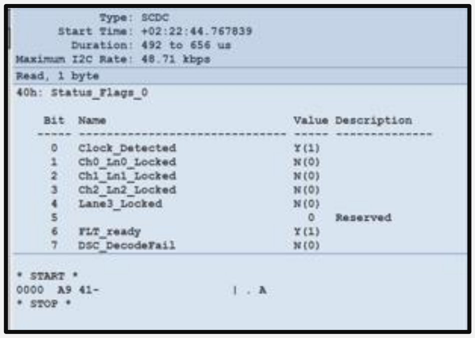
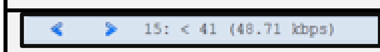
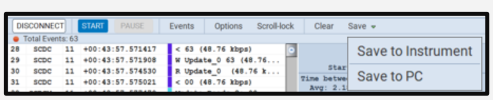
This subsection describes the **ACA Remote Control** utility used for viewing the real time HDMI DDC Channel transactions through the *external* ATP Manager.

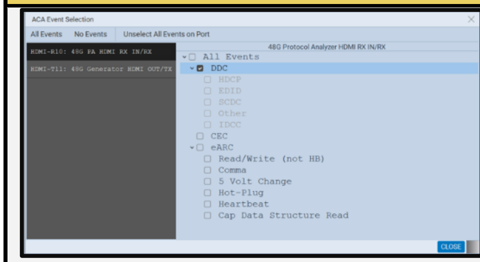
11.2.1 ACA Remote Control – Panel Description

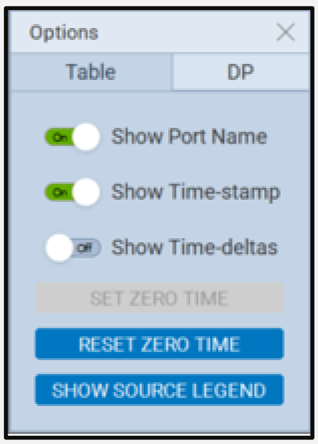
The **ACA Remote Control** panel application is available only on the *external* ATP Manager. It enables you to collect and view the ACA transactions in real time from a remotely connected PC with the ATP Manager application. The control panel elements are described in the table below.



ACA Remote Control	**Information / Function**
Auxiliary Channel Analyzer **ACA Trace Panel** 	The following information is provided in the ACA Remote Control Panel data dialog box for each event: **Item number** – This is a unique sequence number of the transaction. **Type** – There are various types of data that can be monitored on the HDMI interfaces: EDID, HDCP and CEC messages. **M42h Card** number, Interface number. **Time stamp** (optional viewing field) – Shows the timestamp of each transaction. Can either be absolute time based (shown) on the M42h system clock or relative time (Time-deltas) referenced from the initial transaction in the trace. **Transaction Description** – A description of the transaction.

ACA Remote Control	Information / Function
Details Panel 	The following information is provided in the ACA **Event Details** dialog box. Two examples are shown on the left. One for HDCP transactions and another for Link Training transactions: **Type** – There are various types of data that can be monitored on the HDMI interfaces: EDID, HDCP, SCDC and CEC messages. Only SCDC applies at this time. **Start Time** – This the start time of the transaction in microseconds from a reference time determined when the capture of real time data began. **Note**: The information in the Details panel will vary depending on the type of log record that is selected. **Duration** – The duration in milliseconds of the transaction. **Maximum I2C Rate** – The rate that the I2C channel clock is operating. **Details** (text) – The contents of the transaction in human readable text. **Details** (hex) – The contents of the transaction in hex data.
	There are some control arrows and a status panel on the bottom of the ACA Event Details panel. These are as follows: **Left arrow** – The left arrow allows you to see the details of the next transaction. **Right arrow** – The right arrow allows you to see the details of the previous transaction. **Status field** – Shows the sequence number and the description of the selected transaction.
 **ACA Event Selection**	There is a menu associated with the ACA Remote Control Info panel. It is located on the right side of the panel. There are four examples shown to the left reflecting the differ states: **"Viewing Glass"** – This is on the upper left of the ACA window. It is not part of the control menu. When activated it displays a pop-up window that enables you to display the text in Small, Medium, or Large text. **Connect/Disconnect** – Connects or disconnects the ACA Remote Control application from an M42h System. **Start/Stop** – Starts and Stops the collection of auxiliary channel data. **Resume/Pause** – Pauses and/or Resumes the collection of auxiliary channel data to the ACA panel.

<table>
<tr><th>ACA Remote Control</th><th>Information / Function</th></tr>
<tr><td>


</td><td>
Clear – Clears the ACA Trace Panel. The trace collection must be paused or stopped to clear the traces.
Events – Opens up the ACA Event Selection window (below left) enabling you to specify the and port that you wish to collect trace data from. Also selects which events you wish to collect (left). Use the check boxes to select which event you wish to collect or collect All Events.
Options – Opens up a flyout menu described below.
Save to Instrument – Saves the file to the M42h system that the host PC is connected to.
Save to PC – Saves a current trace file to the Host PC.
Hide – Makes the ACA Remote Viewer window disappear.
</td></tr>
<tr><td>
Options Flyout Menu


</td><td>
The Options flyout menu items are described below. These options are only available on the real time ACA when the trace logging is stopped.
Scroll Lock – The left arrow allows you to see the details of the next transaction.
Source Legend – Displays a dialog box listing the interface cards on the M42h Instrument and their slot and port numbers, e.g. 32 is Slot 3, Port 2.
Show Port Name – Enables you to display or not display the Port number.
Show Time-stamp – Enables you to show or not show the time stamps for each transaction.
Show Time-deltas – Enables you to show the time stamps relative to the previous transaction. Only available when time stamps are shown (see above).
Set Zero Time – Enables you to set a log record to zero. Subsequent log records are relative to this new zero
record.
Reset to Zero Time – Resets the initial record in the active log in the ACA Trace window to zero.
</td></tr>
</table>

11.3 Monitoring the HDMI Auxiliary Channel with the ACA Utilities

This subsection describes the procedures for monitoring the auxiliary channel data through the ATP Manager using the Aux Channel Analyzer real time utilities. You can monitor the HDMI DDC transactions in real time either while the M42h 96G Video Analyzer/Generator is emulating a sink device or you can monitor the transactions passively. Most of the screen examples are from the Aux. Channel Analyzer utility which is the embedded M42h GUI utility.

11.3.1 Making the physical connections.

Use the following procedures to make the physical connection from the UHD source to the M42h 96G Video Analyzer/Generator's Rx port.

1. Connect the output of the UHD HDMI source to the input (Rx) port on the M42h 96G Video Analyzer/Generator as shown in the diagram below:

Connection for HDMI sink emulation and source testing – M42h

11.3.2 Monitoring the HDMI DDC Transactions in Real Time with the ACA Utilities

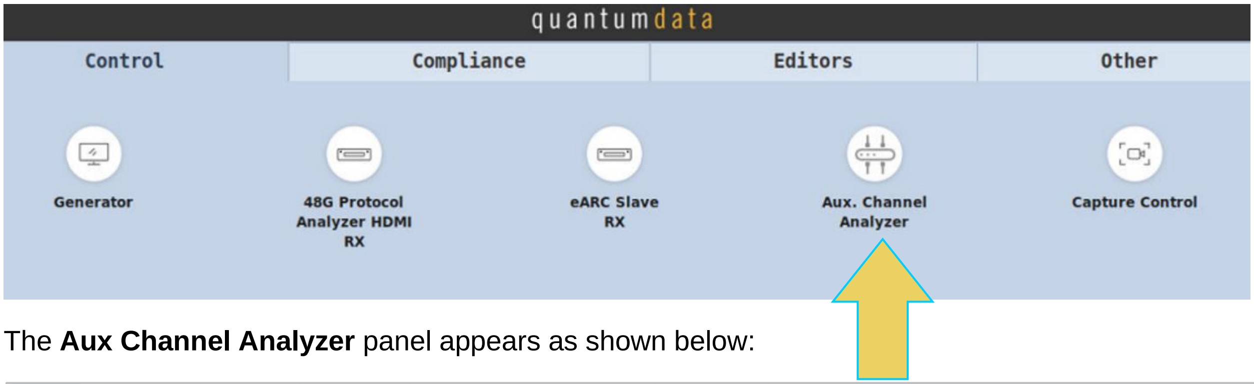
Use the following procedures to monitor the HDMI DDC transactions with an HDMI device in real time. The procedures assume that the HDMI device under test is powered up and connected to one of the M42h 96G Video Analyzer/Generator ports. The operation of the ACA is the same when testing a source or a sink.

The operation of the two ACA real time utilities—**Aux Channel Analyzer** on the *embedded* M42h GUI and the **ACA Remote Control** on the *external* ATP Manager-- is similar. The screen examples used in this subsection are from the **ACA Remote Control** utility on the *external* ATP Manager exceptions related to the operation of the ACA on the embedded ATP Manager are noted.

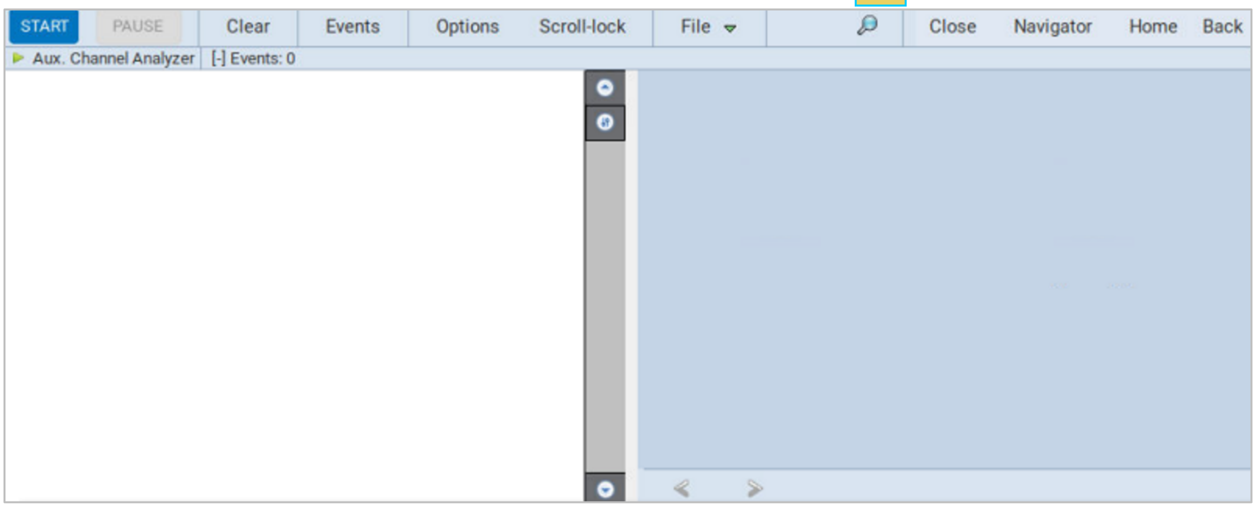
Important Note: You can filter and search through the ACA traces. Procedures for searching and sorting are provided in a separate subsection further below.

To monitor the HDMI DDC transactions:

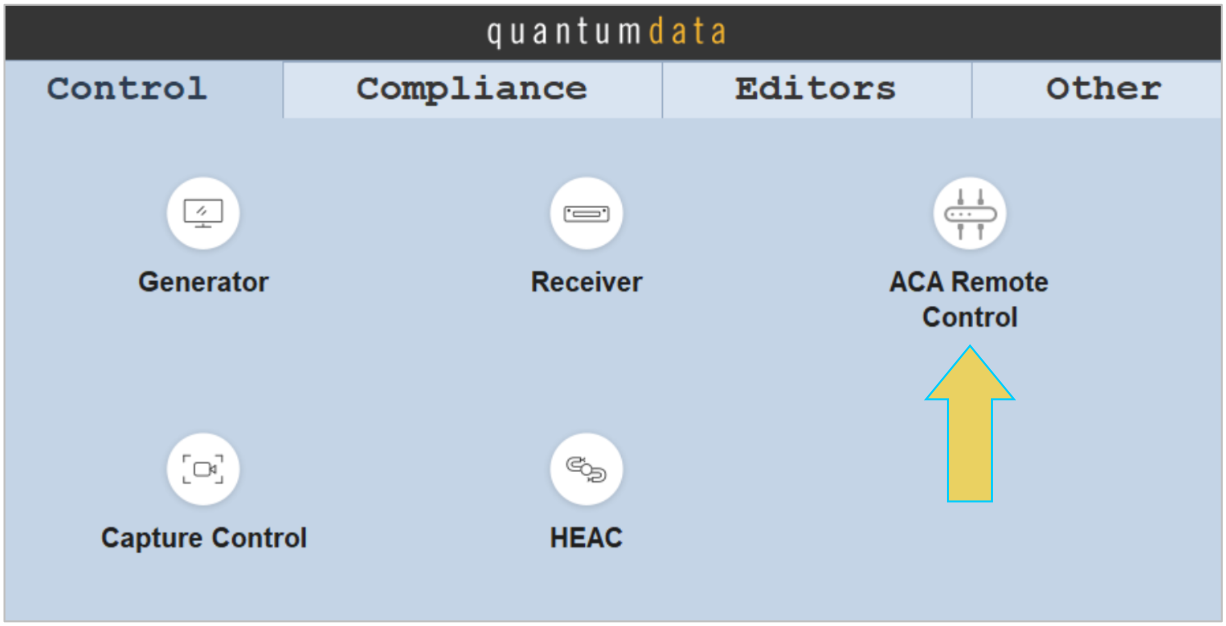
1. For the *embedded* ACA utility, select the **Aux Channel Analyzer** on the page 1 (Card Control) of the **Apps** panel:



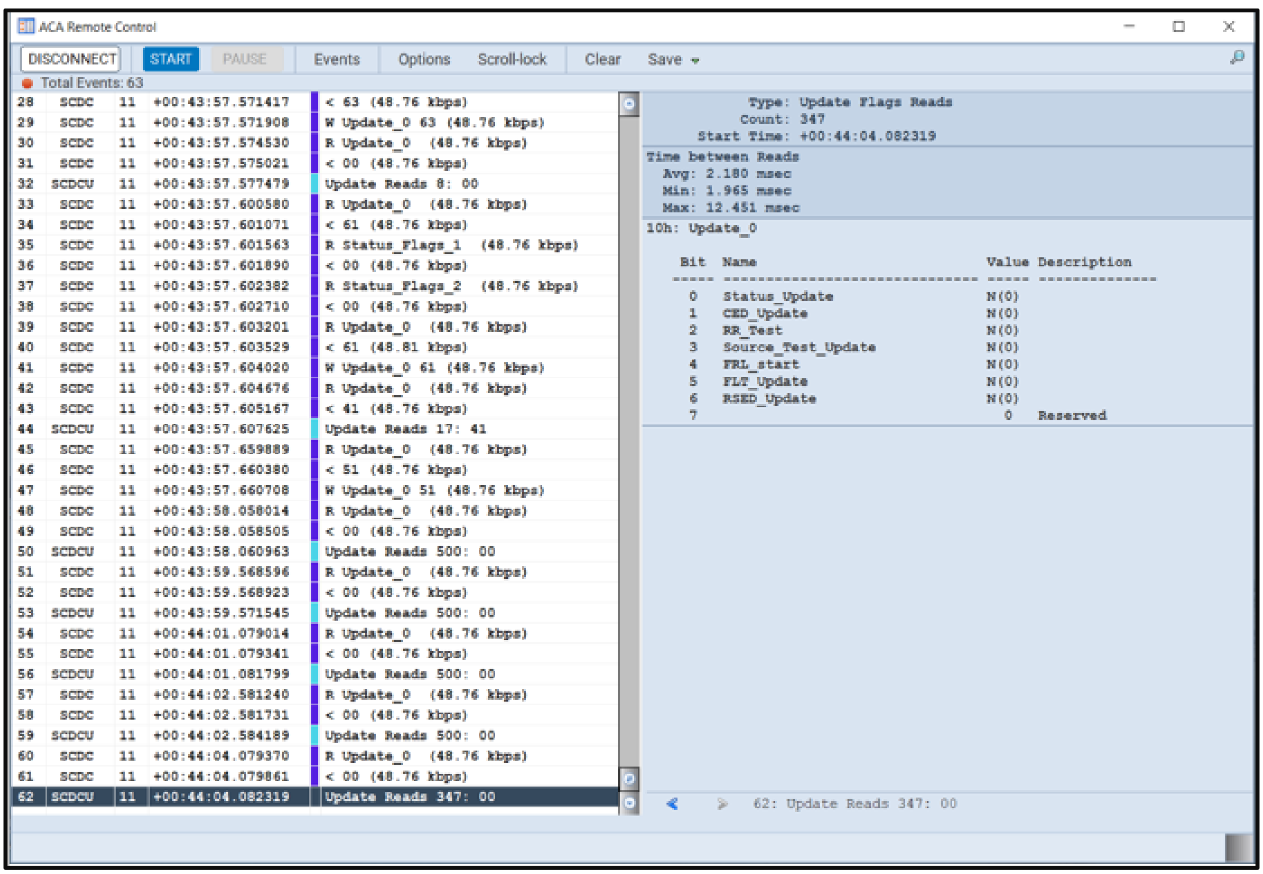
The **Aux Channel Analyzer** panel appears as shown below:



For the remote host PC ACA utility, touch select the **ACA Remote Control** on the page 1 (Card Control) of the **Apps** panel:

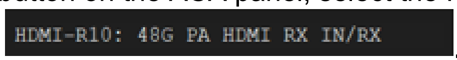


The **ACA Remote Control** panel appears as shown below:

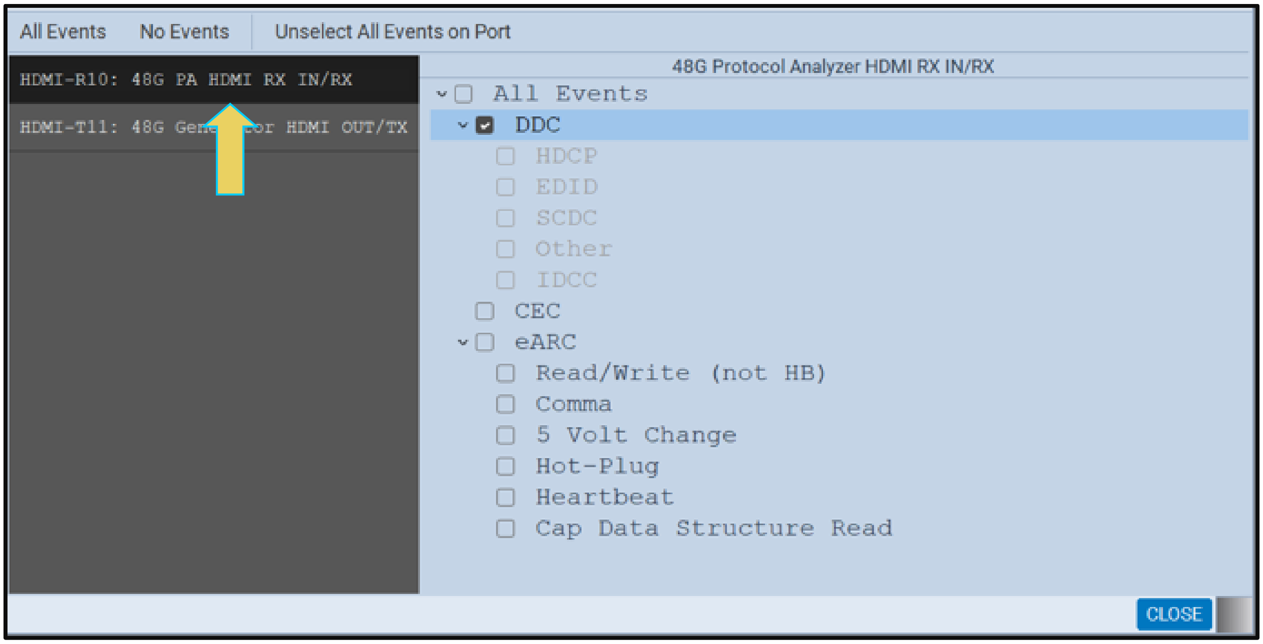


For the **ACA Remote Control** panel you will have to connect to an M42h Instrument that you have provisioned in the external ATP Manager application. The **ACA Remote Control** dialog box will appear showing all the M42h systems you have provisioned in the M42h GUI Manger. Typically you will only have one M42h system provisioned in the application, so you will simply select your lone M42h system and click the **OK** button on the dialog box.

From the **Events** 

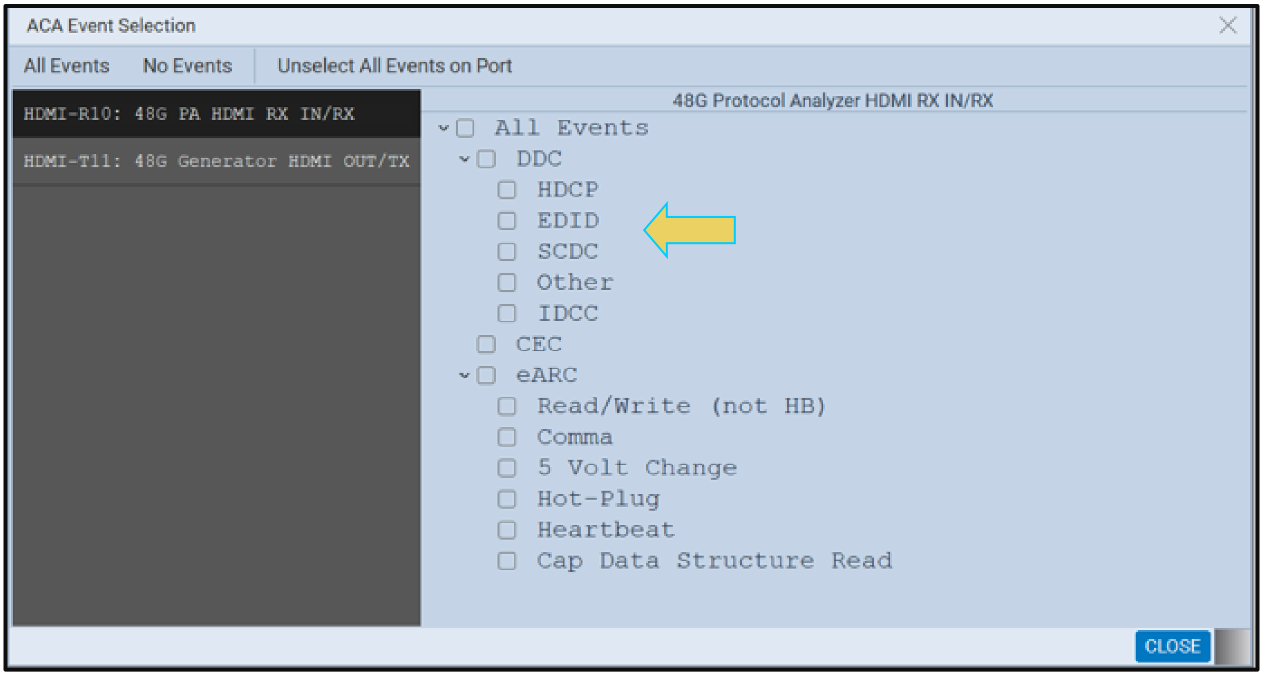
button on the ACA panel, select the HDMI's port that you are monitoring using the pull-down menu 

. Refer to the screen example below.



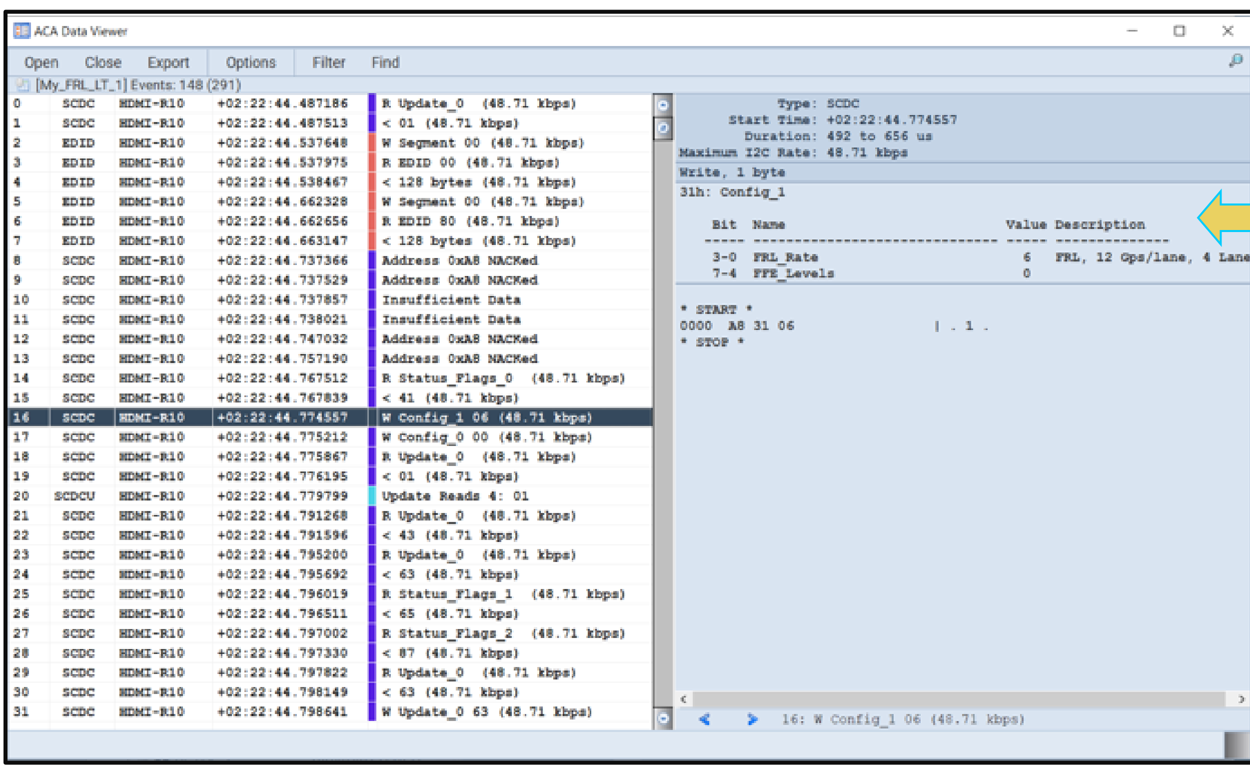
The **ACA Event Selection** dialog box is shown below.

2. Specify which events you wish to monitor. You can select All Events or any set of individual events.



Take the necessary action—such as a hot plug—to initiate EDID, HDCP or CEC transactions. You will see the Aux Chan transactions in the ACA panel as shown below.

Touch select the **Start** START button on the ACA Menu panel on the right to initiate the viewing of the HDMI (or MHL) DDC transactions. An example showing monitored data is shown below. You can stop or pause the collection at any time using the buttons on the ACA menu panel on the right. These are indicated in the screen example below.



Important Note: You can filter and search through the ACA traces. Procedures for searching and sorting are provided in a separate subsection further below.

3. Click on **Save to Instrument** or **Save to PC** depending on whether you are working with the external ACA Remote Control utility or the embedded Aux Channel Analyzer. A dialog box appears (below). Enter a name and then click on **OK**.

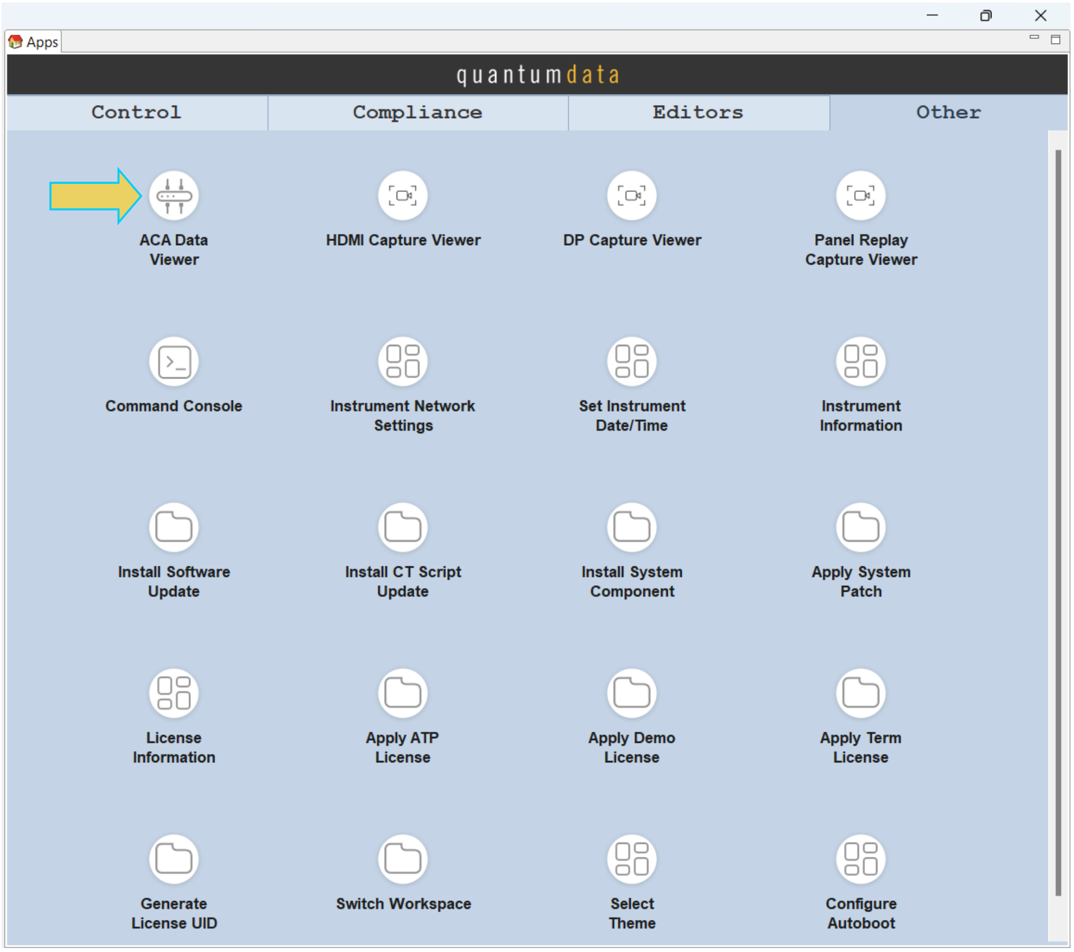
Please note to use the **ACA Data Viewer** utility (next subsection) on your PC to view the traces or the ACA viewer on the M42h embedded display with the powerful searching and filtering features, you must save the file. If you are working on the embedded **Aux Channel Analyzer** viewer but prefer to use **ACA Data Viewer** on the external ATP Manager, you will have to transfer the saved file to your PC using the external ATP Manager.

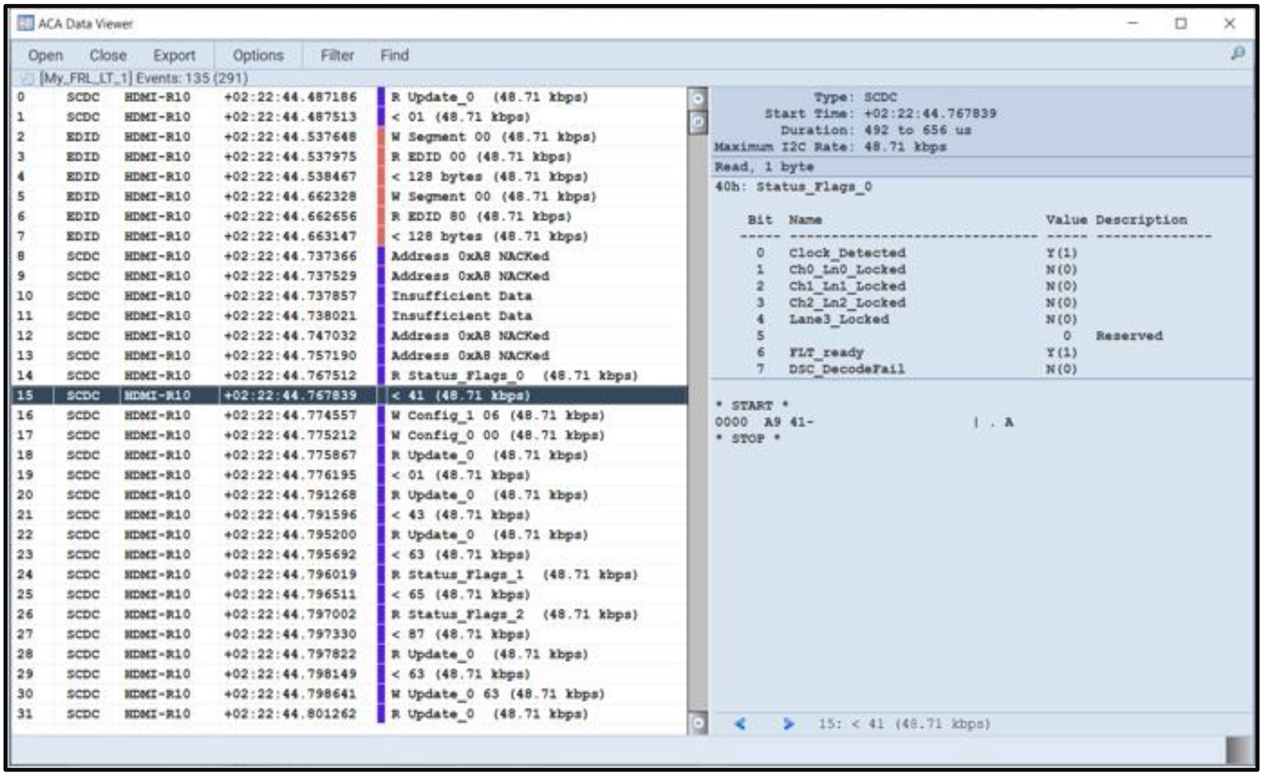
11.4 ACA Data Viewer – Viewing Stored Aux Channel Data

This subsection describes the **ACA Data Viewer** utility used for viewing HDMI (or MHL) DDC transactions that have been stored on the PC hosting the *external* ATP Manager. You can use the **ACA** utility on the *embedded* display to view ACA trace files stored on the M42h instrument itself. The operation of the two ACA utilities is similar. The screen examples used in this subsection are from the **ACA Data Viewer** utility, but the general operation is like the embedded version.

11.4.1 ACA Data Viewer – Panel Description

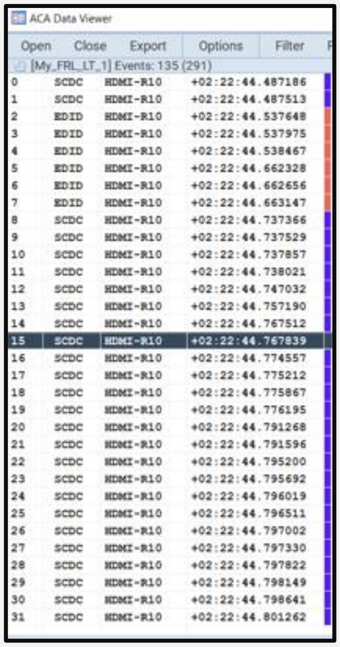
The **ACA Remote Control** panel application is available on the *external* ATP Manager. It enables you to collect and view the ACA transactions in real time from a remotely connected PC with the ATP Manager application. The control panel elements are described in the table below.


Apps
quantumdata
Control
Compliance
Editors
Other
ACA Data Viewer
HDMI Capture Viewer
DP Capture Viewer
Panel Replay Capture Viewer
Command Console
Instrument Network Settings
Set Instrument Date/Time
Instrument Information
Install Software Update
Install CT Script Update
Install System Component
Apply System Patch
License Information
Apply ATP License
Apply Demo License
Apply Term License
Generate License UID
Switch Workspace
Select Theme
Configure Autoboot


ACA Data Viewer
Open Close Export Options Filter Find
[My_FRL_LT_1] Events: 135 (291)
0 SCDC HDMI-R10 +02:22:44.487186 R Update_0 (48.71 kbps)
1 SCDC HDMI-R10 +02:22:44.487513 < 01 (48.71 kbps)
2 EDID HDMI-R10 +02:22:44.537648 W Segment 00 (48.71 kbps)
3 EDID HDMI-R10 +02:22:44.537975 R EDID 00 (48.71 kbps)
4 EDID HDMI-R10 +02:22:44.538467 < 128 bytes (48.71 kbps)
5 EDID HDMI-R10 +02:22:44.662328 W Segment 00 (48.71 kbps)
6 EDID HDMI-R10 +02:22:44.662656 R EDID 80 (48.71 kbps)
7 EDID HDMI-R10 +02:22:44.663147 < 128 bytes (48.71 kbps)
8 SCDC HDMI-R10 +02:22:44.737366 Address 0xA8 NACKed
9 SCDC HDMI-R10 +02:22:44.737529 Address 0xA8 NACKed
10 SCDC HDMI-R10 +02:22:44.737857 Insufficient Data
11 SCDC HDMI-R10 +02:22:44.738021 Insufficient Data
12 SCDC HDMI-R10 +02:22:44.747032 Address 0xA8 NACKed
13 SCDC HDMI-R10 +02:22:44.757190 Address 0xA8 NACKed
14 SCDC HDMI-R10 +02:22:44.767512 R Status_Flags_0 (48.71 kbps)
15 SCDC HDMI-R10 +02:22:44.767839 < 41 (48.71 kbps)
16 SCDC HDMI-R10 +02:22:44.774557 W Config_1 06 (48.71 kbps)
17 SCDC HDMI-R10 +02:22:44.775212 W Config_0 00 (48.71 kbps)
18 SCDC HDMI-R10 +02:22:44.775867 R Update_0 (48.71 kbps)
19 SCDC HDMI-R10 +02:22:44.776195 < 01 (48.71 kbps)
20 SCDC HDMI-R10 +02:22:44.791268 R Update_0 (48.71 kbps)
21 SCDC HDMI-R10 +02:22:44.791596 < 43 (48.71 kbps)
22 SCDC HDMI-R10 +02:22:44.795200 R Update_0 (48.71 kbps)
23 SCDC HDMI-R10 +02:22:44.795692 < 63 (48.71 kbps)
24 SCDC HDMI-R10 +02:22:44.796019 R Status_Flags_1 (48.71 kbps)
25 SCDC HDMI-R10 +02:22:44.796511 < 65 (48.71 kbps)
26 SCDC HDMI-R10 +02:22:44.797002 R Status_Flags_2 (48.71 kbps)
27 SCDC HDMI-R10 +02:22:44.797330 < 87 (48.71 kbps)
28 SCDC HDMI-R10 +02:22:44.797822 R Update_0 (48.71 kbps)
29 SCDC HDMI-R10 +02:22:44.798149 < 63 (48.71 kbps)
30 SCDC HDMI-R10 +02:22:44.798641 W Update_0 63 (48.71 kbps)
31 SCDC HDMI-R10 +02:22:44.801262 R Update_0 (48.71 kbps)
Type: SCDC
Start Time: +02:22:44.767839
Duration: 492 to 656 us
Maximum I2C Rate: 48.71 kbps
Read, 1 byte
40h: Status_Flags_0
Bit Name Value Description
0 Clock_Detected Y(1)
1 Ch0_Ln0_Locked N(0)
2 Ch1_Ln1_Locked N(0)
3 Ch2_Ln2_Locked N(0)
4 Lane3_Locked N(0)
5 0 Reserved
6 FLT_ready Y(1)
7 DSC_DecodeFail N(0)
* START *
0000 A9 41- | . A
* STOP *
15: < 41 (48.71 kbps)

<table>
<tr><th>ACA Data Viewer</th><th>Information / Function</th></tr>
<tr><td>

ACA Data Viewer - Trace Panel



</td><td>

The following information is provided in the ACA Remote Control Panel data dialog box for each event:

Item number – This is a unique sequence number of the transaction.

Type – The type of; either EDID, HDCP or CEC.

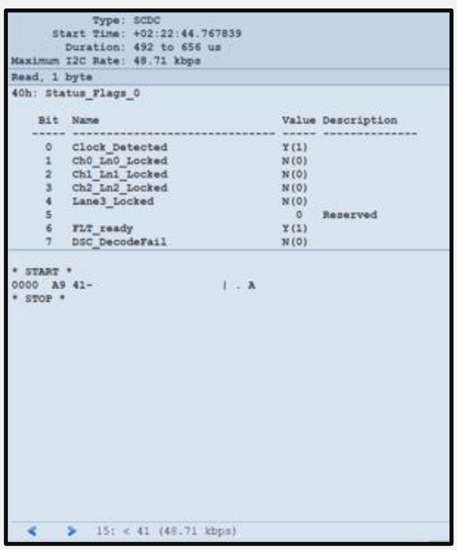
M42h Card Type, Interface number.

Time stamp (optional viewing field) – Shows the time stamp of each transaction. Can either be absolute time based (shown) on the M42h system clock or relative time (Time-deltas) referenced from the initial transaction in the trace.

Transaction Description – A description of the transaction.

</td></tr>
<tr><td>

Details Panel



</td><td>

The data that is displayed in the **Details** panel will vary depending on the type of record. following information is provided in the ACA Event Details dialog box:

Start Time – This the start time of the transaction in microseconds from a reference time determined when the capture of real time data began.

Type – The type of transaction; either EDID, or CEC.

Note: The information in the **Details** panel will vary depending on the type of log record that is selected.

Duration – The duration in milliseconds of the transaction.

Direction – The direction of the transaction either a request or a reply.

Maximum I2C Rate – The rate that the I2C channel clock is operating.

Details (text) – The contents of the transaction in human readable text.

Details (hex) – The contents of the transaction in hex data.

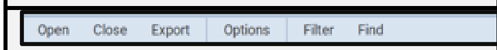
</td></tr>
<tr><td>

</td><td>

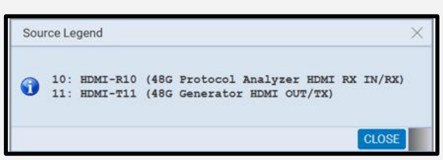
There are some control arrows and a status panel on the bottom of the ACA Event **Details** panel. These are as follows:

Left arrow – The left arrow allows you to see the details of the next transaction.

</td></tr>
</table>

<table>
<tr><th>ACA Data Viewer</th><th>Information / Function</th></tr>
<tr><td></td><td>Right arrow – The right arrow allows you to see the details of the previous transaction.
Status field – Shows the sequence number and the description of the selected transaction.</td></tr>
<tr><td>
</td><td>There is a menu associated with the ACA Remote Control Info panel. It is located on the right side of the panel:

“Viewing Glass” – This is on the upper right of the ACA window. It is not part of the control menu. When activated it displays a pop-up window that enables you to display the text in Small, Medium, or Large text.
Options – Opens up a flyout menu. Described below.
Data – Opens up a flyout check box enabling you to sort the log records by time.
Clear – Clears the ACA Trace panel.
Open – Enables you to open an ACA trace file stored on your PC.
Export – Enables you to export the entire trace file or a range of records in the trace file, to a text file. See dialog box below left.</td></tr>
<tr><td>Options Flyout Menu



</td><td>The Options flyout menu items are described below.
Source Legend – Window that lists the ports and their definition on each available in the M42h system.
Show Port Name – Check box enabling you to display or not display the Port number.
Time-stamp – Check box enabling you to show or not show the time stamps for each transaction.
Time-deltas – Check box enabling you to show the time stamps relative to the previous transaction.
Set Zero Time – Enables you to set a log record to zero. Subsequent log records are relative to this new zero record.
Reset Zero Time – Resets the initial record in the active log in the ACA Trace window to zero.</td></tr>
<tr><td>Export as Text</td><td>The Export as Text dialog box elements are described below.
All – Enables you to specify that you wish to export the entire ACA trace file to a text file stored on your PC.</td></tr>
</table>

ACA Data Viewer	Information / Function
	**Range** – Enables you to display or not display the Port number. **Start** – Field available only when Range button is active to specify the first record of the range of records to include in the export operation. **End** – Field available only when Range button is active to specify the last record of the range of records to include in the export operation. **OK** – Button to initiate the export. **Cancel** – Cancel the export operation.

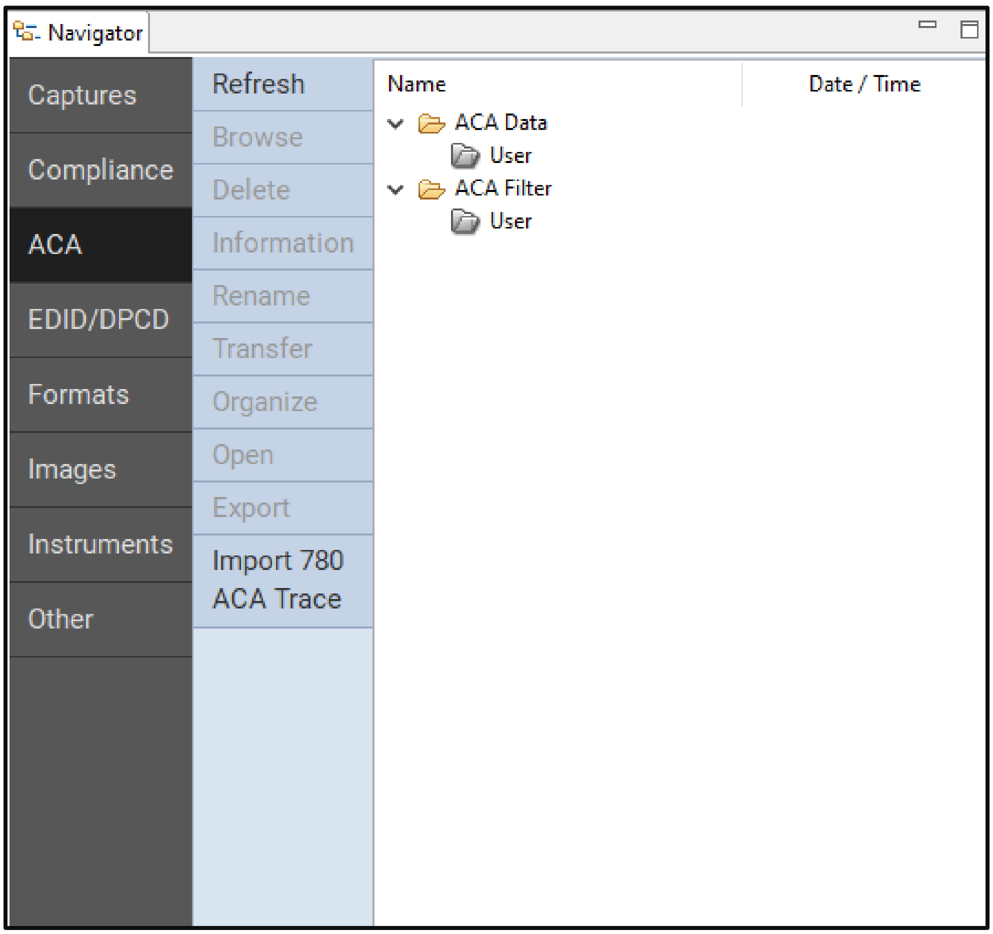
11.5 Viewing Stored HDMI DDC-SCDC traces on a PC with the ACA Data Viewer utility

This subsection describes how you can view ACA traces using the ACA viewer off-line on your PC with the **ACA Data Viewer** utility. To view the ACA files on your PC with the ATP Manager application you will first have to transfer them to the PC using the **Data Transfer** utility.

The ability to save ACA traces enables you to disseminate them to other subject matter experts for analysis or to Quantum Data for support. You can view the ACA traces without an M42h test instrument. You simply download the ATP Manager from the Quantum Data website on the downloads page.

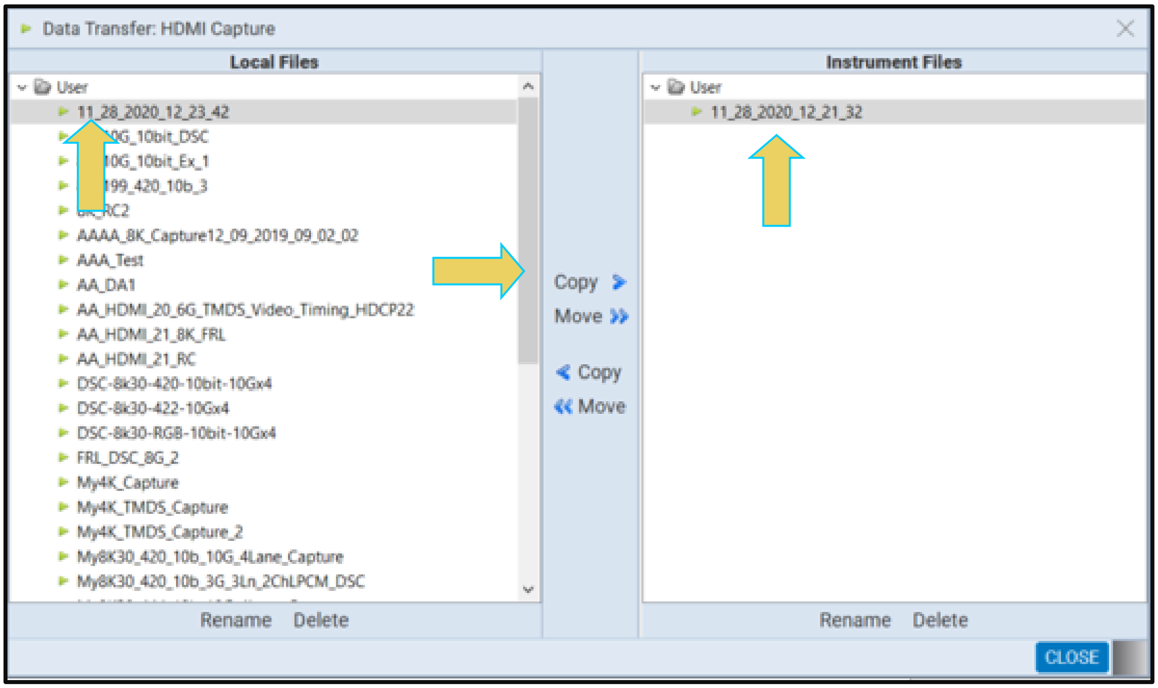
Transferring ACA Trace Files from the M42h to a Host PC with the ATP Manager:

1. Make sure the ATP Manager is installed on your PC. Use the procedures at Downloading and installing the ATP Manager.
2. Access a stored ACA data from the **Navigator** panel and highlight a directory as shown below.



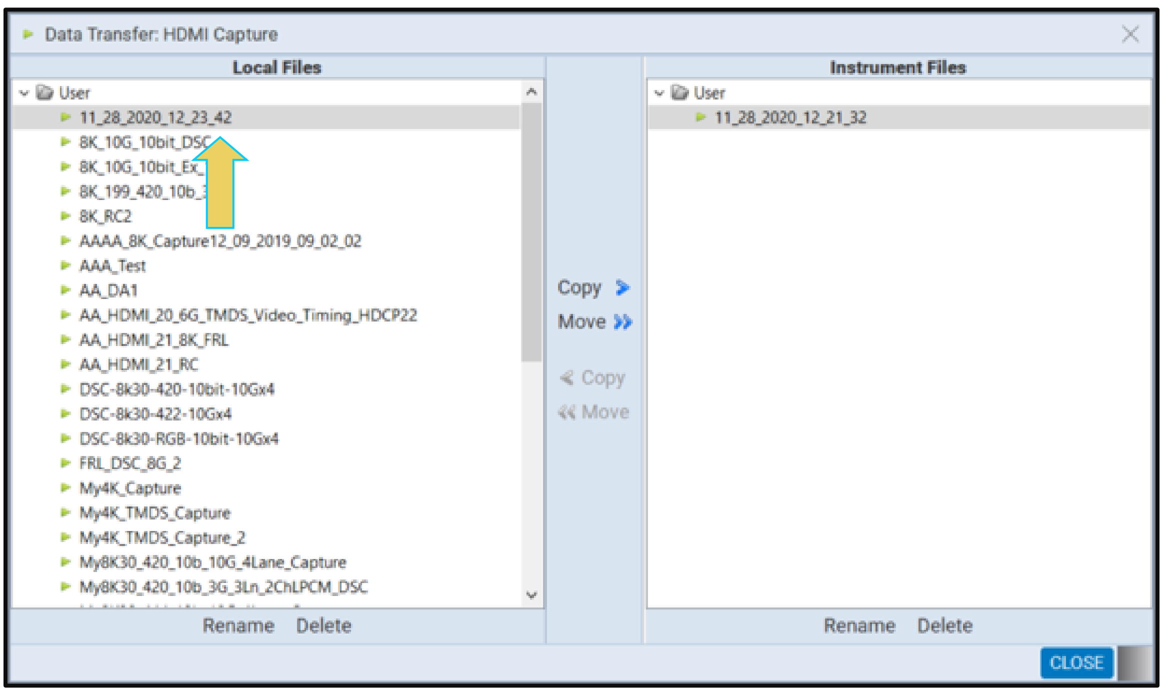
3. Access the **Data Transfer** utility.

This enables you to select what you want to transfer data from.



4. Highlight a directory on the **Local Files** side (host PC) and then initiate a **Copy** or **Move**.

The file appears on the PC host **Local** Files (below).



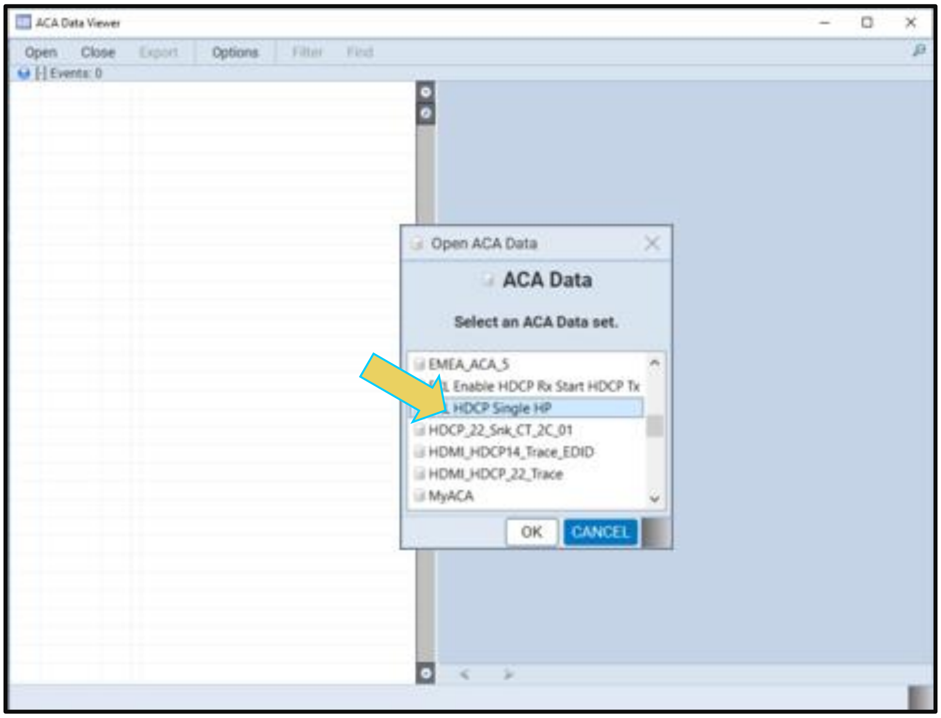
The data appears in the **Navigator** panel under the ACA data.

Viewing ACA trace files with the ACA Data Viewer:

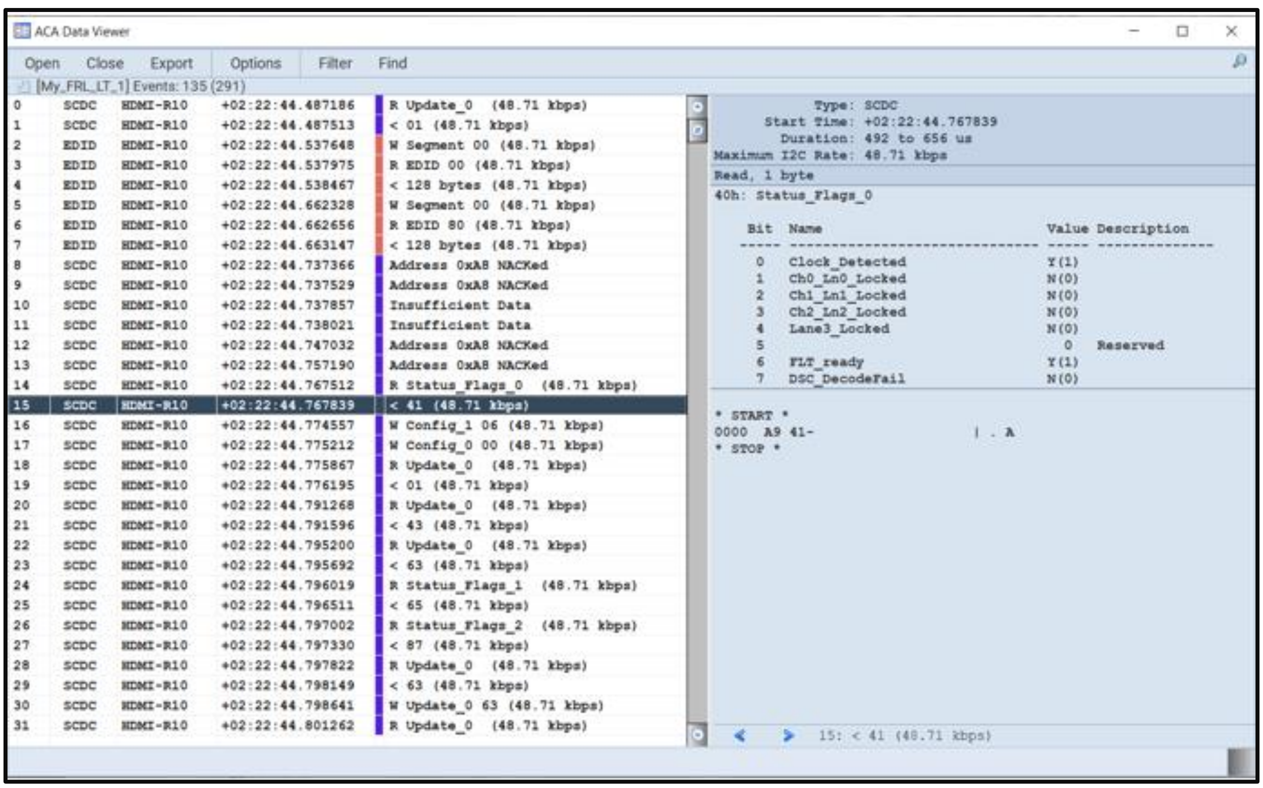
1. Open the ACA panel to view the transferred file. You can access the ACA panel from the **Other** Apps panel (Page 4).

The Aux Channel Analyzer panel appears.

2. Select the **Open** button to open the ACA file as shown below:



3. Click the **OK** activation button on the Open **ACA Data** dialog box. The ACA trace file will appear in the window.

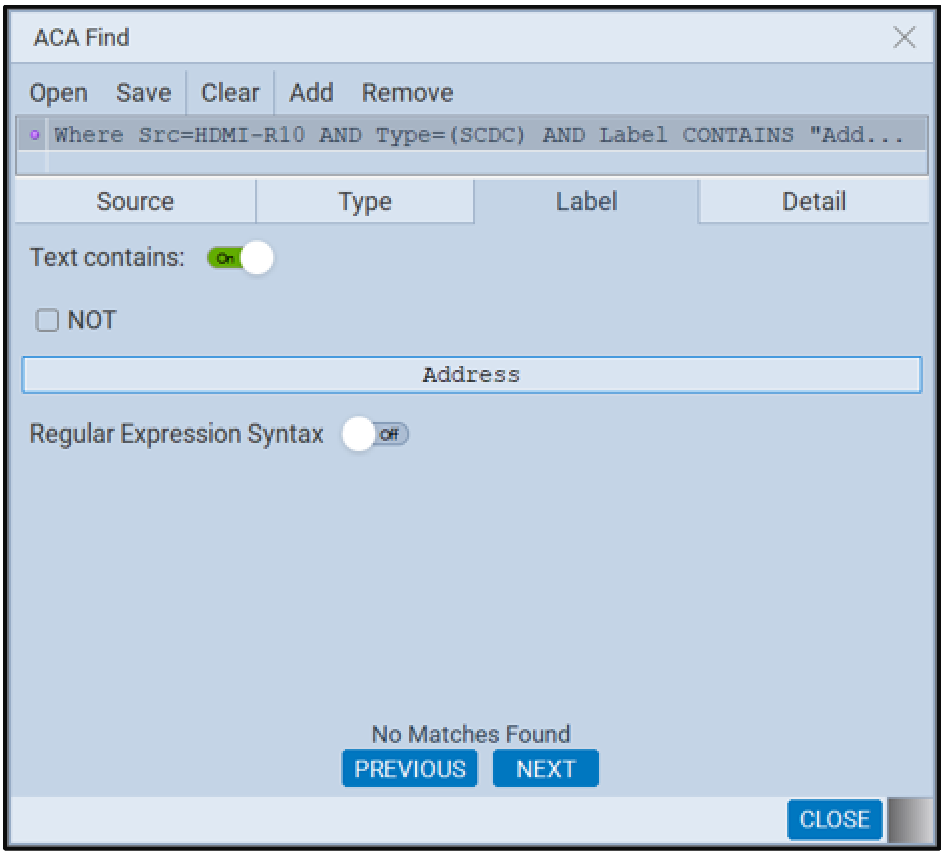


11.6 Using the ACA Find Feature

The **ACA Find** dialog box is accessible through the **Data** pop-out menu shown in the screen example below. The **ACA Find** function enables you to quickly locate different types of events. The ACA Find feature is not available with the **ACA Remote Control** utility. It is only available with the **ACA** feature in the embedded GUI and the **ACA Data Viewer**. If you wish to use the **Find** feature on ACA traces that you have captured using the **ACA Remote Control** utility save the traces as a file and reload them through the **ACA Data Viewer** utility.

You access the **Find** function through the **Data** flyout menu on the control panel of the embedded **ACA utility** and directly from the **Find** button on the control panel of the **ACA Data Viewer**.

The **Find** dialog box is shown below.



The **Find** function enables you to select data types in the **Type** field and then search based on text string occurrences in the log record labels or the message details.

Note: For the **ACA** utility on the embedded ATP Manager, you have to Stop the collection of real time trace activity using the Start/Stop button on the right side control panel.

The following table describes the **Find** function buttons, fields and functions.

ACA Find Window		
Buttons (Top)	**Function**	**Description**
Open Open	Opens a stored user created Find configuration.	You can store commonly used search configurations using the Save function and recall them for quick access using the Open button.
Save Save	Saves a user created Find configuration.	
Clear Clear	Clear the existing Find criteria.	You can build up complex Find configurations by concatenating multiple search criteria. When you add multiple configurations, they behave as a logical OR function whereby if either of the criteria is True, the search will find an entry. You enter criteria through the embedded touch screen with a pop-up keypad in the ACA real time utility or simply by typing on the external ATP Manager interface. When you are assembling Find configurations you can clear individual configurations by highlighting them in the panel provided and then use the Clear button. You can add through the Add button. You can remove an individual configuration using the Remove button. Example screen shots are shown below.
Add Add	Sets the currently defined Find criteria defined in either the Source, Type, Label or Details sub-panels and adds another row for new Find criteria.	
Remove Remove	Removes a highlighted Find criterion of an existing Find configuration.	
Details Detail	Enables or disables the Details panel.	
Buttons (bottom)	**Function**	
Previous PREVIOUS	Enables you to move back to the previous record that meets your search criteria.	
Next NEXT	Enables you to advance to the next record that meets your search criteria.	
Close CLOSE	Closes the ACA Find window.	
Fields	**Function**	**Description**

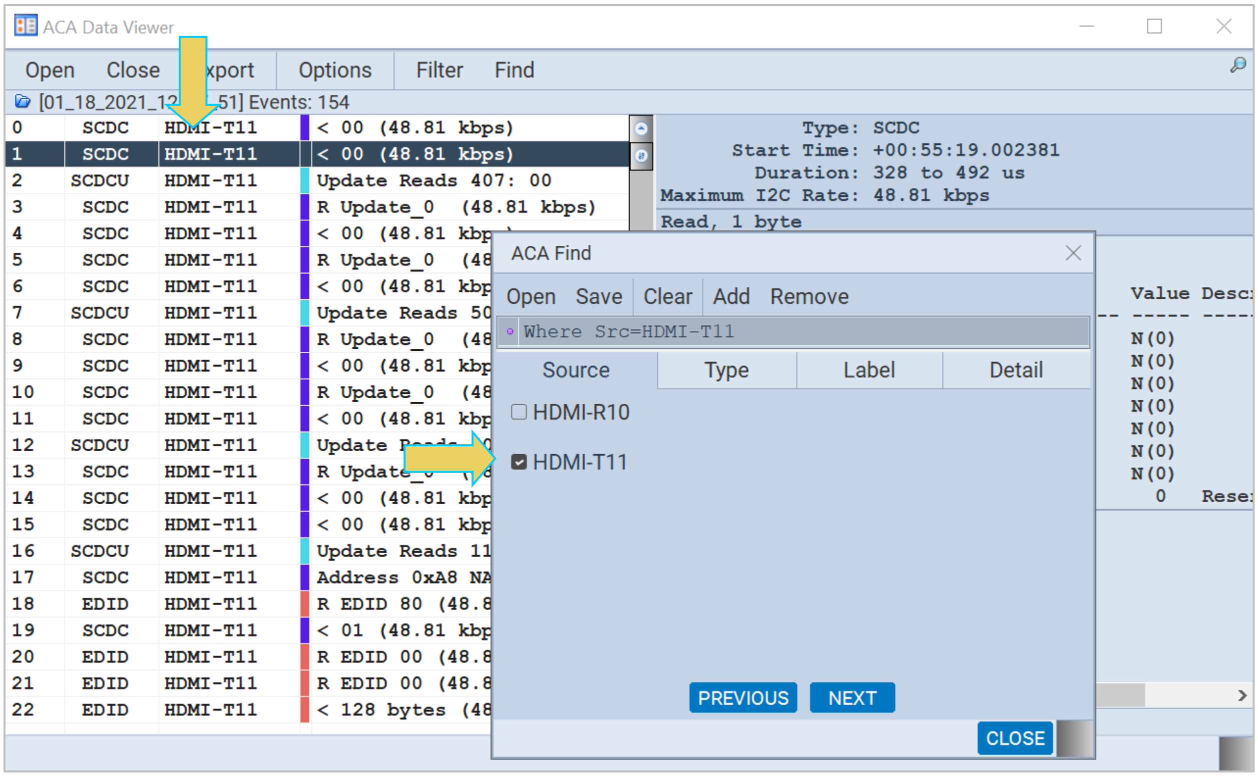
ACA Find Window		
Buttons (Top)	**Function**	**Description**
Source	Check box to select the port that you want to search. Please note that you can collect data in the ACA Trace window from multiple ports.	When you select multiple Source ports they behave as a logical OR function. When you initiate a search, by clicking on the Next or Previous button, the Find function will locate a record matching the criteria. If only the Source (port) is specified, the next or previous record from or to that source will be highlighted.
Type	Check boxes enabling you to specify which data types you wish to search through for the string.	When you select multiple data types they behave as a logical OR function. If only the Type field is specified, the next or previous of that data type will be highlighted.
Label	Combination check boxes and text fields for specifying criteria for text that appears in the Label field of the message. When you enter criteria in the Label field, it will automatically be added to the set of criteria in the panel above it.	**Text Contains** – A check box to activate the Label criteria. **Not** – A check box which when checked will search for records that *do not* meet the criteria in the field beneath it. **Text Field** – A text field to enter a string that will be matched (or Not matched). **Regular Expression Syntax** – A check box to specify whether the text in the Text Field will be treated as plain text or a regular expression. Regular expression syntax is a commonly used set of operators for search text. You can find detailed examples on the web including Wikipedia. If Regular Expression check box is checked, you can enter in any regular expression into the text field for a string match.
Details	Combination check boxes and text fields for specifying criteria for text that appears in the Label field of the message. When you enter criteria in the Label field, it will automatically be added to	**Text Contains** – A check box to activate the Label criteria. **Not**– A check box which when checked will search for records that *do not* meet the criteria in the field beneath it.

ACA Find Window		
Buttons (Top)	**Function**	**Description**
	the set of criteria in the panel above it.	**Text Field** – A text field to enter a string that will be matched (or Not matched). **Regular Expression Syntax** – A check box to specify whether the text the Text Field will be treated as plain text or a regular expression. Regular expression syntax is a commonly used set of operators for search text. You can find detailed examples on the web including Wikipedia. If Regular Expression check box is checked, you can enter in any regular expression into the text field for a string match.
Close	Closes the Find window.	

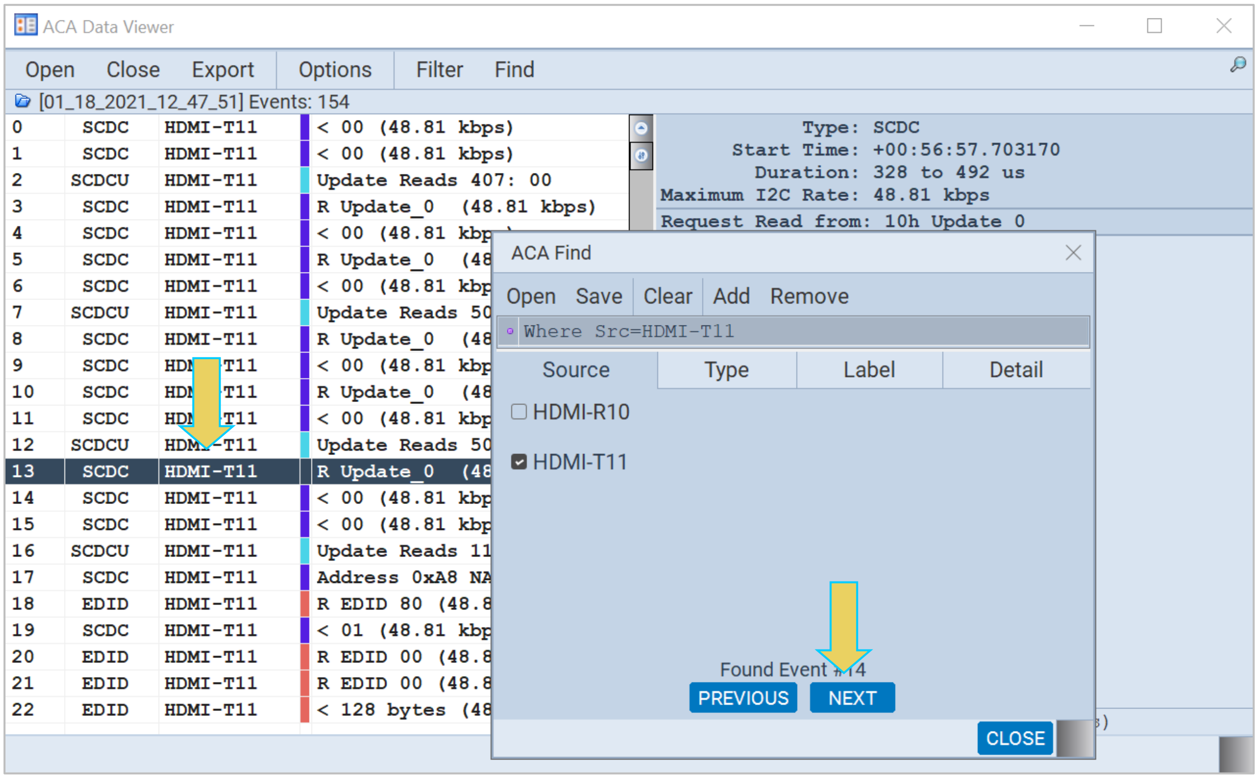
Searching Through the ACA Trace Files with the Find Function:

Here are some screen examples of the **Find** function. Note that the screen examples use the **ACA Data Viewer** utility but the embedded **ACA Data Viewer** works the same way. The only difference is the **ACA** embedded utility uses a pop-up keypad.

1. To find all data types from a specific port, check the respective source in the ACA Find dialog box.

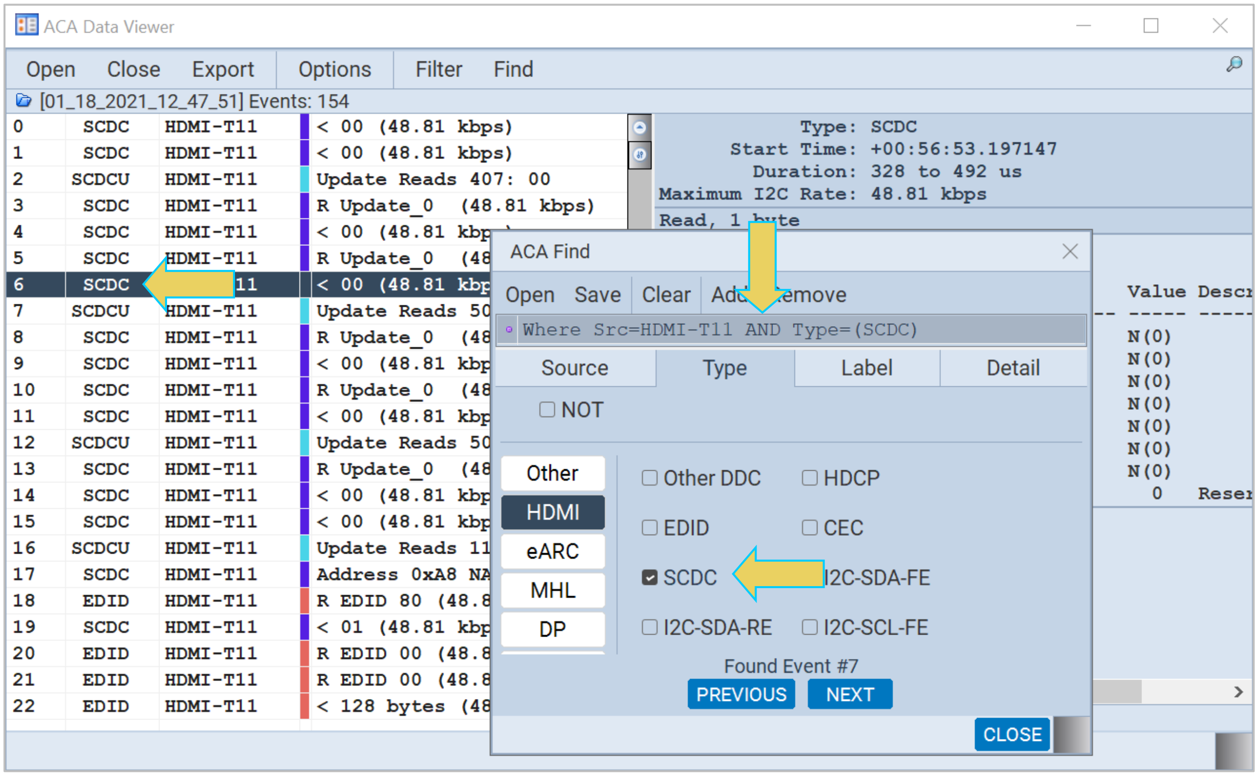

ACA Data Viewer
Open Close Export Options Filter Find
[01_18_2021_12 51] Events: 154
Type: SCDC
Start Time: +00:55:19.002381
Duration: 328 to 492 us
Maximum I2C Rate: 48.81 kbps
Read, 1 byte
ACA Find
Open Save Clear Add Remove
Where Src=HDMI-T11
Source Type Label Detail
HDMI-R10
HDMI-T11
PREVIOUS NEXT
CLOSE

2. Click on the **Next** button to advance to the recording meeting that criteria. The result is shown below.



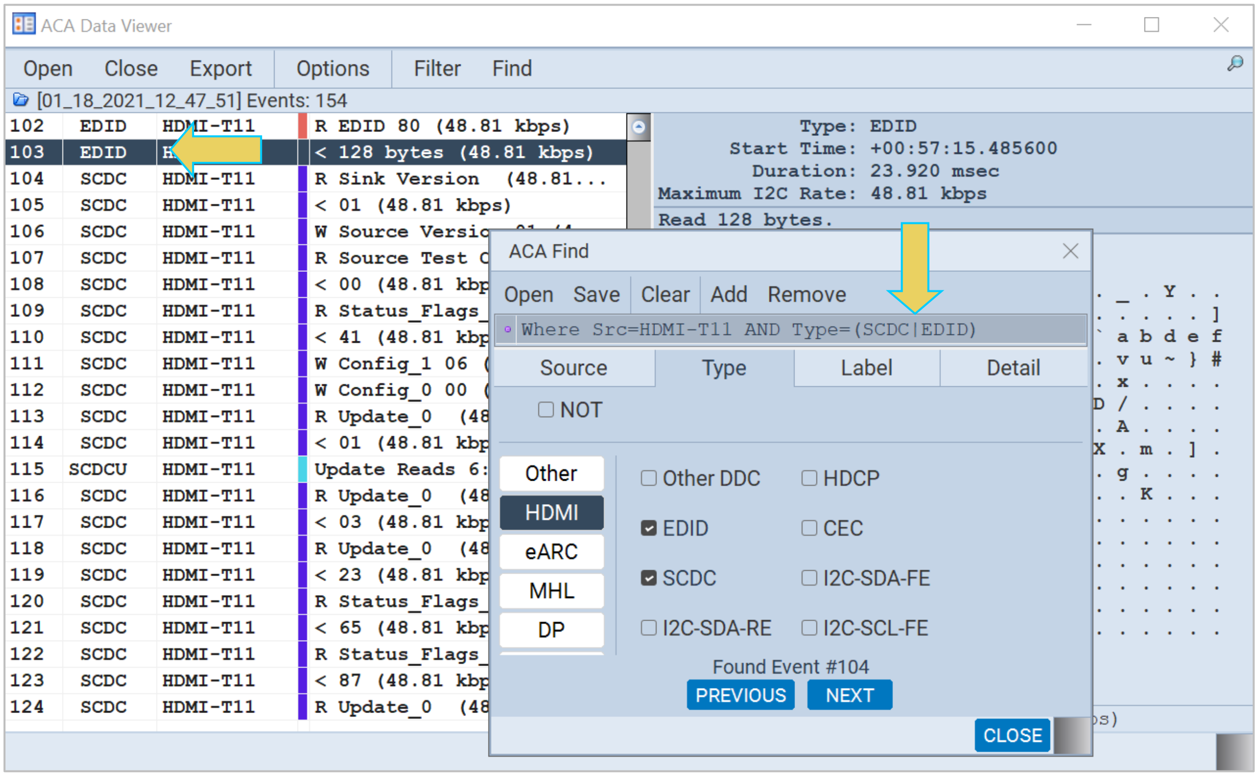
To find all data types from a specific port and that are SCDC transactions, select **SCDC** from the **Type** tab in the ACA Find dialog box. This search behaves like a logical AND function.

3. Click on the **Next** button to advance to the log record meeting that criteria. The result is shown below.

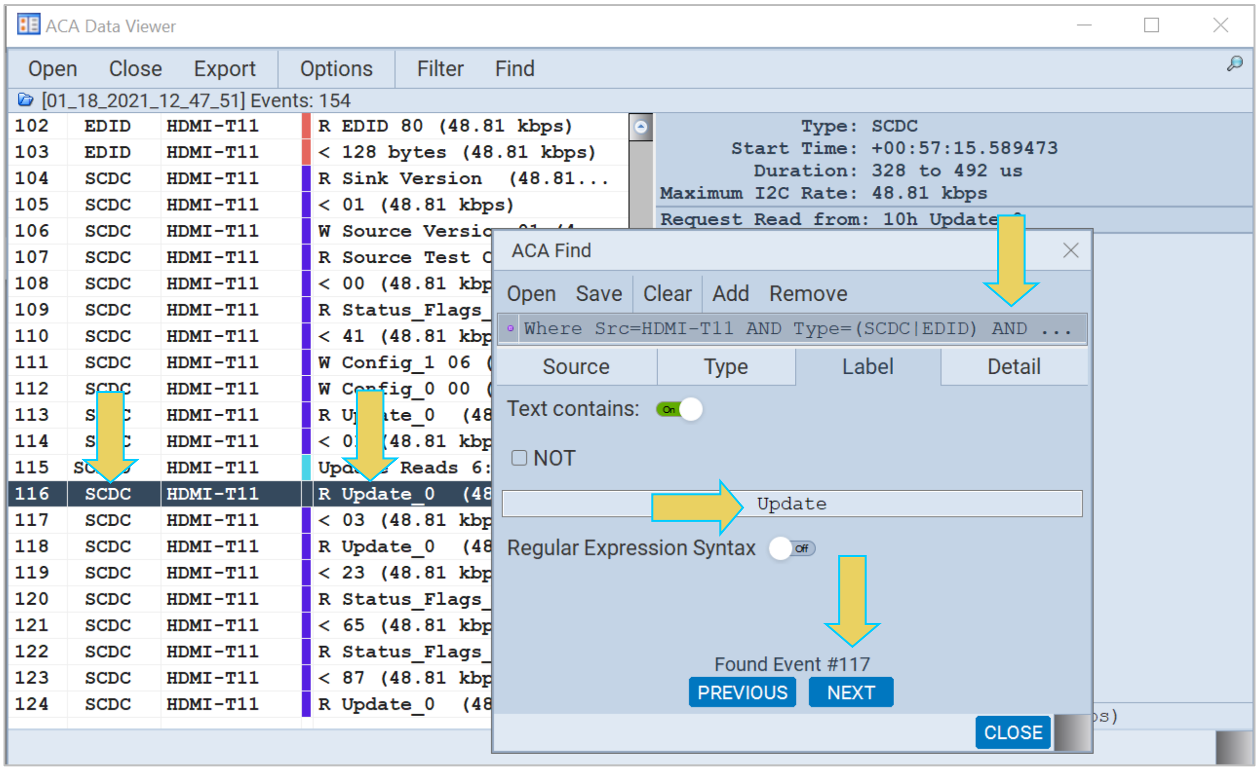


Note that when you select different data type definitions in the same search configuration, example port type and data Type above, the search uses a logical AND function.

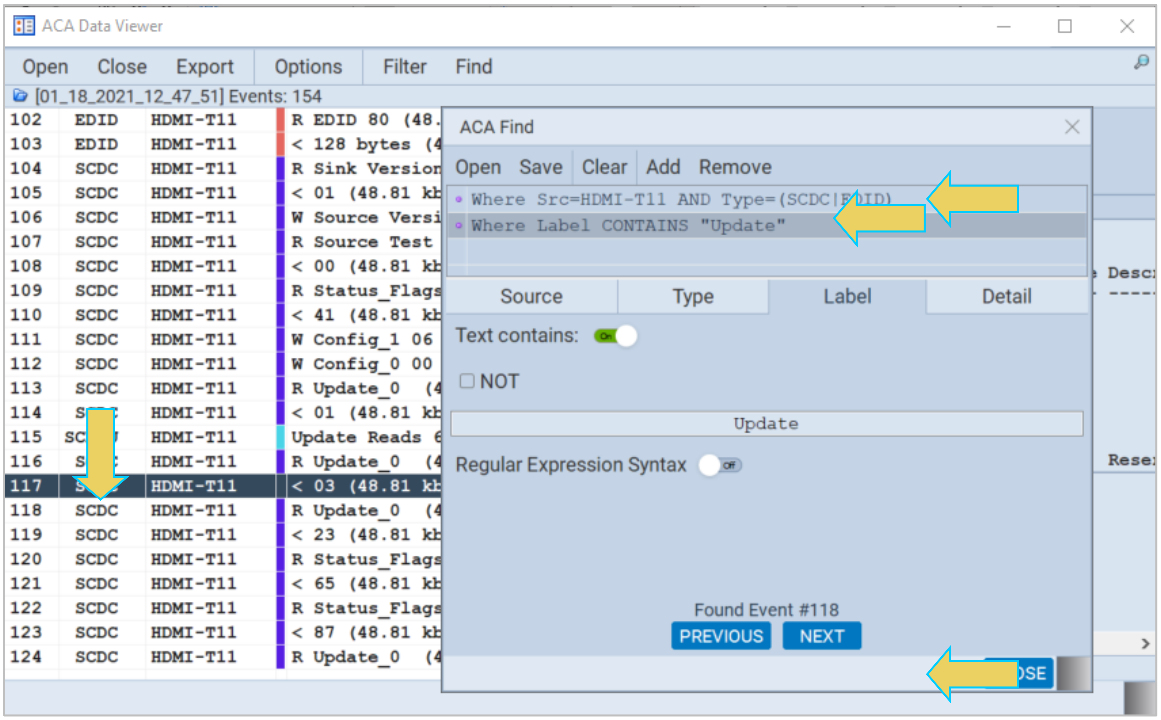
If you specify two different types of data in the **Type** field, the search will be a logical OR function as shown below.



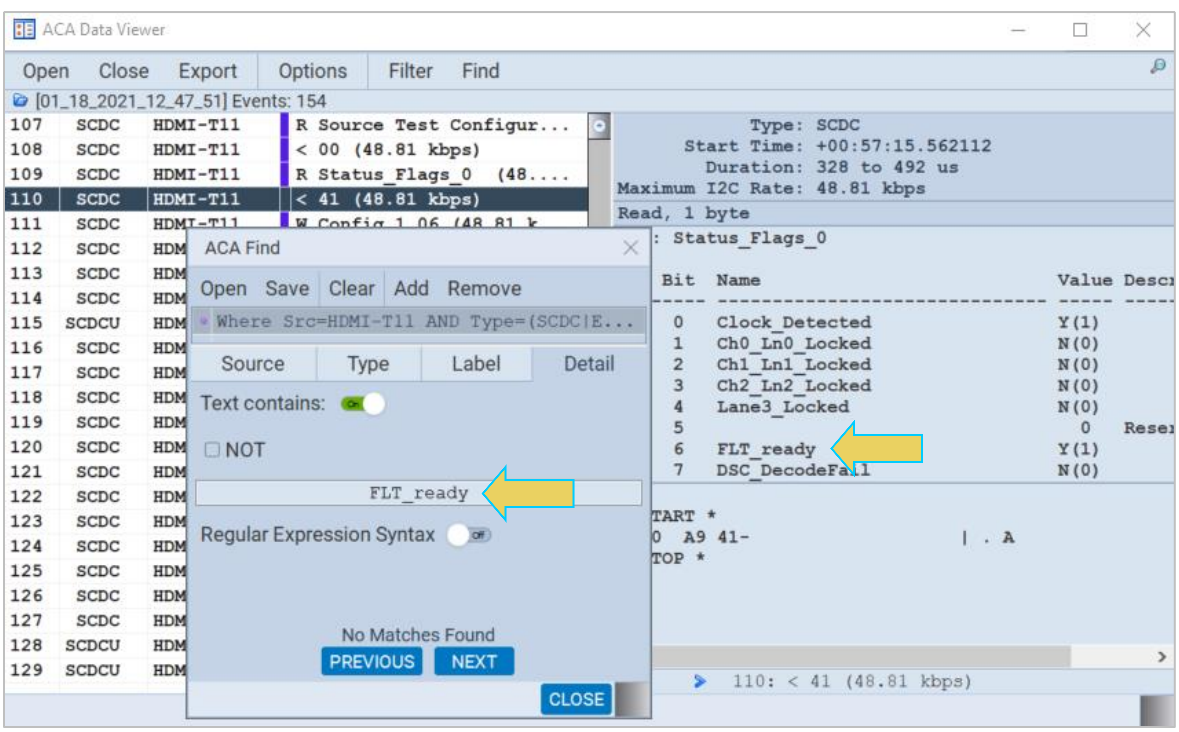
If you specify one or more data types in the **Type** field and enter a string in the **Label** text field in the same search configuration, the search will behave as a logical OR for the data types and a logical AND with the **Type** and the **Label** field as shown below.



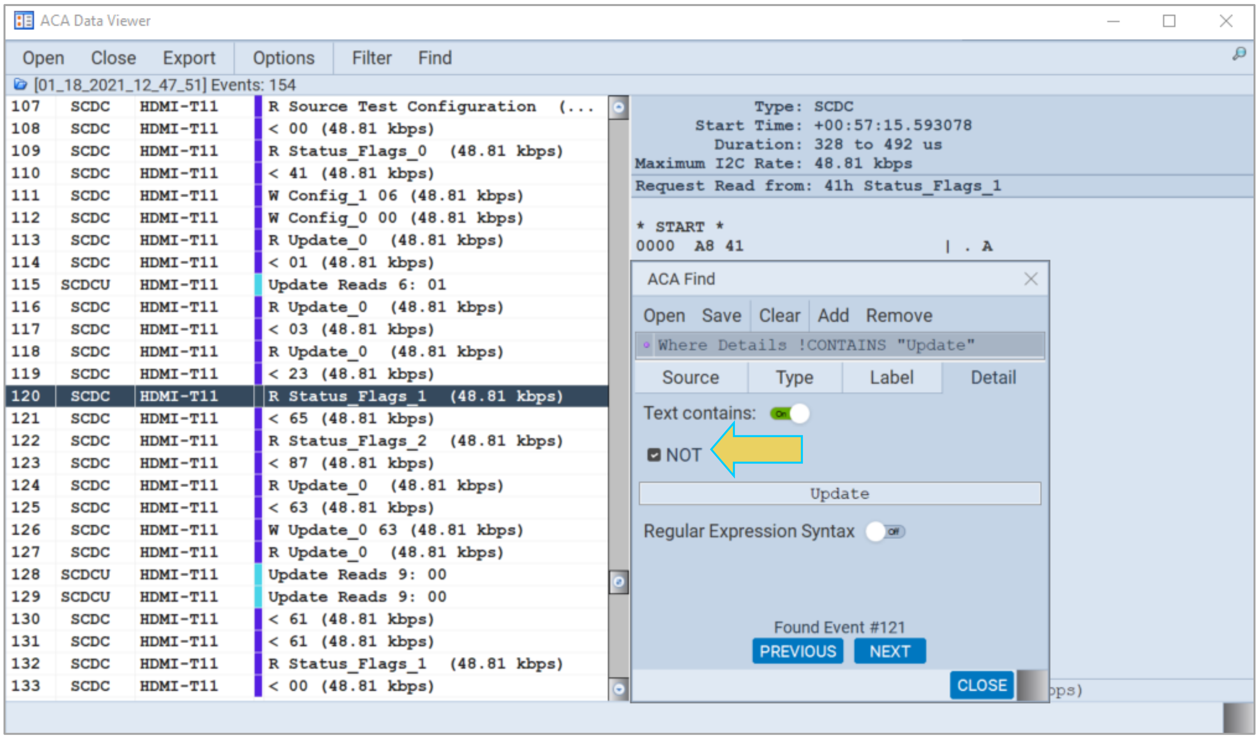
However, if you enter these same criteria using separate configurations as shown below, the search will behave as a logical OR function. In this case it will find the next instance of an SCDC transaction.



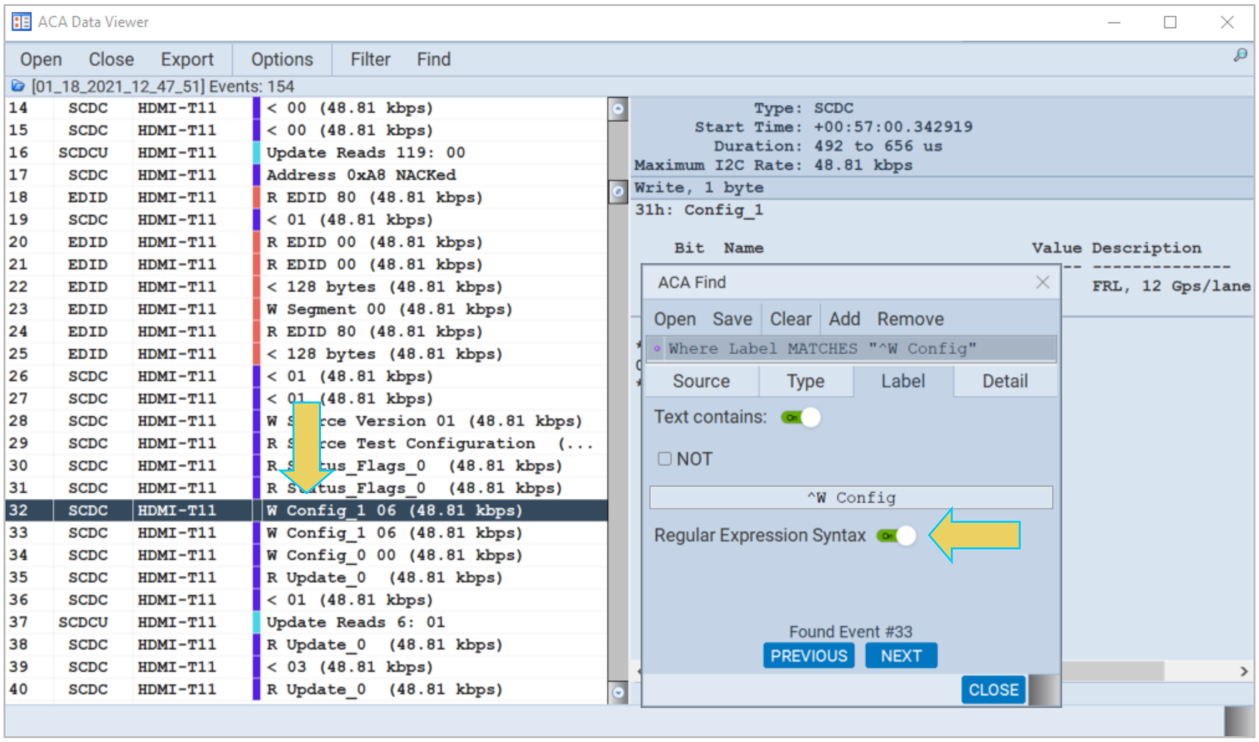
You can also search through the **Details** panel of a record. The following examples depicts this. In this example, we have also restricted the search to SCDC and searching for the text string “FLT_ready” in Details panel.



You can also conduct a string search with a NOT function to exclude message labels or details that contain a specific string. There are not many uses of this type of search but it is supported. The following example shows this type of search.



You can use regular expressions as well in either the **Label** field or the **Details** field. The following example shows how you can advance to HDMI SCDC transaction that contains the string "> W Config" at the beginning (^ operator) of it.

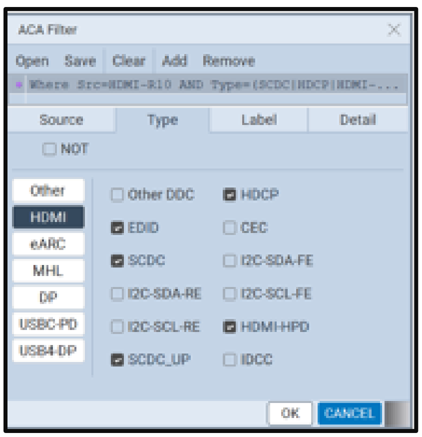


11.7 Using the ACA Filter Feature

The **ACA Filter** dialog box is accessible through the **Data** pop-out menu. The **ACA Filter** function enables you to filter an ACA trace file to view a subset of the log records in a particular file. The ACA Filter feature is not available with the **ACA Remote Control** utility. It is only available with the ACA feature in the embedded GUI (once you have reloaded a stored ACA trace file) and the **ACA Data Viewer**. If you wish to use the Filter feature on ACA traces that you have captured using the **ACA Remote Control** utility, you must save the traces as a file and reload them through the **ACA Data Viewer** utility.

You access the ACA Filter function through the **Data** flyout menu on the control panel of the embedded **ACA utility** and directly from the **Filter** button on the control panel of the **ACA Data Viewer**.

The **ACA Filter** dialog box is shown below.



The **Filter** function enables you to select data types in the **Type** field and then search based on text string occurrences in the log record labels or the message details.

Note: For the **ACA** utility, you have to Stop the collection of real time trace activity using the Start/Stop button on the right side control panel.

The following table describes the **Filter** function buttons, fields and functions.

ACA Filter Window		
Buttons (Top)	**Function**	**Description**
Open Open	Opens a stored user created Filter configuration.	You can store commonly used filter configurations using the Save function and recall them for quick access using the Open button.
Save Save	Saves a user created Filter configuration.	

ACA Filter Window		
Buttons (Top)	**Function**	**Description**
Clear Clear	Clear the existing Filter criteria.	You can build up complex filter configurations by concatenating multiple filter criteria. When you add multiple configurations, they behave as a logical OR function whereby if either of the criteria is True, the filter function will filter an entry. You enter criteria through the embedded touch screen with a pop-up keypad in the ACA real time utility or simply by typing on the external ATP Manager interface. When you are assembling filter configurations you can clear individual configurations by highlighting them in the panel provided and then use the Clear button. You can add through the Add button. You can remove an individual configuration using the Remove button. Example screenshots are shown below.
Add Add	Sets the currently defined Filter criteria defined in either the Source, Type, Label or Details sub-panels and adds another row for new filter criteria.	
Remove Remove	Removes a highlighted filter criterion of an existing filter configuration.	
Buttons (bottom)	**Function**	
OK OK	Initiate the filter and closes the **ACA Filter** window.	
Cancel CANCEL	Cancels and closes the filter configuration.	
Fields	**Function**	**Description**
Source	Check box to select the port that you want to filter. Please note that you can collect data in the ACA Trace window from multiple ports.	When you select multiple Source ports they behave as a logical OR function. When you initiate a search, by clicking on the Next or Previous button, the Filter function will locate a record matching the criteria. If only the Source (port) is specified, the next or previous record from or to that source will be highlighted.
Type	Check boxes enabling you to specify which data	When you select multiple data types they behave as a logical OR function.

ACA Filter Window		
Buttons (Top)	**Function**	**Description**
	types you wish to data types you wish to filter on based on the string.	If only the Type field is specified, the next or previous of that data type will be highlighted.
Label	Combination check boxes and text fields for specifying criteria for text that appears in the Label field of the message. When you enter criteria in the Label field, it will automatically be added to the set of criteria in the panel above it.	**Text Contains** – A check box to activate the Label criteria. **Not** – A check box which when checked will filter for records that *do not* meet the criteria in the field beneath it. **Text Field** – A text field to enter a string that will be matched (or Not matched). **Regular Expression Syntax** – A check box to specify whether the text in the Text Field will be treated as plain text or a regular expression. Regular expression syntax is a commonly used set of operators for filtering the text. You can find detailed examples on the web including Wikipedia. If Regular Expression check box is checked, you can enter in any regular expression into the text field for a string match.
Details	Combination check boxes and text fields for specifying criteria for text that appears in the Label field of the message. When you enter criteria in the Label field, it will automatically be added to the set of criteria in the panel above it.	**Text Contains** – A check box to activate the Label criteria. **Not** – A check box which when checked will search for records that *do not* meet the criteria in the field beneath it. **Text Field** – A text field to enter a string that will be matched (or Not matched). **Regular Expression Syntax** – A check box to specify whether the text in the Text Field will be treated as plain text or a regular expression. Regular expression syntax is a commonly used set of operators for filtering the text. You can find detailed examples on the web including Wikipedia. If Regular

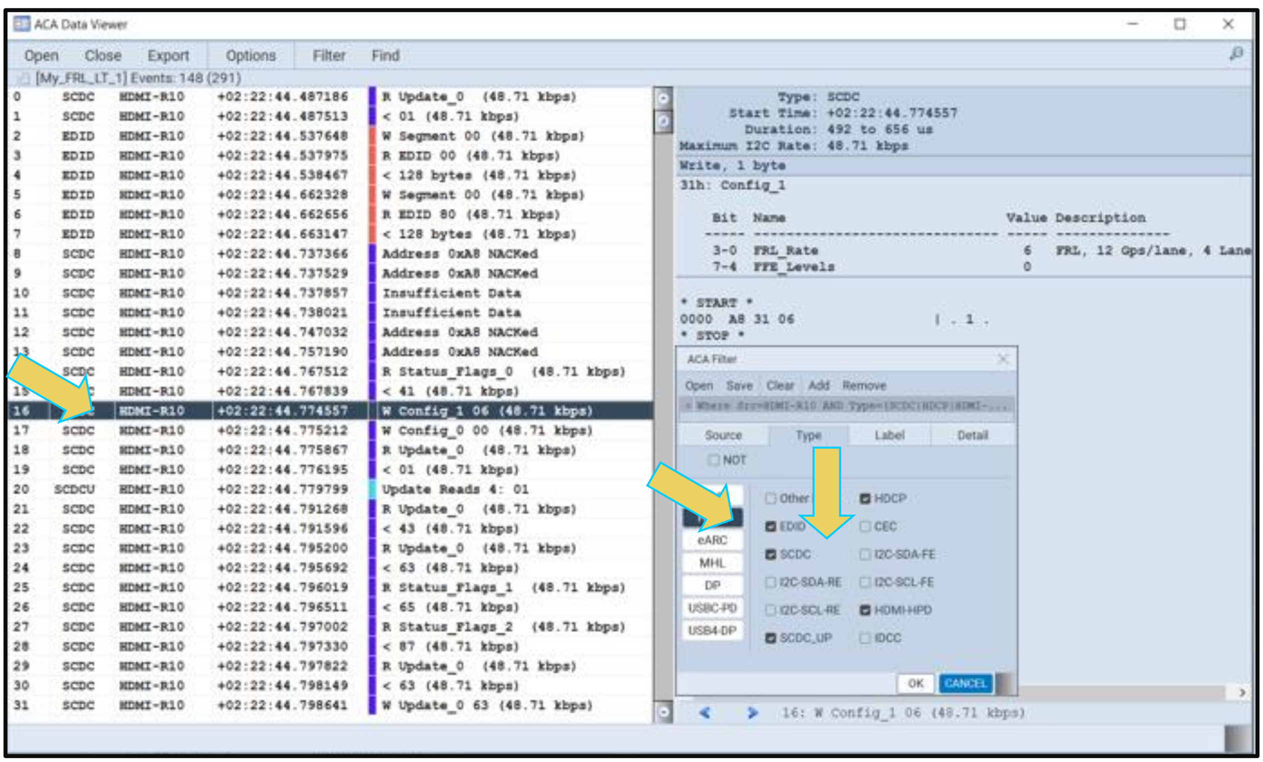
ACA Filter Window		
Buttons (Top)	**Function**	**Description**
		Expression check box is checked, you can enter in any regular expression into the text field for a string match.
Close	Closes the Filter window.	

Here are some screen examples of the **Filter** function. Note that the screen examples use the **ACA Data Viewer** utility but the embedded **ACA Data Viewer** works the same way. The only difference is the **ACA** embedded utility uses a pop-up keypad.

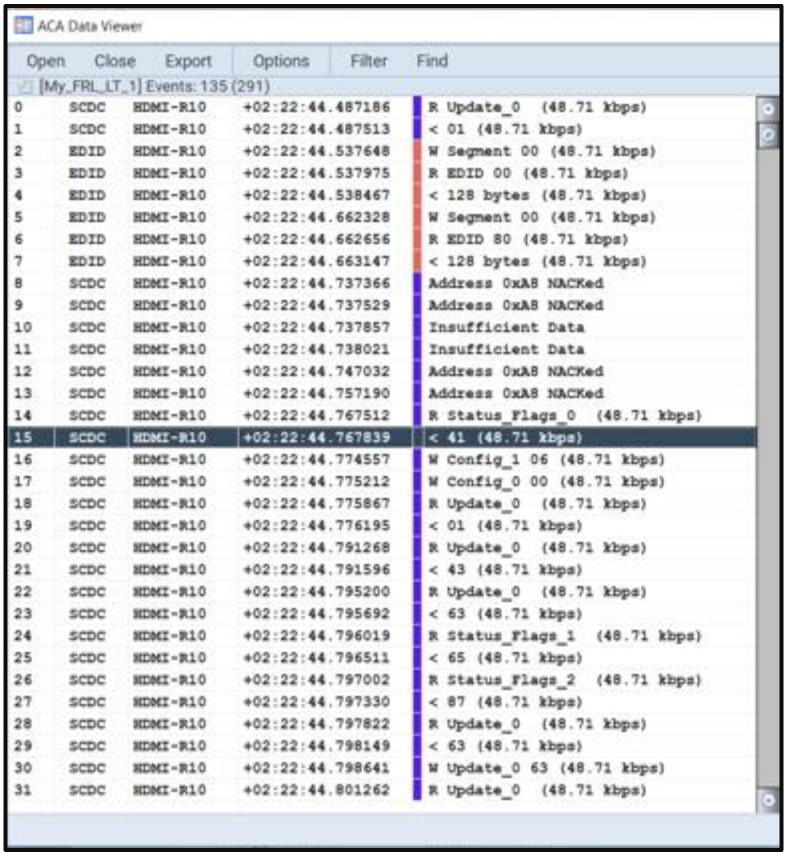
Filtering the ACA trace files with the Filter function:

Here are some screen examples of the **Filter** function. Note that the screen examples use the **ACA Data Viewer** utility but the embedded **ACA Data Viewer** works the same way. The only difference is the **ACA** embedded utility uses a pop-up keypad.

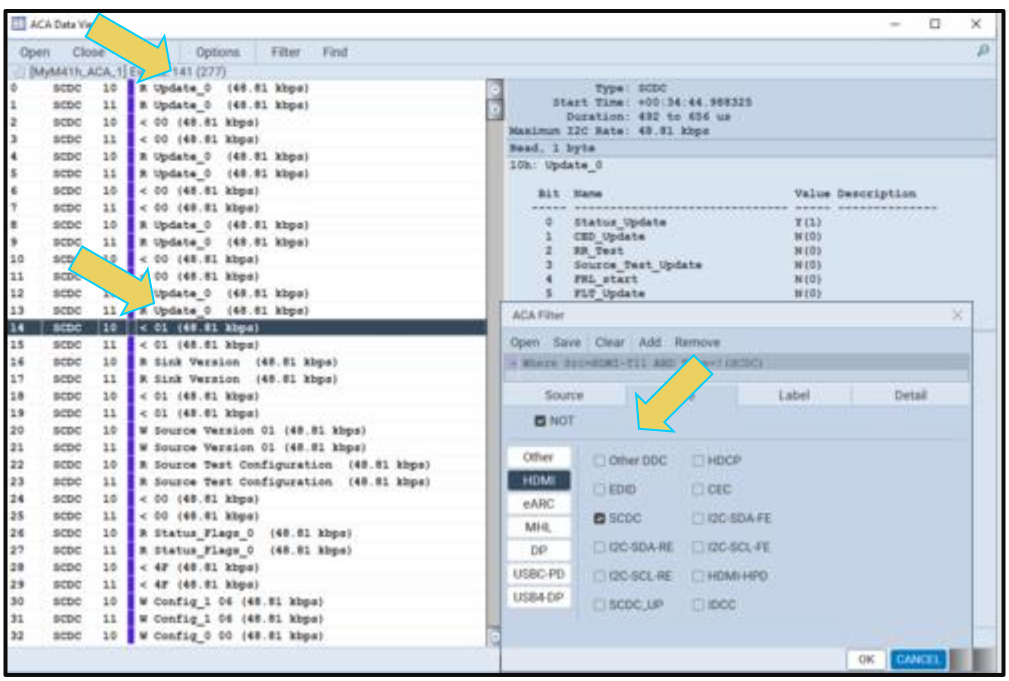
1. To filter all data types from a specific port (interface on the), enter the following (example uses port HDMI-T70 transmit port).



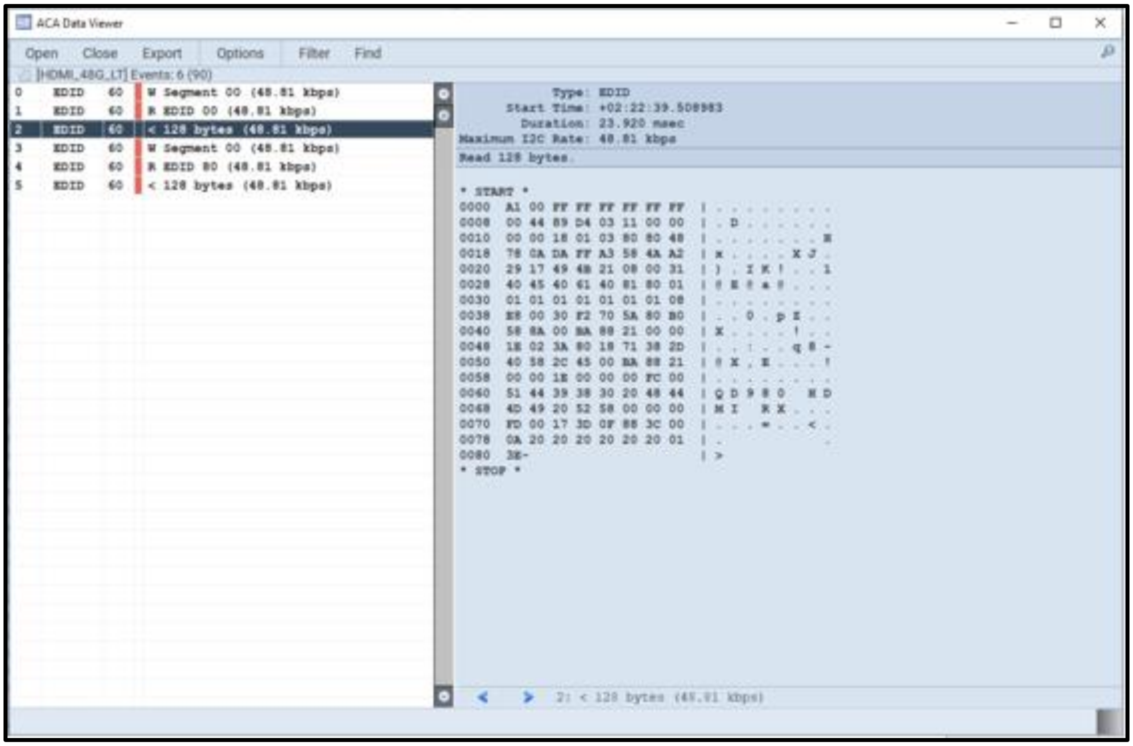
4. Click on the **OK** button to initiate the filter. The result is shown below. Notice the EDID entries go away.



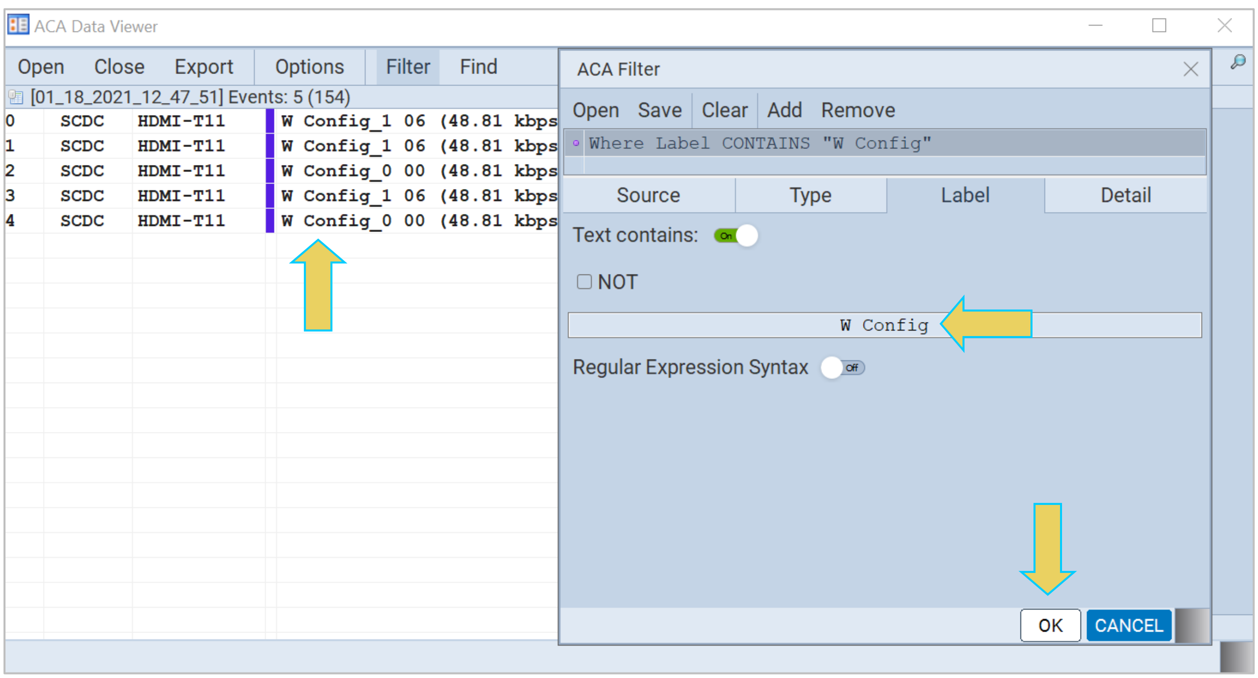
To filter out all SCDC messages use the NOT operator as follows.



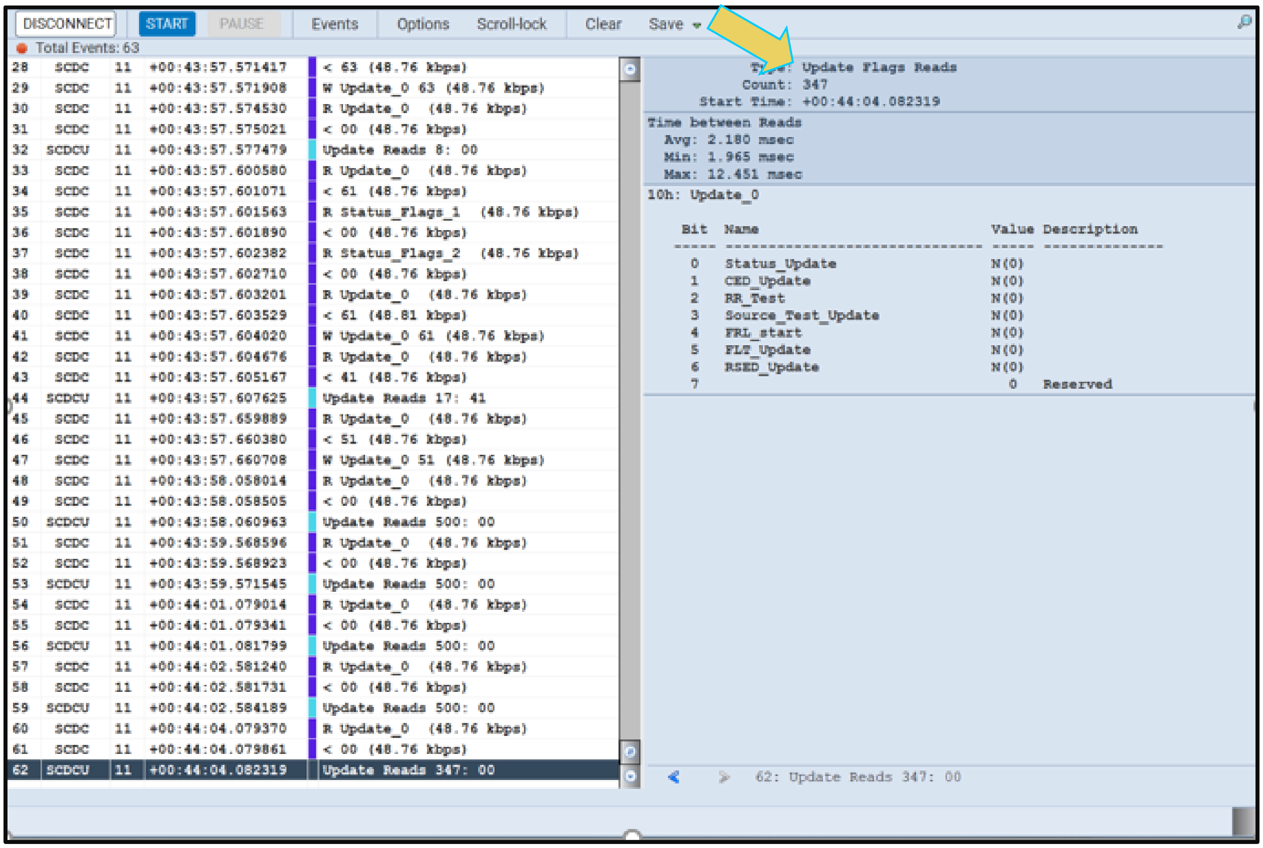
Click on the **OK** button to initiate the filter. The result is shown below. The HDMI SCDC message are stripped from the list leaving only the EDID transactions.



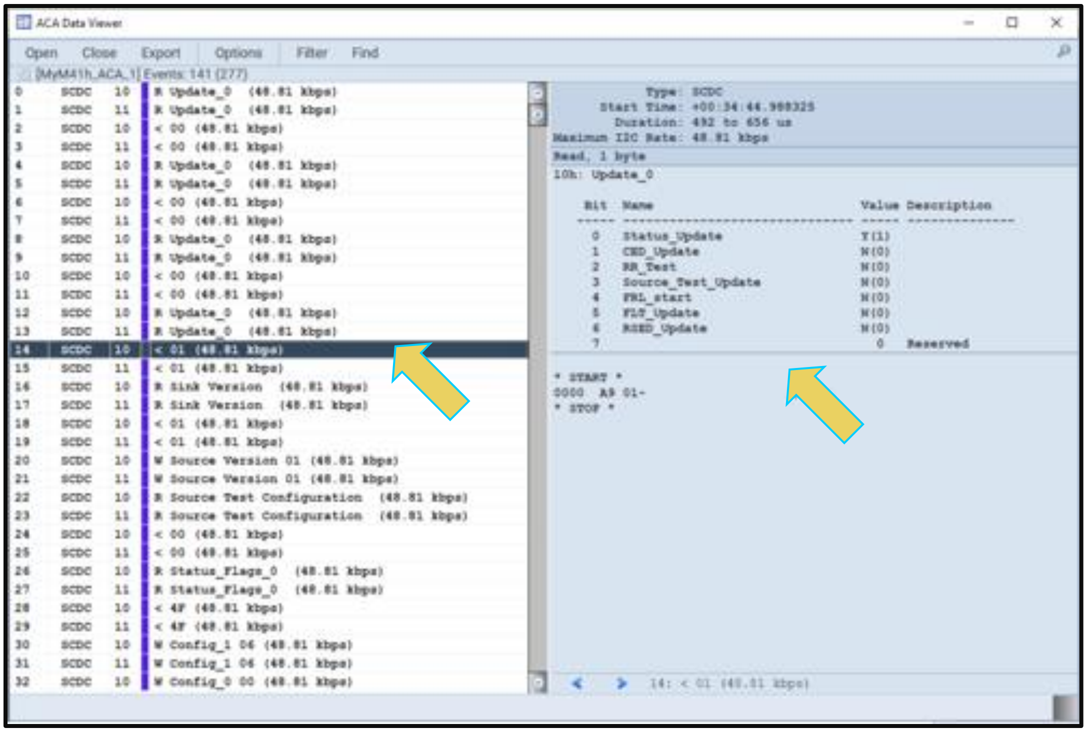
To filter using text strings appearing in the message label, use the check box(es) on the **Label** section of the **ACA Filter** window. You can also include a text string filter with a filter applied to the **Type** field. For example, if you wish to establish a filter based on a text string that includes “W Config” you would use the following:



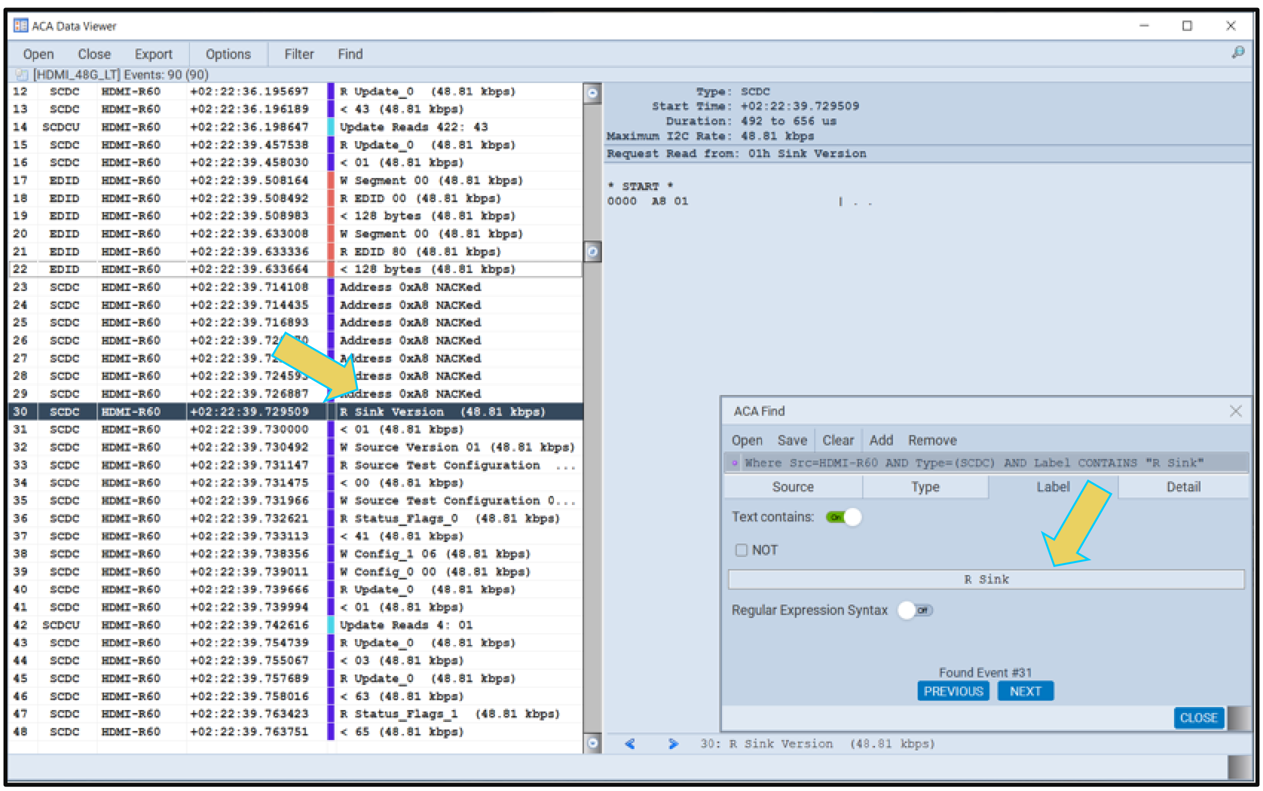
To filter using text strings in the message details, use the check box on the **Details** section of the **ACA Filter** window. The following example uses filters using a text string in the **Details** field.



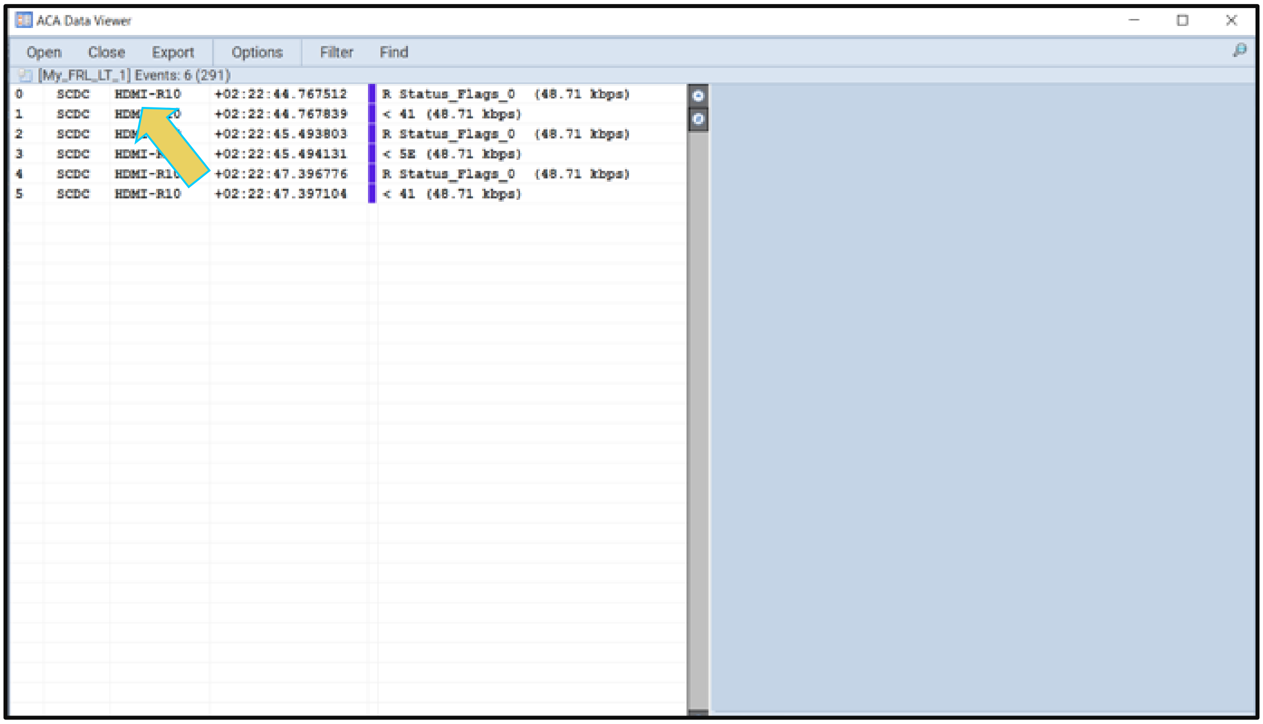
The result of the above filter criteria would be the following.



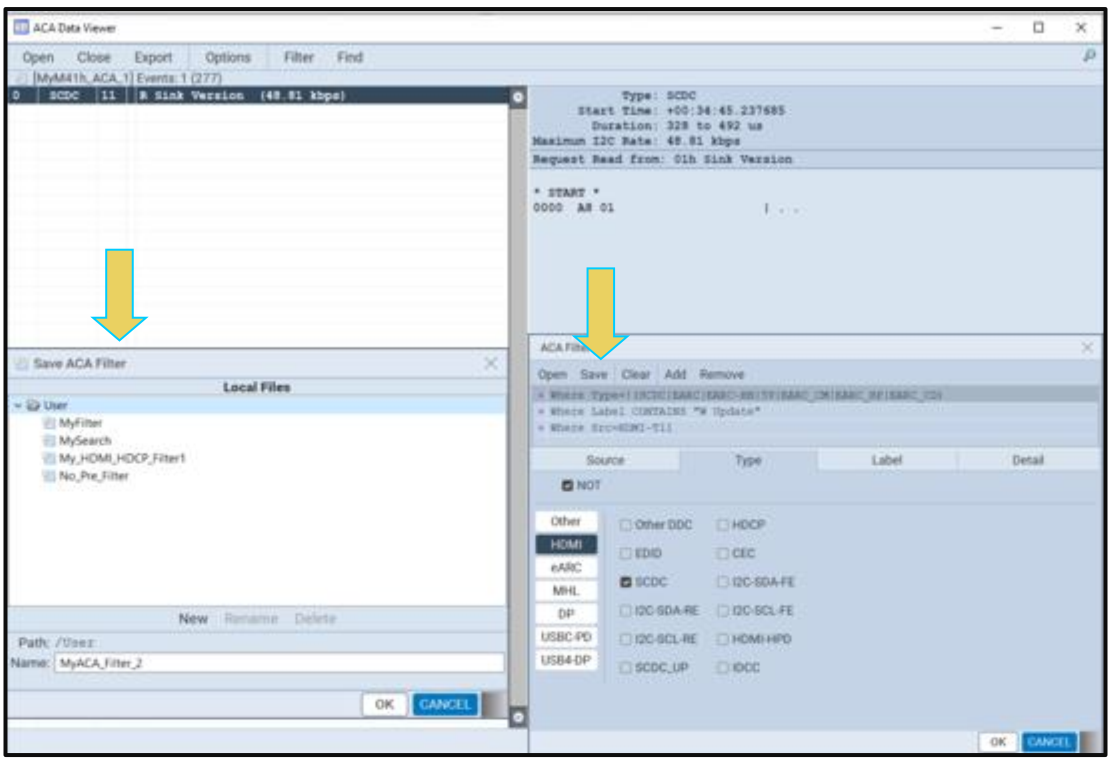
To filter using regular expression text in the message label, text strings in the message details, use the **Regular Expression Syntax** check box on the **Label** section of the **ACA Filter** window. Refer to the following example. Note that the (^) operator filters for text strings that begin with the text you enter after it, in this case, “> R Sink”



The result of the above filter criteria would be the following.

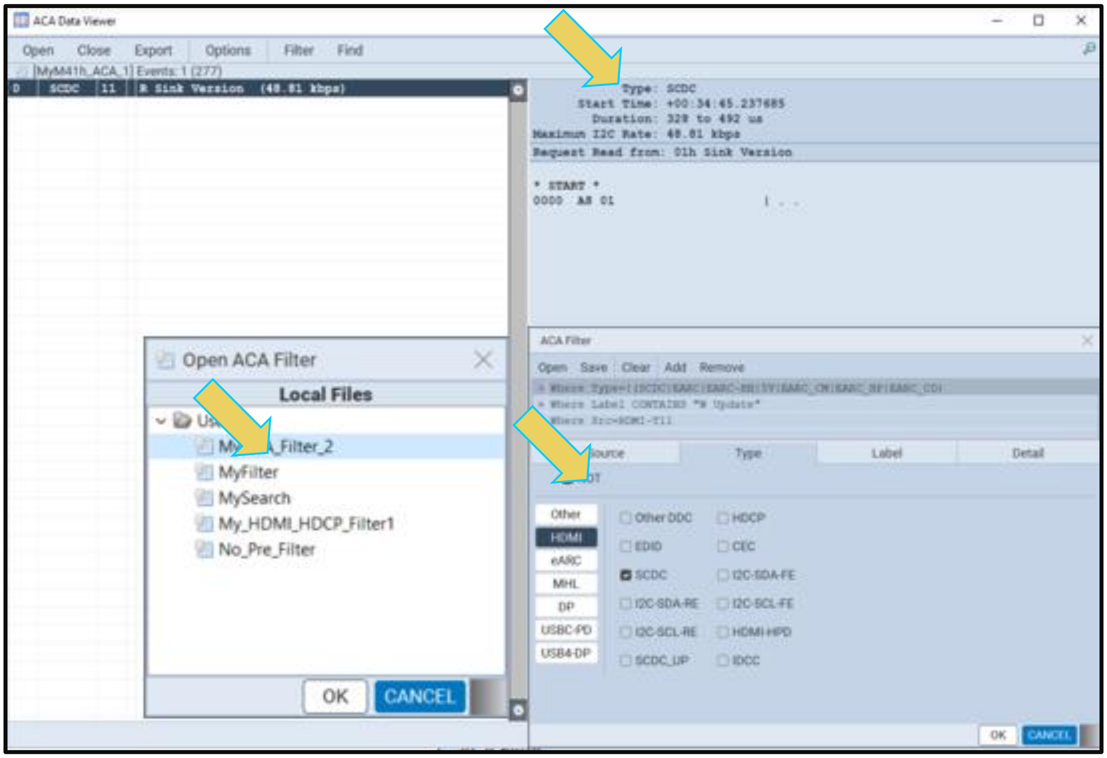


To save a filter configuration for quick recall, use the **Save** button.



A dialog box appears as shown above. Enter a name and click on **OK**.

To recall a filter simply click on the open button and an open dialog box appears as shown below.



12 Loading and Importing Capture Files

This chapter describes how to use access captured files taken from other M42h 96G Video Analyzer/Generator HDMI® systems and how to transfer capture files taken through the embedded ATP Manager.

12.1 Loading an Existing Capture with the M42h 96G Video Analyzer/Generator

You can load a decoded file that had been captured previously for analysis.

12.1.1 Loading an existing capture

Use the following procedures to load a capture that you have listed in the ATP Manager for the M42h 96G Video Analyzer/Generator. You can load a file in one of three ways:

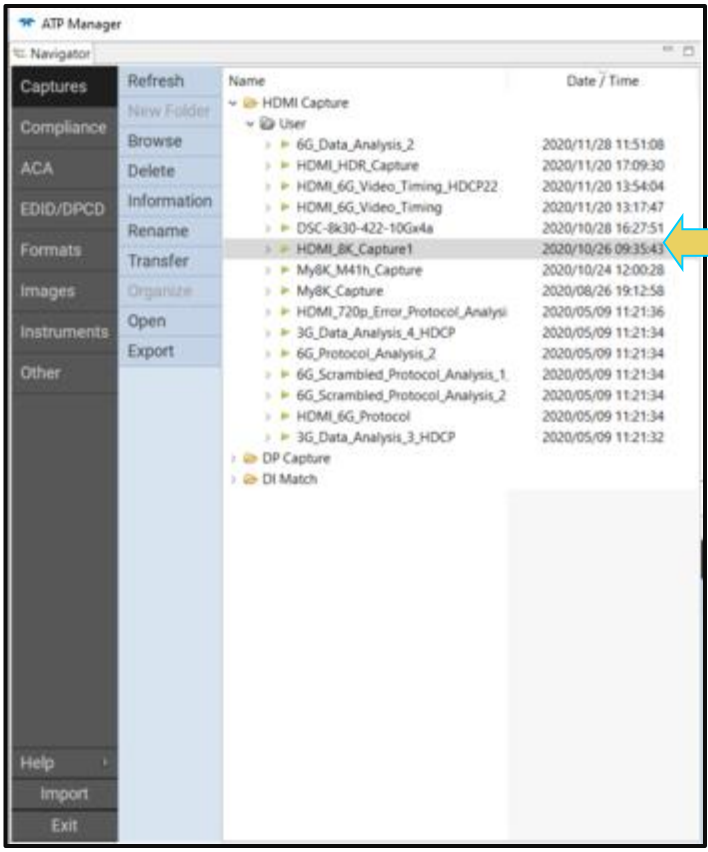
- Double-clicking on the captured file in the Captures panel
- Accessing the Open option from the right-click menu of a selected capture in the Data pull-down menu
- Clicking on Open 

in the area near the top of the Data panel

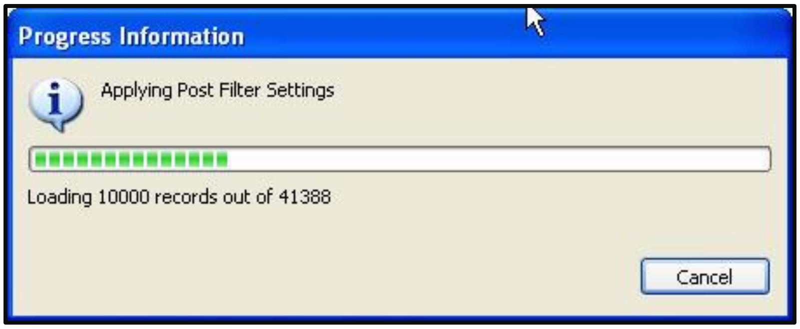
The procedures below show you how to load the capture from the right-click menu.

To Load a captured data file:

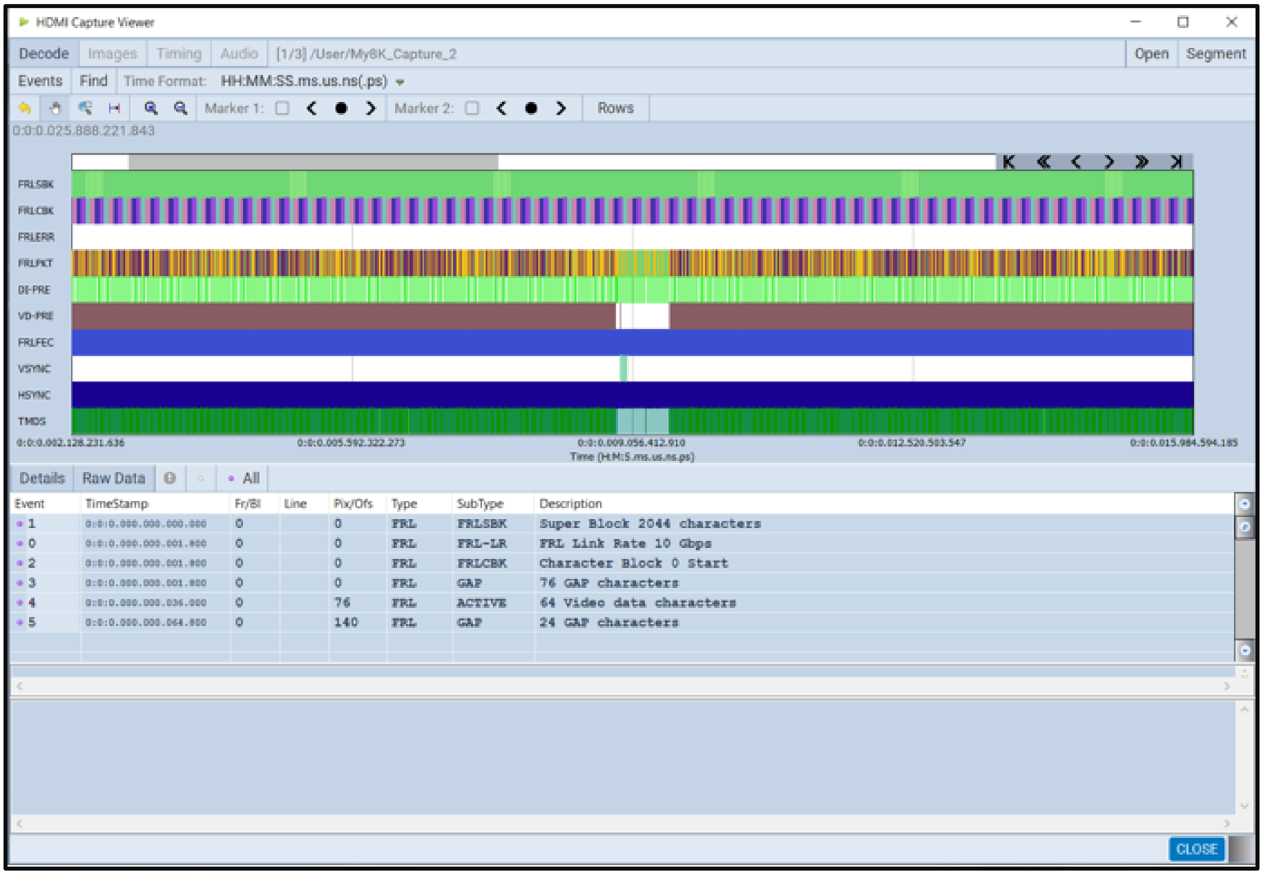
1. Load a capture for analysis by right-clicking on it and then select the **Open** item on the list.



A dialog box will display indicating the progress in loading the capture (sample shown below). Once the data is fully loaded it is displayed through the ATP Manager in both the **Event Plot** and **Decode** panels.



The captured file appears in the **Capture Viewer** window as shown below.



12.2 Importing Capture Files from Other M42h Systems

This subsection provides procedures on loading a previously captured file and procedures for importing captured files taken from another M42h 96G Video Analyzer/Generator.

The captured data from the M42h 96G Video Analyzer/Generator is portable. You can open captured files that have been taken by any other M42h 96G Video Analyzer/Generator at any other location. You do not need an M42h 96G Video Analyzer/Generator to examine captured files taken elsewhere; you just need the ATP Manager. For example, you may wish to send a set of captured files to a colleague at a different location and this colleague may not have an M42h Protocol Analyzer. In that case, the colleague can simply download the ATP Manager from the Quantum Data website to view the captured files that you sent them. Of course, it may be the case that your colleague is sending you a set of captured files as well. Typically, the file would be posted on an FTP site as a zip file. You would then need to download the file, unzip it, and then access it by browsing utilities provided in the ATP Manager.

In some cases, you may wish to put a series of captured files in an ATP Manager local directory for easy access. In this case move these files to the proper ATP Manager directory. Procedures for this are provided below as well.

12.2.1 Importing Capture Files

Use the following procedures to import a capture. The first procedure describes how to install the ATP Manager on your PC. The second procedure describes how to import the capture.

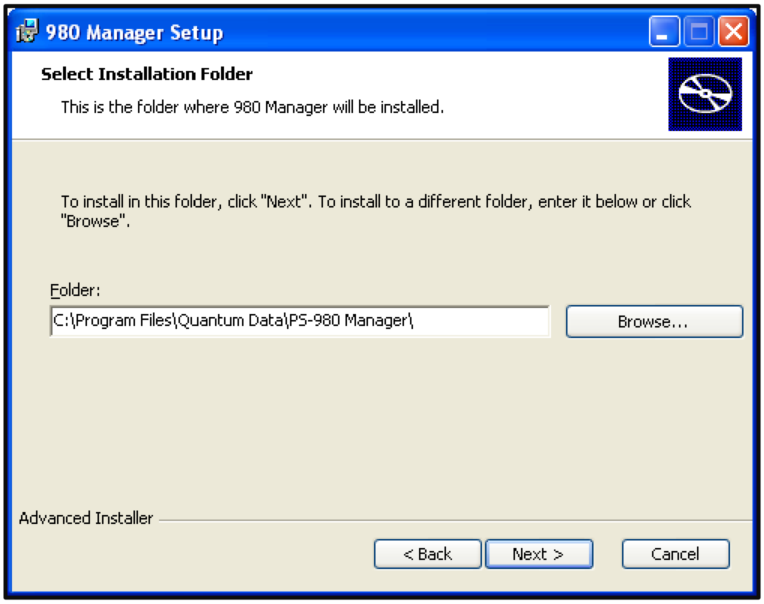
To Install the ATP Manager on your PC:

Download the ATP Manager from the quantumdata *downloads* page to your PC. The link to the *downloads* page is: http://www.quantumdata.com/downloads.

Start the installation by double-clicking on your downloaded *.msi file.

The Setup Wizard will launch.

Select the installation folder. We recommend installation in the default folder.

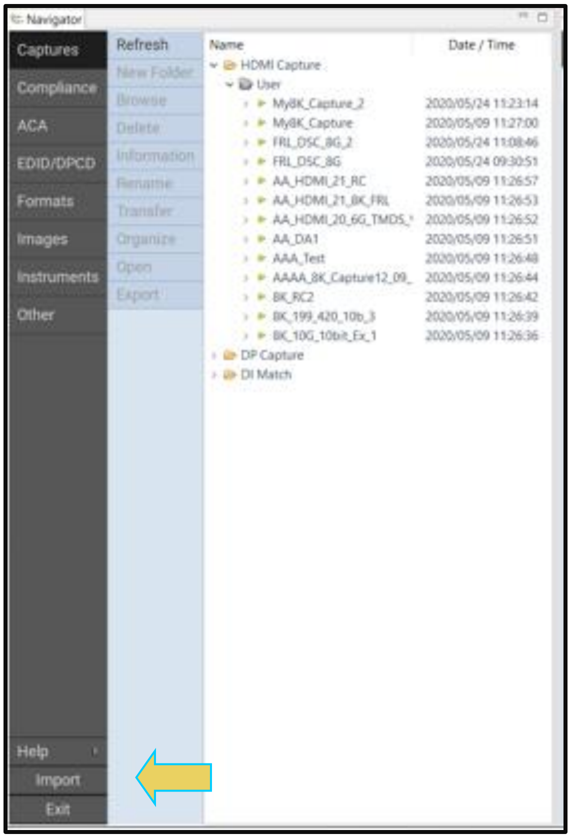


After installation completes, run the new ATP Manager. It should be available in the Start Menu under **All Programs** → **Quantum Data**, and from an icon on your Desktop.

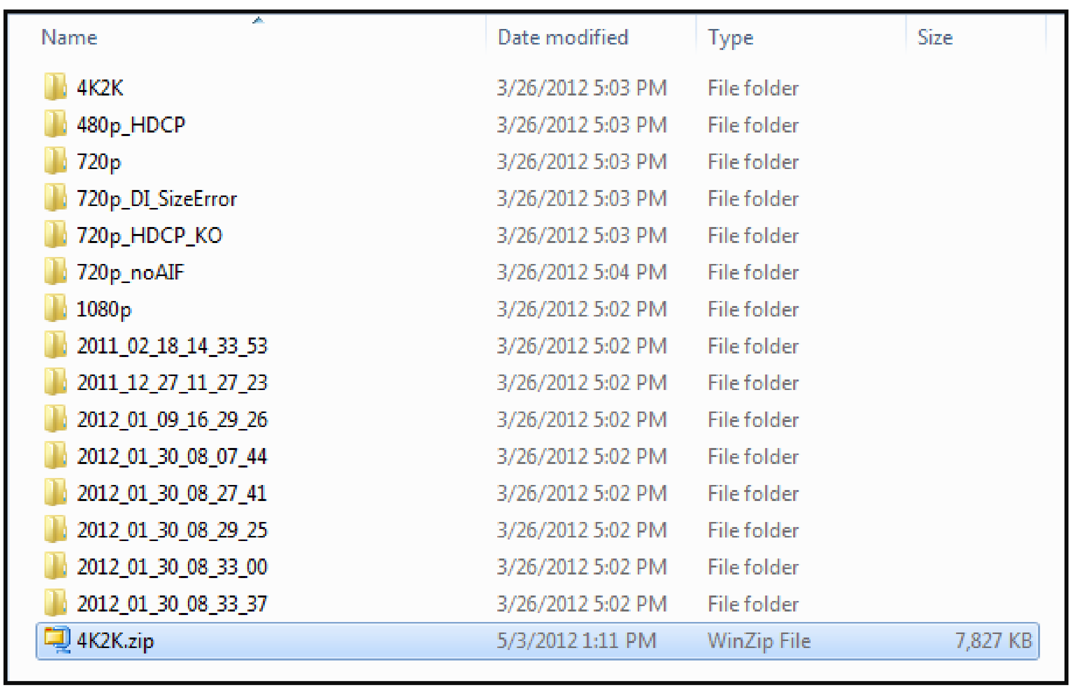
Verify that the version number in the title bar matches the version on the website.

Importing capture files

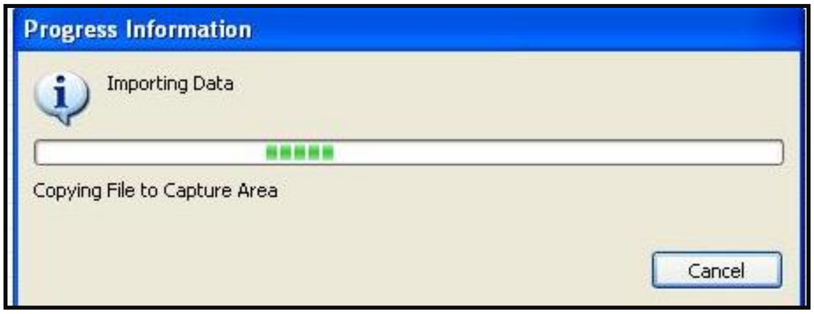
1. Download the captures zip file from your FTP site, save it and unzip it on your PC that now has the ATP Manager installed.
2. Import a previous capture using the **Import** utility available from the **File** menu. (See below.)



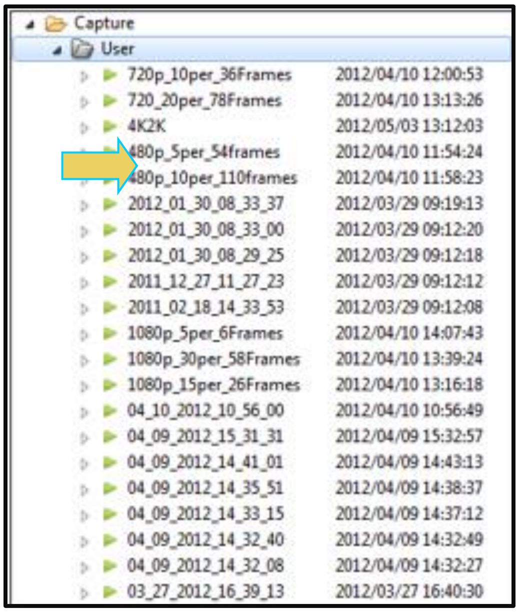
You will be asked to browse for a file through a standard Windows dialog.



Once you select the file you will see a progress dialog box as shown below:



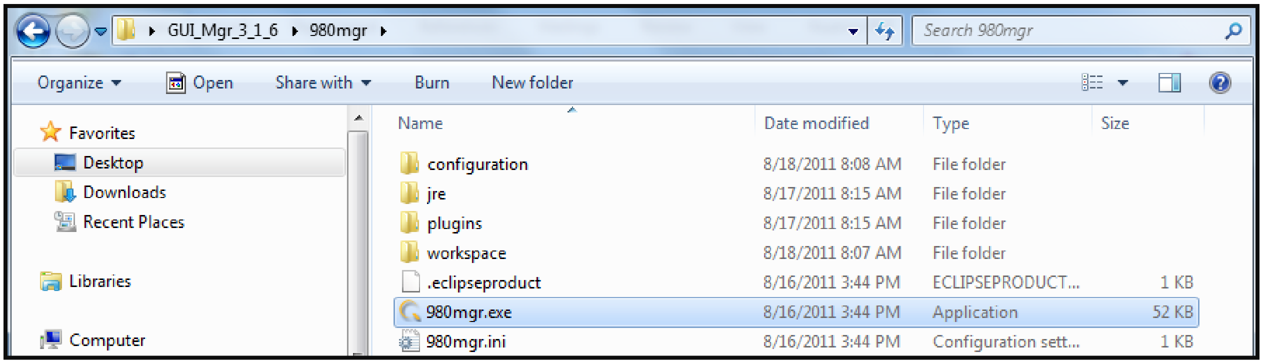
The imported file will then appear in the **Data** directory of the **M42h Navigator** panel as shown below. The captured file is loaded automatically and has an asterisk in front of it to indicate that this capture is the one that is loaded:



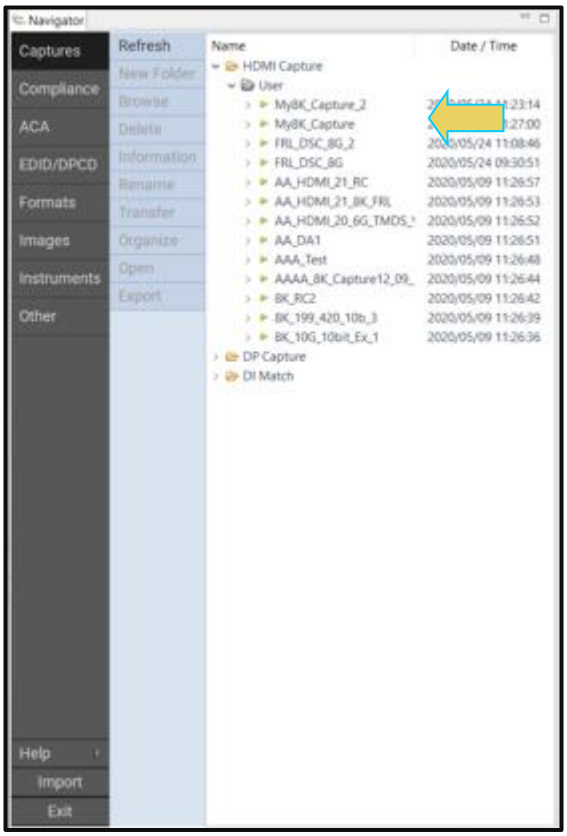
Relocating capture files to the ATP Manager directory

If you receive a capture file from a colleague for analysis, you will need to be able to access it on your ATP Manager. To do this you will need to place the file in a directory that the ATP Manager will be able to access it. Use the following procedures.

3. Download the captured zip file from your FTP site, save it and unzip it on your PC that now has the ATP Manager installed.

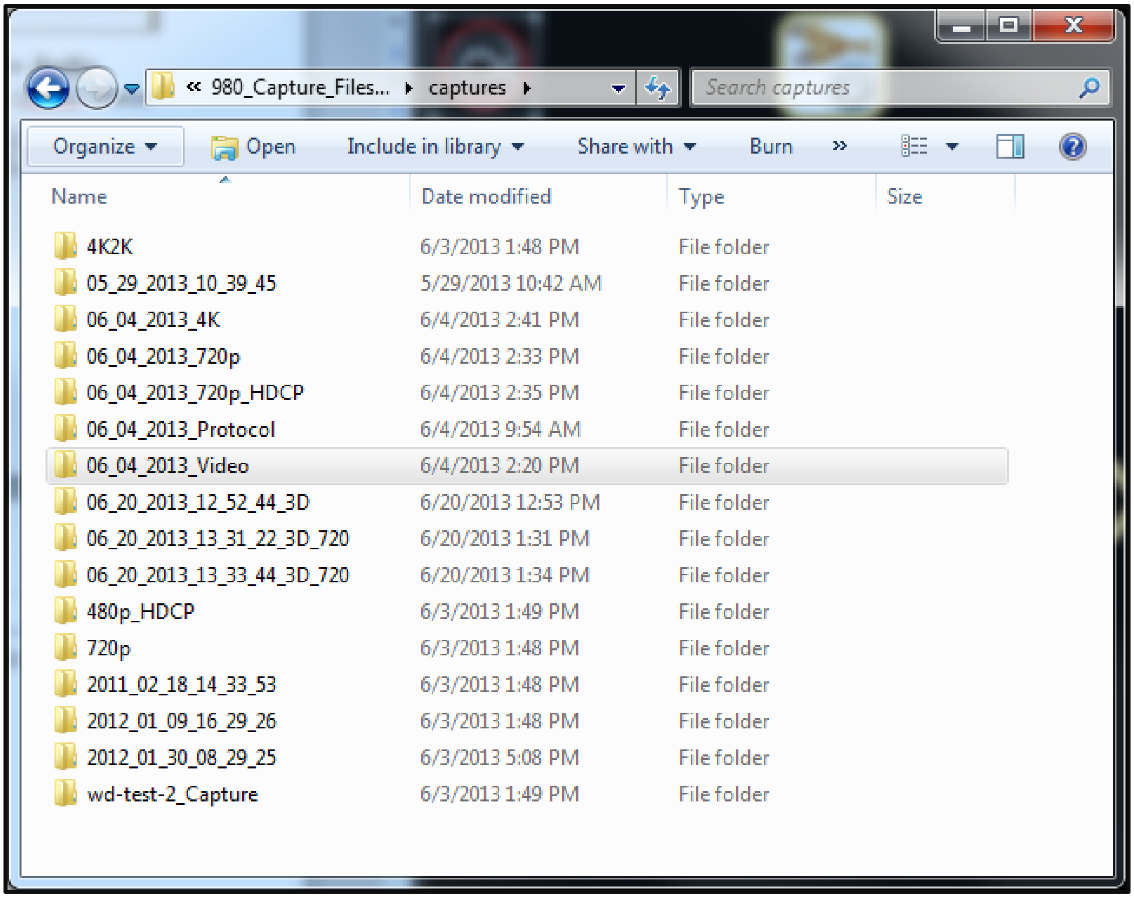


4. Launch the ATP Manager.
5. Locate the ATP Manager **Captures** directory using the Open Selected Folder icon indicated below.



A Windows Explorer window will appear at the captured file. From there you can determine the location of the **capture** directory.

6. Transfer the capture directory (from the file you unzipped) to the ATP Manager captures directory using standard Windows methods. The screen example below shows the resulting files stored in the directory.



When you relaunch the ATP Manager you will see all the capture files that you transferred to the directory.

13 Transferring Capture Files from the M42h to a PC

The M42h 96G Video Analyzer/Generator for HDMI® offers portability of data. You can disseminate captured files or even compliance tests to other locations for analysis by other colleagues. When you make a capture using the embedded GUI the captured files are retained on the M42h test instrument.

Note: The procedures provided in this chapter show how to transfer ACA traces and captures playback files, but you can transfer EDIDs, image lists, or any other type of data type under the Navigator tab.

If you want to disseminate these captured files to others you will have to transfer these capture files to your PC. You can transfer files from the M42h 96G Video Analyzer/Generator to your host PC in three ways: 1) Data Transfer GUI utility, 2) USB drive, 3) command line FTP.

13.1 Transferring Capture Files Using the Data Transfer Utility

You can transfer files easily using the ATP Manager's **Data Transfer** utility. Follow the procedures below.

To transfer ACA files from the M42h to your PC using the Data Transfer utility:

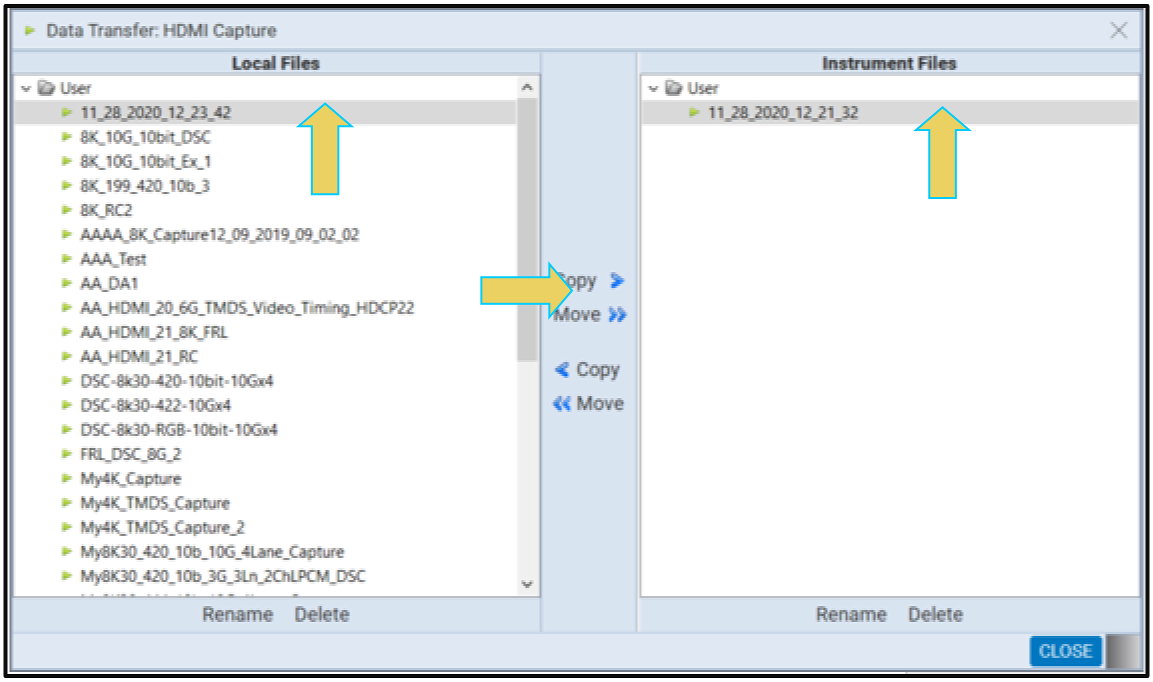
1. Through the external ATP Manager, access the **Generator/Port Control** panel either through the View pull-down menu or the **Generator** button located on the top of the interface. Refer to the screen shots below.

Note: This procedure shows examples of transferring ACA traces, capture files and Playback files but you can transfer EDIDs, image lists or any other type of data type under the Navigator tab.

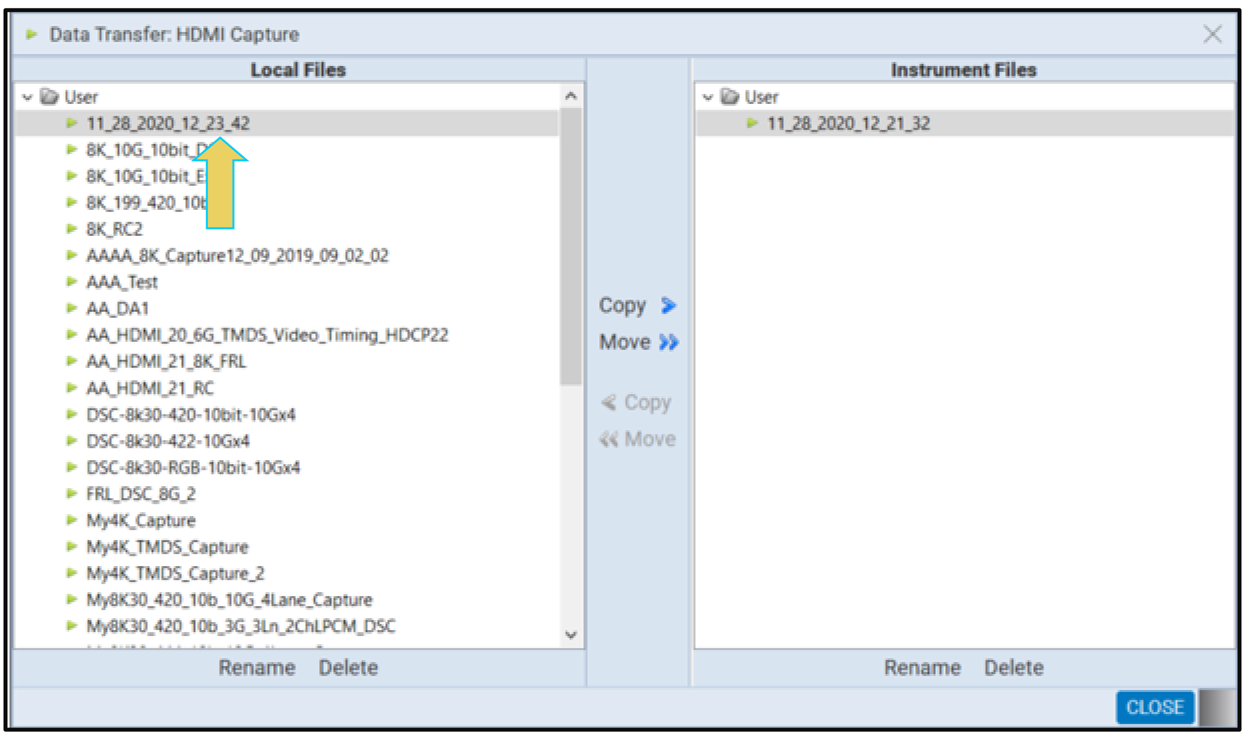
2. Access the **Data Transfer** utility by double-clicking on Transfer on one of the data sets in the **Navigator** window.

This enables you to select the M42h 96G Video Analyzer/Generator that you want to transfer data from.

The **Data Transfer** panel appears in context with the ACA files on the M42h (Instrument) under the **Instrument Files** available as shown below.



3. Highlight a directory on the **Local Files** side (host PC) and then initiate a **Copy** or **Move**. The file appears on the PC host **Local** Files (below).

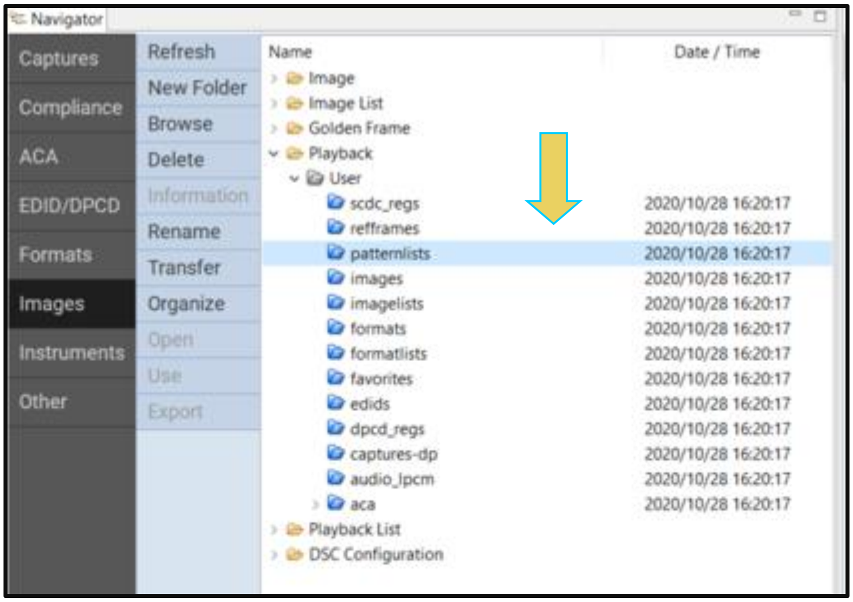


To transfer Playback files from the M42h to your PC using the Data Transfer utility:

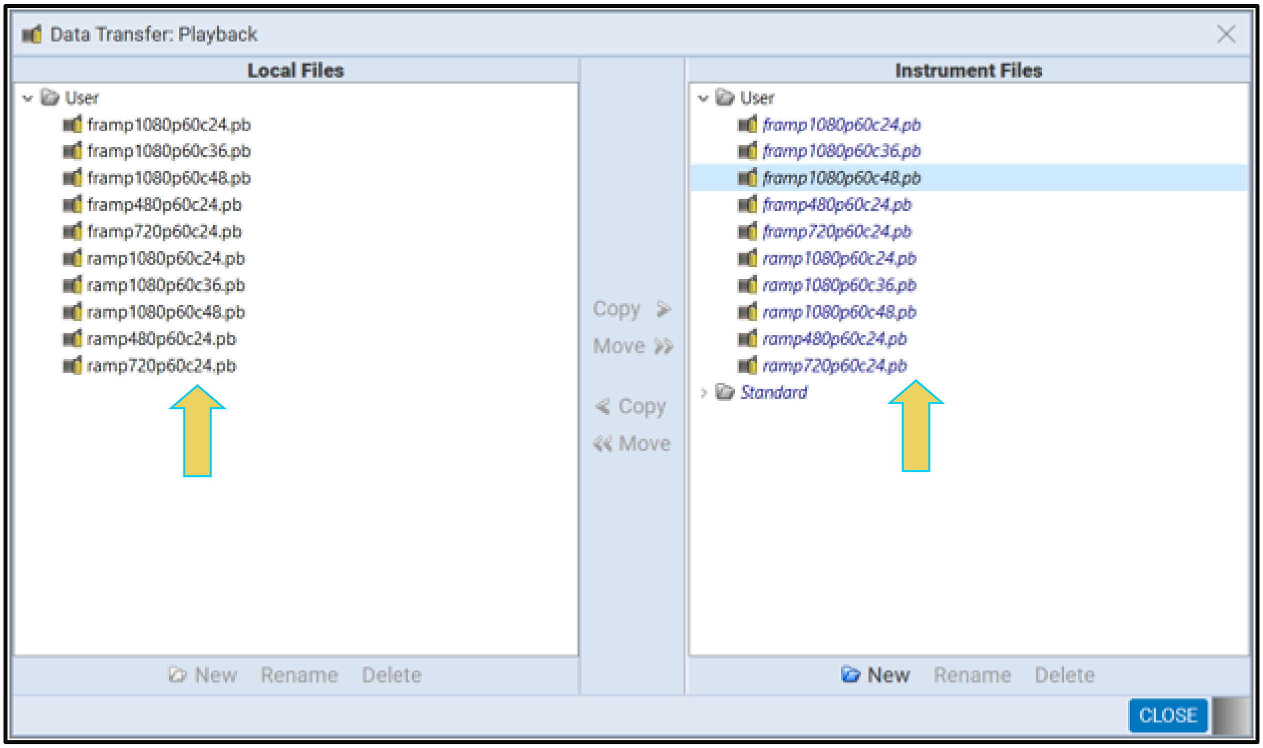
2. Through the external **ATP** Manager, access the Generator/Port Control panel either through the **View** pull-down menu or the **Generator** button located on the top of the interface. Refer to the screen shots below.

Note: This procedure shows examples of transferring ACA traces, capture files and Playback files but you can transfer EDIDs, image lists, or any other type of data type under the Navigator tab.

3. Access the **Data Transfer** utility by double-clicking on **Transfer** on one of the data sets in the Navigator window.



The **Data Transfer** panel appears in context with the ACA files on the M42h (Instrument) under the **Instrument Files** available as shown below.

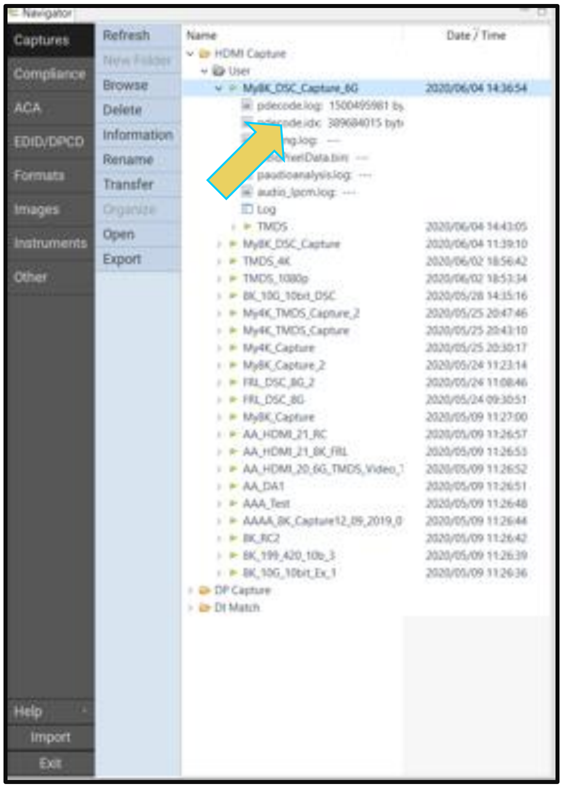


4. Highlight a directory on the **Local Files** side (host PC) and then initiate a **Copy** or **Move**.

The file appears on the PC host **Local** Files (below).

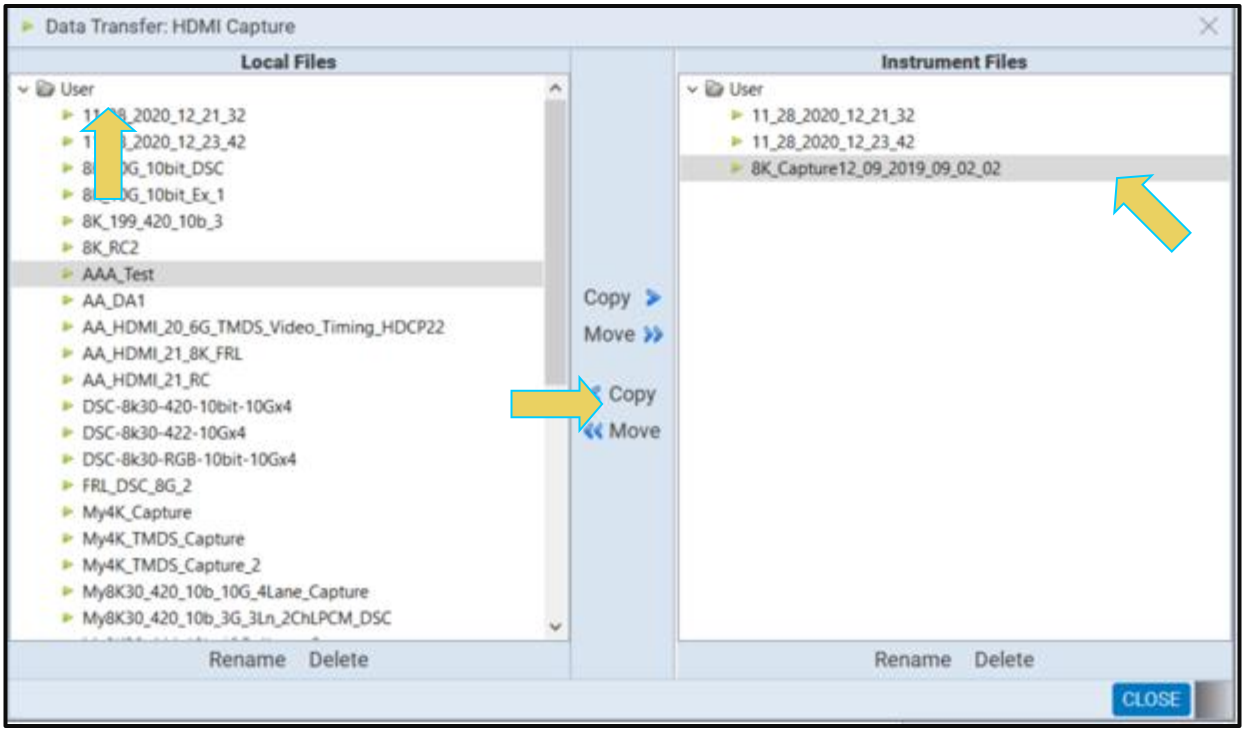
To transfer Capture files from the M42h to your PC using the Data Transfer utility:

5. Through the external **ATP** Manager, access the **Generator/Port Control** panel either through the **View** pull-down menu or the **Generator** button located on the top of the interface. Refer to the screen shots below.
6. Access the **Data Transfer** utility by double-clicking on **Transfer** on one of the data sets in the **Navigator** window.



The **Data Transfer: Capture Data** dialog box appears (below) enabling you to select the M42h 96G Video Analyzer/Generator that you want to transfer data from. Select the desired M42h 96G Video Analyzer/Generator and click OK.

The **Data Transfer** panel appears in context with the Capture files on the M42h (Instrument) under the **Instrument Files** available as shown below.



7. Highlight a directory on the **Local Files** side (host PC) and then initiate a **Copy** or **Move**.

The file appears on the PC host **Local** Files.

13.2 Transferring Capture Files Using the Command Line

If you have initiated captures through the embedded ATP Manager through the built-in touch screen, you can transfer these capture files to your PC where the external ATP Manager is installed. This enables you to view the captured data on the external ATP Manager and to disseminate these captures to other colleagues for additional analysis.

There are three ways you can transfer files from the M42h to the PC. 1) using an FTP utility, 2) using the FTP command, or 3) saving the files to a USB drive connected to the M42h.

Instructions for transferring files using the command line FTP and saving to a USB are provided. Procedures for transferring the captured files using an FTP utility such as FileZilla are not provided. Please refer to the user documentation provided with FileZilla. You can download FileZilla at: https://www.ohloh.net/projects/filezilla/download?filename=FileZilla_3.3.2_win32-setup.exe.

You will need to use the username of **qd** and the password of **qd** to login to the M42h in each case.

To transfer capture files using the FTP command:

1. Open the DOS utility window on your PC.
2. Enter the following command at the prompt:

```
ftp 192.168.254.237  // where 192.168.254.237 is the IP address of the M42h
```

You will then be prompted for a login. Enter **qd** and **qd** for the username and password as shown below.

```
User (192.168.254.237:(none)): qd
Password required for qd
```

3. Change directories to the specific **workspace** directory using the DIR and CD commands.

```
ftp> dir
ftp> cd workspace
ftp> cd captures
ftp> cd 2010_07_14_01_37_01
```

4. Use the binary mode for the FTP transfer.

```
ftp> bin
```

5. Initiate the FTP get command on the **pdecode.log** file.

```
ftp> get pdecode.log
```

6. Repeat the FTP GET command for the other files you wish to view through the external ATP Manager. You will want to transfer the .log files at a minimum. You may also want to transfer the .img files for the video thumbnails.
7. Exit the FTP command line with the following command:

```
ftp> bye
```

8. Recreate the directory with an appropriate name in the ATP Manager's working directories: quantumdata/M42hManager/M42hmgr/workspace/captures/.
9. Move the pdecode.log file and other files that you transferred to your PC into the new directory.

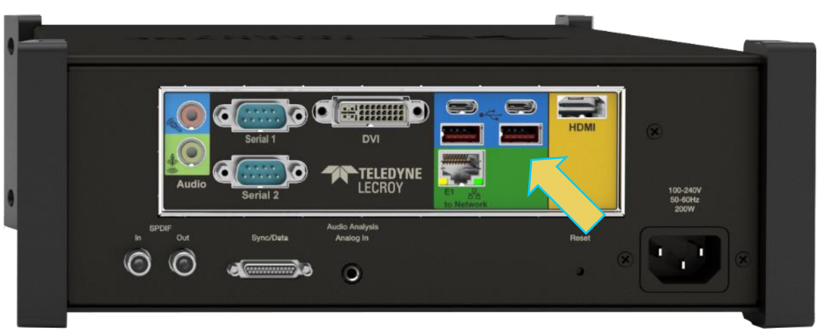
You will now be able to view the files through the ATP Manager.

13.3 Transferring Capture Files Using USB Drives

If you have initiated captures through the embedded ATP Manager through the built-in touch screen, you can transfer these capture files to a PC using a USB drive.

To transfer capture files using a USB drive:

1. Connect a USB thumb drive on the back of the M42h.



M42h Advanced Test Platform

2. Minimize or close the embedded GUI by touch selecting the **Quantumdata M42h Manager** icon on the bottom status panel of the GUI.
3. Touch the workspace icon on the touch screen desktop.

A navigation directory window appears.

4. Browse and locate the capture files in /home/qd/workspace/captures/
5. Touch select and highlight the captures directory
6. Touch select the top-level Edit pull-down menu and select Copy.
7. Touch select the lower left button just above the Start button to change the left panel view.

You should see qd, Desktop, USB flash disk, and 2 GB Volume if you touched the correct button on lower left.

8. Touch select the USB flash disk to change the right panel view to show the USB thumb drive's contents.
9. Touch any white space on the right panel to focus it.
10. Touch select Edit at top and then touch Paste to copy the capture directory to your USB drive.

You can now place the USB drive in your PC and move the files over to the M42h Manager's working directories: quantumdata/M42hManager/M42hmgr/workspace/captures/.

14 Passive Probing and Pass Through Mode

Important Note: This functionality is not yet supported in the M42h. This section is for future reference only.

The M42h offers the ability to monitor video/transactional data in two passive modes:

- Passively Probing: monitor DDC Channel transactions between a source and sink in FRL and TMDS mode
- Card Pass Through: monitor video and metadata between a source and sink in TMDS mode

There are certain restrictions when working with these two features, which are detailed in the following sections.

Note: These features require License 114 (SKU 95-00230) to enable functionality. Contact Teledyne-LeCroy support for information on obtaining new licenses.

14.1 Physical Connections for Pass Through Mode and Passive Probing

Special connections need to be made between the source and sink devices and the M42h for both Pass-Through Mode and Passive Probing. Pass-through Mode has a typical Passive Monitoring physical connection setup, while Passive Probing (or “sniffing”) of DDC Channel Transactions requires a custom-made cable that Teledyne-LeCroy provides.

14.1.1 Connections for Pass through Mode (TMDS Only)

Important Note: This features is not currently supported in the M42h.

You must establish a new connection when using Pass-through mode to monitor video and metadata in TMDS mode. This procedure describes how to connect a source and sink to the M42h for Pass through Mode.

Use the diagram below as a guideline. Connect the HDMI Source DUT to the M42h In/Rx port, and connect the HDMI® Sink DUT to the M42h Out/Tx port, as shown below.

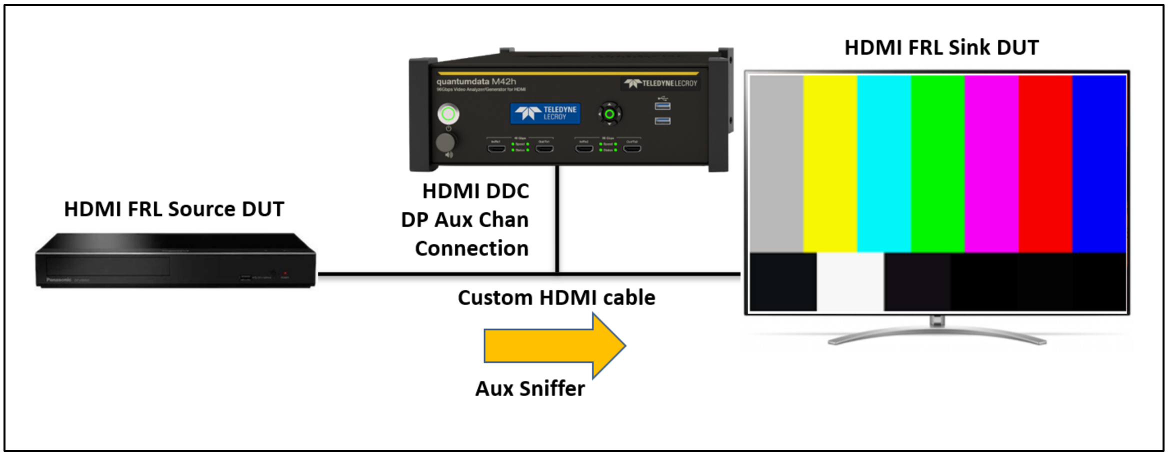
Note: During passive monitoring of HDCP protected content, only the external source and sink devices participate in the encryption. The Passive-mode Analyzer does not have access to the encryption key and therefore cannot display the transported video.

14.1.2 Connections for Passive Probing of DDC Channel Transactions (FRL and TMDS)

For passive probing of DDC Channel, you must establish connection between the Source, Sink, and M42h devices using a custom HDMI cable. The cable, shown below, is supplied by Teledyne-LeCroy.

This procedure describes how to monitor the DDC channel passively between a source and sink device in either TMDS or FRL mode. This feature is optional and requires a license.

Refer to the example test setup below. Connect one end of the special HDMI cable to each the HDMI FRL Source DUT, the HDMI FRL Sink DUT, and the In/Rx port of the M42h instrument, as shown below.


HDMI FRL Sink DUT
HDMI DDC
DP Aux Chan
Connection
HDMI FRL Source DUT
Custom HDMI cable
Aux Sniffer

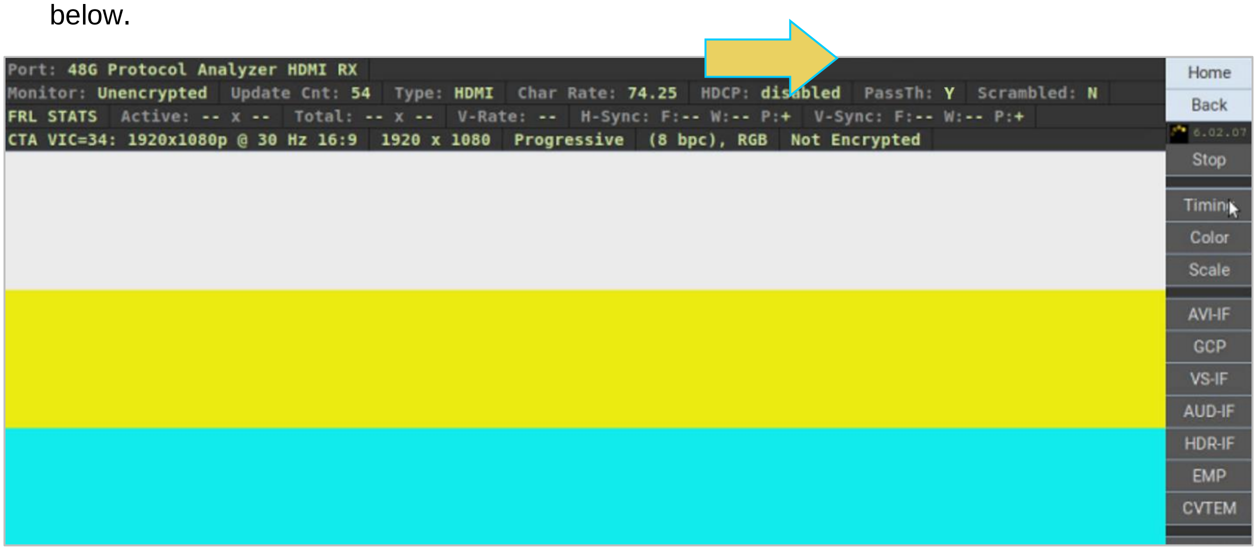
14.2 Enabling Passive Mode in Realtime Analyzer

Use the following procedure to connect your source and sink DUT to the M42h in Passive mode:

1. Open the “RealTime” Receiver (Basic Analyzer) window of the embedded ATP (running on the externally connected display connected to the HDMI port in the back).
2. Click on the Mode flyout button on the right-hand side bar. Sink Emulation should be enabled prior to activating Pass-through mode.

1. Click on Pass-Through (indicated above) to enable passive monitoring.

   Passive monitoring will be indicated in the **PassTh** field of the Analyzer Dashboard, as shown below.



14.3 Card Pass Through for Monitoring TMDS Video and Metadata

Pass Through mode is used to monitor only TMDS video and metadata. TMDS DDC Channel Monitoring is possible, and procedures for that are in the next section.

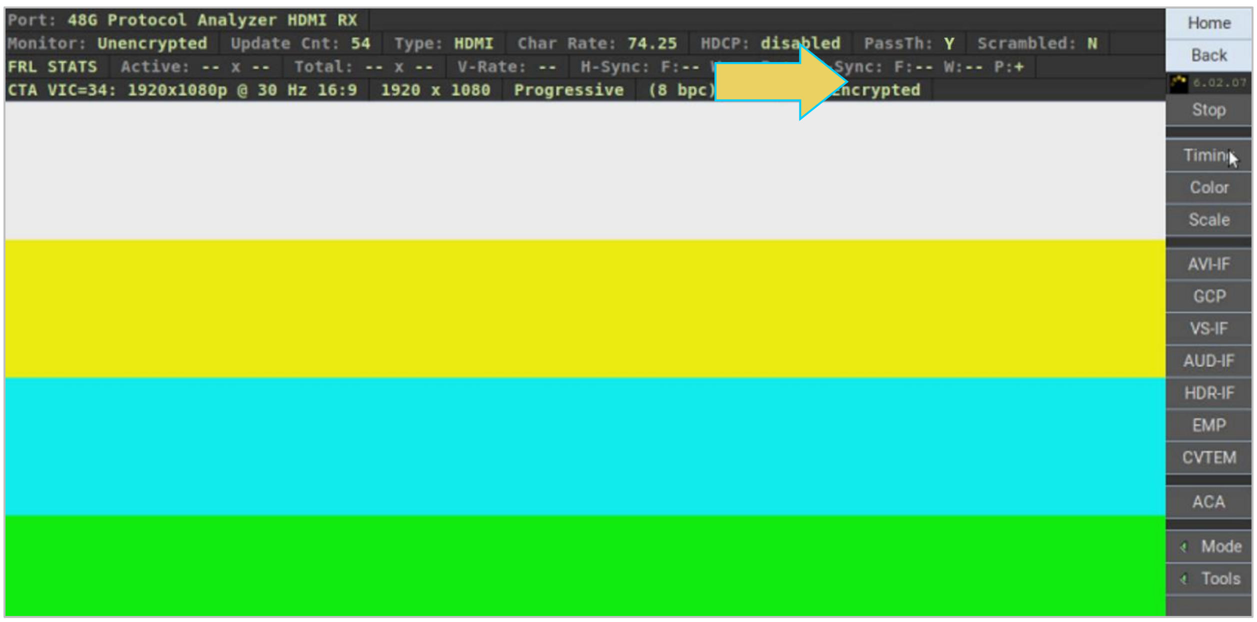
After establishing the physical connections and enabling passive monitoring per the procedures in the previous section, Pass Through mode is enabled.

Use the procedures in this section to monitor TMDS video and metadata in Pass Through mode.

14.3.1 Verifying Passed-Through Video

Prior to initiating a capture of the passed-through video, verify that the video signal is being properly transmitted by the source. Navigate to the Basic Analyzer and verify that the image is properly displayed, and the snapshot data in the Analyzer dashboard is correct for the transmitted signal.

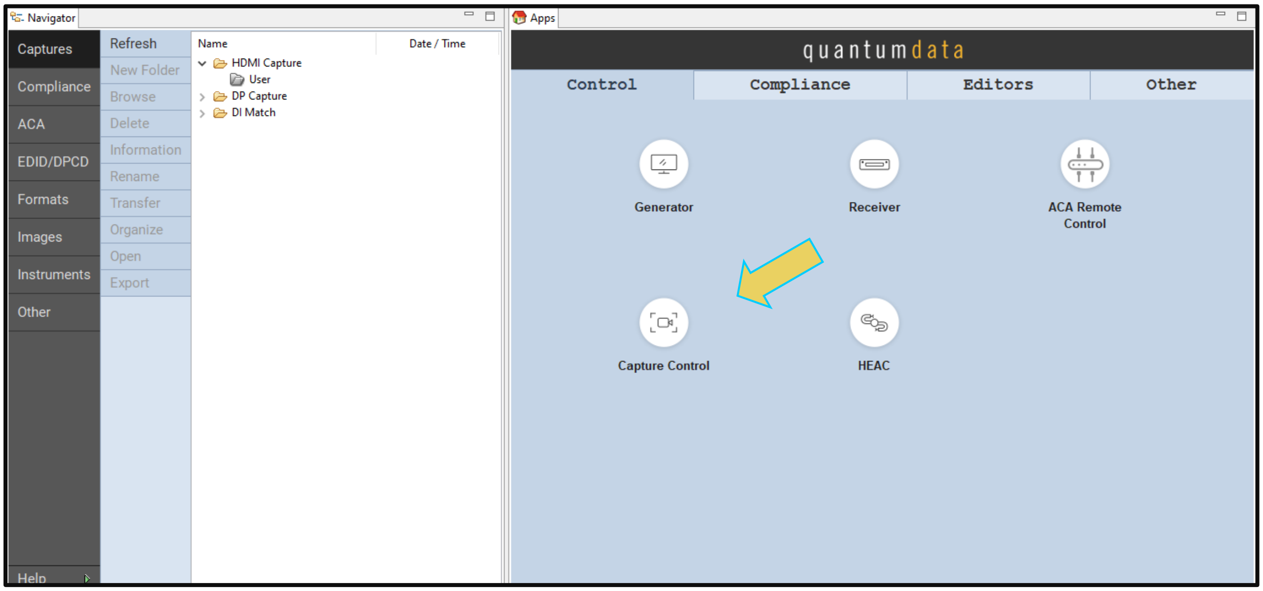
The Analyzer will also indicate in the dashboard if Pass-through mode is enabled, which it should be if you follow the procedures in the previous section. See the example below for details.



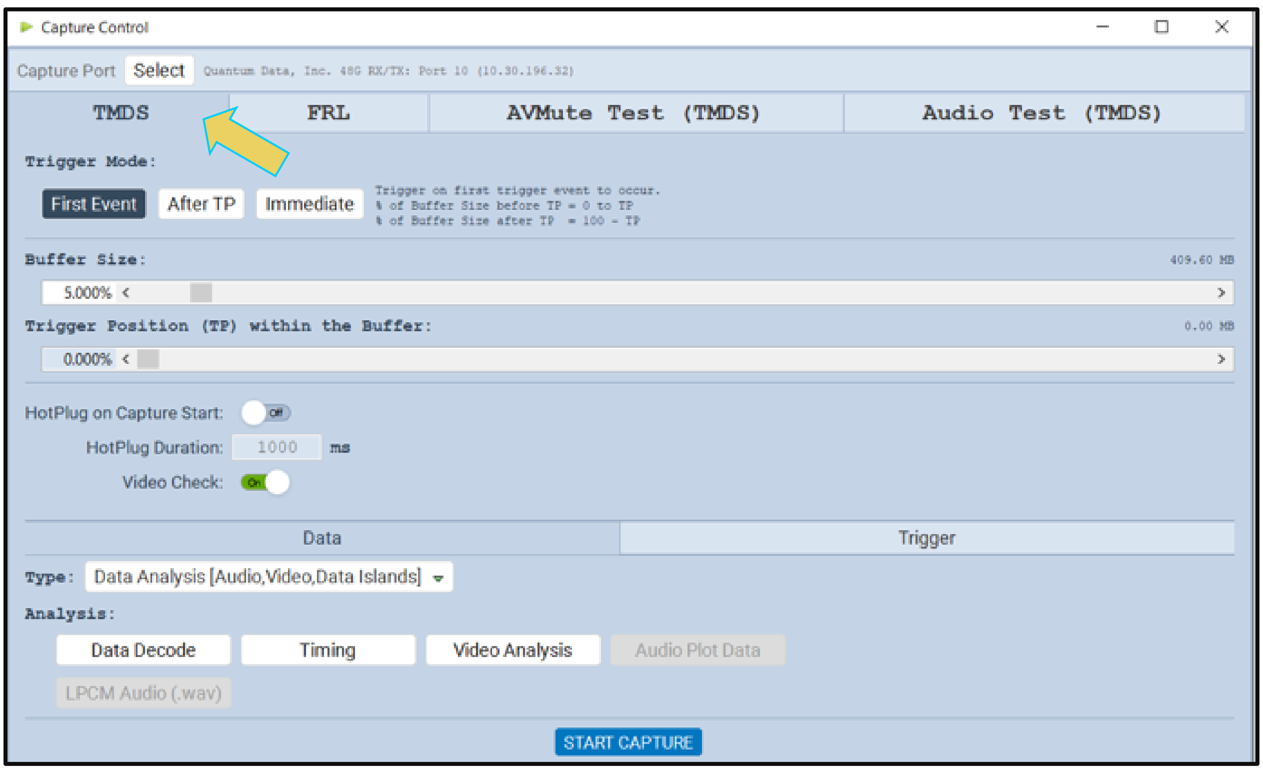
14.3.2 Capture Control

This subsection briefly describes the procedures for capturing passed-through TMDS streams. Detailed explanation/procedures can be found in the **Capture Control Chapter**. The functions are the same for Capture Control during basic source testing and Pass-through mode.

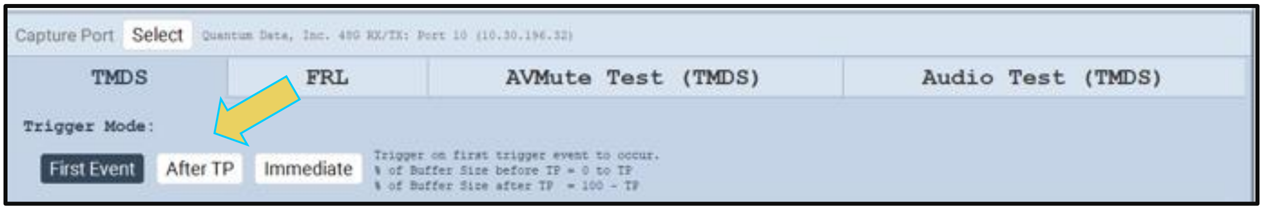
1. Select the **Capture Control** application from the **Control Page** of the Main screen.



2. Select the TMDS tab at the top of the **Capture Control** window.



3. Set the **Video Trigger** mode using the information described below:

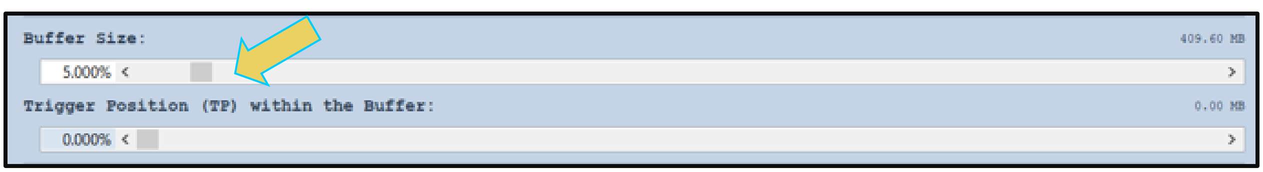


First Event – The trigger occurs on the first event—first occurrence—of the trigger condition defined in the Trigger Type pull-down menu (Vsync, encryption Enabled, Encryption Disabled, External Trigger, Manual Trigger, TMDS Clock Change). Depending on the setting of the Trigger Position slider, you may have some of the captured data in the buffer that accumulated prior to the trigger condition and some of the captured data in the buffer that accumulated after the trigger condition. At the left most position there will be no data in the capture buffer that occurred prior to the trigger event. At the right most position, all the data in the capture buffer will be data that accumulated prior to the trigger event. Because the trigger condition could be met quite quickly, the capture buffer may not be filled to the amount specified in Buffer Size.

After TP (Trigger Position) – In this setting the trigger condition specified in the Trigger Type pull-down menu will be ignored until data has accumulated in the capture buffer up to the point where the Trigger Position slider is set. Once the data has accumulated to the setting of the Trigger Position, any event matching the Trigger Type specified will cause a trigger condition and data accumulation will begin. Some of the data in the capture buffer will be data that has accumulated prior to the trigger condition being met and some of the data in the capture buffer will be data that has accumulated after the trigger condition was met. This setting will ensure that the capture buffer is filled to the Buffer Size setting.

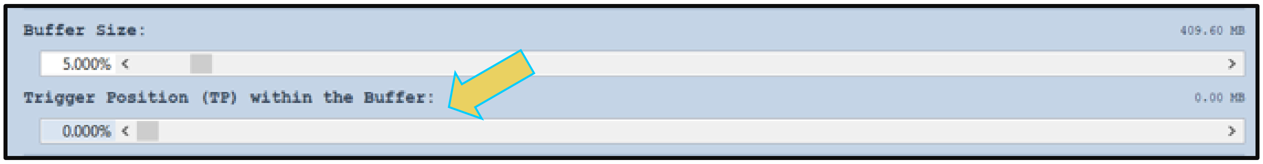
Immediate – Data capture begins accumulating immediately when the Start Capture button is activated. Data capture halts when buffer is filled. This setting will not provide any capture history, i.e. none of the captured data accumulated in the capture buffer will be data that occurred prior to the capture trigger event (activating the Start Capture button).

4. Set the Buffer Size slider to a percent value to meet your requirements. You can capture up to about 4GB of data which is about 1150 frames at 576p/480p and about 204 frames at 1080p which includes the passed-through video. If you do not want to capture the video and only capture the passed-through metadata, you can store well over 200,000 frames of data with the 4GByte storage capabilities.

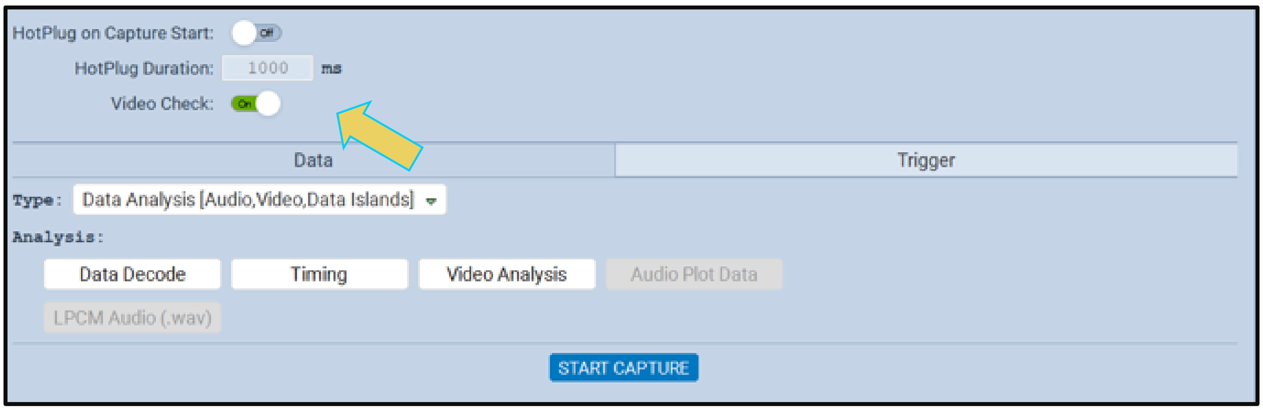


5. Set the Trigger **Position** within the **Buffer** slider to a percent value to meet your requirements. This slider enables you to set the position of the trigger event within the captured pass-through data. This is a slider that provides an indication (on the left) of the location within the captured data, expressed as a percent with 0% indicating that the trigger event occurs at the beginning of the captured data and 100% indicating that the trigger event occurs at the end of the captured data.

Note: When using **Manual** trigger, it is important to set the Trigger Position to ensure that there is some captured data prior to the manual trigger start point. The manual trigger is particularly useful when you are observing the behavior of a connected sink and then manually initiating the trigger when a particular symptom exhibits itself. Typically, you should move the trigger position to the right nearest the 100% mark. This way you ensure that there is data prior to the trigger event by accounting for reaction time between the time the symptom occurs and the time you initiate the trigger. Refer to the settings below which are typical.

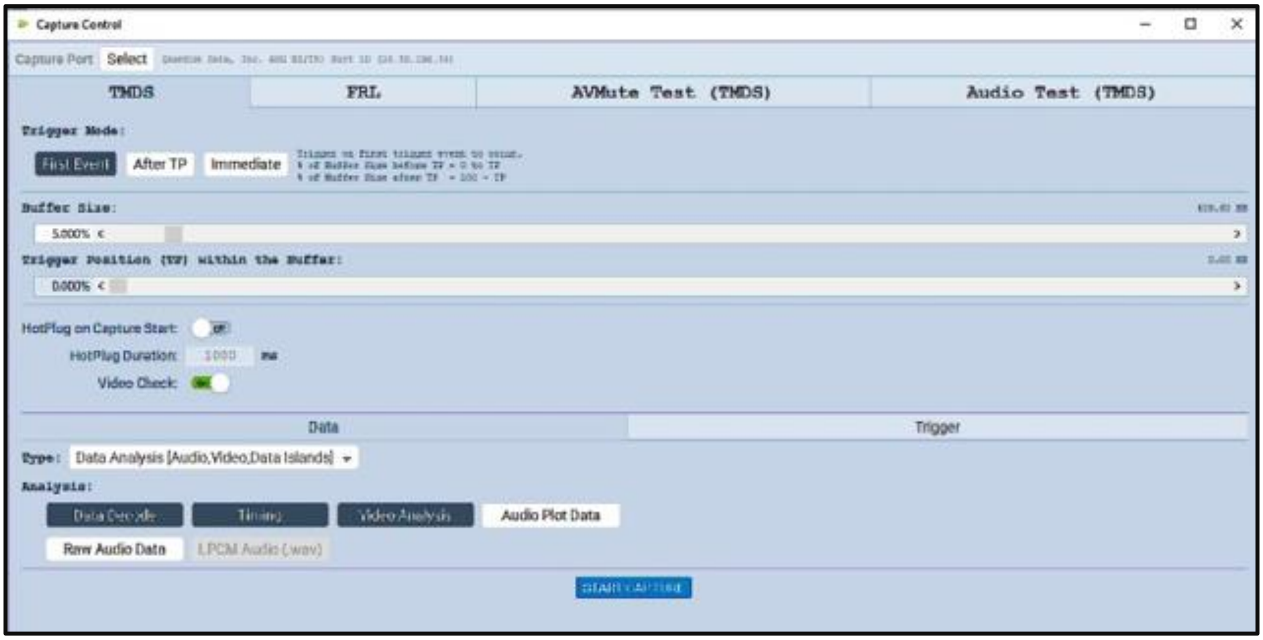


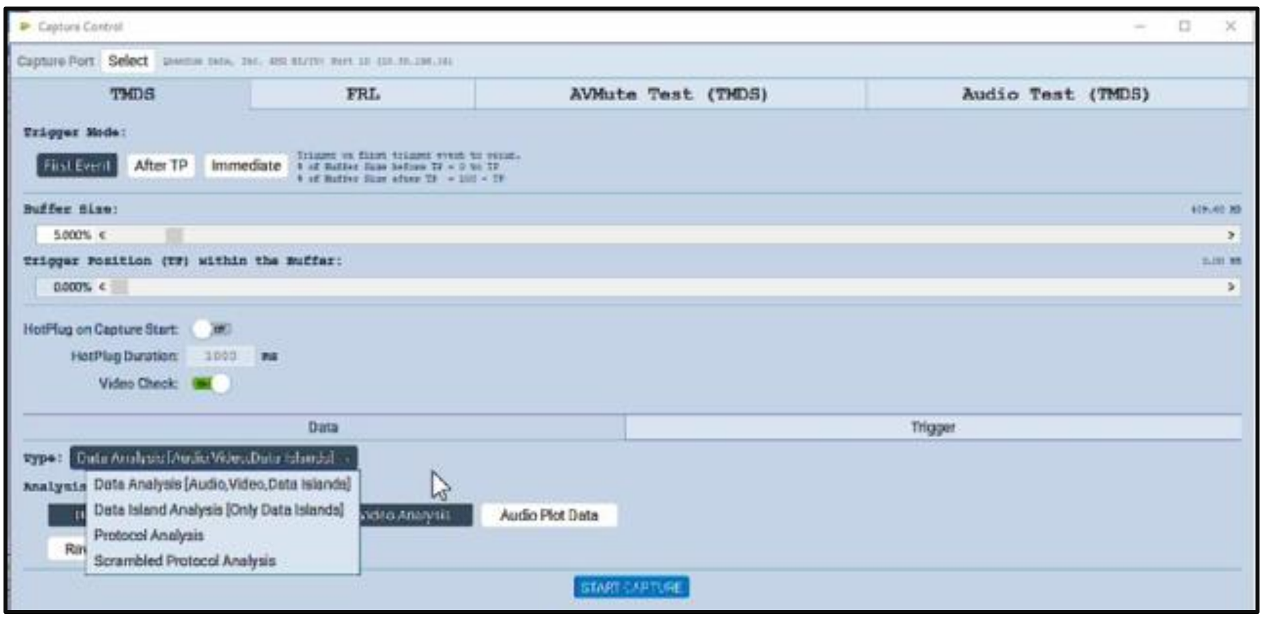
Note: If you are going to be taking some action on the device under test that will halt video being passed-through, such as unseating and reseating the HDMI cable, you will need to turn on the **Video Check** radio button in the Capture Configuration section of the **Capture Control** dialog box.



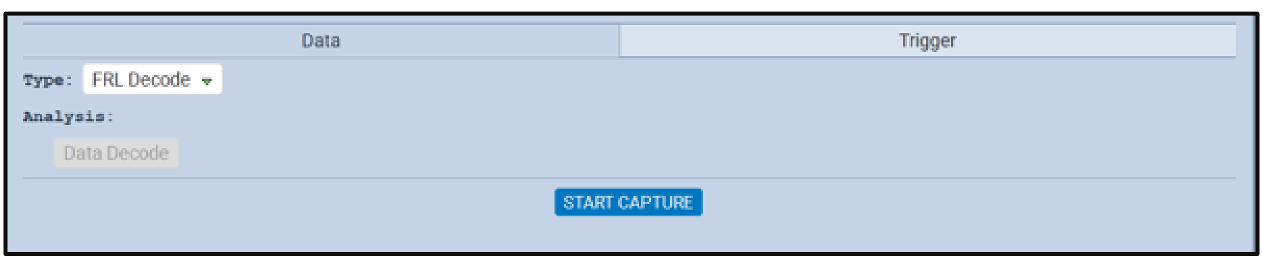
6. Select the **Capture** tab.

7. Select the **Data Selection** Type from the pull-down menu provided.

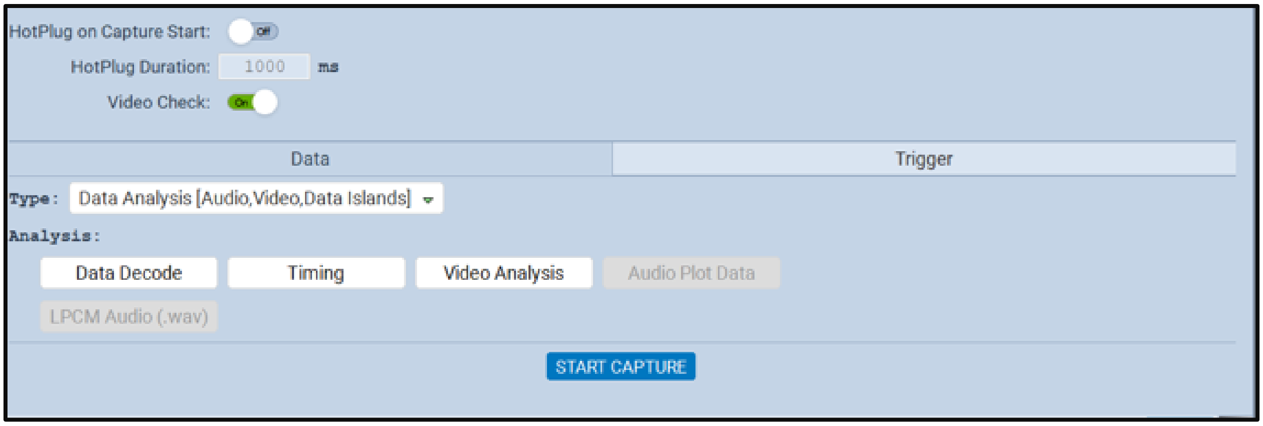




8. Select the Trigger selection **Condition**.



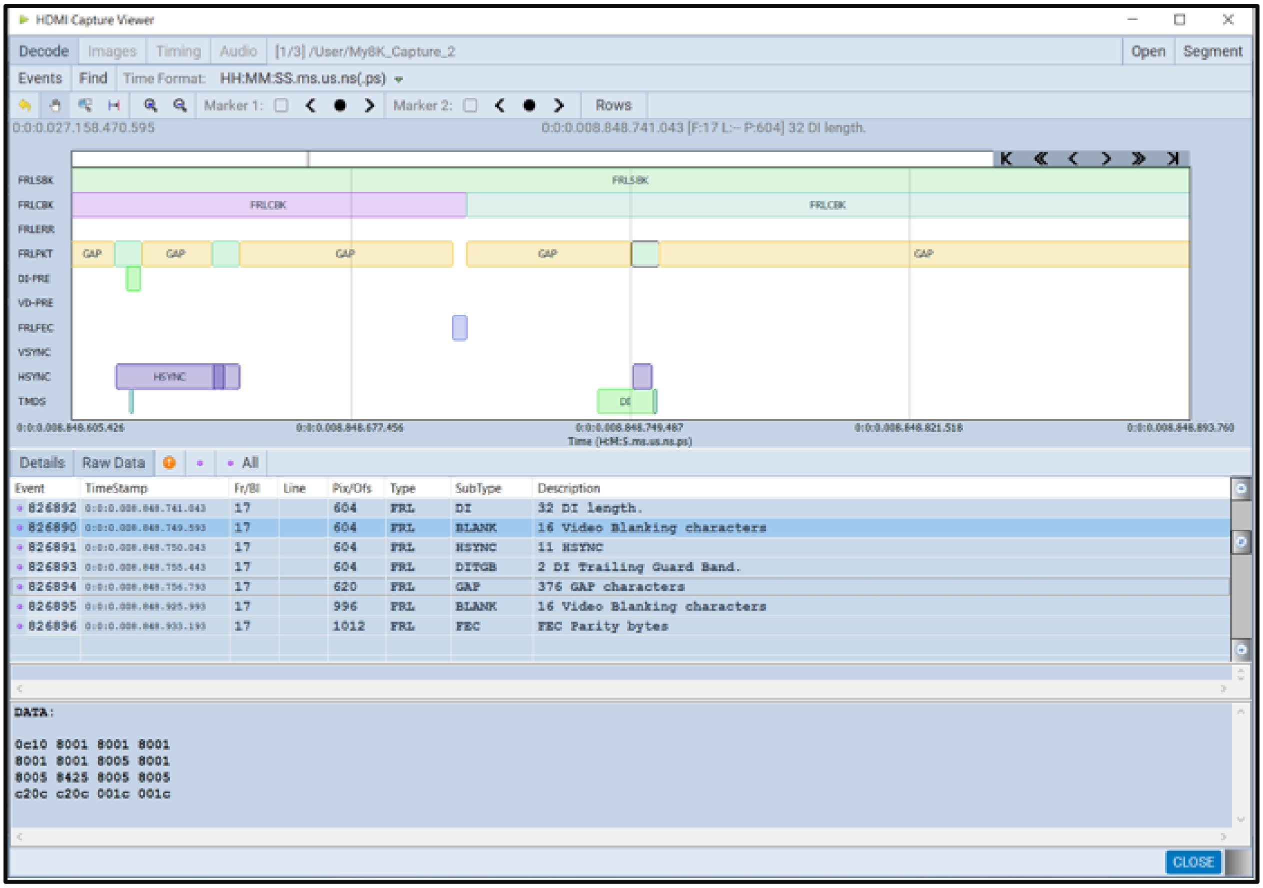
9. Click on the **Start Capture** button.



The M42h 96G Video Analyzer/Generator will capture the passed-through data for analysis. A series of dialog boxes will appear showing the capturing in progress (one example shown below).

Note: If there is some action that needs to be taken by a user to cause the trigger condition to occur, the capture dialog box will state "**Waiting for capture trigger to occur…**"

When the M42h 96G Video Analyzer/Generator is finished capturing data a decode file is shown in the **Event Plot** panel and the **Decode** panel.



Detailed explanation/procedures for the Capture Viewer can be found in the **TMDS Capture Viewer section** of the Capture Control chapter. The functions are the same for Capture Control during source testing and Pass-through mode.

14.4 Passive Probing for Monitoring DDC Channel Transactions

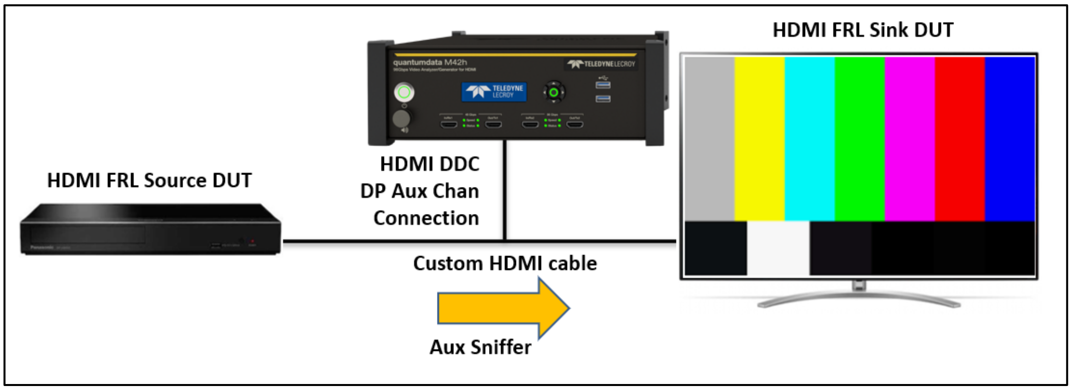
The M42h is also capable of Passive Probing for monitoring DDC Channel Transactions with both TMDS and FRL video streams. Passive Probing may also be referred to as “sniffing” the DDC Channel transactions.

14.4.1 Establishing Connections

For passive probing of DDC Channel, you must establish connection between the Source, Sink, and M42h devices using a custom HDMI cable. The cable, shown below, is supplied by Teledyne-LeCroy.

This procedure describes how to monitor the DDC channel passively between a source and sink device in either TMDS or FRL mode. This feature is optional and requires a license.

Refer to the example test setup below. Connect one end of the special HDMI cable to each the HDMI FRL Source DUT, the HDMI FRL Sink DUT, and the In/Rx port of the M42h instrument, as shown below.



14.4.2 Operating ACA Utility for DDC Channel Analysis

This subsection briefly covers the ACA Utility for Passive DDC Channel Capture/Analysis. For full explanation/procedures, refer to the **ACA Utility Chapter**. The operation of the ACA is the same during passive monitoring as when testing a source or a sink.

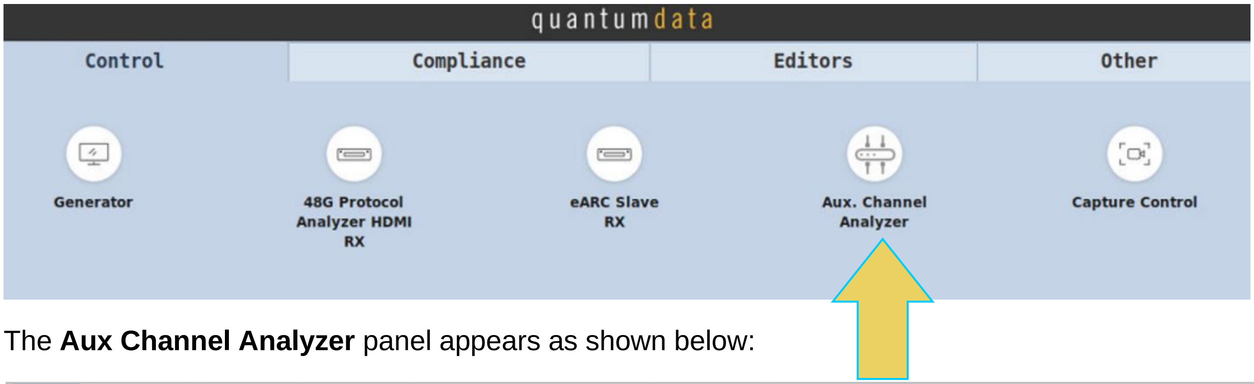
Use the following procedures to passively monitor the HDMI DDC transactions with an HDMI device in real time. The procedures assume that the HDMI device under test is powered up and connected to one of the M42h 96G Video Analyzer/Generator ports.

The operation of the two ACA real time utilities—**Aux Channel Analyzer** on the *embedded* M42h GUI and the **ACA Remote Control** on the *external* ATP Manager-- is similar. The screen examples used in this subsection are from the **ACA Remote Control** utility on the *external* ATP Manager exceptions related to the operation of the ACA on the embedded ATP Manager are noted.

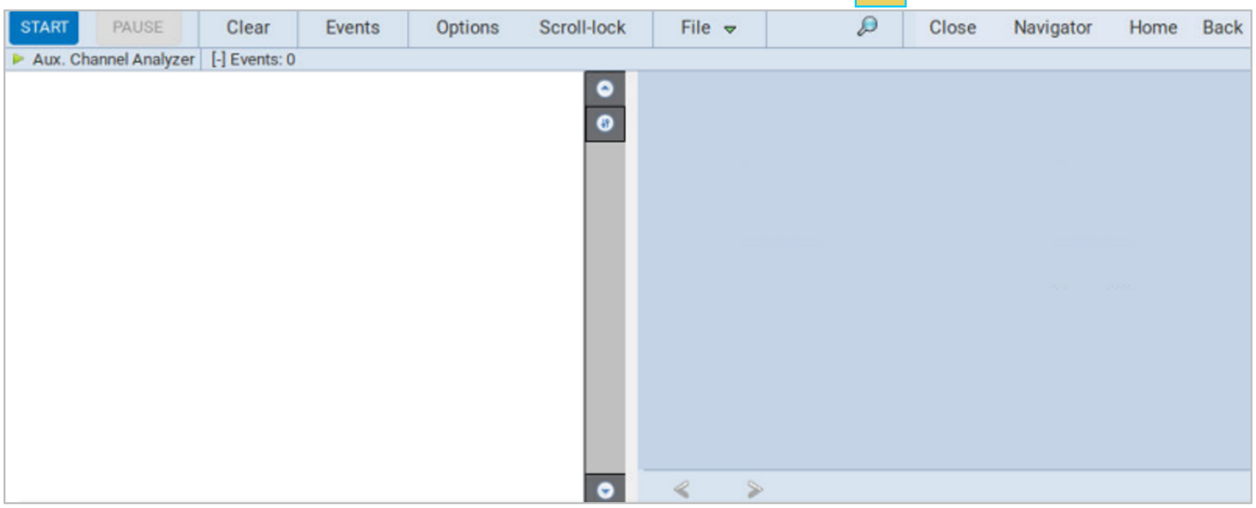
Important Note: You can filter and search through the passively captured ACA traces. Procedures for searching and sorting are provided in the **Find/Filter sections within the ACA Chapter**.

To monitor the HDMI DDC transactions:

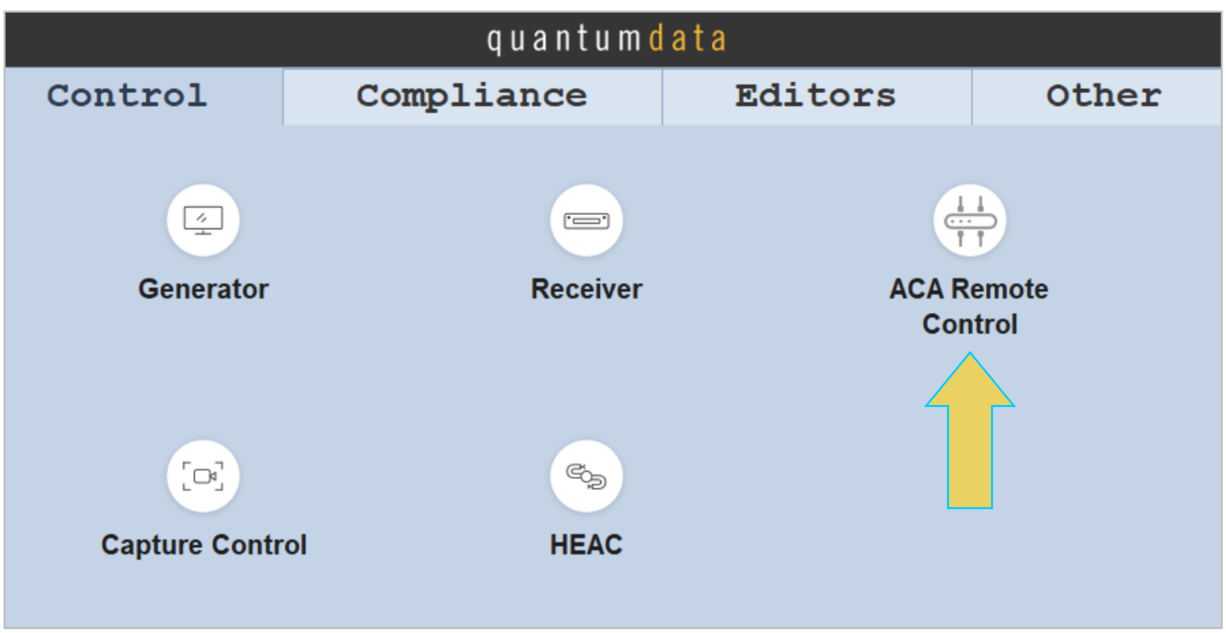
1. For the *embedded* ACA utility, select the **Aux Channel Analyzer** on the page 1 (Card Control) of the **Apps** panel:



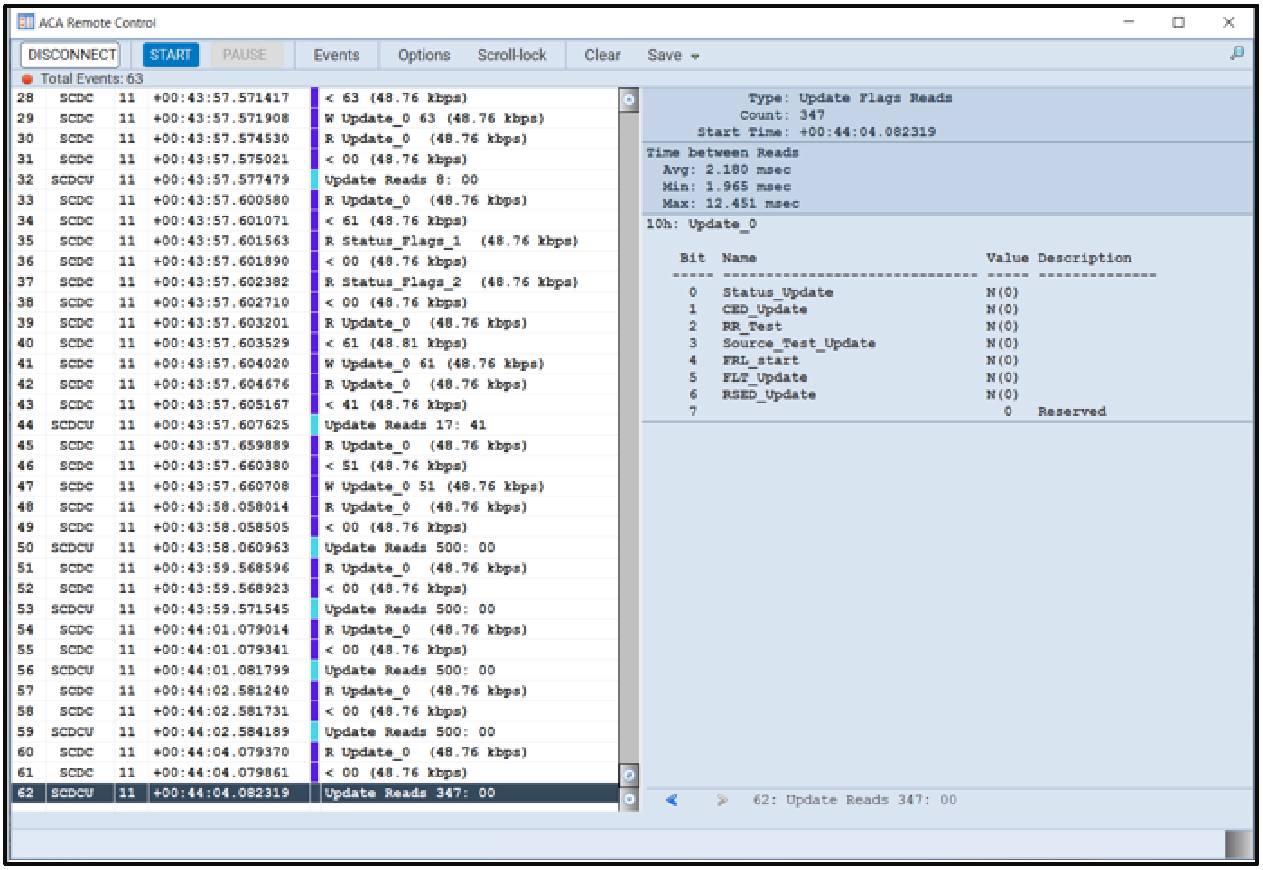
The **Aux Channel Analyzer** panel appears as shown below:



For the remote host PC ACA utility, touch select the **ACA Remote Control** on the page 1 (Card Control) of the **Apps** panel:

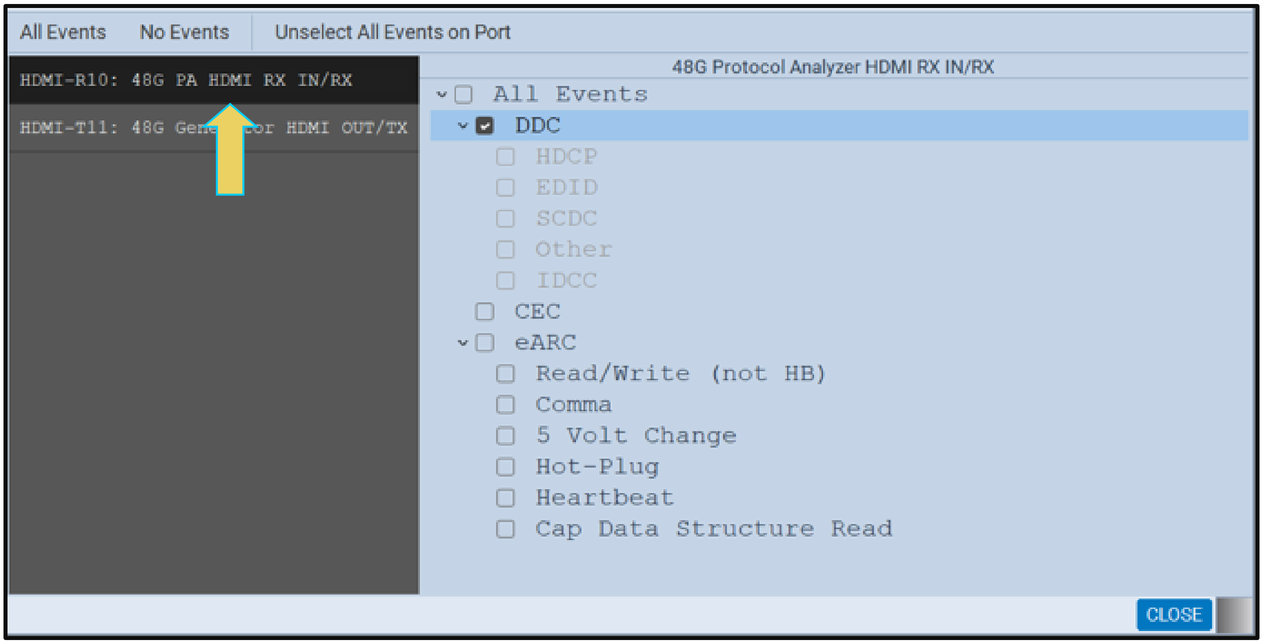


The **ACA Remote Control** panel appears as shown below:



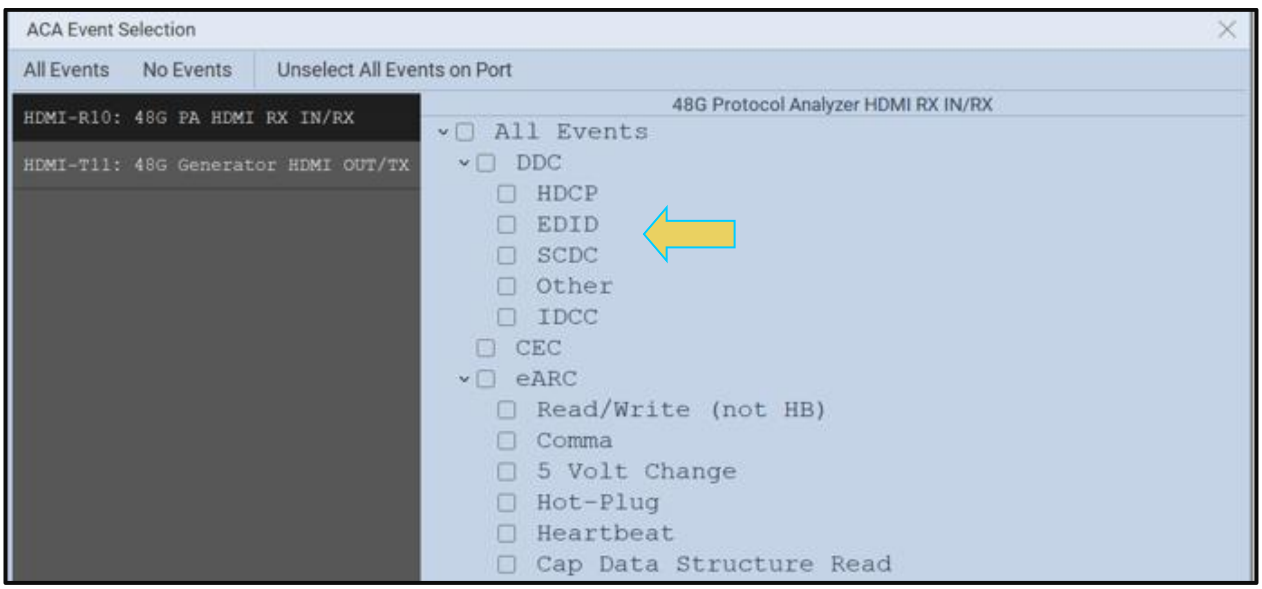
For the **ACA Remote Control** panel you will have to connect to an M42h Instrument that you have provisioned in the external ATP Manager application. The **ACA Remote Control** dialog box will appear showing all the M42h systems you have provisioned in the M42h GUI Manger. Typically you will only have one M42h system provisioned in the application, so you will simply select your lone M42h system and click the **OK** button on the dialog box.

From the **Events** Events button on the ACA panel, select the HDMI's port that you are monitoring using the pull-down menu HDMI-R10: 48G PA HDMI RX IN/RX. Refer to the screen example below.



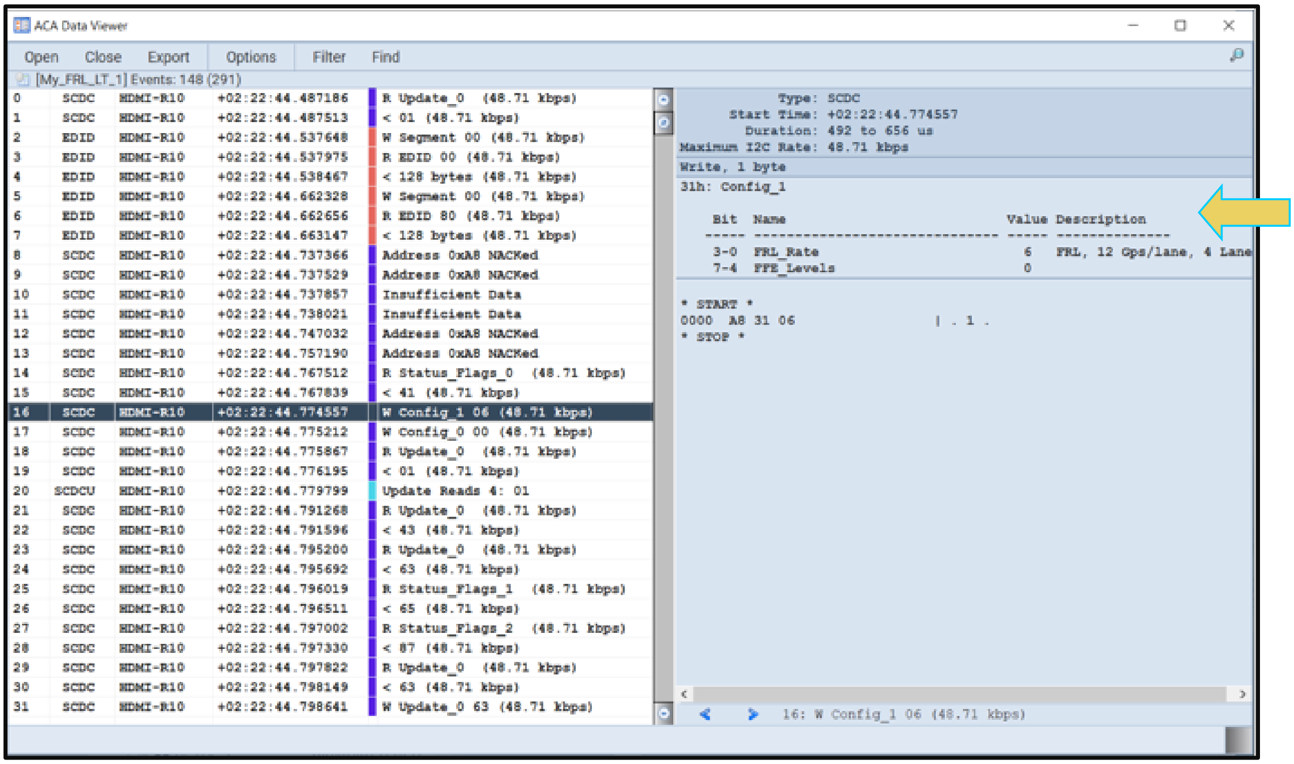
The **ACA Event Selection** dialog box is shown below.

2. Specify which events you wish to passively monitor. You can select All Events or any set of individual events.

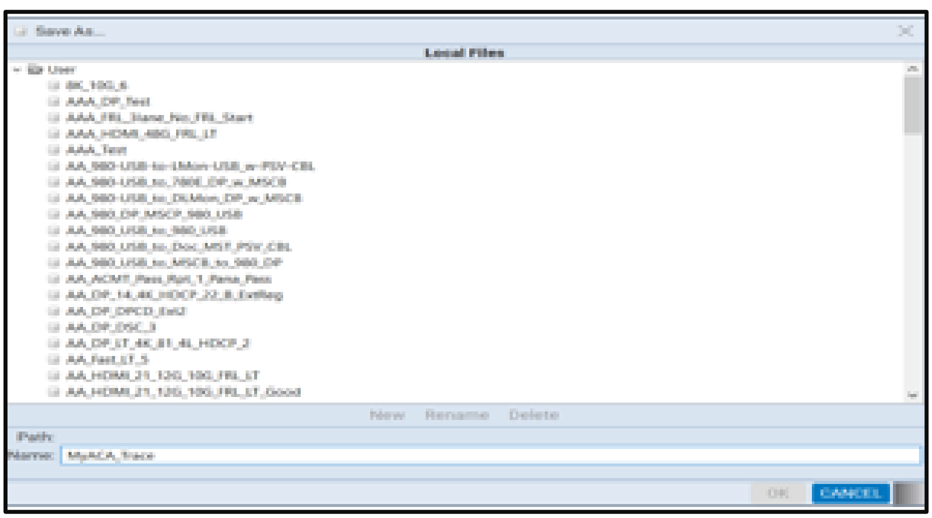


Take the necessary action—such as a hot plug—to initiate EDID, HDCP or CEC transactions. You will see the Aux Chan transactions in the ACA panel as shown below.

Select the **Start** START button on the ACA Menu panel on the right to initiate the passive viewing of the HDMI (or MHL) DDC transactions. An example showing passively monitored data is shown below. You can stop or pause the collection at any time using the buttons on the ACA menu panel on the right. These are indicated in the screen example below.



3. Click on **Save to Instrument** or **Save to PC** depending on whether you are working with the external ACA Remote Control utility or the embedded Aux Channel Analyzer. A dialog box appears (below). Enter a name and then click on **OK**.



Please note to use the **ACA Data Viewer** utility on your PC to view the traces or the ACA viewer on the M42h embedded display with the powerful searching and filtering features, you must save the file. If you are working on the embedded **Aux Channel Analyzer** viewer but prefer to use **ACA Data Viewer** on the external ATP Manager, you will have to transfer the saved file to your PC using the external ATP Manager.

Detailed explanation/procedures for the ACA Data Viewer can be found in the **ACA Data Viewer section** of the Chapter on the ACA Utility.

15 Testing HDMI Displays with the M42h 96G Video Analyzer/Generator

Important Note: Not all functionality described in this section is currently supported in the M42h, but will be in a future release.

This chapter describes how to operate the M42h 96G Video Analyzer/Generator to test HDMI® 2.1 ultra-high-definition displays.

15.1 Workflow for running the video pattern testing of HDMI 2.1 displays

The workflow below is a high-level set of tasks for operating the M42h 96G Video Analyzer/Generator. Note that the installation of the external ATP Manager and the Ethernet session are optional; you can run the tests through the embedded ATP Manager.

1. Power up the M42h. Refer to the procedures in Powering up the M42h.

Note: The power switch in the front is used when you are turning off the M42h for a short period of time. For extended periods of off time, it is best to power the M42h down by first using the power button on the front and then the rocker switch on the back.

2. (Optional) Establish an Ethernet/IP connection between the external ATP Manager and the M42h Advanced Test Platform using the procedures in the M42h Quick Start Guide.
3. Connect the HDMI sink device under test to one of the Tx ports.
4. Access M42h's interface through the ATP Manager.
5. Select HDMI.
6. Select the formats (timing or resolution).
7. Select the test patterns you wish to test with.
8. Select any video options and settings.
9. Read the EDID of the connected display.
10. Read the SCDC registers of the connected display.
11. Select the audio format.
12. Test HDCP authentication response on the HDTV.
13. Monitor the sink DUT for any anomalies.

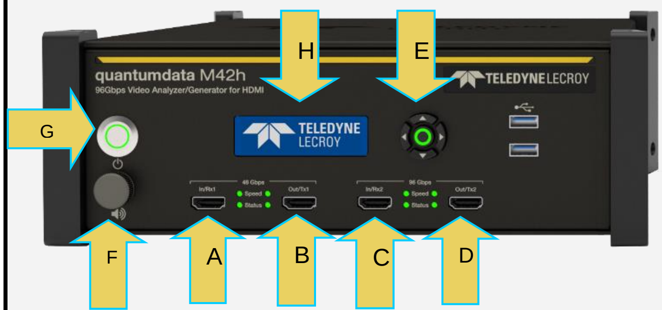
15.2 Connector Description

The following table provides images and descriptions of the front and rear panel features of the M42h 96G Video Analyzer/Generator.

Note: The M42h 96G Video Analyzer/Generator contains an internal speaker for audio monitoring. Speaker level is controlled by the front panel Volume knob. Audio monitoring and the volume control are specifically for eARC Rx audio.

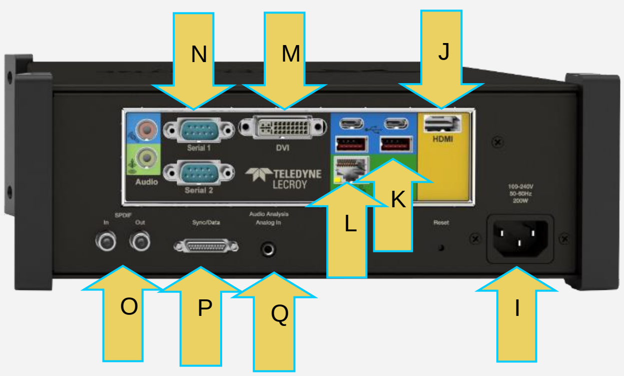
The following table describes the connectors and controls on the M42h front and back panels.

M42h Configurations	Information / Function
Protocol Analyzer in M42h	**Front panel:**

<table>
<tr><th>M42h Configurations</th><th>Information / Function</th></tr>
<tr><td>


</td><td>

A – HDMI 48G Rx port for analyzing HDMI 2.1 sources.
B – HDMI 48G Tx port for testing HDMI 2.1 sinks.
C – HDMI 96g Rx port for analyzing HDMI 2.2 sources.
D – HDMI 96G Tx port for testing HDMI 2.2 sinks.
Note: LEDs (described in subsection 2.2.2 above).
E – USB ports (2) used for connecting a mouse and keyboard.
F – Volume knob for adjusting the internal speaker level. Used for eARC Rx audio only.
G – Power button, press for on/off. See Note following table.
H – LCD Display (described in subsection 2.2.3 below).

</td></tr>
<tr><td>


</td><td>

E – USB ports (2) used for connecting a mouse and keyboard.
F – Volume knob for adjusting the internal speaker level. Used for eARC Rx audio only.
G – Power button, press for on/off. See Note following table.
H – LCD Display (described in section 2.2.3 above).

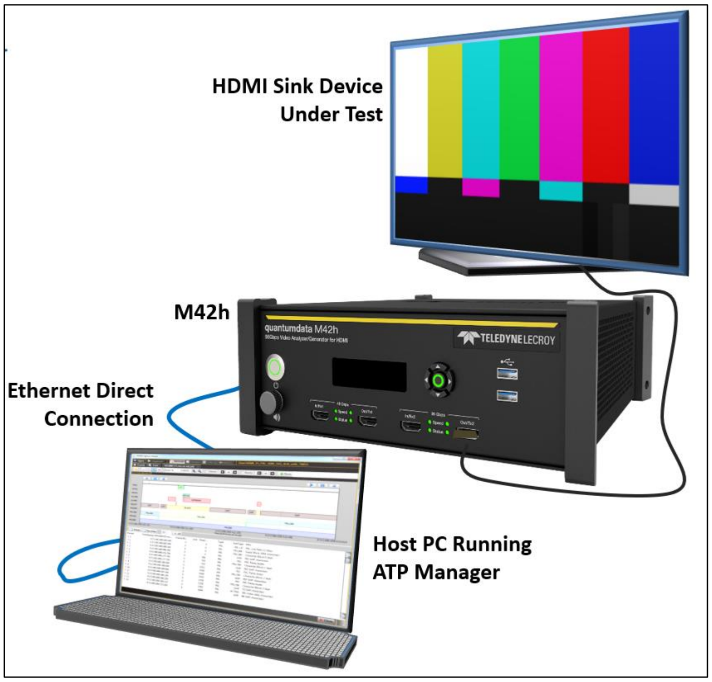
Back panel:

I – Power plug (100-240VAC 50/60Hz)
J - HDMI – Admin port for connecting external HDMI UHD display for M42h ATP Manager.
K - USB/USB-C (2 ea.) – For mouse & keyboard.
L - RJ45 (2) - E1 Network for connecting host PC running ATP Mgr. E2 Aux – Not used
M - DVI Not used.
N - RS-232 (2) – Possible future use.
O - Audio (2) – Possible future use.
P – CrossSync – Possible future use.
Q – 3mm Stereo Audio Jack Tip Ring Sleeve (future)

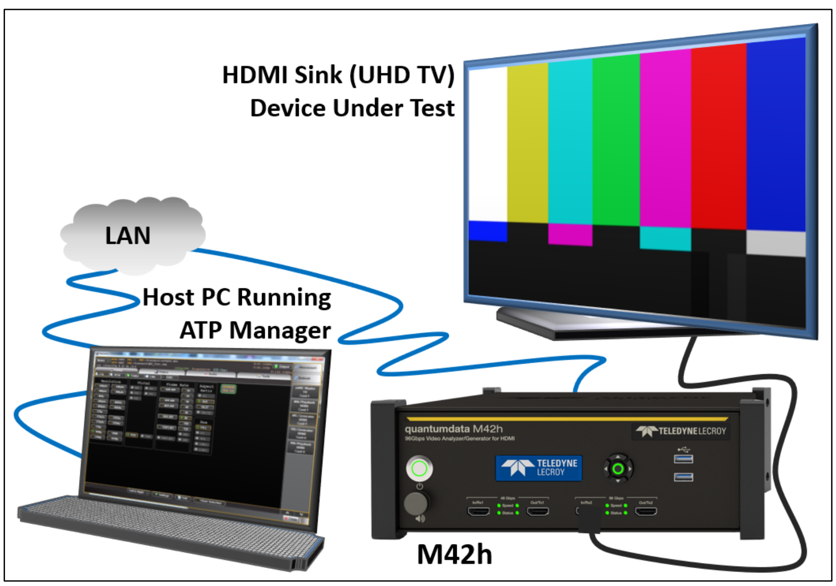
</td></tr>
</table>

15.3 Making the Physical HDMI Connections

This subsection describes the physical HDMI connections required to run the video pattern tests on an HDMI display.



Connection for Video Testing – M42h Ethernet Direct Connection

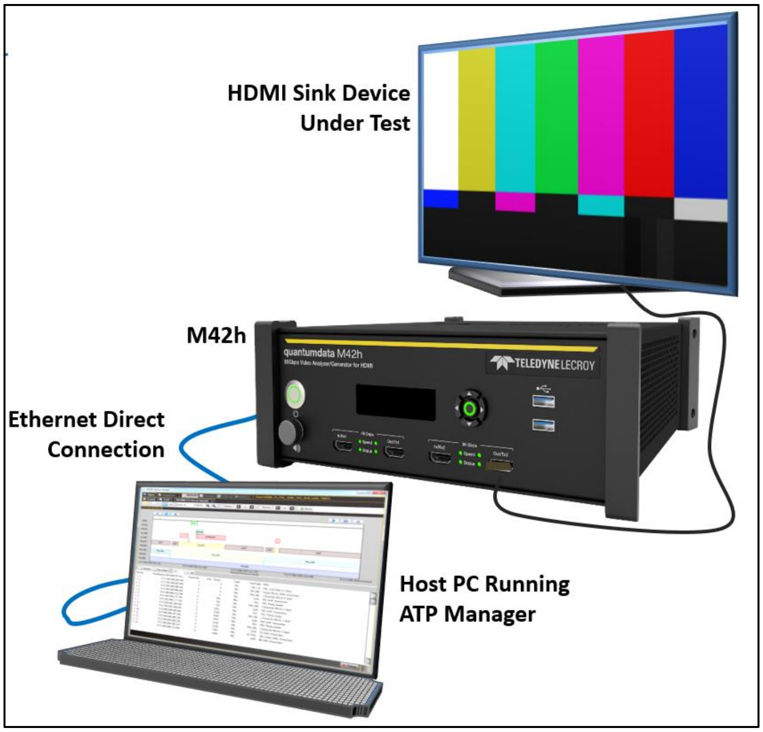


Connection for Video Testing – M42h Ethernet Hub or Corporate LAN

To make the physical HDMI connections:

This procedure assumes that you have assembled the M42h with the M42h 96G Video Analyzer/Generator and the HDMI sink device under test and applied power to all these devices. Refer to the procedures below and the diagrams above.

Connect your HDMI 2.1 sink device under test to the HDMI Tx/Out connector on the M42h 96G Video Analyzer/Generator. Use an HDMI high speed compliant cable. Refer to the illustrations below.


HDMI Sink Device
Under Test
M42h
Ethernet Direct
Connection
Host PC Running
ATP Manager

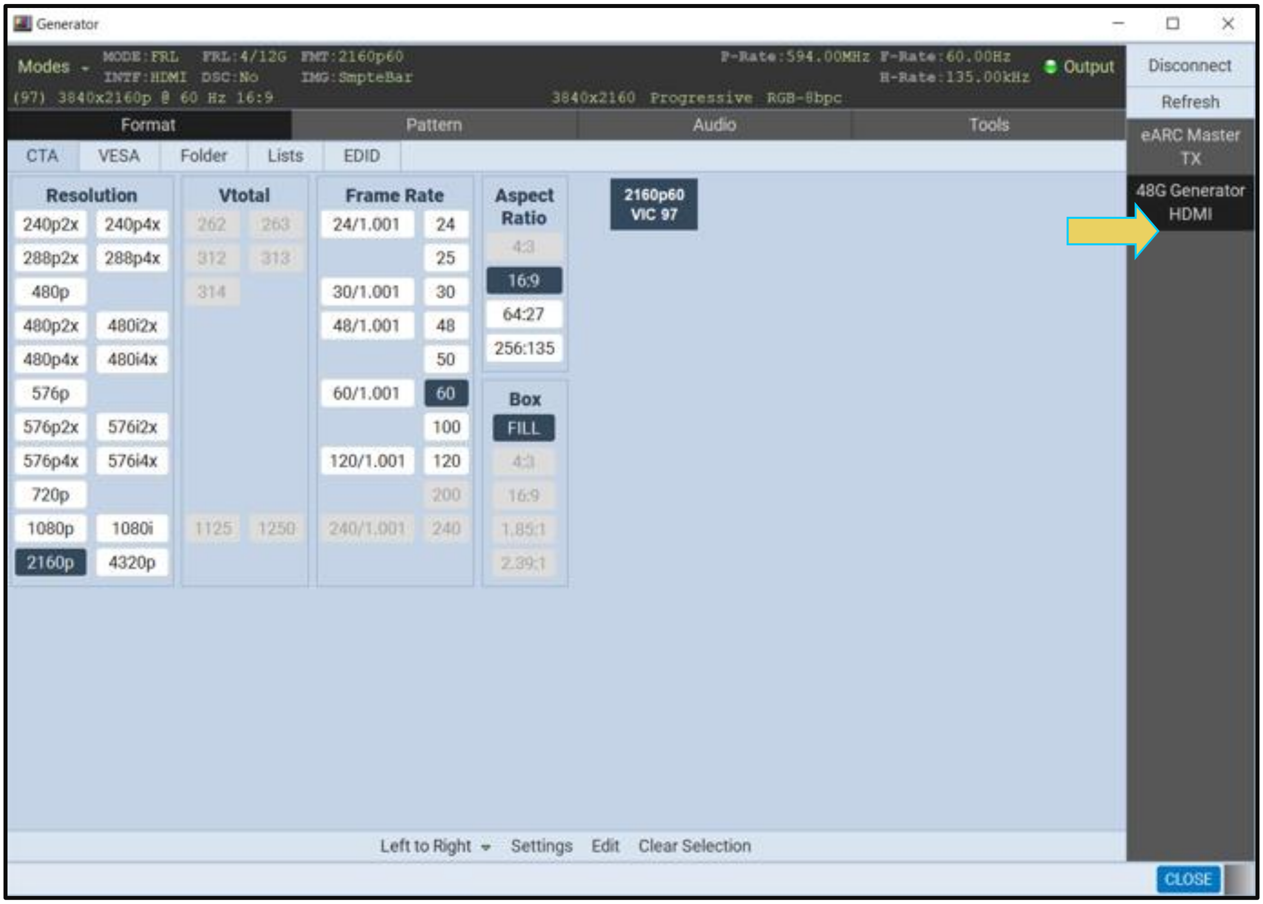
15.4 Navigating through the ATP Manager interface

Use the following procedures to navigate to the M42h 96G Video Analyzer/Generator testing functions. You can access the M42h 96G Video Analyzer/Generator functionality through the Card Control tab (Page 1 of 4) of the Apps panel as described below.

To navigate to the video test functions:

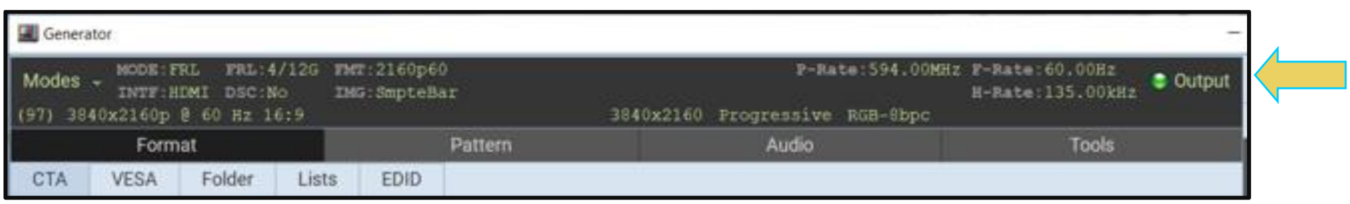
1. From the **View** menu, enable select the **Generator** item.

Once you establish the connection, the **Generator** panel will be populated as shown below:



The M42h 96G Video Analyzer/Generator can be identified by its name and slot number (Card 5) in the example above.

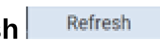
The Generator screen has a status area on the top of its panel.



The status area provides the following information:

Generator Status Area (Top)	
Item	**Description**
INTF	The currently selected interface type for test. This could be either HDMI or DVI. The sampling mode is included in parentheses after the interface.
FMT	The currently active format (selected resolution) and its directory path.
IMG	The currently active image (selected test pattern) and its directory path.

Generator Status Area (Top)	
Item	**Description**
Video Identification Code (VIC)	The VIC code is shown on the lower left of the upper status panel
Resolution, scan and color and color depth	The resolution, scan and colorimetry type and color depth are shown on in the lower portion of the upper status panel in the center.
H:(Rate)	The horizontal refresh rate of the selected timing.
F:(Rate)	The frame or vertical refresh rate of the selected timing.
P:(Pixel Rate)	The pixel clock rate of the selected timing.

Please note that if you are also making changes through the command line the information in the status area it is not automatically updated. You must click on the **Refresh** 

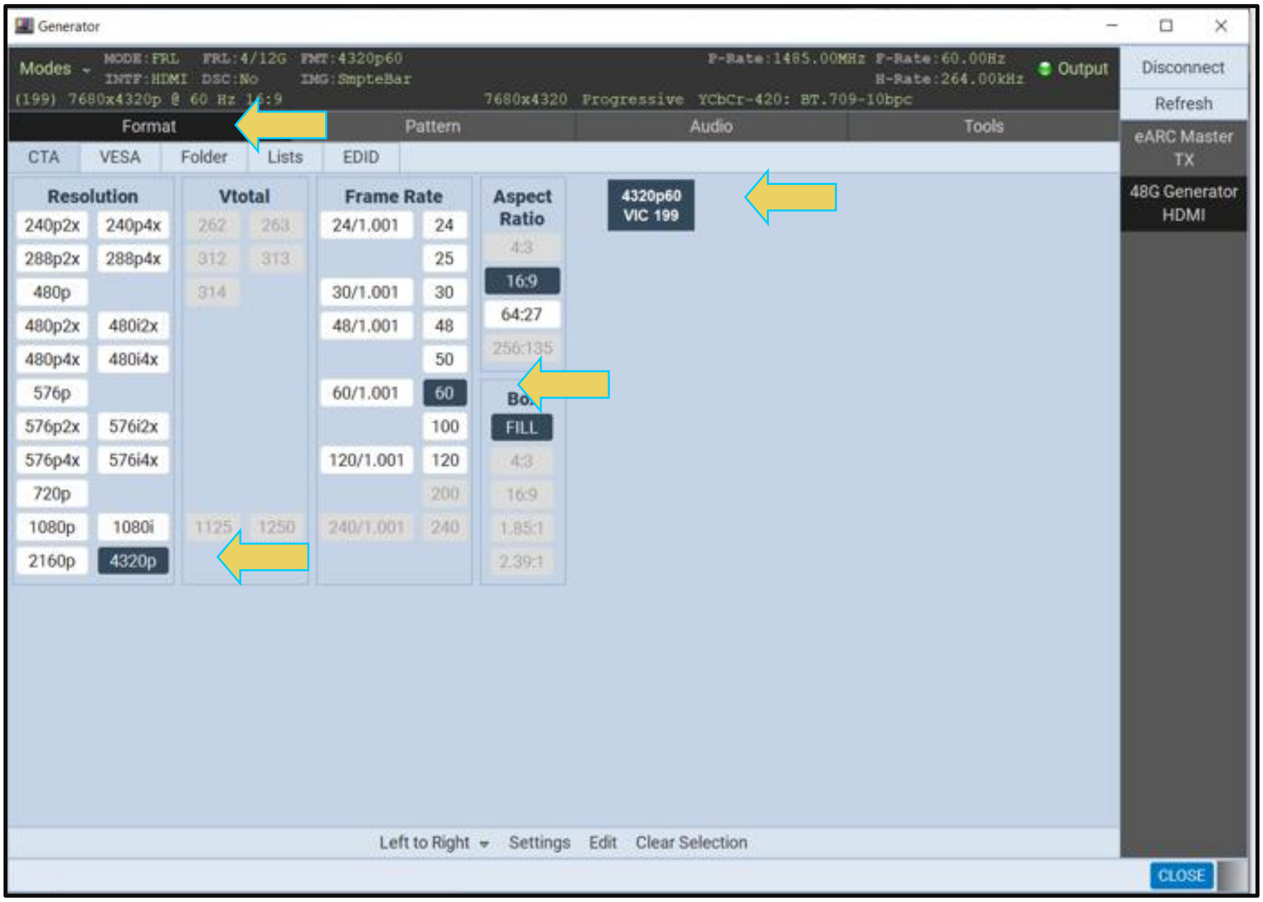
activation button to re-sync the status area.

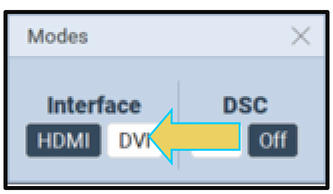
15.5 Selecting HDMI or DVI Formats

Use the following procedures to select the mode, HDMI or DVI on the M42h 96G Video Analyzer/Generator.

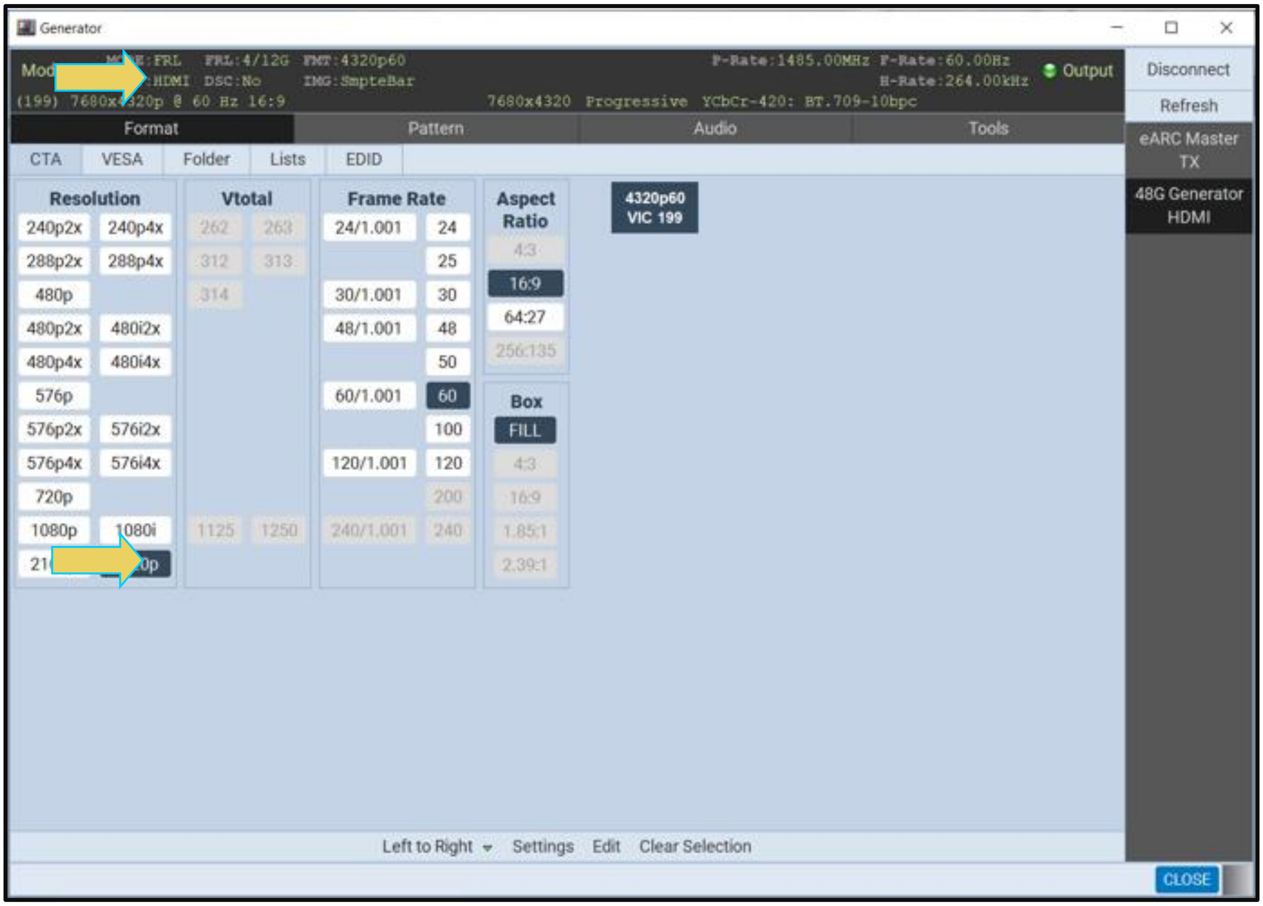
To select Modes:

1. From the Main menu of the M42h 96G Video Analyzer/Generator, click the Modes pull-down menu to select HDMI or DVI. Example shows 8K format at 1485MHz pixel rate.





When you select the interface type you will get a listing of HDMI (or DVI) formats and the **INTF** field in the status area will show HDMI (or DVI). The screen example below depicts a set of HDMI formats.



15.6 Selecting Formats (Resolutions) – FRL Mode

You can select formats (timings) from the M42h 96G Video Analyzer/Generator's format library. You can select either from the entire list of formats or you can select from a subset or reduced set of the formats that have or can define. You can select from a reduced set or subset of formats in either of two ways:

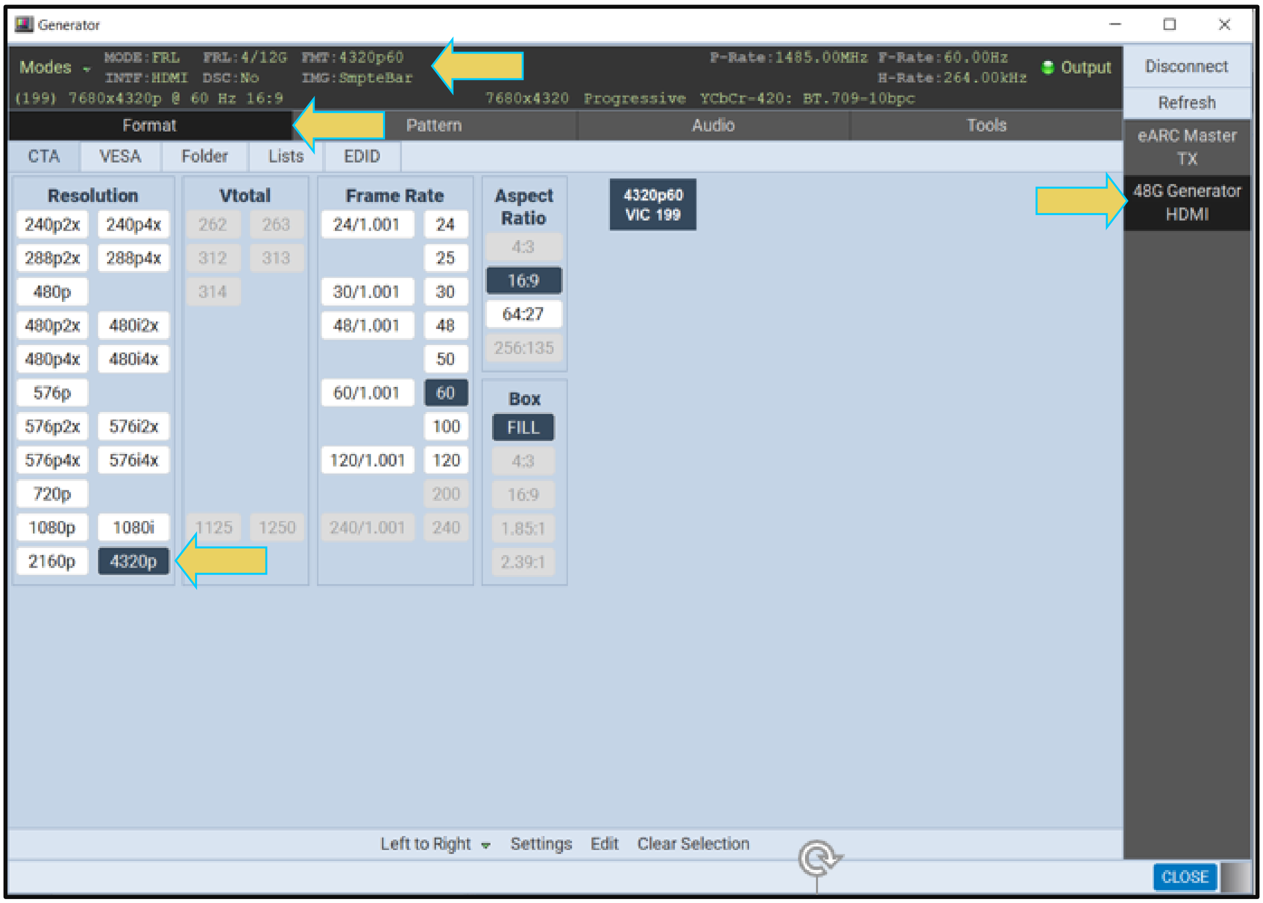
- Select from a custom list you have created using the Format List Editor.
- Select from a list of formats configured from the EDID of the connected display.

Use the following procedures to select a video resolution (format). The procedure assumes that you have already selected an interface (HDMI or DVI).

To select a format:

1. From the main window of the M42h 96G Video Analyzer/Generator, click the **Format** tab.

A list of HDMI or DVI formats will appear as shown in the example below.

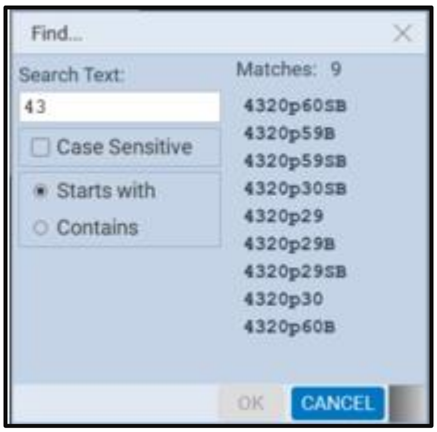


The highlighted format is the format that is active. You can also determine this from the status information at the top of the panel. Alternatively, you can click on the Star button to show the selected format. When you click on the Star button the list of formats will be repositioned such that the selected format is shown on the top line.

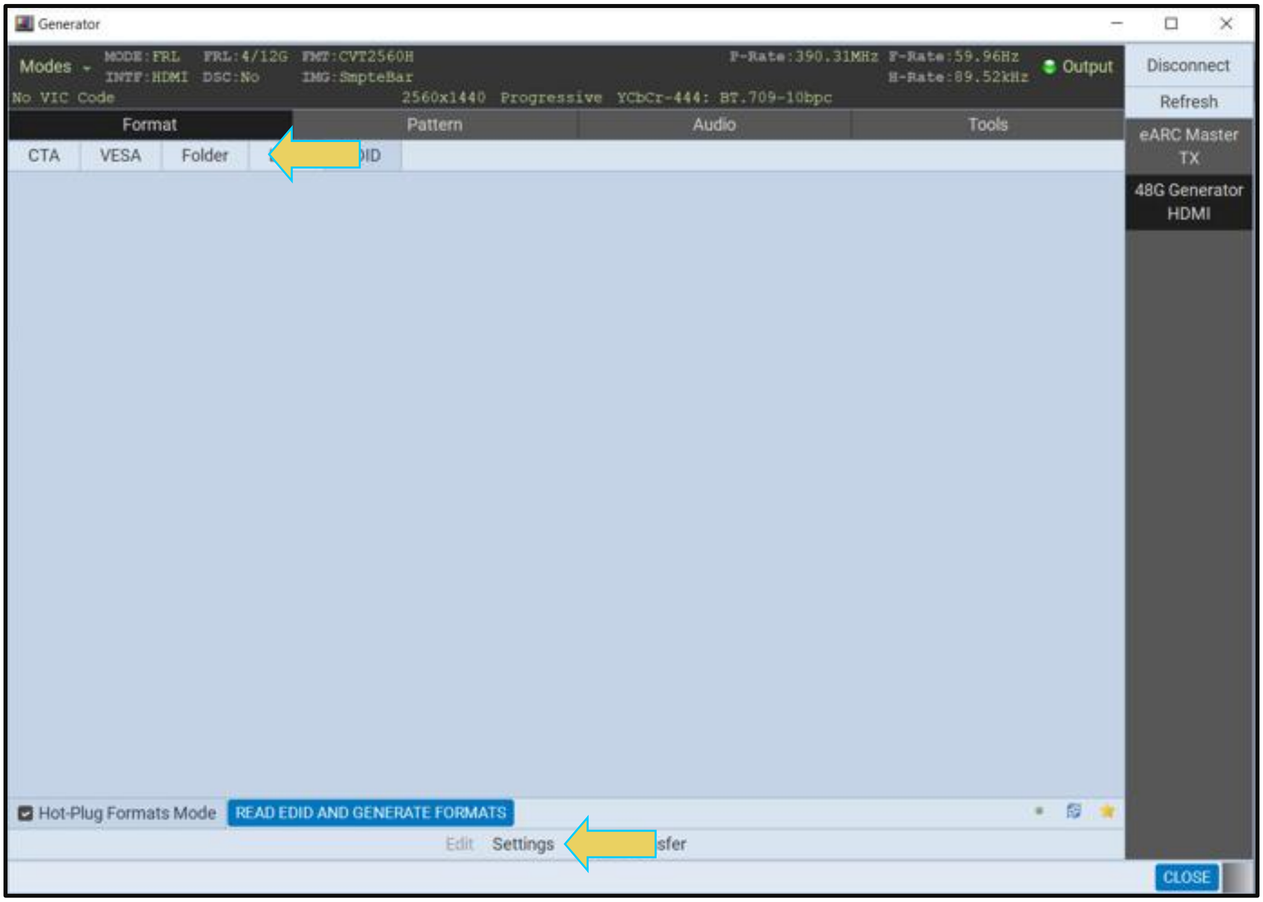
Note that you can browse for a format using the scroll bar. You can also search for a format using test strings on the Find Format dialog box.

2. Select a format from the list by clicking on it.
3. Click on the **Find** activation button on the lower portion of the Format panel.

The **Find Format** dialog box appears as shown below. Enter a string in the Search Text field to find a format. You can specify either Starts with or Contains using the radio buttons and you select the Case Sensitive check box to indicate case sensitivity in your text. Click on the **OK** button when you have located the format.

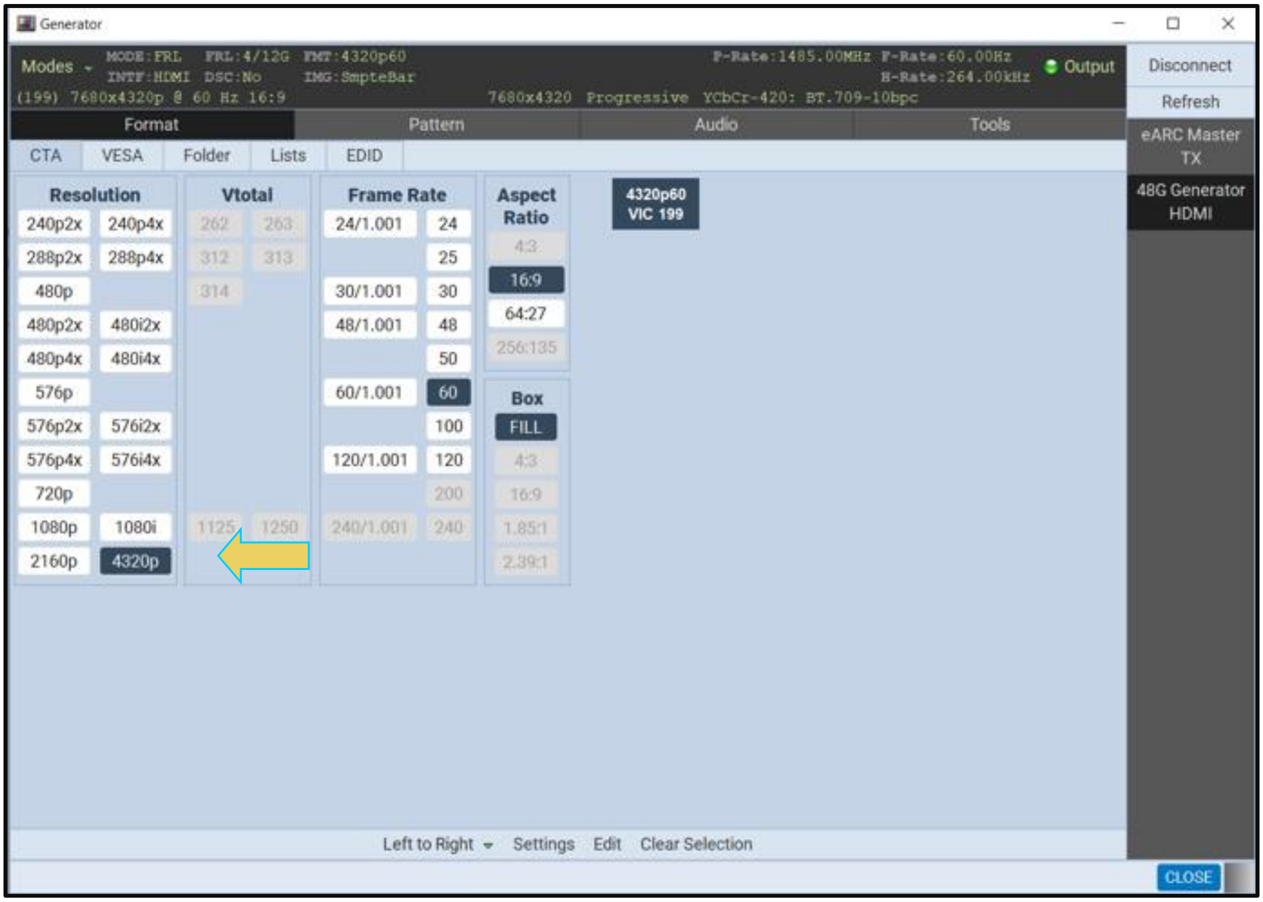


4. Click on the EDID smart activation button on the upper panel under the tabs to configure the list of formats in accordance with the EDID for the connected display.



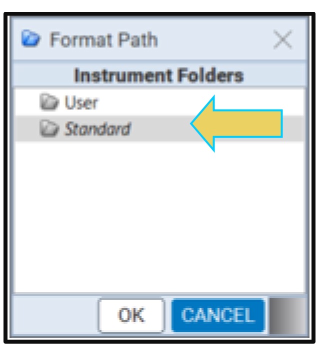
You can determine if the list of formats displayed is derived from the EDID of the connected display by looking at lower status bar: READ EDID AND GENERATE FORMATS.

When EDID formats are not active, the directory whose formats are being displayed is listed in the lower panel as indicated below. Typically, this would be the Standard directory where the M42h's format list is stored. The default path is the Standard path. The following screen example shows the Standard list indicated.

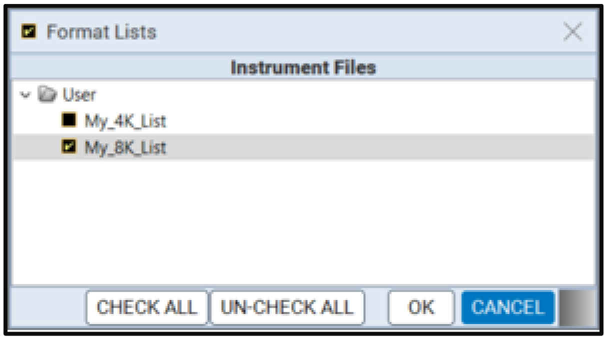


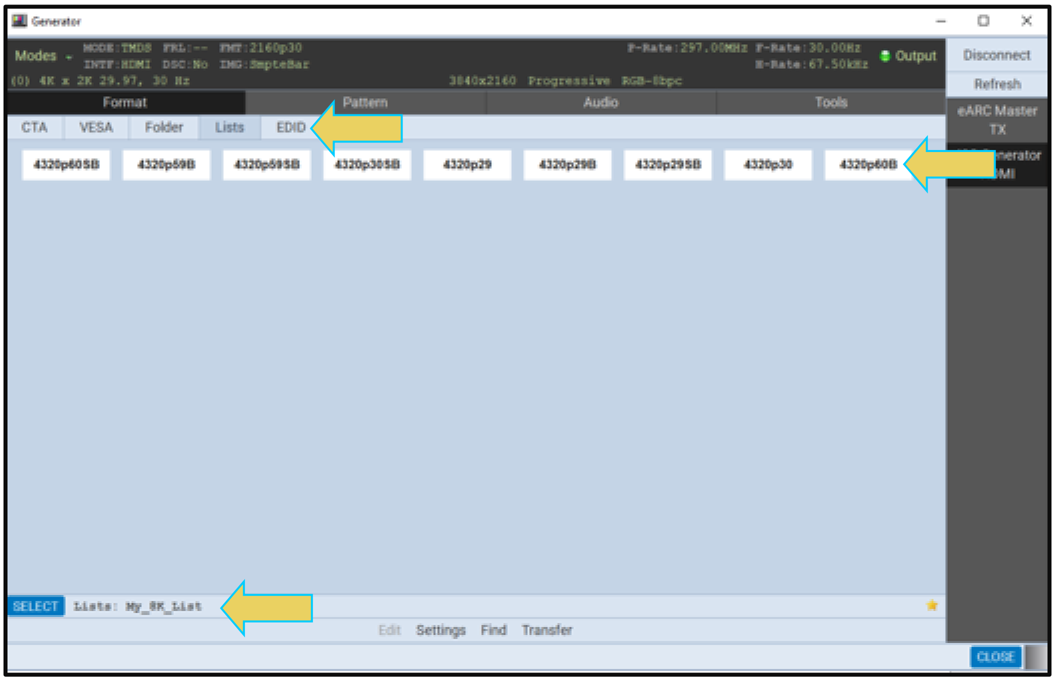
You can change the directory of formats using the directory activation button SELECT FOLDER Path: /Standard. You might wish to change the directory path if you have created your own custom formats using the Format Editor to create custom formats. Note also that you can configure a smaller list of formats to choose from using the **Format List Edit**; refer to Format List Editor.

By default, when you create a custom format, the new format will be saved in the User directory. When you select the directory activation button SELECT FOLDER Path: /Standard a dialog box will appear allowing you to select the alternative path such as the User path shown highlighted and selected in the dialog box below.

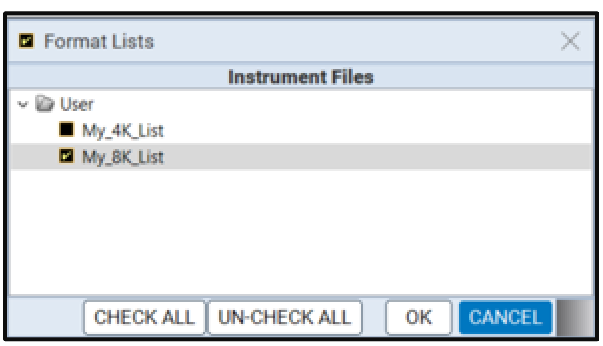


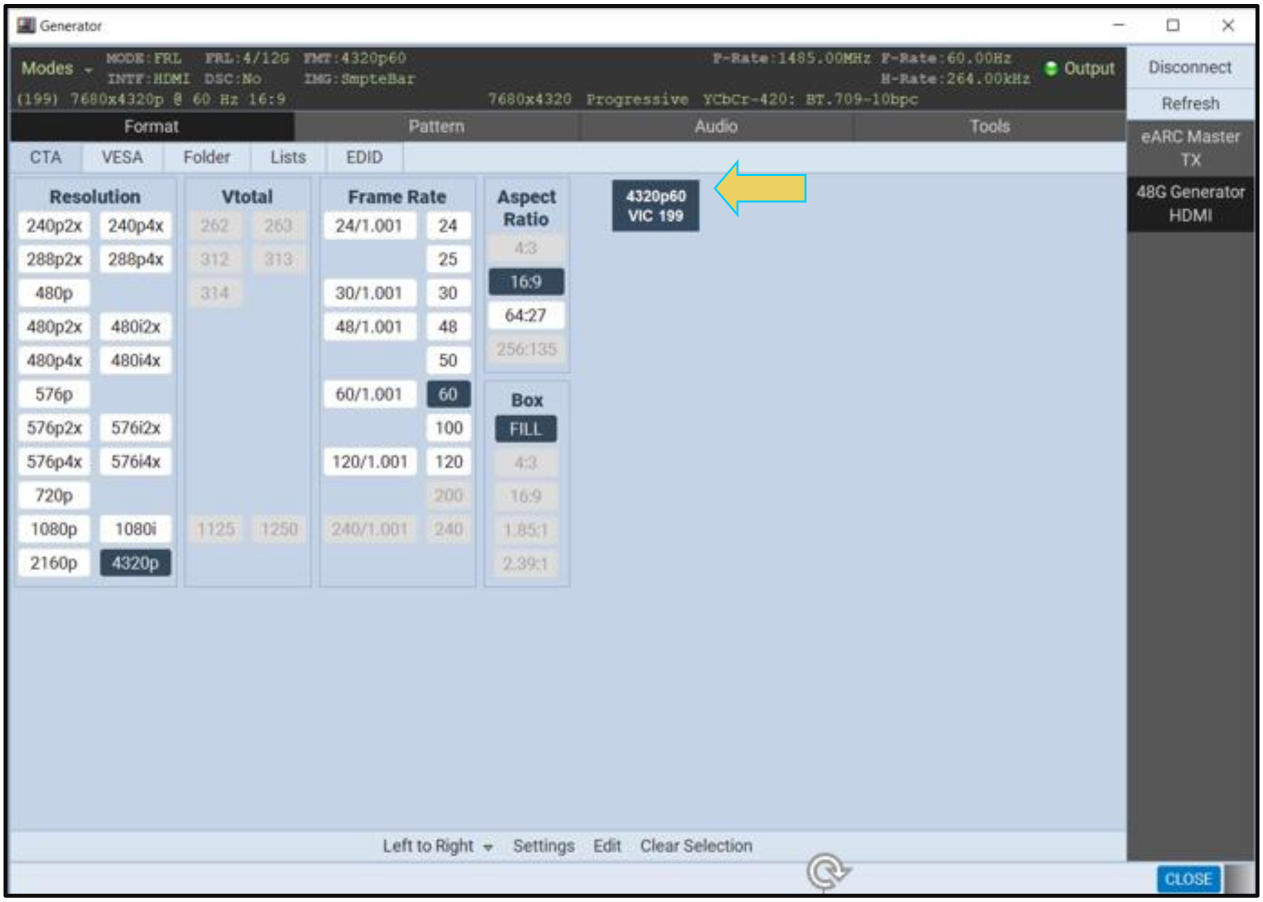
You can open and activate any custom Format Lists you have previously defined using SELECT FOLDER Path: /Standard. A dialog box will appear enabling you to select a custom format list or lists (below).





You can select all or one custom Format List or any combination if you have several defined. The example here shows selecting one Format List. The **CHECK ALL** and **UN-CHECK ALL** activation buttons allow convenient selection where you have many Format Lists to choose from. The result of selecting one custom Format List is shown in the screen example below. A limited set of formats are displayed. The Path icon on the bottom status panel will display that new list (indicated below).

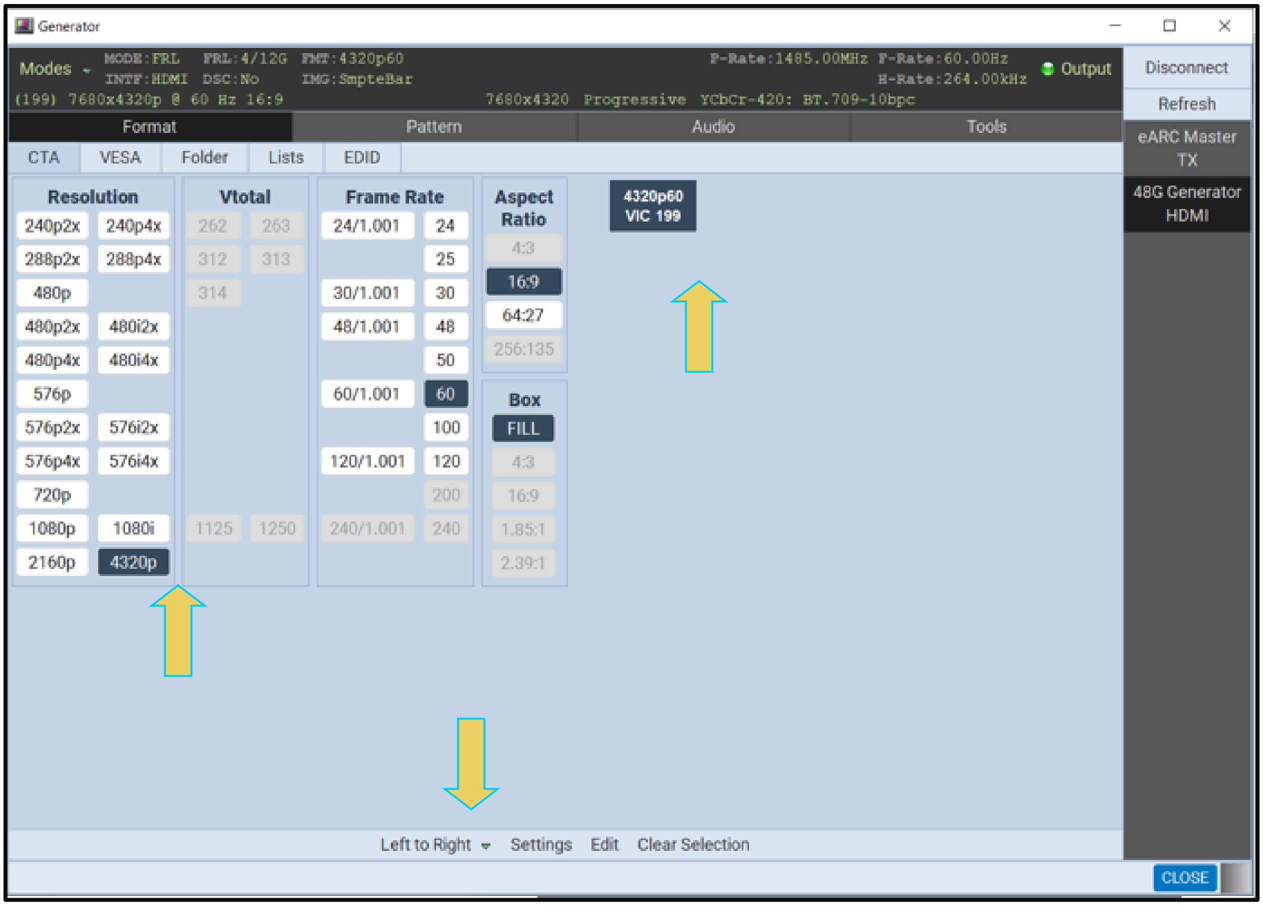




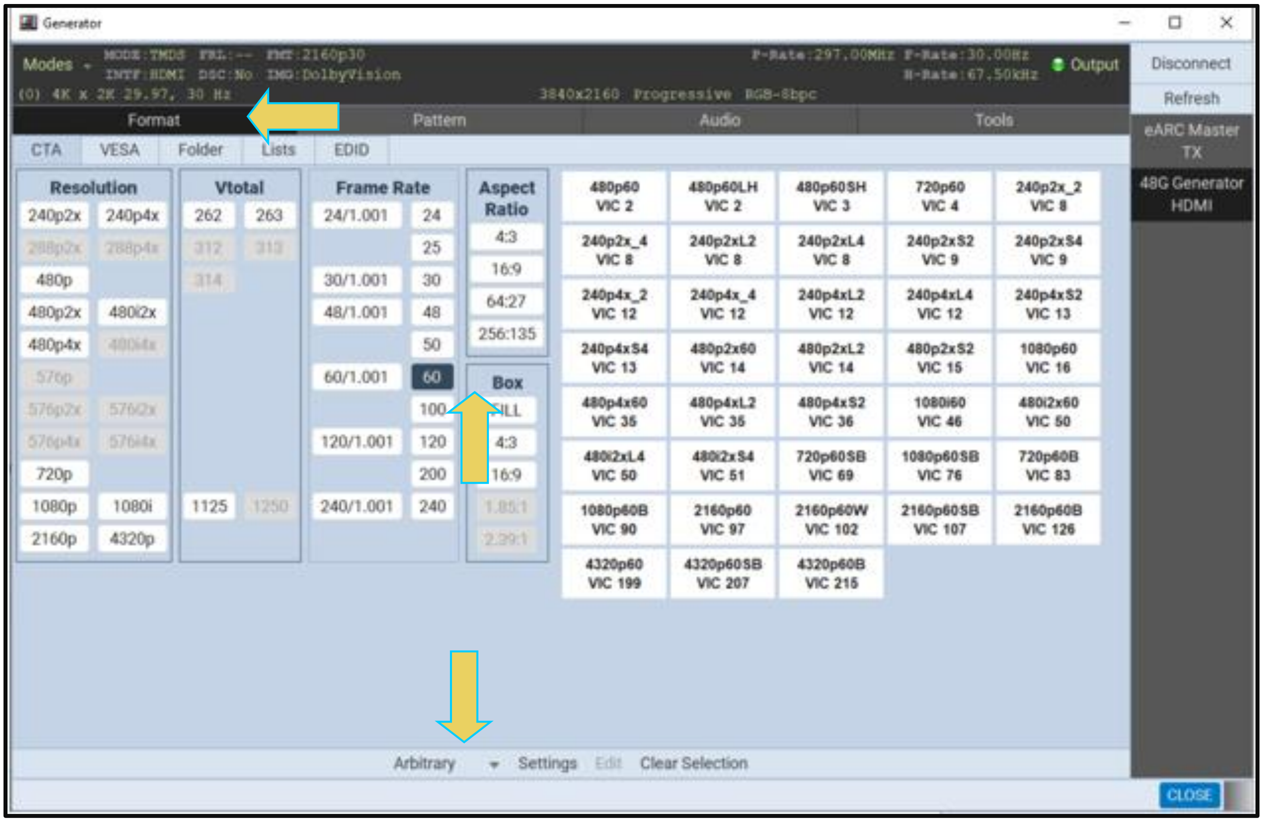
To select a format from the CEA smart filtering button:

1. From the main window of the M42h 96G Video Analyzer/Generator, click the **Format** tab.

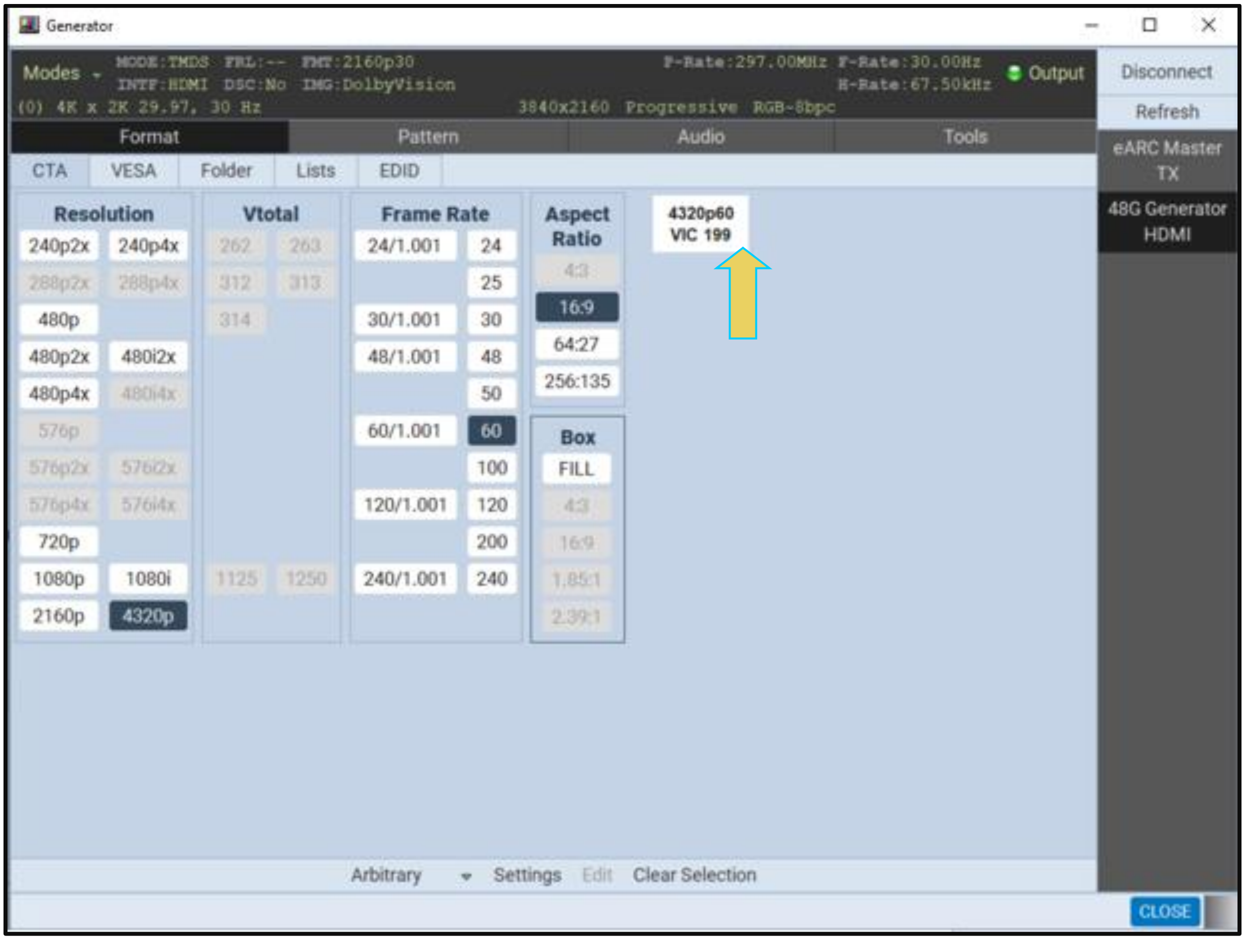
The default for HDMI is to present the CTA smart filtering list as shown below. If the CTA button is not active, simply click on the CTA button on the upper left of the top panel (indicated in the screen shot below). The CTA smart filtering screen enables you to select formats through filtering of various video parameters such as Resolution, Vtotal, Frame Rate and Aspect Ratio. As you optionally move from left to right on the screen the list of available formats that meet the filtering criteria is shown on the right.


Generator
Modes
MODE:FRL FRL:4/12G FMT:4320p60
INTF:HDMI DSC:No IMG:SmpteBar
(199) 7680x4320p @ 60 Hz 16:9
P-Rate:1485.00MHz F-Rate:60.00Hz
H-Rate:264.00kHz
7680x4320 Progressive YCbCr-420: BT.709-10bpc
Output
Disconnect
Refresh
eARC Master TX
48G Generator HDMI
Format
Pattern
Audio
Tools
CTA
VESA
Folder
Lists
EDID
Resolution
240p2x 240p4x
288p2x 288p4x
480p
480p2x 480i2x
480p4x 480i4x
576p
576p2x 576i2x
576p4x 576i4x
720p
1080p 1080i
2160p 4320p
Vtotal
262 263
312 313
314
1125 1250
Frame Rate
24/1.001 24
25
30/1.001 30
48/1.001 48
50
60/1.001 60
100
120/1.001 120
200
240/1.001 240
Aspect Ratio
4:3
16:9
64:27
256:135
Box
FILL
4:3
16:9
1.85:1
2.39:1
4320p60
VIC 199
Left to Right
Settings
Edit
Clear Selection
CLOSE

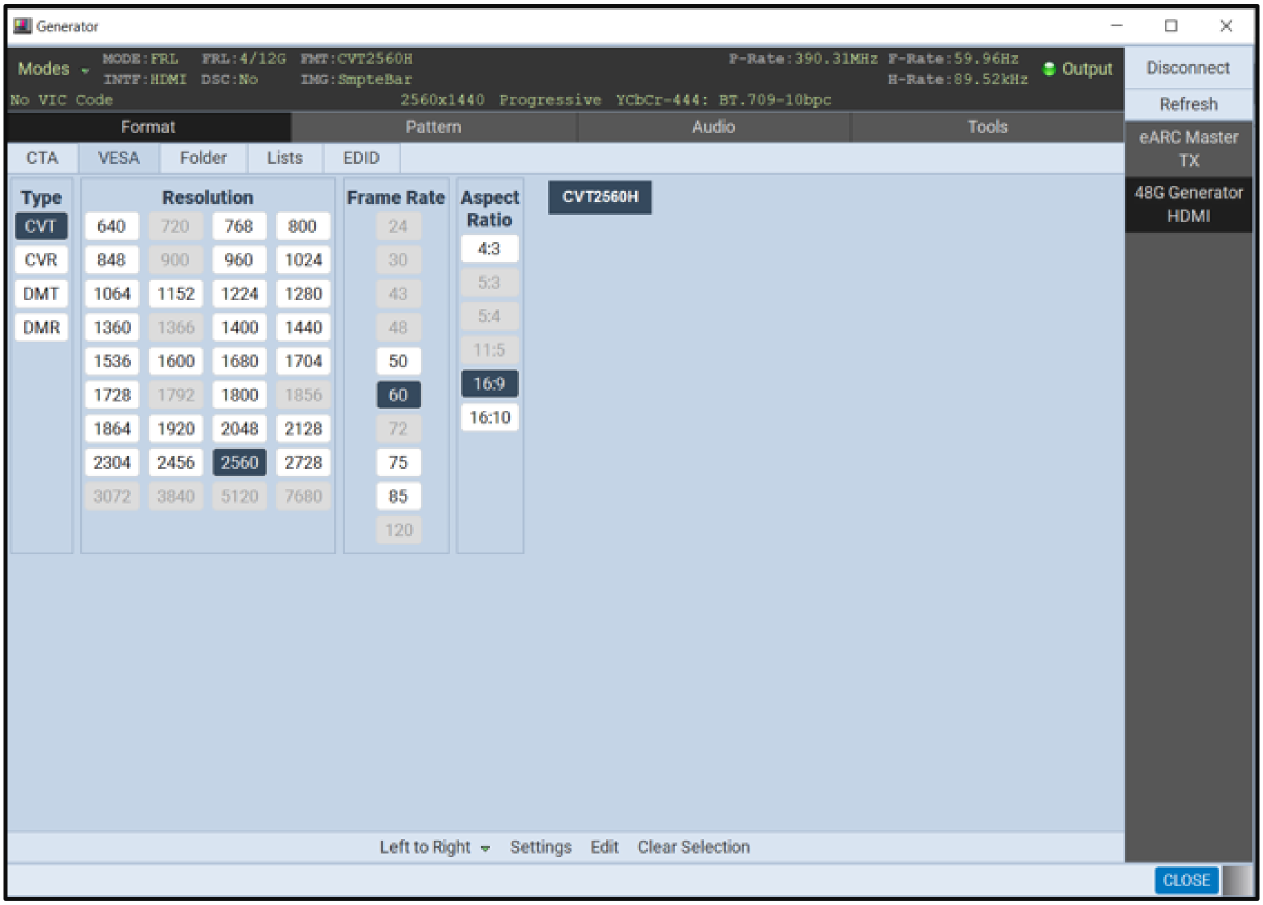
Alternatively, you can select Arbitrary on the pull-down list on the lower control panel. The Arbitrary selection enables you to specify filtering criteria in any order. Refer to the example below.



Regardless of whether you choose Arbitrary or Left to Right, once you specify enough criteria, you will be presented with one or a few format options on the right as shown in the example below.



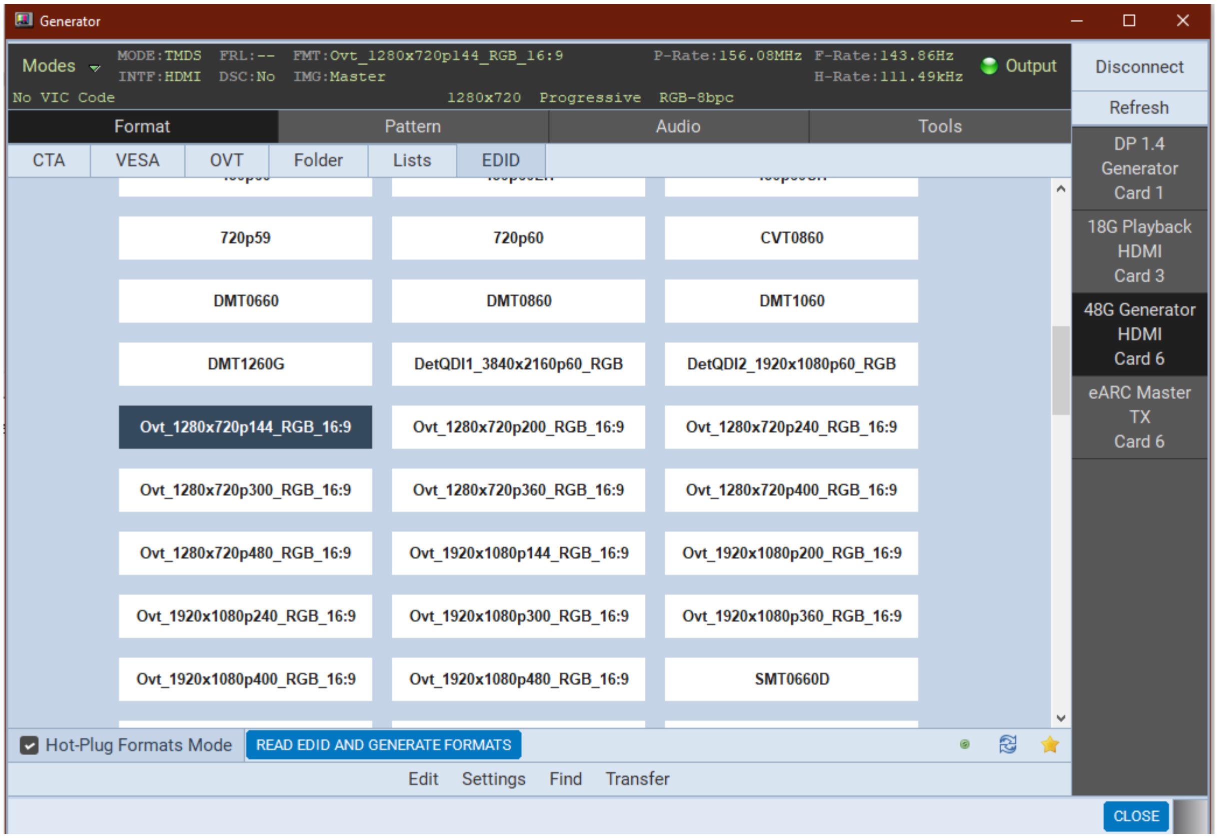
The selection of formats works the same way when selecting VESA formats as shown in the following sample screen.


Generator
Modes
MODE:FRL FRL:4/12G FMT:CVT2560H
INTF:HDMI DSC:No IMG:SmpteBar
P-Rate:390.31MHz F-Rate:59.96Hz
H-Rate:89.52kHz
Output
No VIC Code
2560x1440 Progressive YCbCr-444: BT.709-10bpc
Disconnect
Refresh
Format
Pattern
Audio
Tools
eARC Master TX
48G Generator HDMI
CTA
VESA
Folder
Lists
EDID
Type
CVT
CVR
DMT
DMR
Resolution
640 720 768 800
848 900 960 1024
1064 1152 1224 1280
1360 1366 1400 1440
1536 1600 1680 1704
1728 1792 1800 1856
1864 1920 2048 2128
2304 2456 2560 2728
3072 3840 5120 7680
Frame Rate
24 30 43 48 50 60 72 75 85 120
Aspect Ratio
4:3 5:3 5:4 11:5 16:9 16:10
CVT2560H
Left to Right
Settings
Edit
Clear Selection
CLOSE

15.7 Selecting Optimized Video Timing Formats

The M42h video generator function now provides a tab for OVT formats as shown below.

The M42h video generator function can generate OVT formats from an EDID read as shown below.



15.8 Configuring the Format Settings

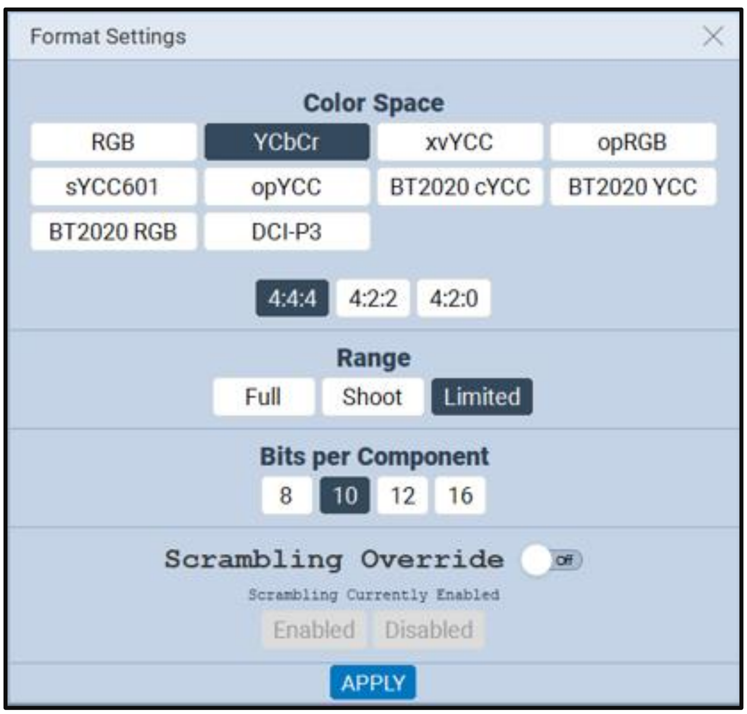
Use the following procedures to configure the format settings. The Settings dialog box enables you to configure the Color Space, Range and Bits per Component.

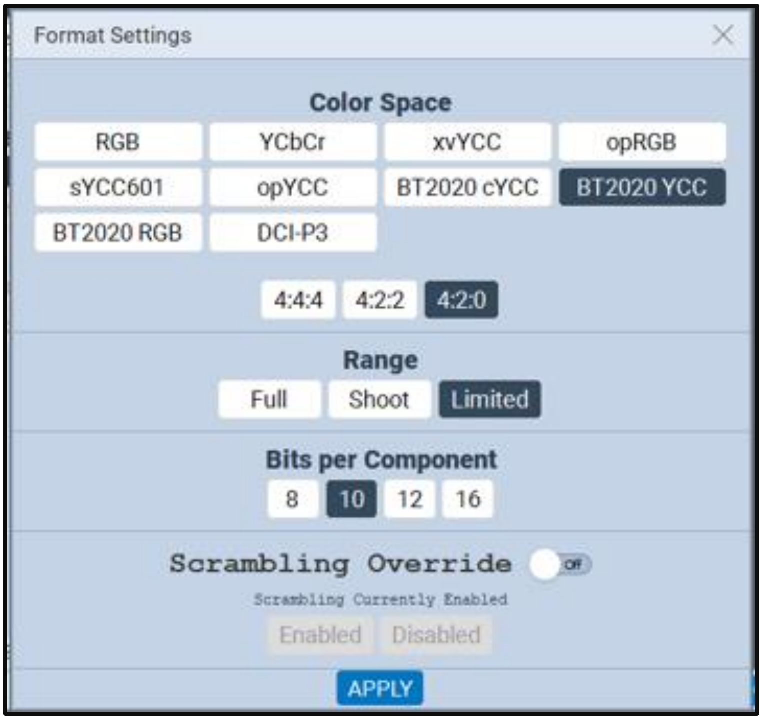
To select a format:

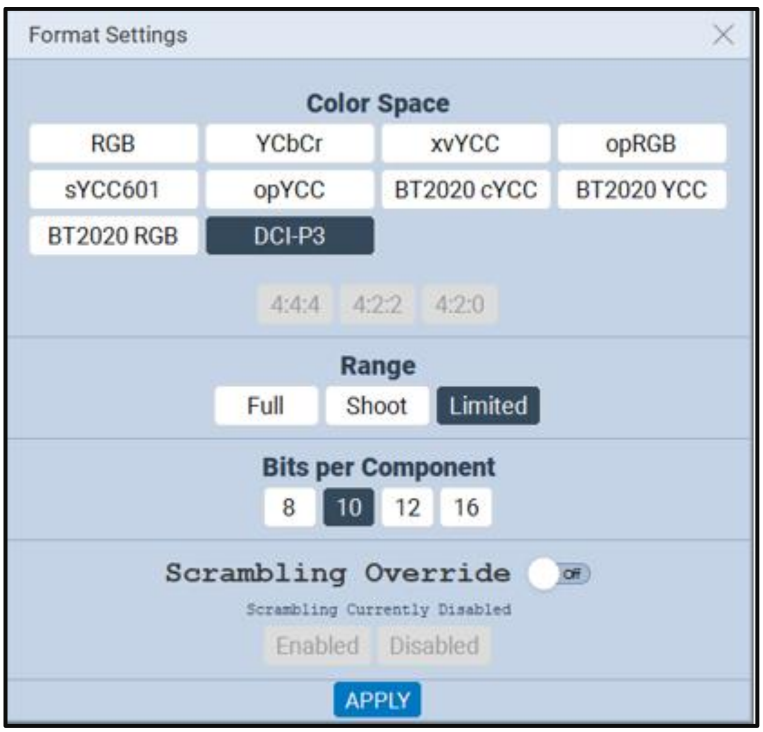
1. Specify the format settings by clicking on the **Settings** button on the lower center of the panel (indicated below).

The **Settings** dialog box appears as shown below. Four examples are shown below; the first with RGB selected, the second with YCbCr selected and the third with BT.2020 and fourth with DCI-P3 colorimetry selected.


Format Settings
Color Space
RGB
YCbCr
xvYCC
opRGB
sYCC601
opYCC
BT2020 cYCC
BT2020 YCC
BT2020 RGB
DCI-P3
4:4:4
4:2:2
4:2:0
Range
Full
Shoot
Limited
Bits per Component
8
10
12
16
Scrambling Override
Off
Scrambling Currently Disabled
Enabled
Disabled
APPLY


Format Settings
Color Space
RGB
YCbCr
xvYCC
opRGB
sYCC601
opYCC
BT2020 cYCC
BT2020 YCC
BT2020 RGB
DCI-P3
4:4:4
4:2:2
4:2:0
Range
Full
Shoot
Limited
Bits per Component
8
10
12
16
Scrambling Override
Off
Scrambling Currently Enabled
Enabled
Disabled
APPLY





2. Select the Color Space, Range and Bits per Component from the **Format Settings** dialog box in accordance with your requirements.

Format Settings		
Parameter	**Description**	**Options**
Color Space	Colorimetry and video pixel encoding settings	**RGB** – Uses 4:4:4 sampling. **YCbCr** – Uses either 4:4:4, 4:2:2 or 4:2:0 sampling. **xvYCC** – High-definition colorimetry based on IEC 61966 2-4. **AdobeRGB** – The AdobeRGB color space is defined in IEC 61966-2-5. If the connected display does not support Adobe color modes, then the sink shall not transmit Adobe encoded video. **sYCC601** – Colorimetry based on IEC 61966-2-1/Amendment 1. **AdobeYCC** - The AdobeRGB color space is defined in Annex A of IEC 61966-2-5. If the connected display does not support Adobe color modes, then the sink shall not transmit Adobe encoded video. **BT.2020 YCC** – Rec 2020 for YCbCr BT.2020 cYCC Rec 2020 for YCbCr with linear encoding **BT.2020 RGB** – Rec 2020 for RGB. **DCI-P3** – Digital Cinema Initiatives color space.
Range	These values are described in CEA-861E. They pertain to the number of levels for RGB and YCbCr mode.	**Limited** – Use for CEA formats. Please refer to the HDMI specification section on Video Quantization Ranges for more details. **Shoot** – for testing the undershoot/overshoot signal code margins. **Full** - Use for PC formats. Please refer to the HDMI specification section on Video Quantization Ranges for more details.
Bits per Component	Color depth per component.	**8** – Eight (8) bit per component (24 bit per pixel) color depth. **10** – Ten (10) bit per component (30 bit per pixel) color depth; deep color.

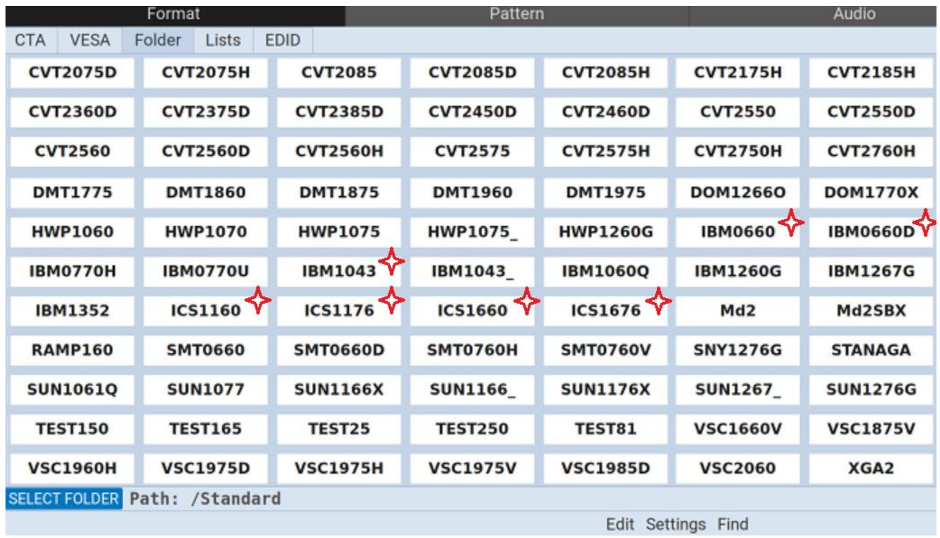
Format Settings		
Parameter	**Description**	**Options**
		12 – Twelve (12) bit per component (36 bit per pixel) color depth; deep color. **16** – Sixteen (16) bit per component (48 bit per pixel) color depth; deep color.

15.8.1 Important Note Regarding HDMI Formats

Some of the formats require a slight modification to the HFront in order for the M42h Video Generator to produce the correct video signal.

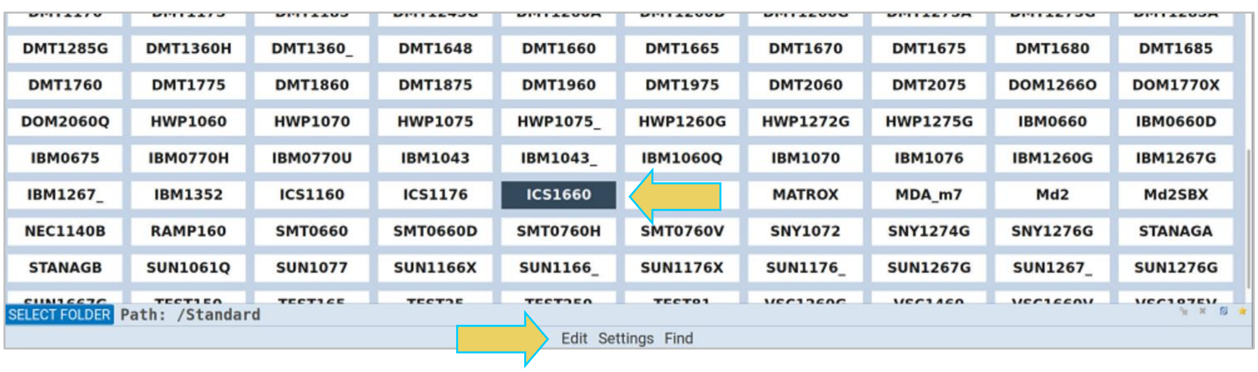
The HFront (also referred to as Front Porch, Pulse Delay, Horizontal Offset) must be greater than or equal to 8 pixels. This setting can easily be changed within the Format Editor utility. The formats affected by this are:

- **ICS1160**
- **ICS1176**
- **SUN1667G**
- **ICS1660**
- **ICS1676**
- **IBM0660D**
- **IBM0660**
- **IBM1043**



Screenshot showing a few of the affected HDMI Formats

In order to edit the format's specifications, highlight the format you wish to use, and click **Edit** at the bottom of the menu, as shown below.



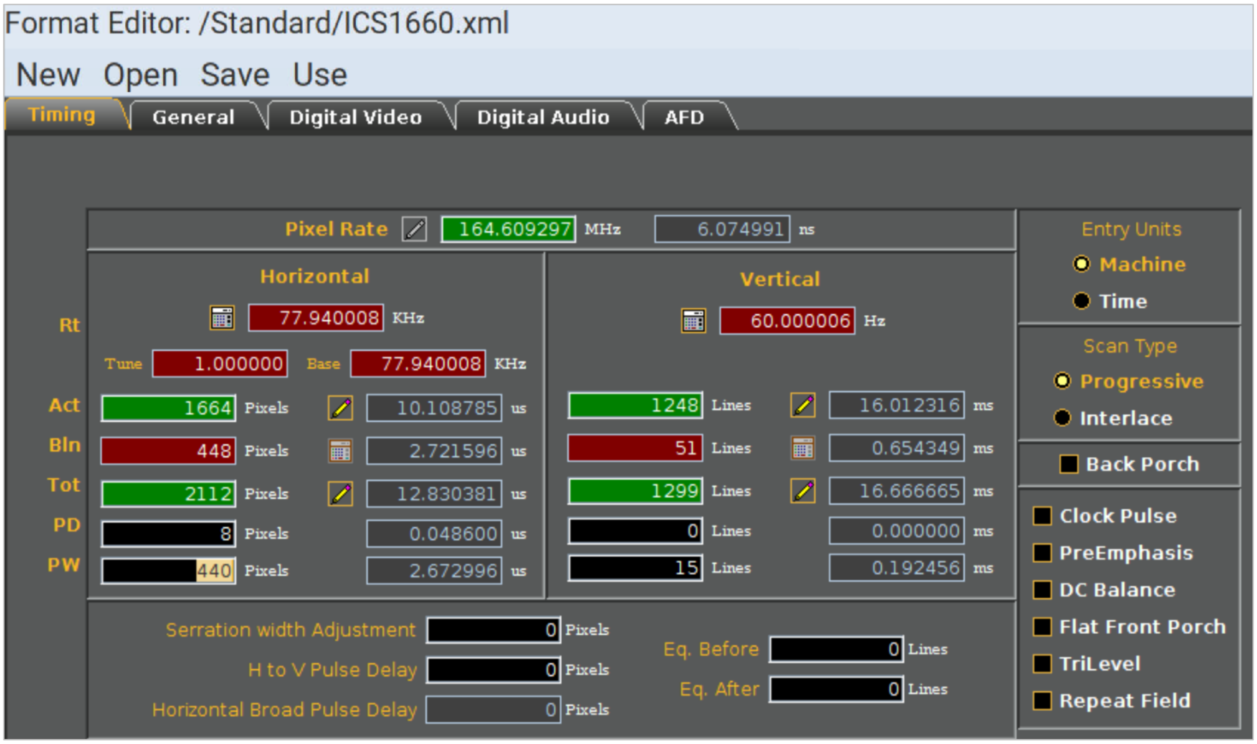
The M42h Format Editor will appear, as shown below. The Format Editor is covered in detail within another chapter, but this subsection will provide only the procedures for modifying the horizontal pulse delay (Hfront).

To adjust the Horizontal Pulse Delay (Hfront), first ensure that **Back Porch** is **NOT** selected on the right-hand side of the Editor utility, as shown in the above screenshot.

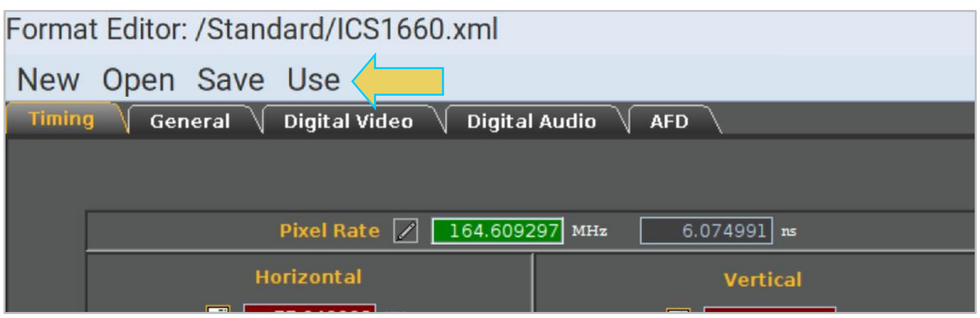
Select the text box corresponding to the **PD** label in the **Horizontal** column of configurations, as shown in the screenshot below. Enter a value of 8 or more and click **Enter**.

Certain fields within the Format Editor utility will automatically adjust based on the values of other fields, but you may need to manually update the Horizontal Pulse Width after adjusting the Pulse Delay.

In the example below, the Pulse Width has been lowered to 440 pixels.



Once the required configurations have been made to the format file, click **Use** at the top of the screen to begin generating video signal with the modified format.

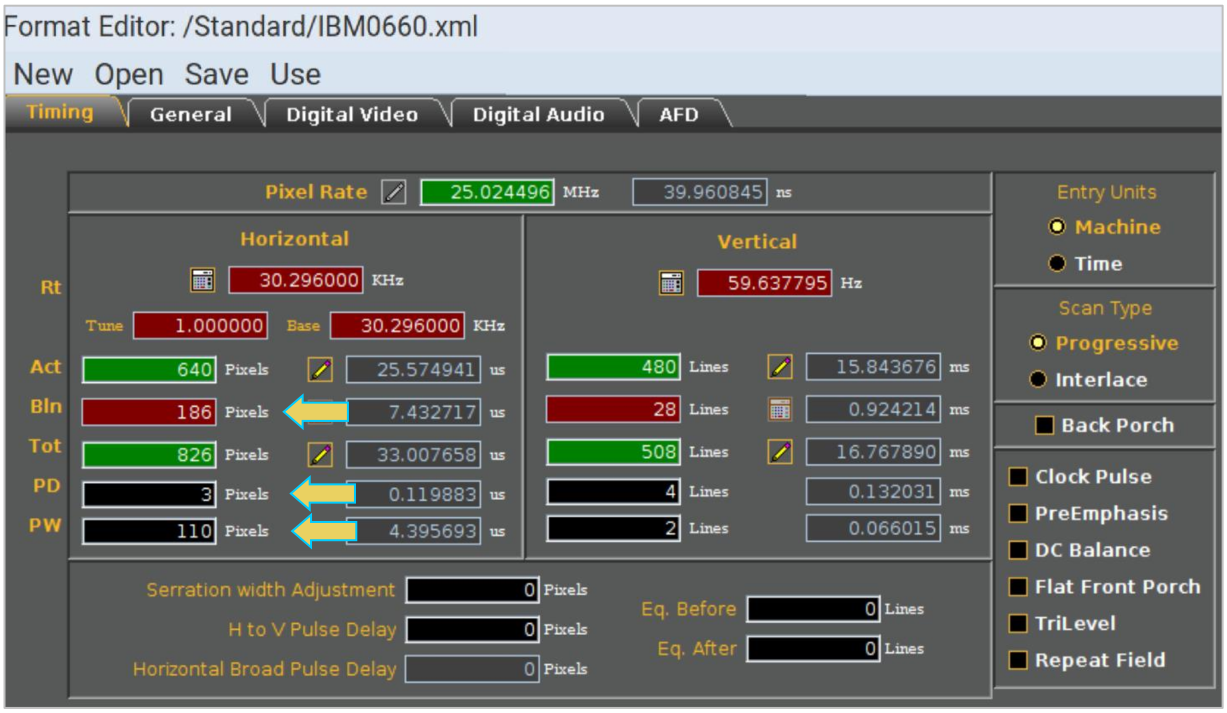


Note: You may also **Save** the modified format file if you wish.

The following screenshots demonstrate another example. Format **IBM0660** has been modified to increase the Horizontal Pulse Delay to 8 pixels, as well.

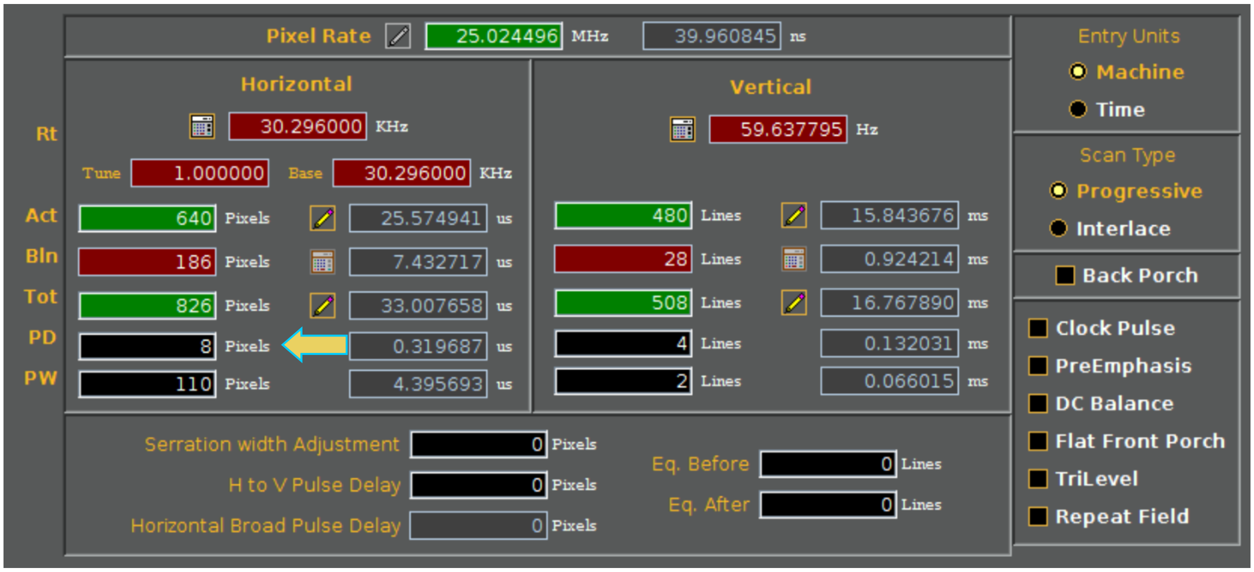
The first two screenshots on this page show the default configurations of format IBM0660, with the following specifications:

- **Horizontal Blanking: 186 pixels**
- **Hfront (Front Porch): 3 pixels**
- **Hback (Back Porch): 73 pixels (second screenshot)**
- **Pulse Width: 110 pixels**



The following two screenshots show the specifications after configuring the Front Porch Pulse Delay:

- **Horizontal Blanking: 186 pixels (unchanged)**
- **Hfront (Front Porch): 8 pixels (manually configured)**
- **Hback (Back Porch): 68 pixels (second screenshot- automatically set based on Hfront value)**
- **Pulse Width: 110 pixels (unchanged)**

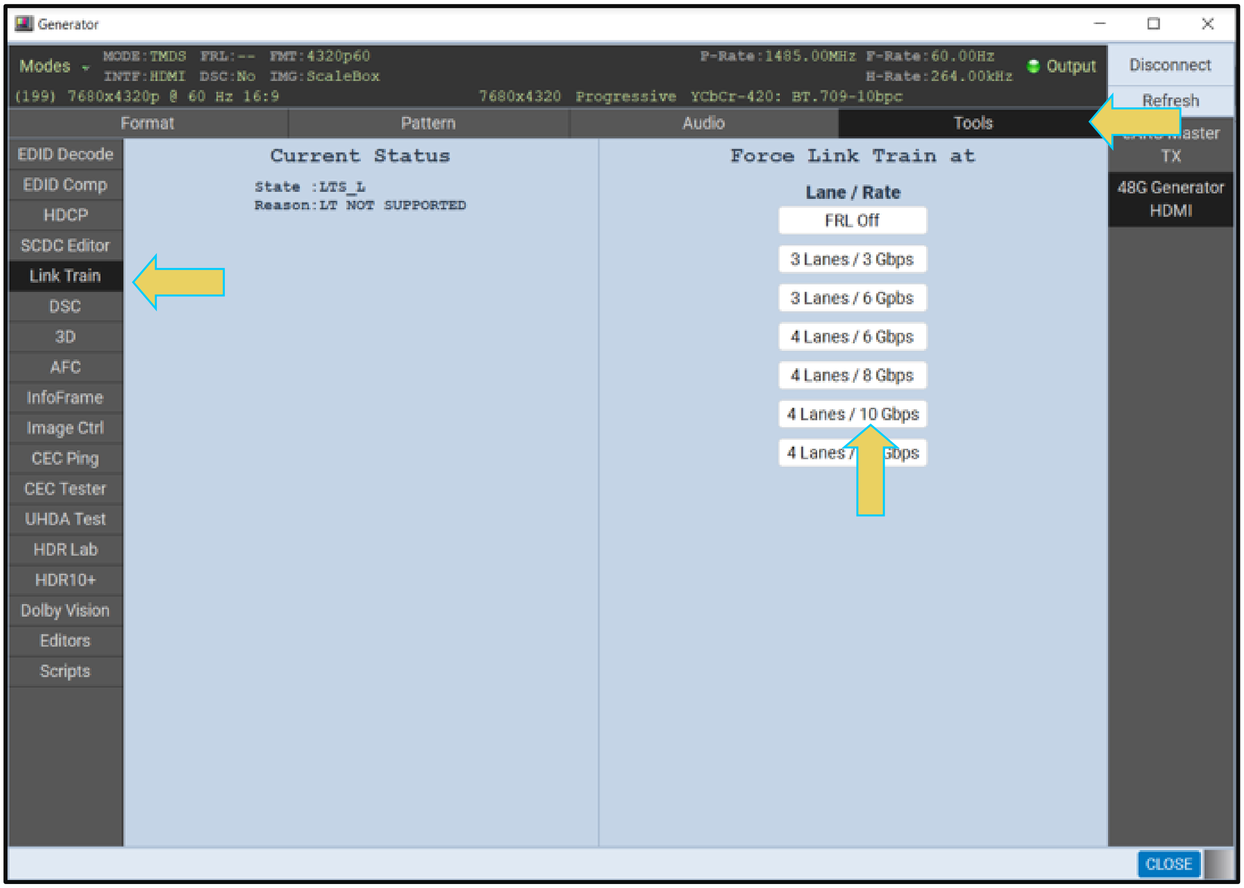


15.9 Configuring the Link Training Settings

Use the following procedures to configure the link training settings. The link training panel is accessible from the Link Train button on the **Tools** tab. You can set the Lane/Rate configuration using the provided buttons on the right side of the panel **Force Link Train** rate. The link training status is shown on the left side **Current Status**.

To select a format:

1. Specify the link training configuration by clicking on the desired button on the right side of the Link Train panel button (indicated below).

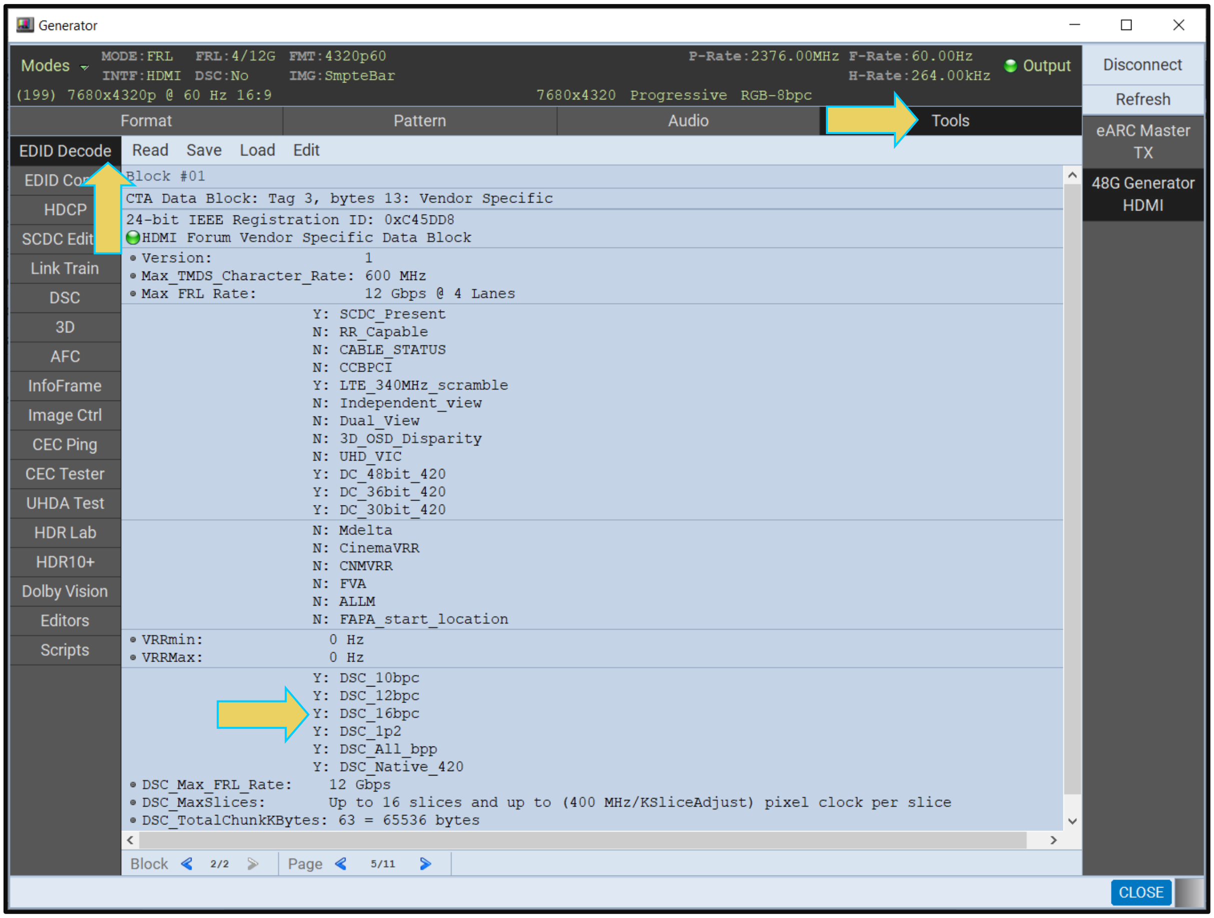


15.10 Generating FRL Display Stream Compression (DSC) Video Streams

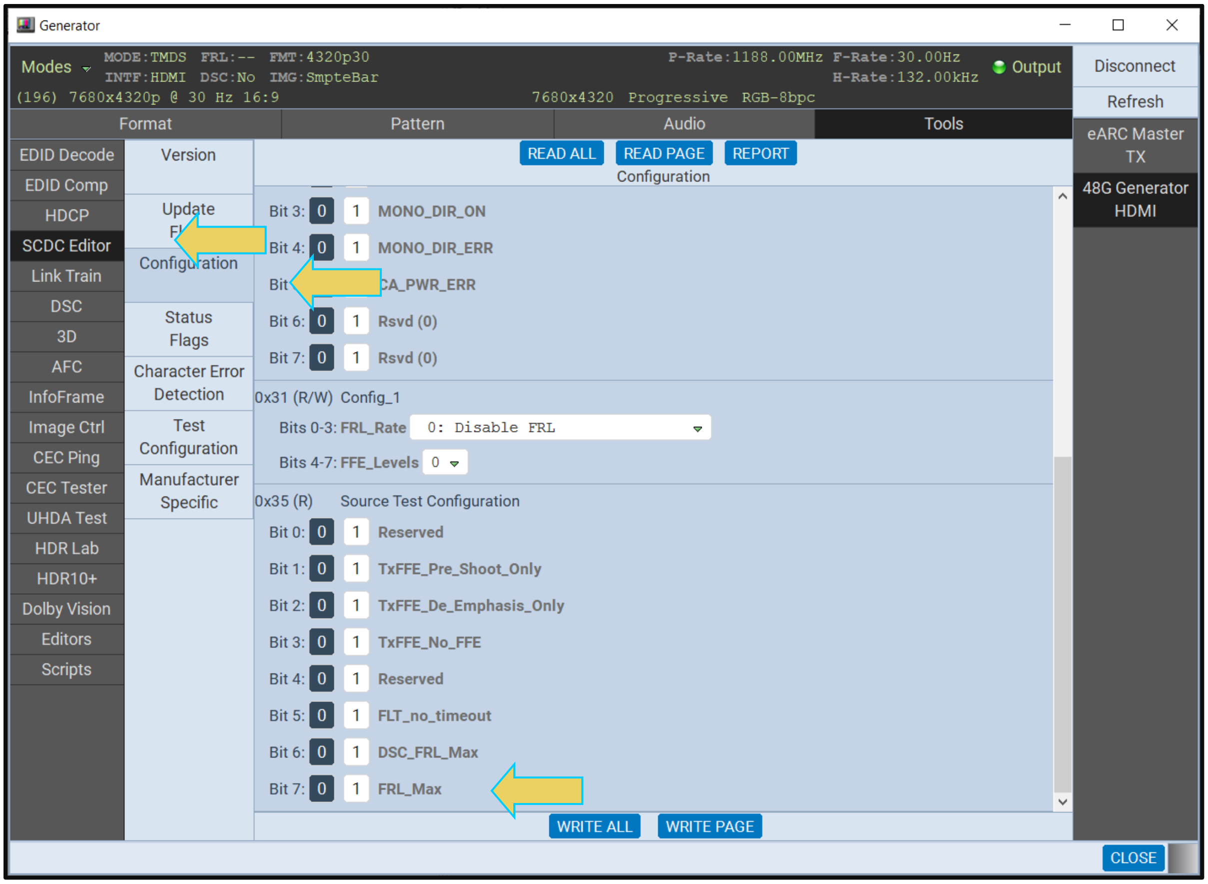
Use the following procedures to configure the 980 96G Protocol Analyzer/Generator module to generate an FRL Display Stream Compression (DSC) stream. You can only generate DSC when the generator is in the FRL mode. You can disable FRL using the FRL Off button.

To specify FRL Display Stream Compression (DSC) mode:

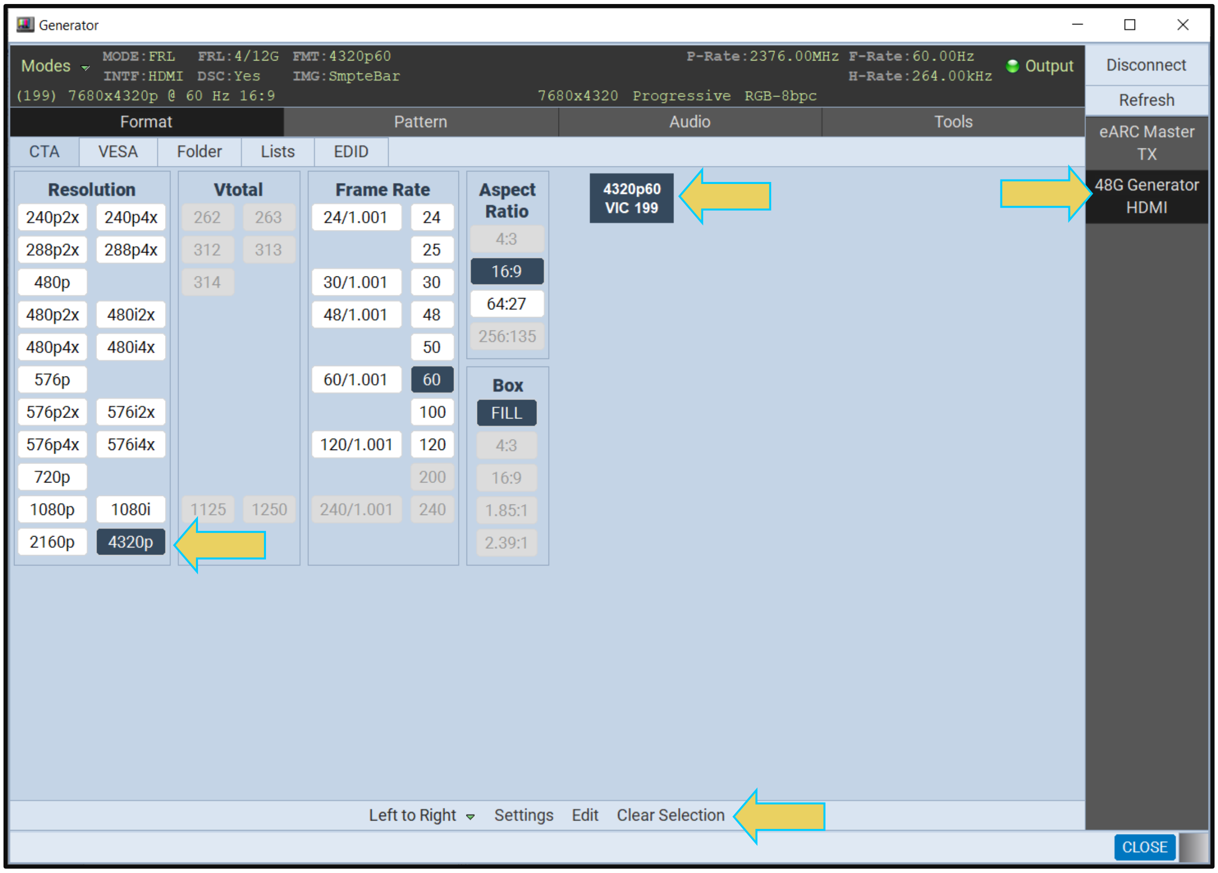
1. To specify the DSC mode first ensure that the display you are connected supports Display Stream Compression (DSC). To do this you read the EDID and verify the Vendor Specific Data Block of the EDID shown below.



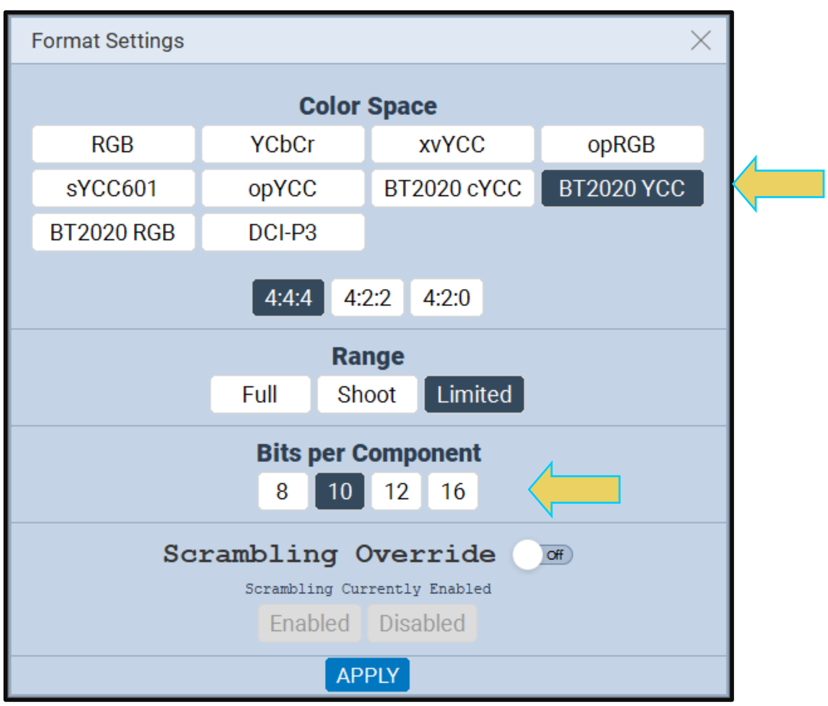
You can also read the SCDC registers as there are some configuration flags that indicate DSC support as shown below.



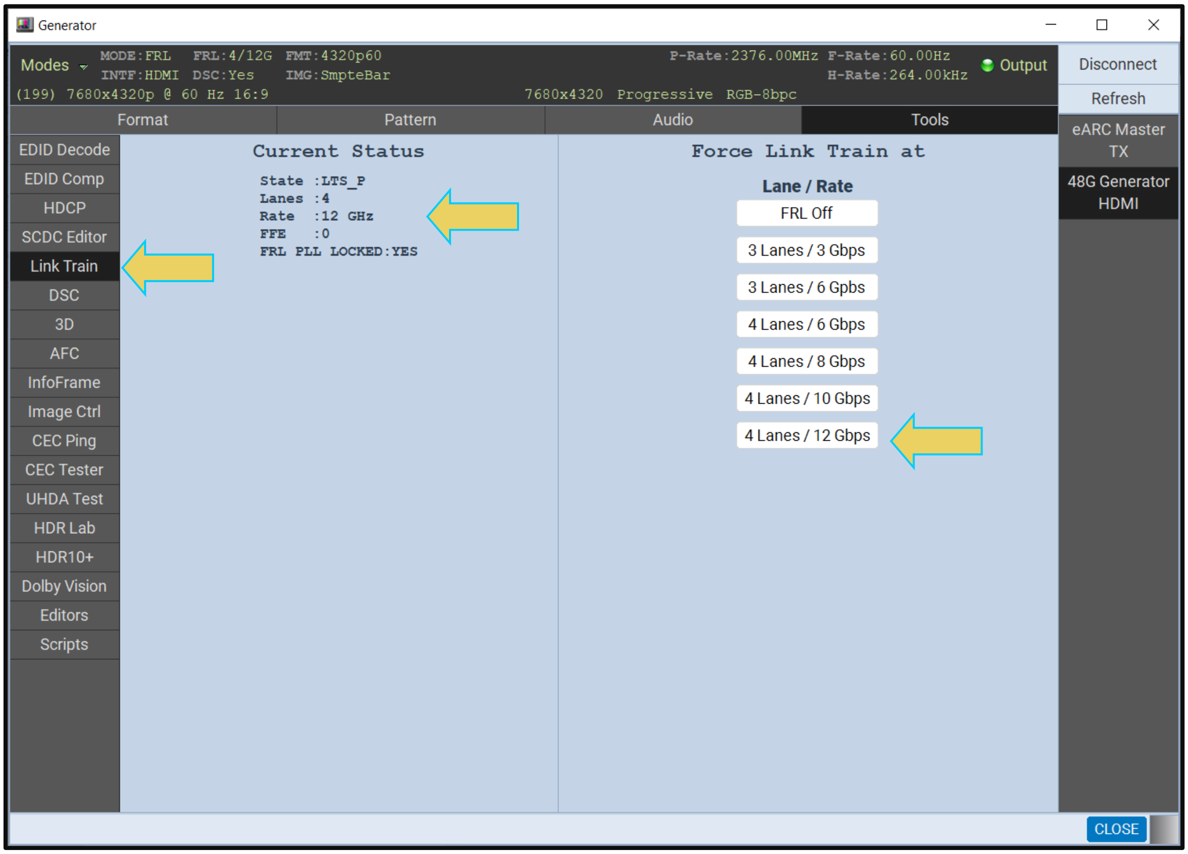
2. Configure the generator for the FRL mode and select a 4K or an 8K format as shown below.



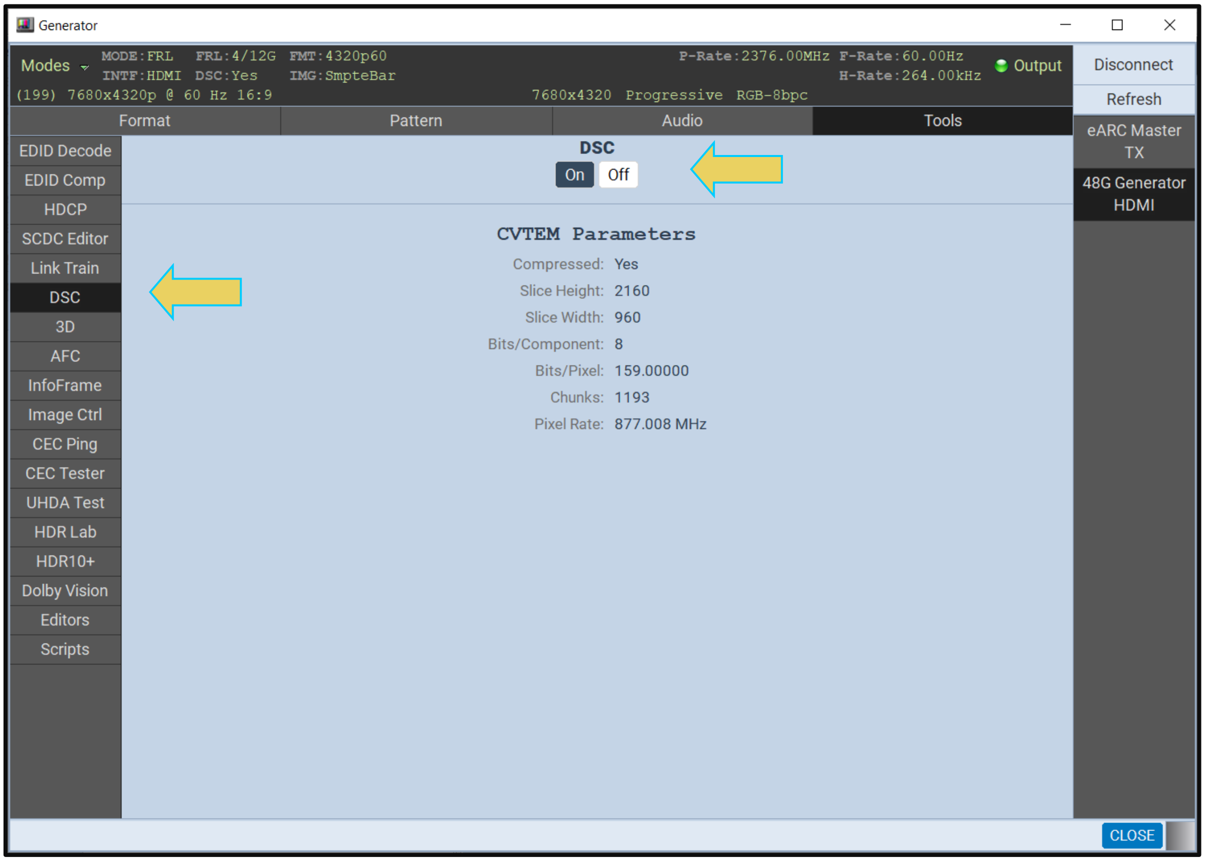
3. Select the settings from the Format Settings dialog box for chroma subsampling, color depth and colorimetry.



4. Configure the Lane and Lane rate of the FRL transmission stream as shown below.



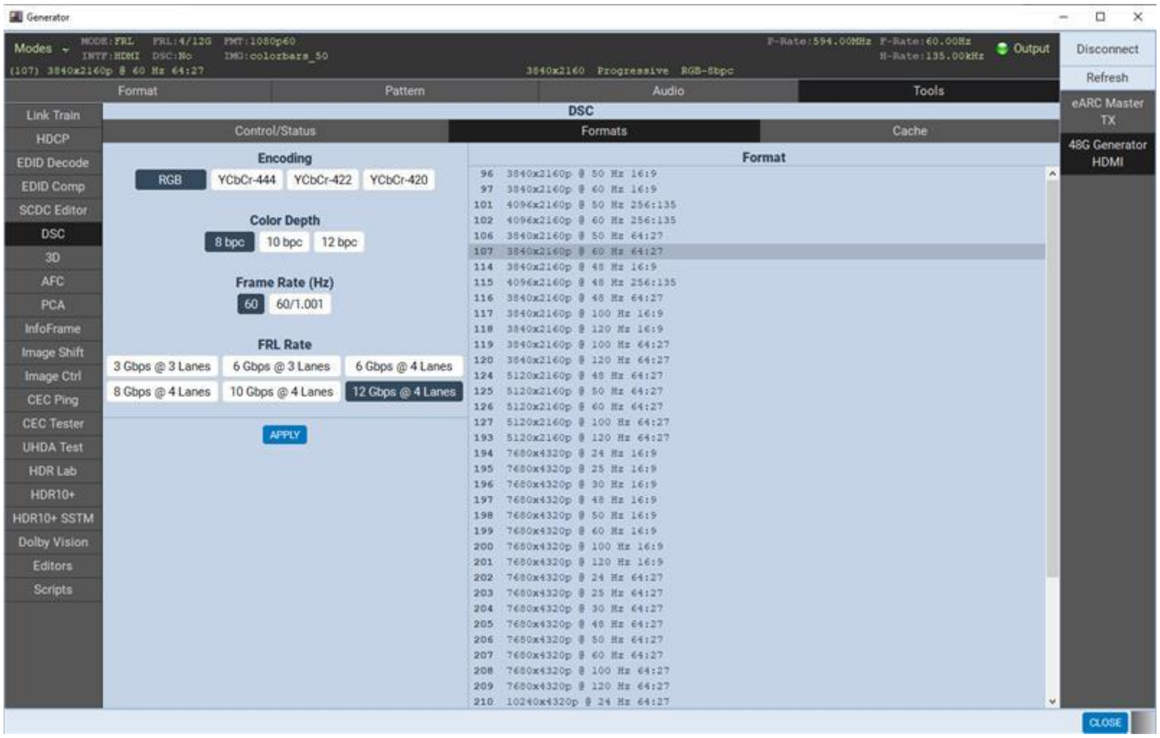
5. Enable Display Stream Compression (DSC) from the DSC window as shown below.

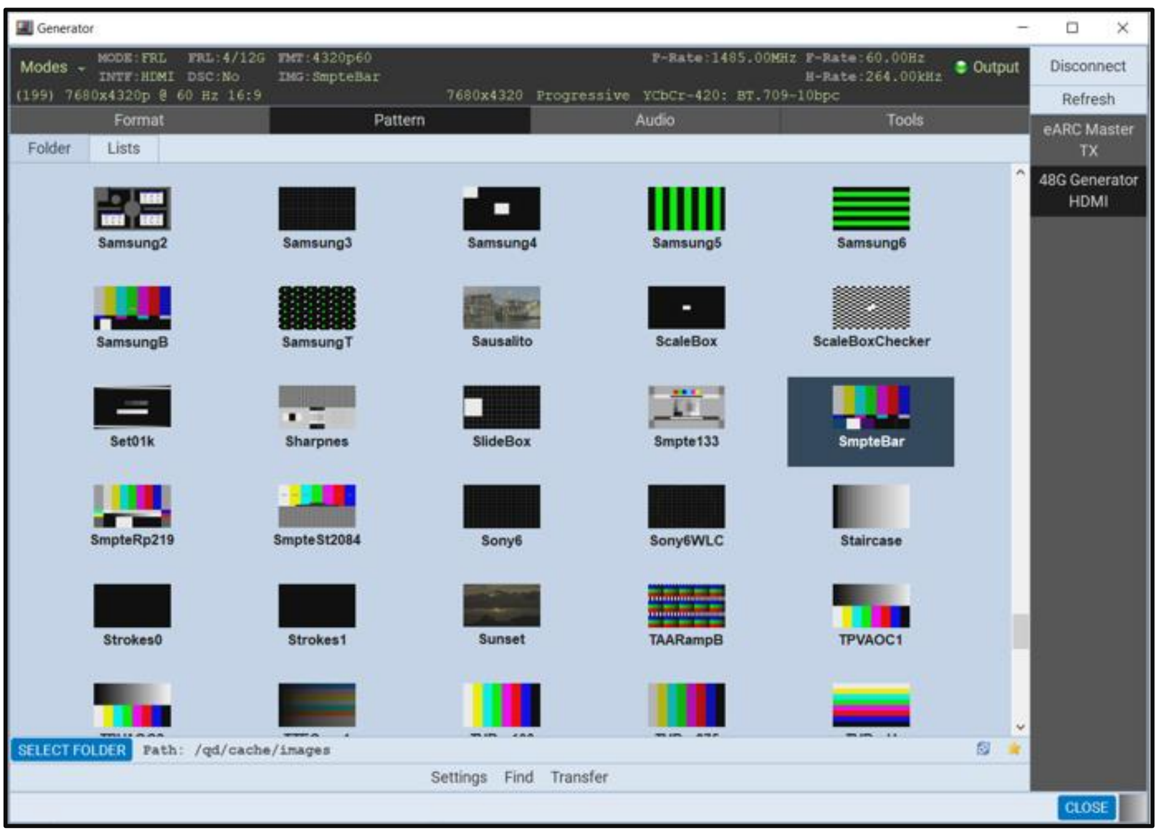


15.10.1 Adding a DSC image to Cache

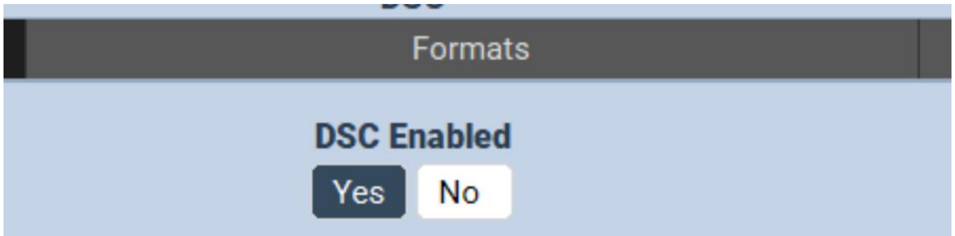
Use the following procedure to add a DSC image to the cache. The procedure assumes that you have already selected an HDMI interface.

1. Select the FRL format and pattern in the generator. Refer to **Section 14.6** and **Section 14.11** as needed. See the following two images.



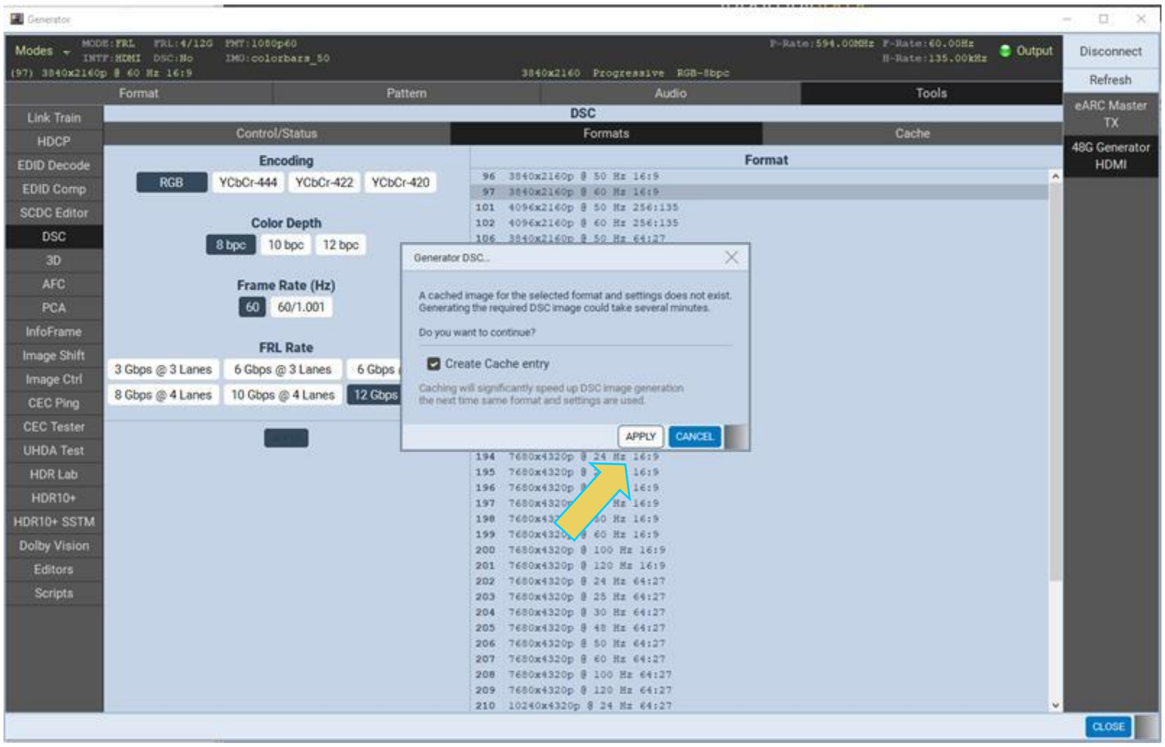


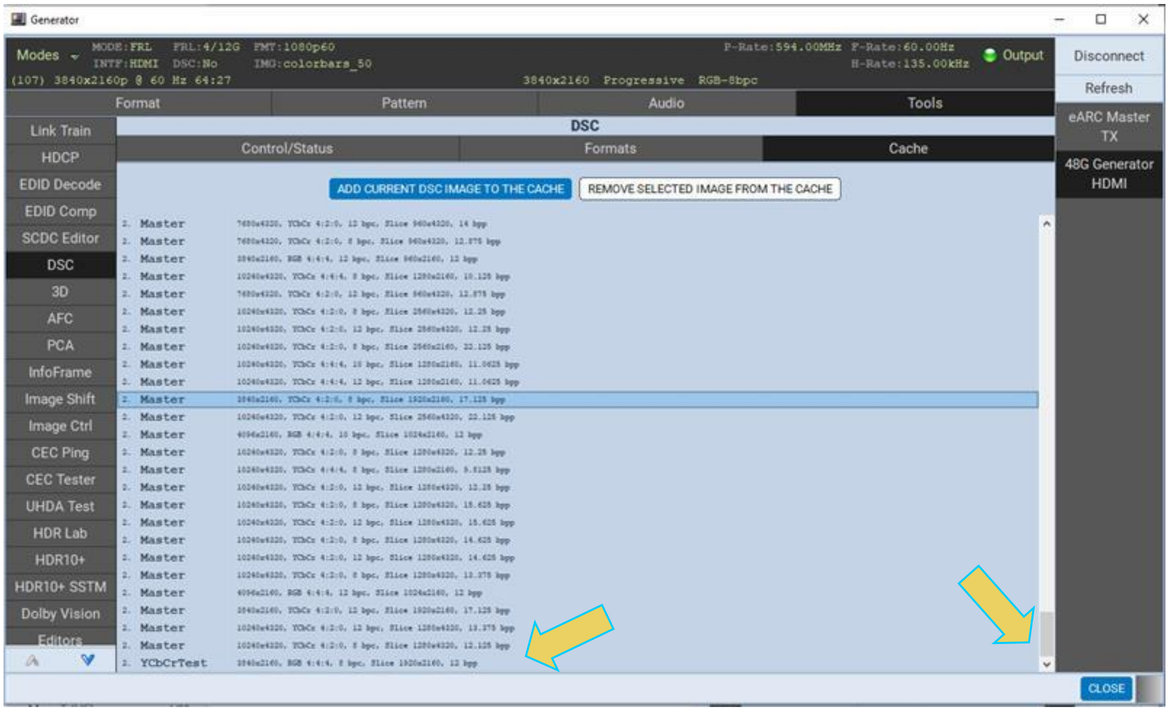
2. Go to **Tools -> DSC -> Control/Status**. Select Yes to the DSC Enabled prompt.



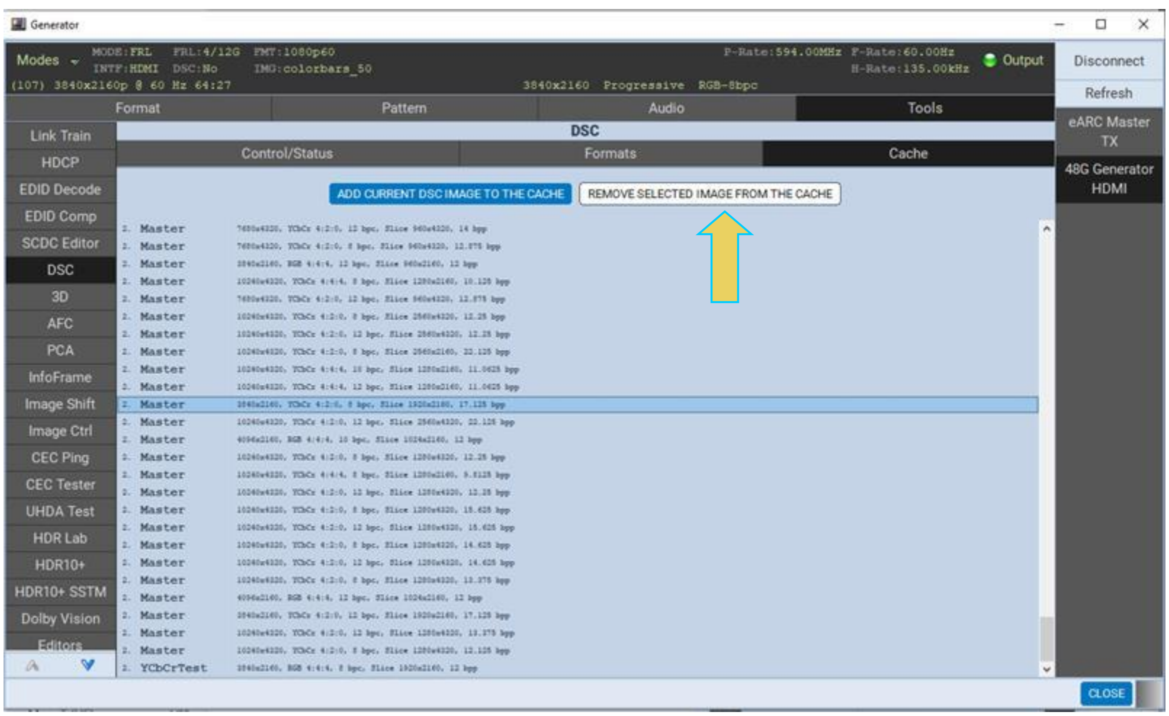
Note: When you enable DSC, if the configuration (format/pattern) is not in the cache, DSC generation will start. This may take a minute or two.

3. Once you have a new DSC format you can add it to the cache by selecting APPLY. See following image. The new entry should appear at the bottom of the list. See second image below.





4. From this screen you may also remove a DSC format entry from the cache by selecting the format and then clicking **REMOVE SELECTED IMAGE FROM THE CACHE**.

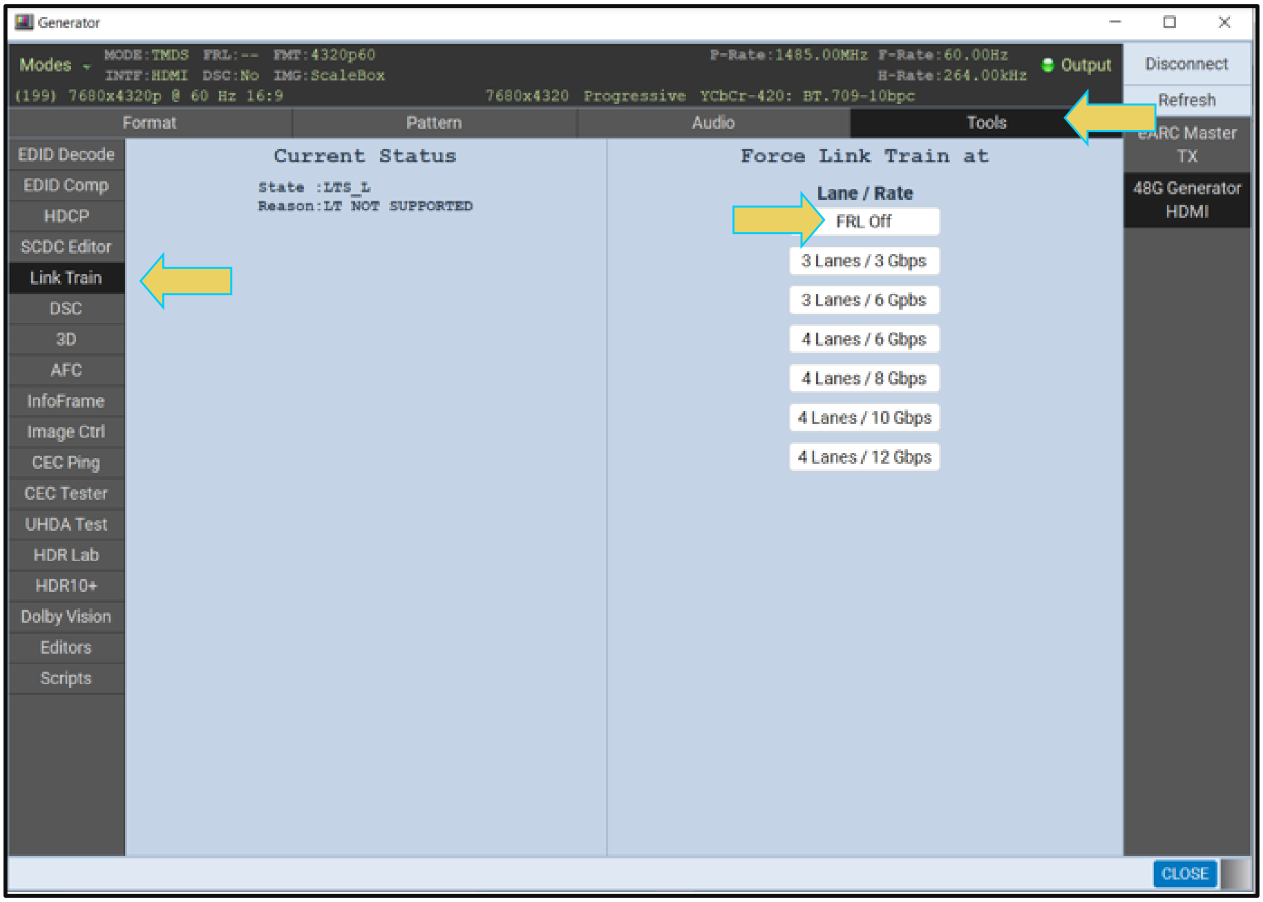


15.11 Generating TMDS Video Streams

Use the following procedures to configure the M42h 96G Video Analyzer/Generator to generate TMDS streams instead of FRL streams. You will use the Link Training panel to set this. The Link Training panel is accessible from the Link Train button on the **Tools** tab. You can disable FRL using the FRL Off button.

To specify TMDS mode:

1. Specify the TMDS mode by disabling the FRL mode as shown below. Once you have disabled FRL you can select Formats and Patterns in the same manner as you select FRL formats.

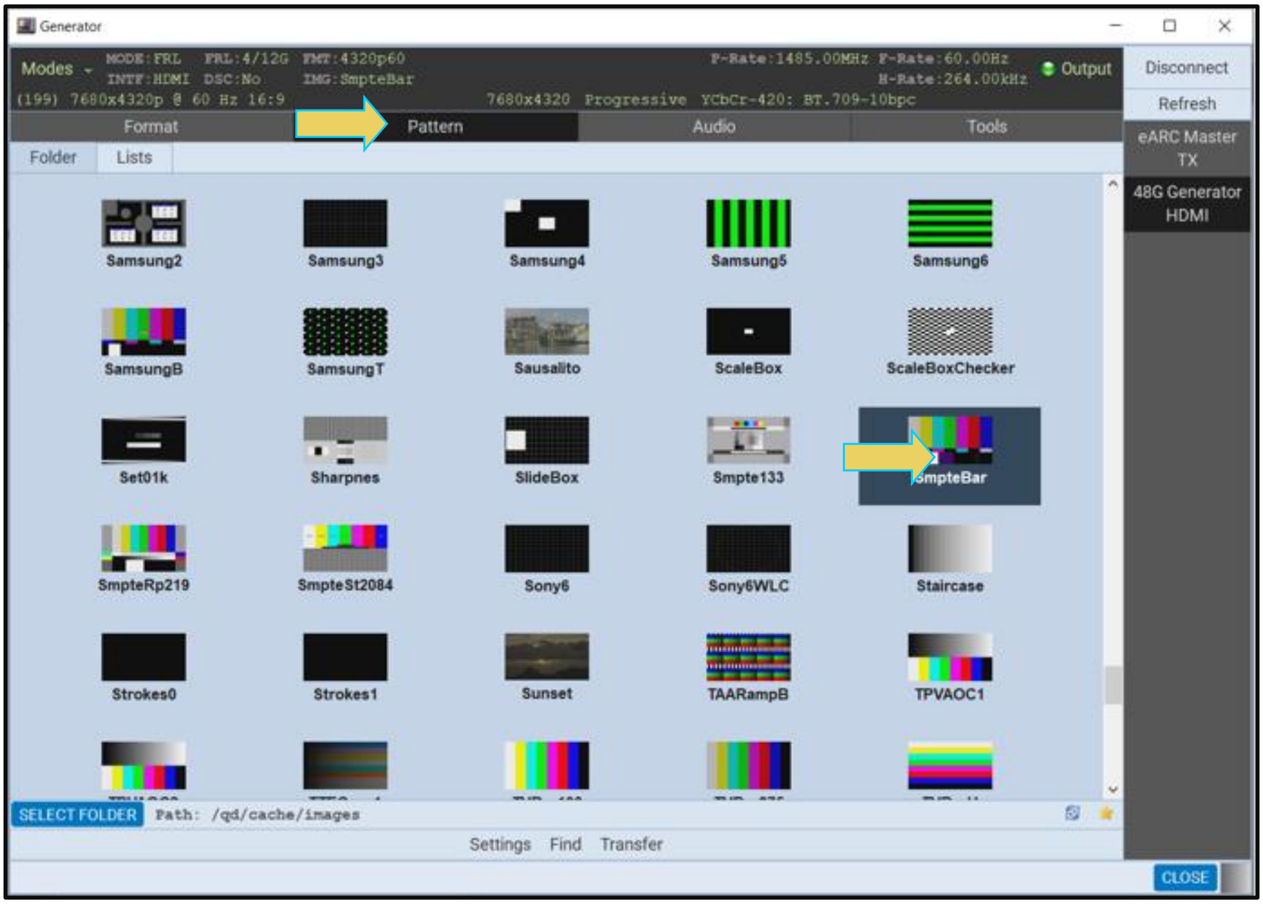


15.12 Selecting Test Patterns

Use the following procedures to select a test pattern.

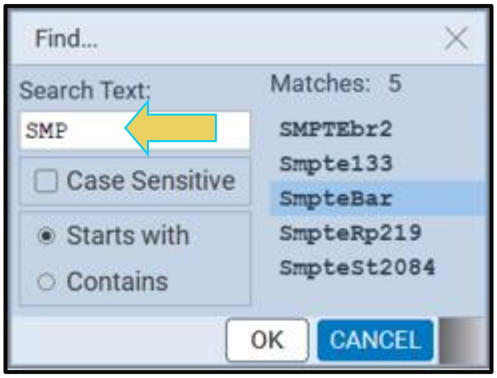
To select a test pattern:

1. From the main window of the M42h 96G Video Analyzer/Generator, click the **Pattern** tab to access the list of test patterns. Clicking the star on the bottom right shows the active pattern.



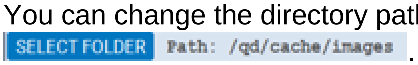
2. Select a test pattern from the list by clicking or selecting it. There is a scroll bar on the right to allow access to the entire list by browsing.

You can either scroll through the list of test patterns or use the **Find** feature to search for patterns. When you press the **Find** activation button, you are presented with a dialog window where you can search for a pattern by name using initial and mid string partial searches (below).

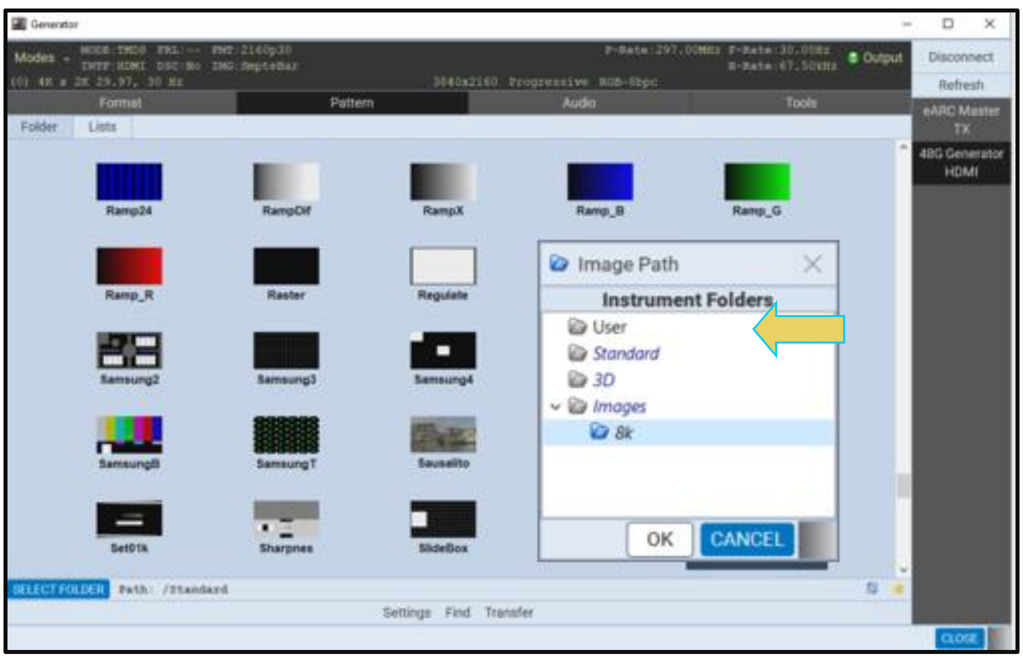


The directory whose images (patterns) are being displayed is listed in the lower panel as indicated below. In the example below, the path is set to Standard which will display the entire test pattern library and is the default path.

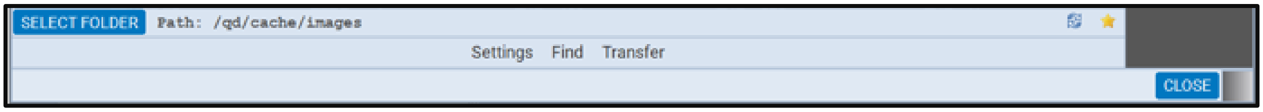
You might wish to change the directory path if you have added your own bitmap patterns and wanted to select them without scrolling through the complete list. You may also have created a custom Pattern List using the **Pattern List Editor**. Refer to Pattern List Editor for details on creating a custom Pattern List.

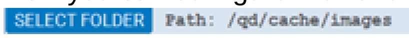
You can change the directory path with the directory activation button 

. When you select the directory a dialog box will appear allowing you to select the alternative path such as the User path shown in the dialog box below.

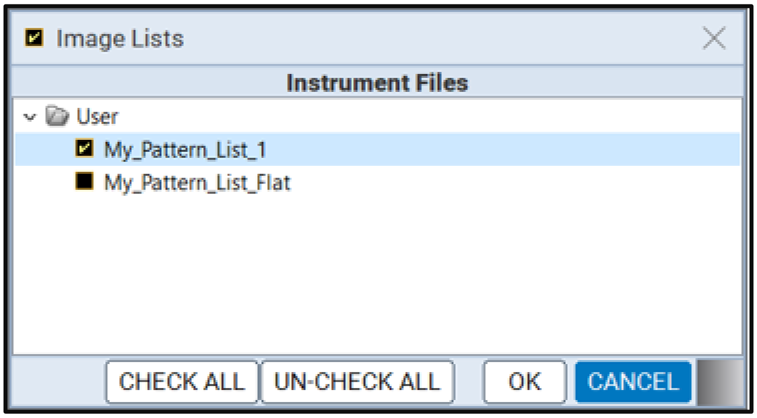


When you have changed the directory the User directory will be indicated on the lower panel beside the associated icon as shown below.

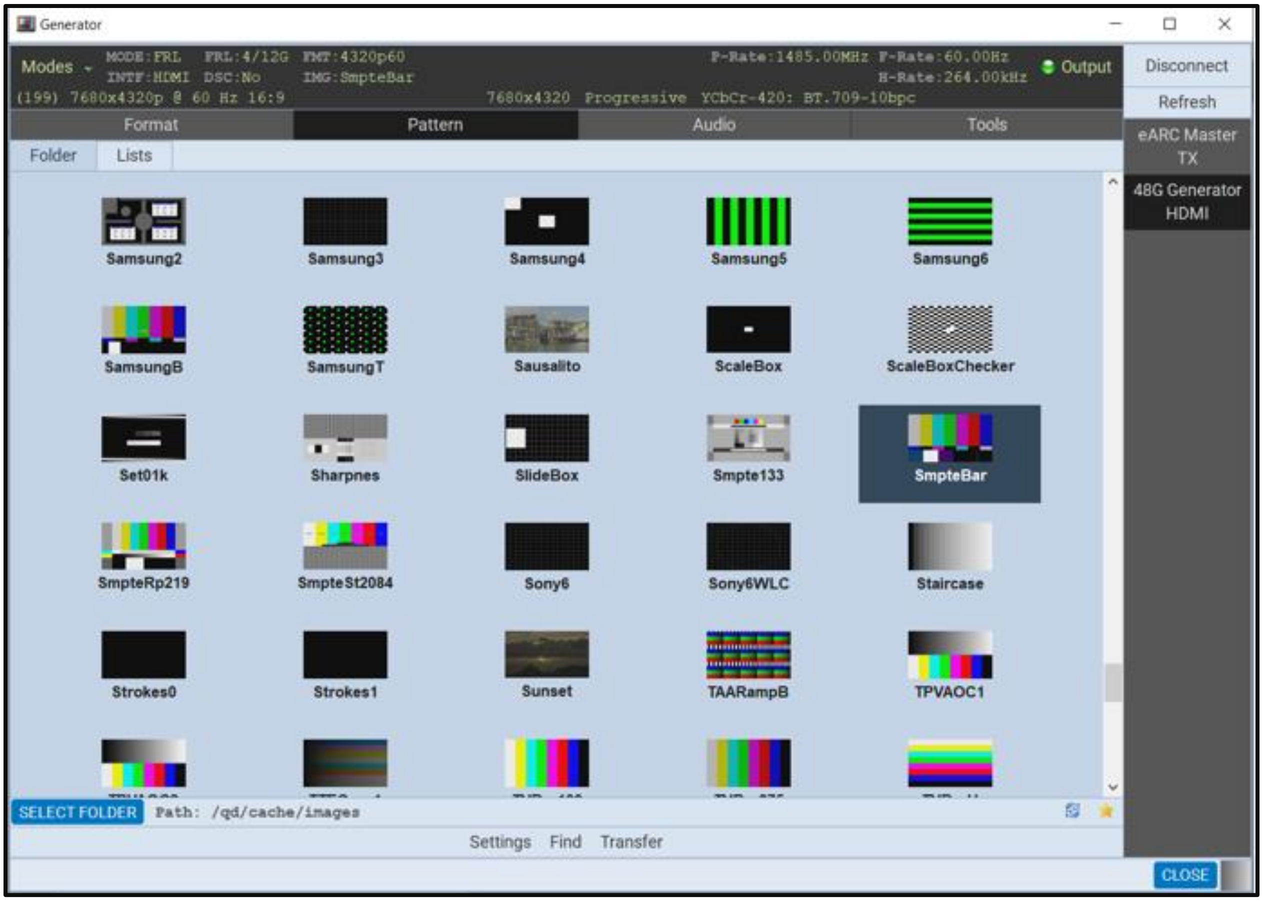


Now you can configure the list of patterns in accordance with a custom Pattern List by using 

. A dialog box will appear enabling you to select a custom image list (below).



You can select all or one custom Pattern List or any combination if you have several defined. The example above shows selecting one Pattern List. The **CHECK ALL** and **UN-CHECK ALL** activation buttons allow convenient selection where you have many Pattern Lists to choose from. The result of selecting one custom Pattern List is shown in the screen example below. A limited set of patterns are displayed. The Path icon on the bottom status panel will display that new list (indicated below).

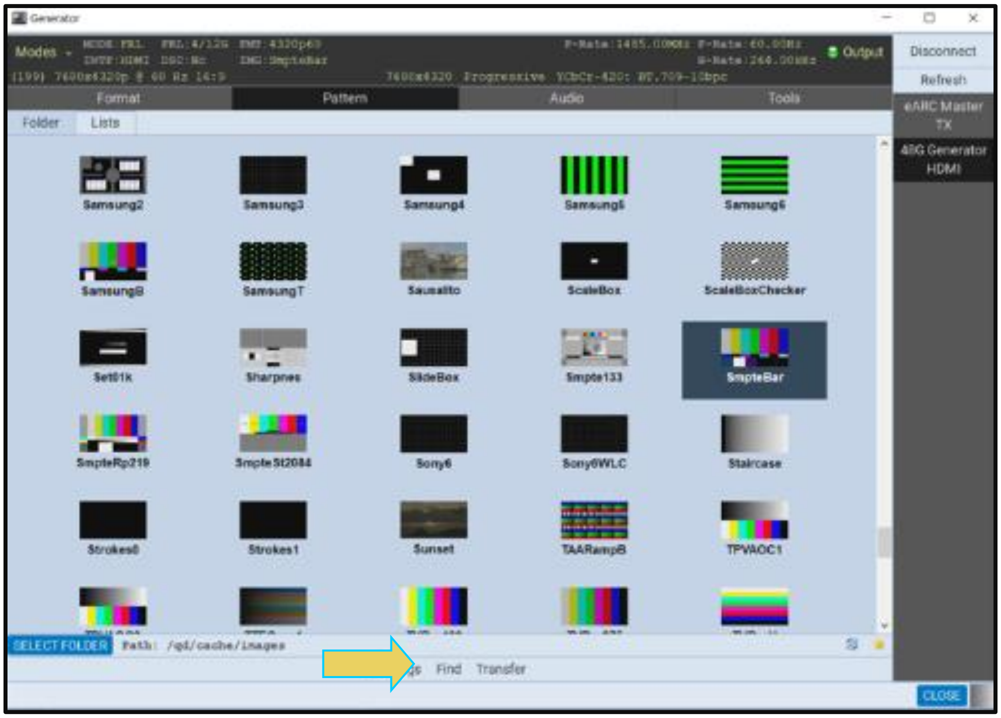

Generator
Modes
MODE:FRL FRL:4/12G FMT:4320p60
INTF:HDMI DSC:No IMG:SmpteBar
(199) 7680x4320p @ 60 Hz 16:9
P-Rate:1485.00MHz F-Rate:60.00Hz
H-Rate:264.00kHz
7680x4320 Progressive YCbCr-420: BT.709-10bpc
Output
Disconnect
Refresh
eARC Master TX
48G Generator HDMI
Format
Pattern
Audio
Tools
Folder
Lists
Samsung2
Samsung3
Samsung4
Samsung5
Samsung6
SamsungB
SamsungT
Sausalito
ScaleBox
ScaleBoxChecker
Set01k
Sharpnes
SlideBox
Smpte133
SmpteBar
SmpteRp219
SmpteSt2084
Sony6
Sony6WLC
Staircase
Strokes0
Strokes1
Sunset
TAARampB
TPVAOC1
SELECT FOLDER
Path: /qd/cache/images
Settings
Find
Transfer
CLOSE

15.13 Selecting Test Patterns Settings

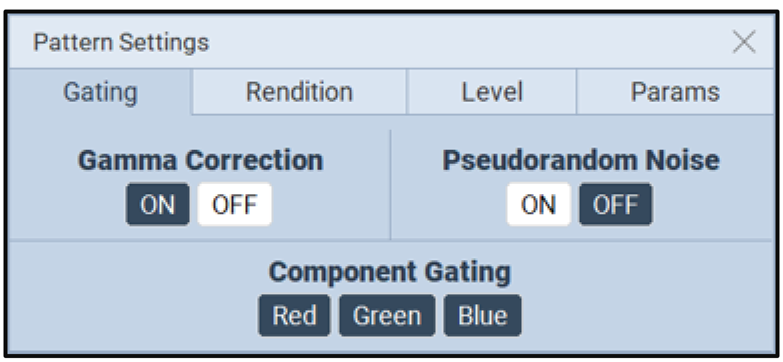
Use the following procedures to select a test pattern.

To specify test pattern settings:

1. From the main window of the M42h 96G Video Analyzer/Generator, click the **Pattern** tab to access the list of test patterns.
2. Specify the image settings by clicking on the **Settings** button on the lower center of the panel.



The **Settings** dialog box appears as shown below:



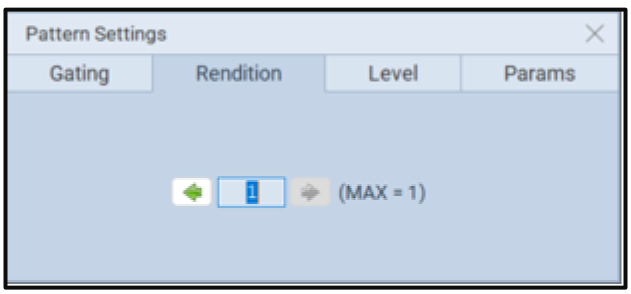
3. Enable and disable Gamma and Pseudorandom noise and set the gating as desired. Refer to the table below for details on these optional settings.

Pattern Settings - Gating	Description	Options
Gamma Correction	Enables or disables gamma correction which compensate for properties of human	On Off

Pattern Settings - Gating	Description	Options
	vision, to maximize the use of the bits or bandwidth relative to how humans perceive light and color.	
Pseudorandom Noise	Renders a test pattern with high level of volatility between adjacent pixels.	On Off
Component Gating	Turns on or off the three primary color components.	Red Green Blue

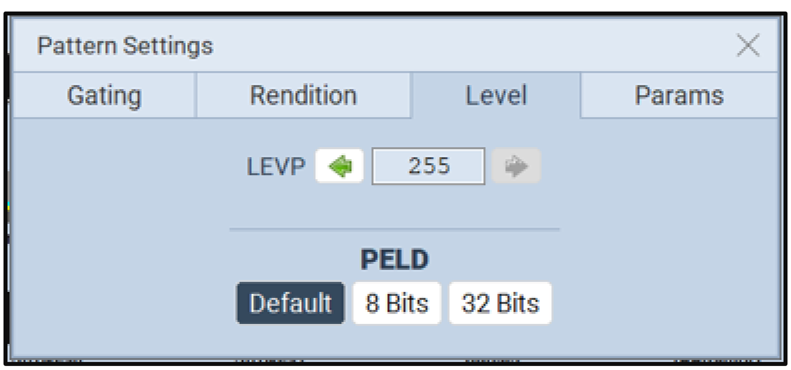
4. Select the rendition where applicable using the Rendition button. The associated dialog box is shown further below.

Some test patterns have multiple versions such as GraysAll. These multiple versions can be applied using the Rendition button and associated dialog box as shown below. There is a default that is iteration 0. In the example below iteration 1 is currently being rendered on the sink DUT.



5. Set the luminance level of the image with the Level button. The associated dialog box is shown further below.

You can increment the color component values or can decrement the color component values for all pixels of any image through the front panel or the command line. This feature enables you to increment or decrement the values in increments (or decrements) of 1 throughout a range of 0 to 255. The LEVP feature increments or decrements all color component values (R,G,B) for each action by the use.



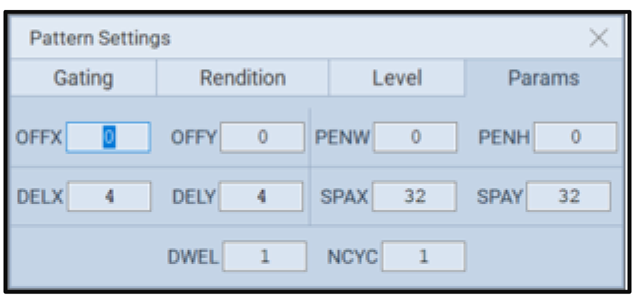
6. Set the pixel depth (PELD) if necessary, through the Level button and associated dialog box shown above.

PELD establishes the number of data bits that represent each active pixel in video memory (frame buffer). The default setting and setting of 8 allows 256 colors on an image (test pattern) to be rendered. This is suitable for most test patterns. However, some test patterns contain more colors and either require PELD 32 or look optimal only when PELD is set to 32. The test pattern will indicate when PELD 32 setting is required.

Default - uses the M42h video generator default
8 - 8 bits-per-pixel (256 colors)
24 - 24 bits-per-pixel (16,777,216 colors).

7. Set the pattern parameters if necessary, through the **Params** button and associated dialog box shown below. The following table describes each parameter.

Pattern Settings - Parameters	Description
OFFX	Set horizontal offset for large patch of Regulate image
OFFY	Set vertical offset for large patch of Regulate image
DELX	Set horizontal shift for each step of SlideG/SlideRGB image
DELY	Set vertical shift for each step of SlideG/SlideRGB image
DWEL	Set number of frames for each step of SlideG/SlideRGB image
PENW	Set width variable for line thickness in EeRise, NAWC, and Slider images
PENH	Set height variable for line thickness in EeRise, NAWC, and Slider images
SPAX	Set horizontal spacing
SPAY	Set vertical spacing
NCYC	Internal use



15.14 Testing Variable Refresh Rate (VRR) Capable Sink Display

The M42h HDMI 96G Generator offers support for Variable Refresh Rate (VRR) functional testing. This feature is also referred to as Gaming Option Functional Testing.

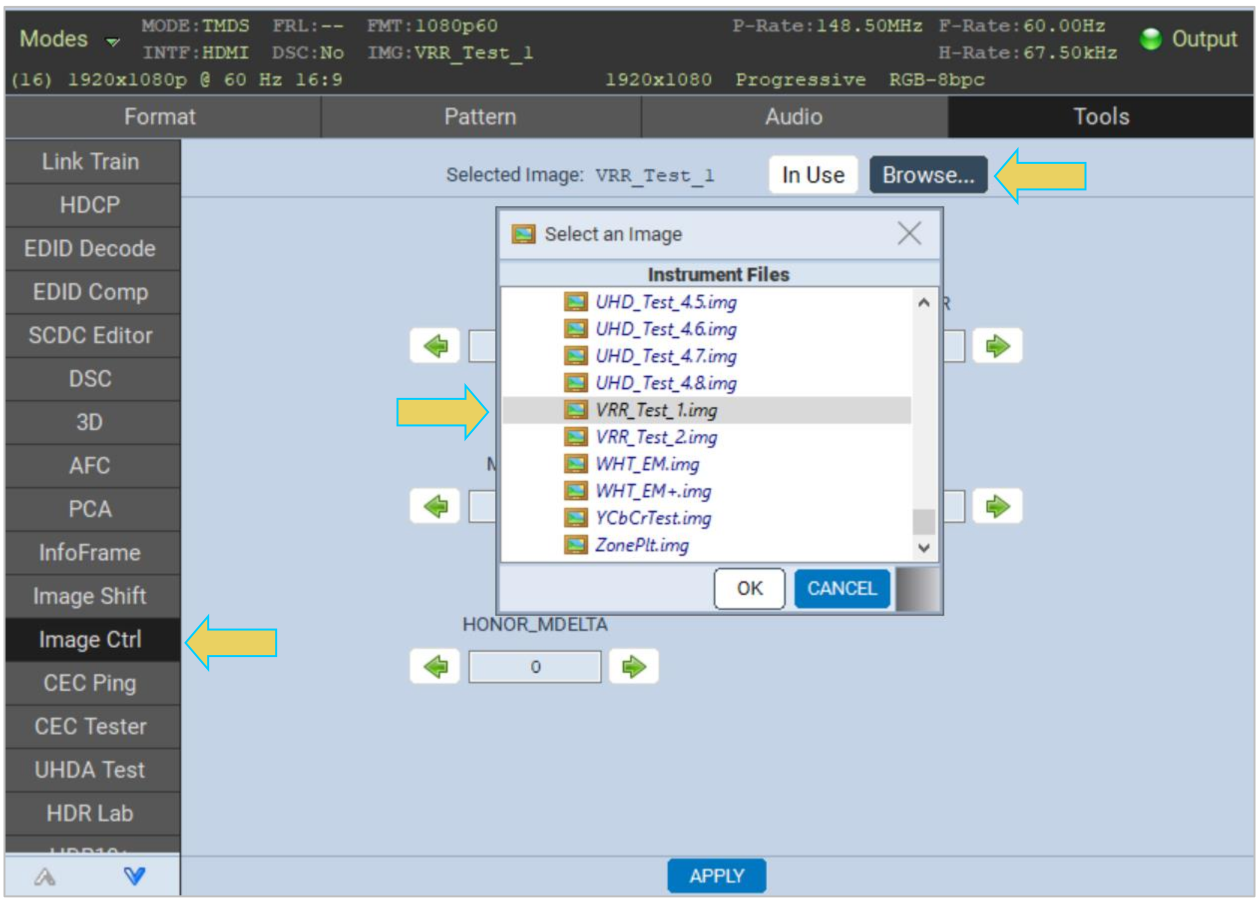
Testing VRR on a Sink Device

Use the following procedure to test VRR on a sink display.

Note: This feature is currently only supported on the embedded ATP manager of the M42h.

Set a format as normal within the **Format** tab of the generator. See section 14.6-14.7 for further instruction on setting formats.

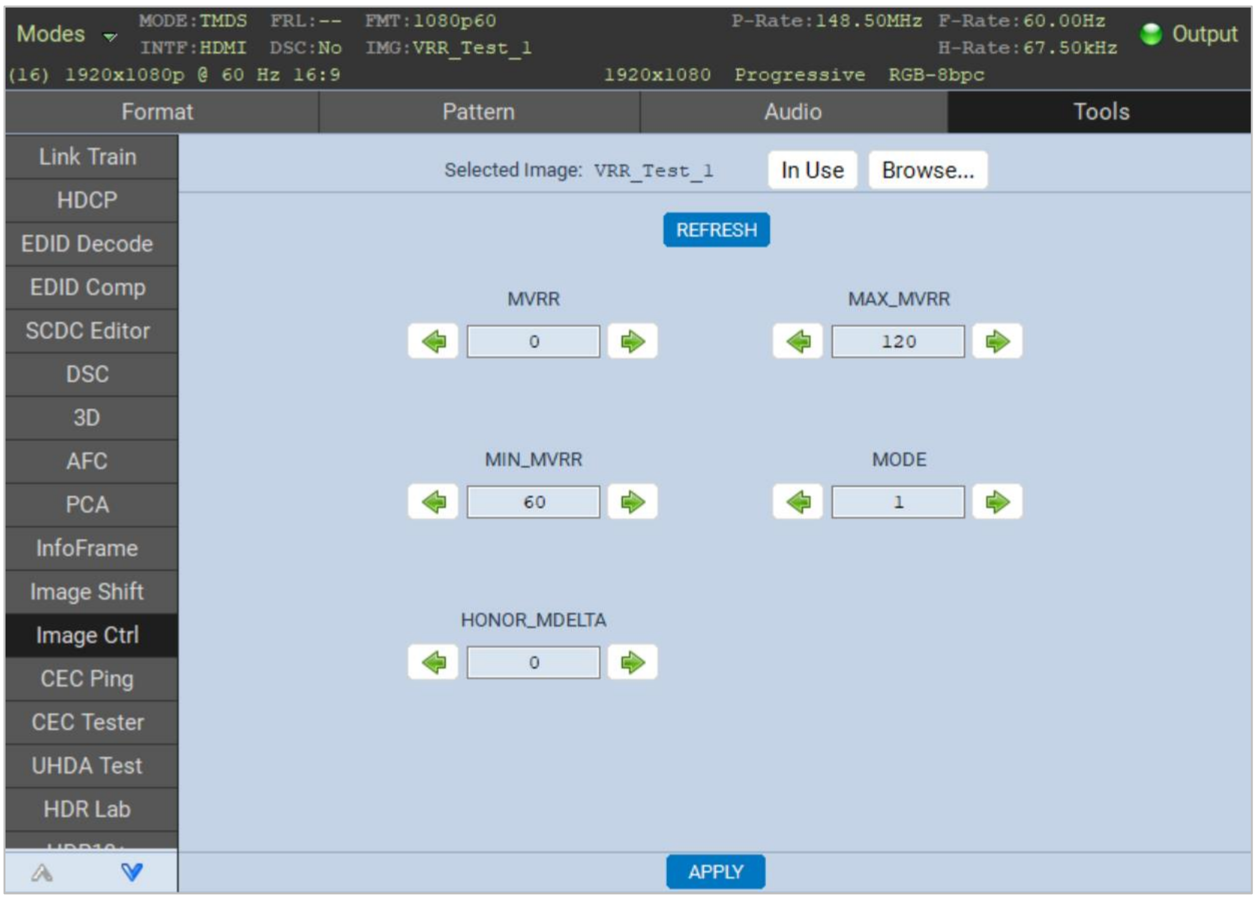
Navigate to the **Image Ctrl** tab within the **Tools** utility of the 96G HDMI Generator, and **Browse** for the **VRR_Test_1.img** Instrument File, as shown below.



Set the controls as desired according to your testing specifications. Below is a list of the configurable controls and their definitions.

- **MVRR:** For static VRR mode, used to set the precise amount to of lines to add to VFront
- **MODE:** Set to 0 for Static Mode or 1 for Dynamic Mode. MAX/MIN MVRR are used to randomly generate new VRR values every frame if set to dynamic mode.
- **MAX_MVRR:** Set the maximum number of lines for Dynamic Mode VRR
- **MIN_MVRR:** Set the minimum number of lines for Dynamic Mode VRR
- **HONOR_MDELTA:** Set to 0 for Delta mode off or 1 for Delta mode on. With Delta mode on, refresh rate changes in step increments, rather than all at once.

The example below has set Dynamic mode, with the maximum number of lines set to 120 and minimum set to 60



Click **APPLY** when finished configuring the VRR test image to begin signal generation.

For detailed information on timing transitions, you can go to the Capture tool and perform a small data island capture (1% or less). You will then be able to see all the transitions to V-Freq and V-Front for each frame. See Chapter 7 for a detailed overview of the Capture Control tool.

15.15 Testing Quick Media Switching

The M42h HDMI 96G Generator offers support for QMS (Quick Media Switching) functional testing.

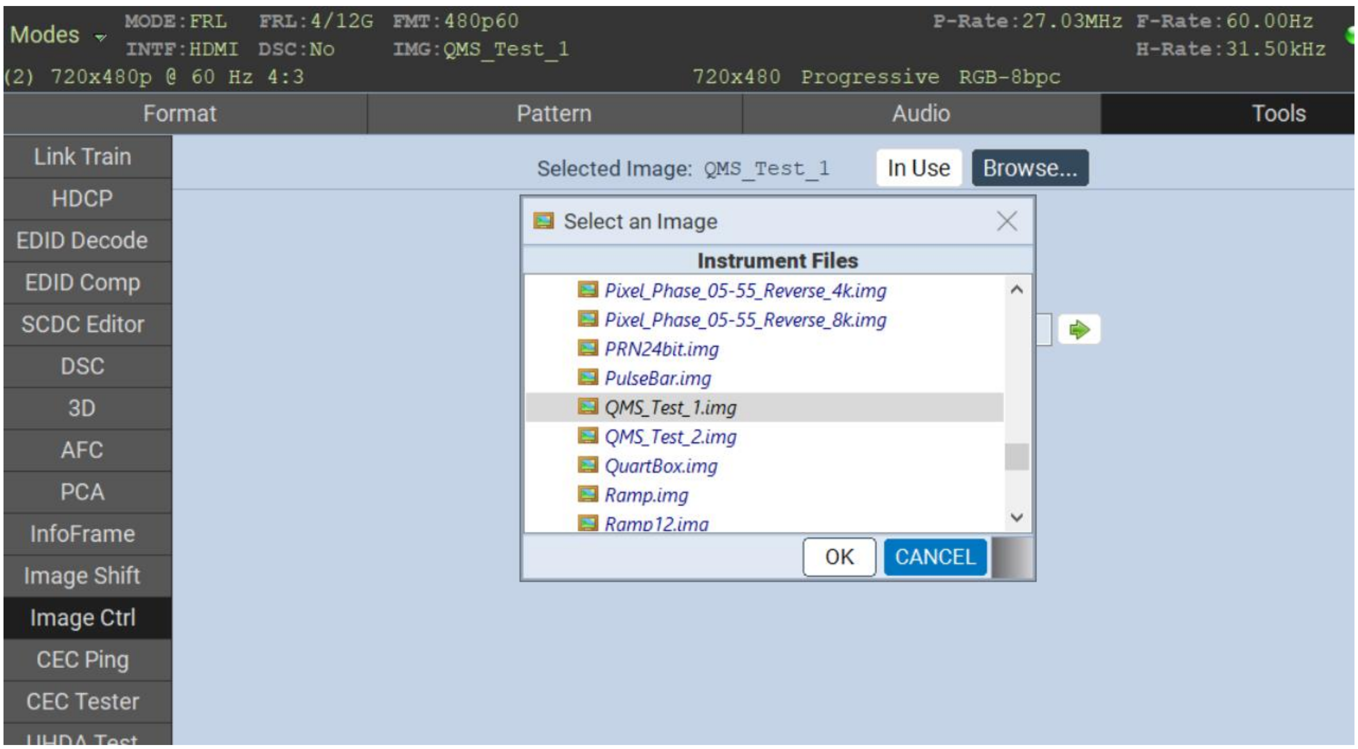
Testing QMS on a Sink Device

Use the following procedure to test QMS on a sink display.

Note: This feature is currently only supported on the embedded ATP manager of the M42h.

Set a format as normal within the **Format** tab of the generator. See section 14.6-14.7 for further instruction on setting formats.

Navigate to the **Image Ctrl** tab within the **Tools** utility of the 96G HDMI Generator, and **Browse** for the **QMS_Test_1.img** Instrument File.

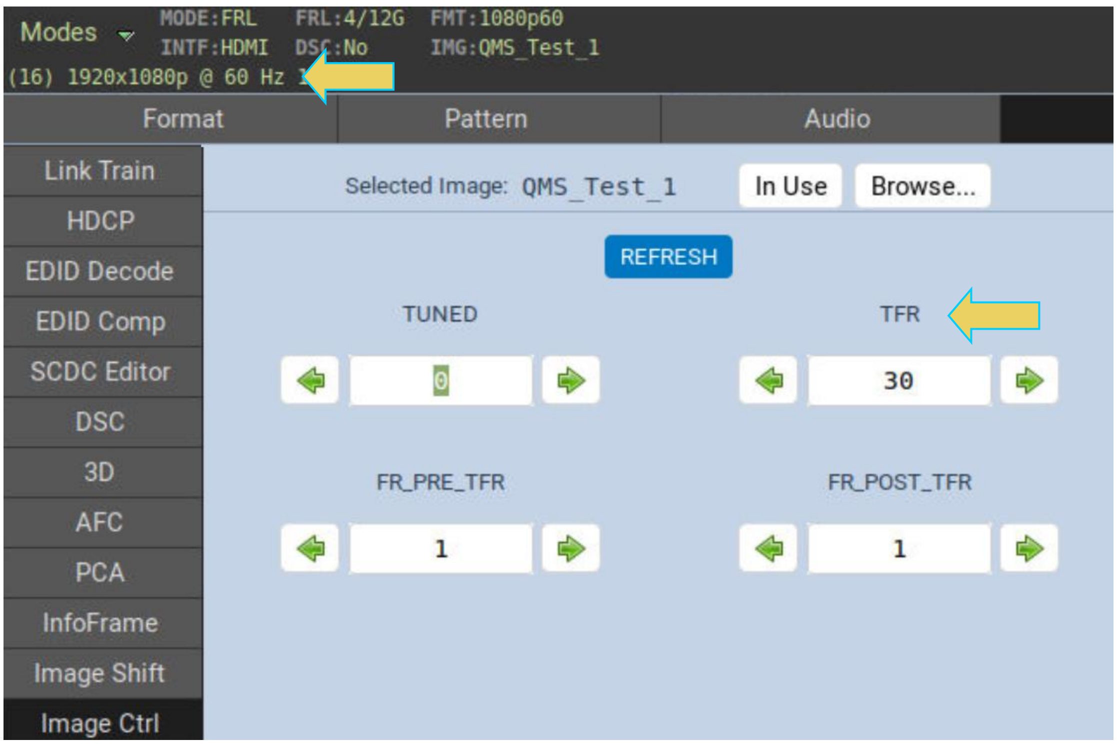


Note that loading or changing the selected image or format, QMS default state is off. Verify that the QMS_Test_1 image is selected by clicking the **In Use** button, pictured above.

Once the QMS_Test image is selected, set your parameters to configure QMS within the M42h Generator.

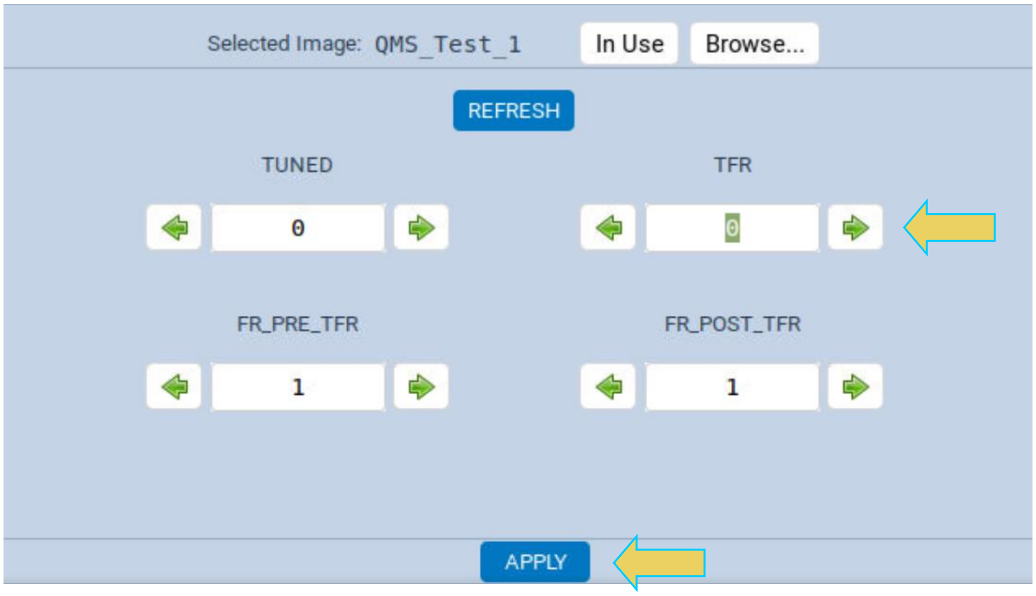
- **TUNED** – Allows user to use a factorial refresh rate such as 48/1.001. Set to 1 for True, set to 0 for False
- **TFR** – Target frame rate. According to spec, the TFR value should be set between 24 – 120 Hz.
- **FR_PRE_TFR** – Number of frames before frame rate change once **MCONST** bit is set to zero (0).
- **FR_POST_TFR** – Number of frames after frame rate change before setting **MCONST** to one (1).

The example below shows the generator Tx set at 60 Hz with the Target Frame Rate (TFR) set to 30 Hz.



Once the parameters are set according to your testing specifications, click the **APPLY** button at the bottom of the window to begin signal generation.

To disable QMS, simply change the **TFR** field to 0 (zero), and click **APPLY** again, as shown below.



15.16 Testing PCA-Capable Sink Display

The M42h 96G HDMI 2.1 Generator offers support for PCA-capable signal generation. Currently the feature is only available via the command line.

See Chapter 17 for instructions on accessing the command line.

Use the following procedures to operate testing of PCA capability.

Default PCA-capability is off, use the following command to enable PCA-capable generation:

```
OUT<port number>:setpca 1
```

To turn off PCA-capability, issue the following command:

```
OUT<port number>:setpca 0
```

Use the following command to check the status of PCA Capability in the generator:

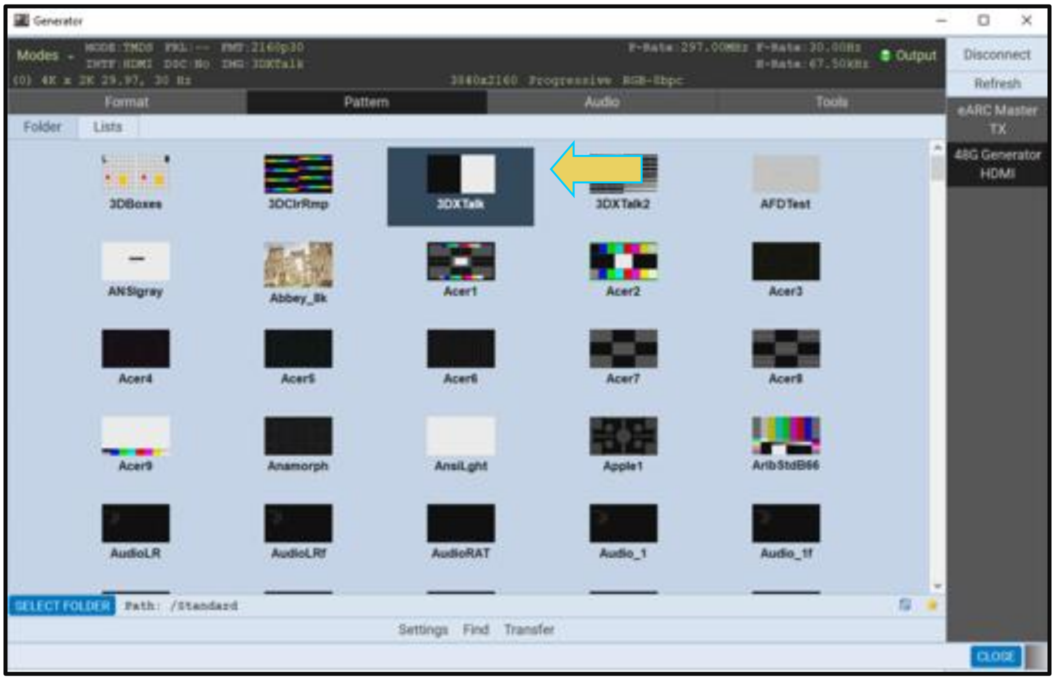
```
OUT<port number>:setpca?
```

15.17 Testing 3D Displays

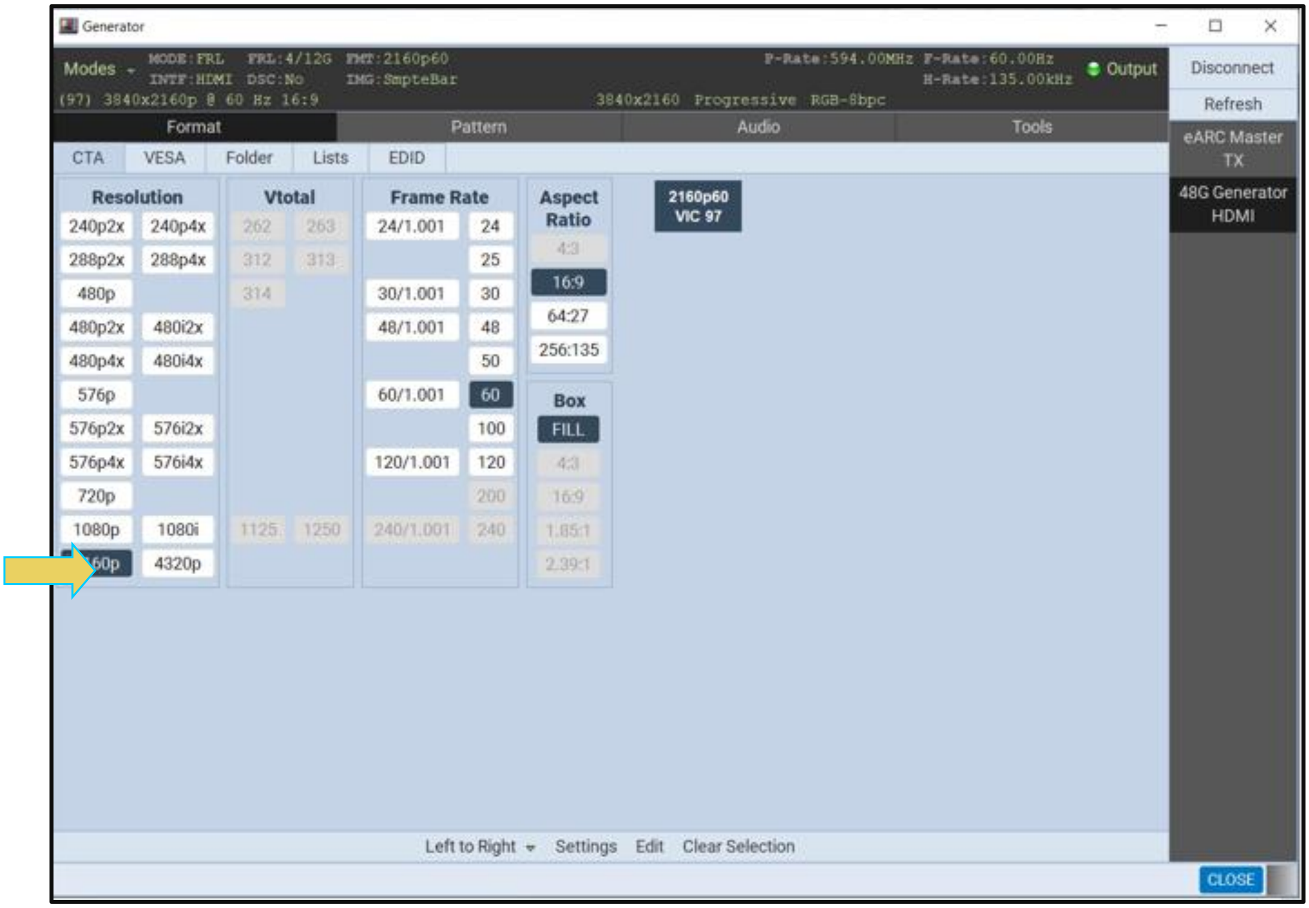
Use the following procedures to test 3D displays.

To test 3D capable HDMI displays:

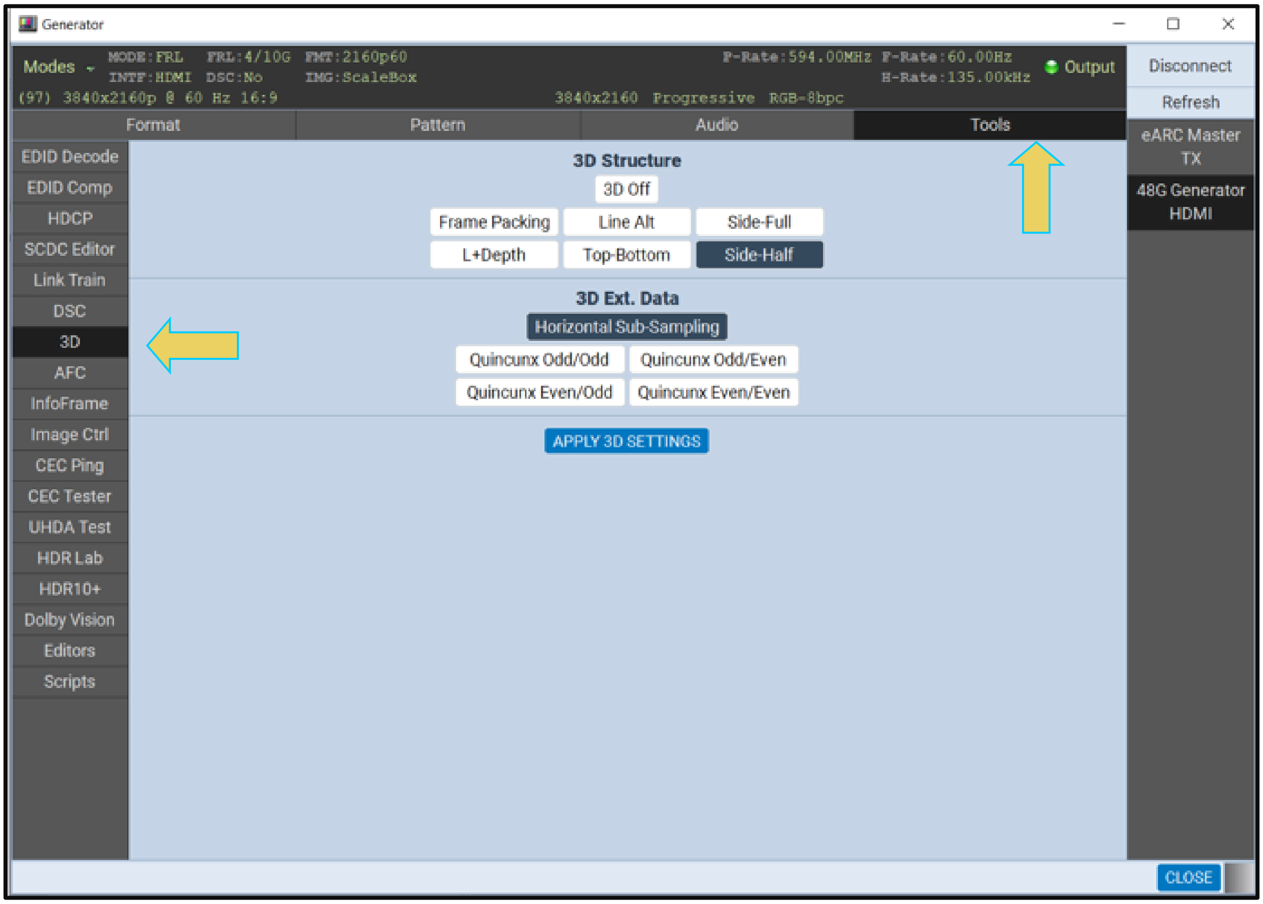
1. From the main window of the M42h 96G Video Analyzer/Generator, select a 3D test pattern for example 3DXTalk indicated in the screen example below.



2. Select the **Format** tab to select a format (resolution).



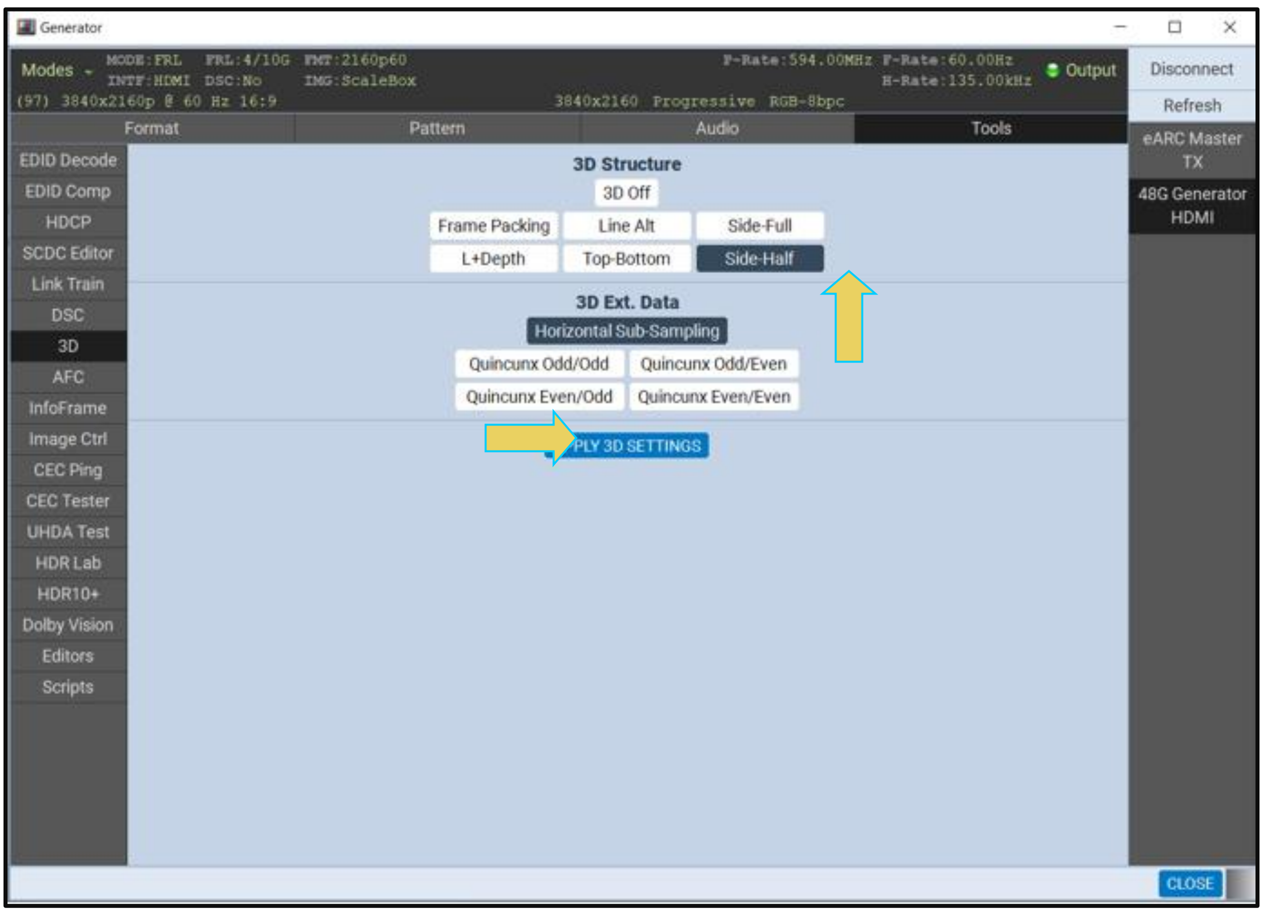
3. Select the **Tools** tab to access the 3D configuration utilities.



The following table describes the information on the **3D** dialog box.

3D Structure Method	Half Sampling Method	Left Sampling Position	Parameter – Vertical Blanking Lines	Right Sampling Position	Maximum pixel rate
Frame Packing	Not Applicable	Not Applicable	The number of lines between the left and right eye image - typically set to 30 lines for 720 timings and 45 lines for 1080 timings	Not Applicable	150MHz
Top and Bottom	Not Applicable	Not Applicable	Not Applicable	Not Applicable	300MHz
Side by Side (Full)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	150MHz
Side by Side (Half)	One of: - Horizontal - Quincunx	One of: - Odd position - Even position	Not Applicable	One of: - Odd position - Even position	300MHz

4. Apply 3D settings with the activation button provided.



15.18 Testing UHD Displays with UHD Alliance Test Patterns

The UHD Alliance test patterns are called out in the Ultra-High Definition Alliance Test Specification. The test pattern pack is required to assess a UHD TV's compliance to all tests in the specification including:

- Section 4.2 High Dynamic Range: Peak White
- Section 4.3 High Dynamic Range: Black Level
- Section 4.4 High Dynamic Range: Tone Mapping
- Section 4.5 Wide Color Gamut
- Section 4.6 Resolution
- Section 4.7 Input Frame Rate and Bit Depth
- Section 4.8 Grey-Scale Tracking

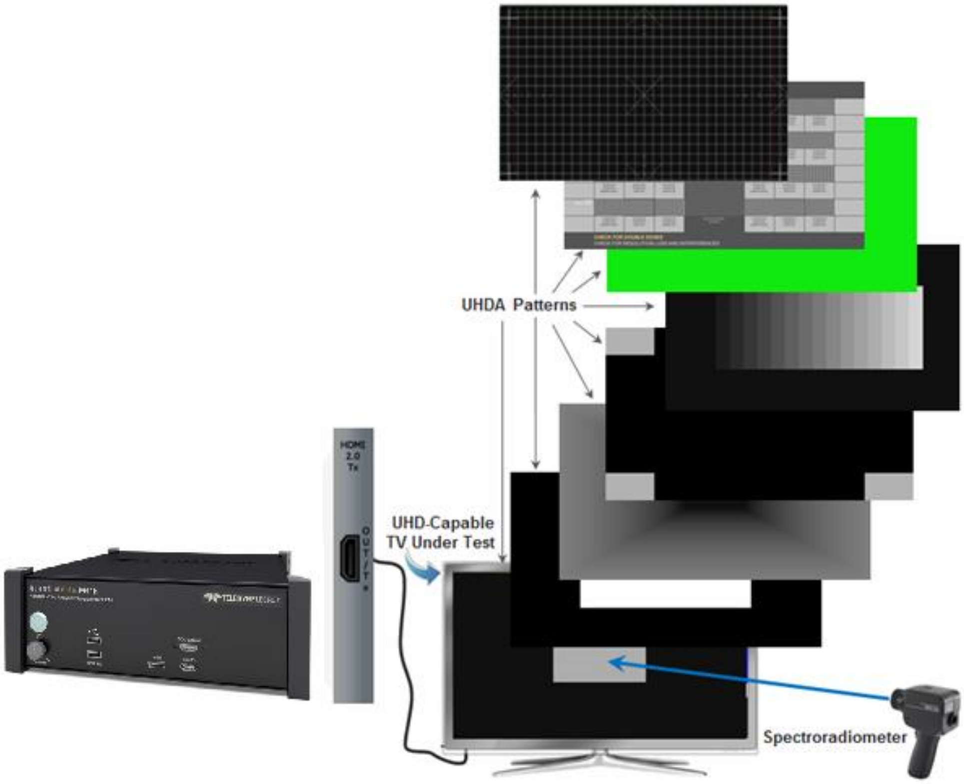
15.18.1 UHD Test Setup

For testing a UHD-Capable TV, the M42h 96G Video Analyzer/Generator offers the necessary high-resolution format, the test patterns and ease of use to quickly conduct functional testing using visual assessment or to conduct UHD compliance tests (Spectroradiometer required). When the UHD test patterns are selected through the M42h GUI interface, it emulates an UHD-capable source by transmitting the UHD test pattern and, where required, will also transmit the necessary Dynamic Range and Mastering InfoFrame metadata.

The Dynamic Range and Mastering InfoFrame data includes an Electro-Optical Transfer Function (EOTF) and the Static Metadata with the dynamic range of the video stream.

The following illustration depicts the test setup.

PELD establishes the number of data bits that represent each active pixel in video memory (frame buffer). PELD establishes the number of data bits that represent each active pixel in video memory (frame buffer).



15.18.2UHD Test Procedures

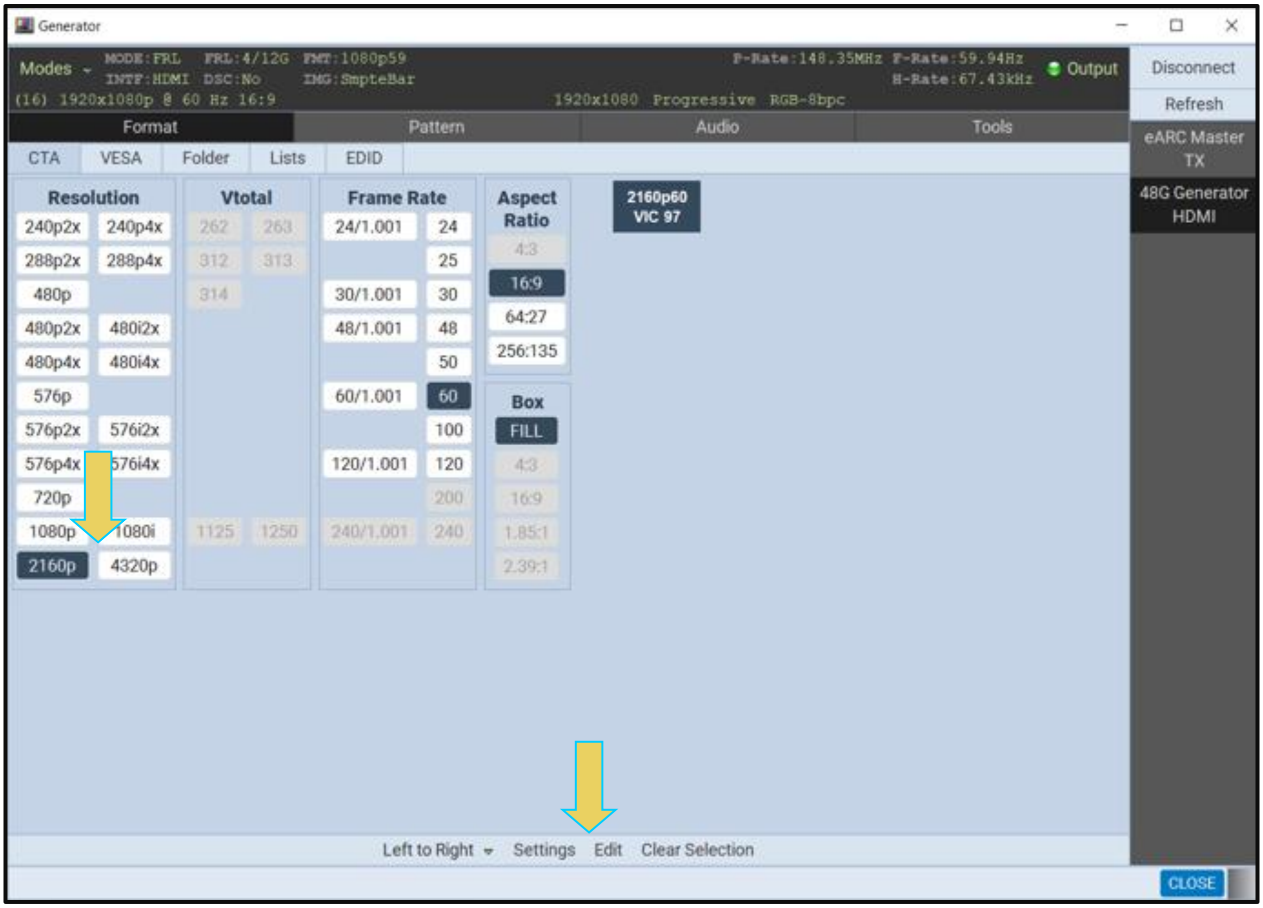
For detailed procedures to test UHD capable HDMI displays refer to the UHD Alliance Application Note.

15.19 Testing 4:2:0 Capable Displays

Use the following procedures to send HDMI 2.1-compliant 4:2:0 pixel encoding to a 4K-capable HDMI HDTV.

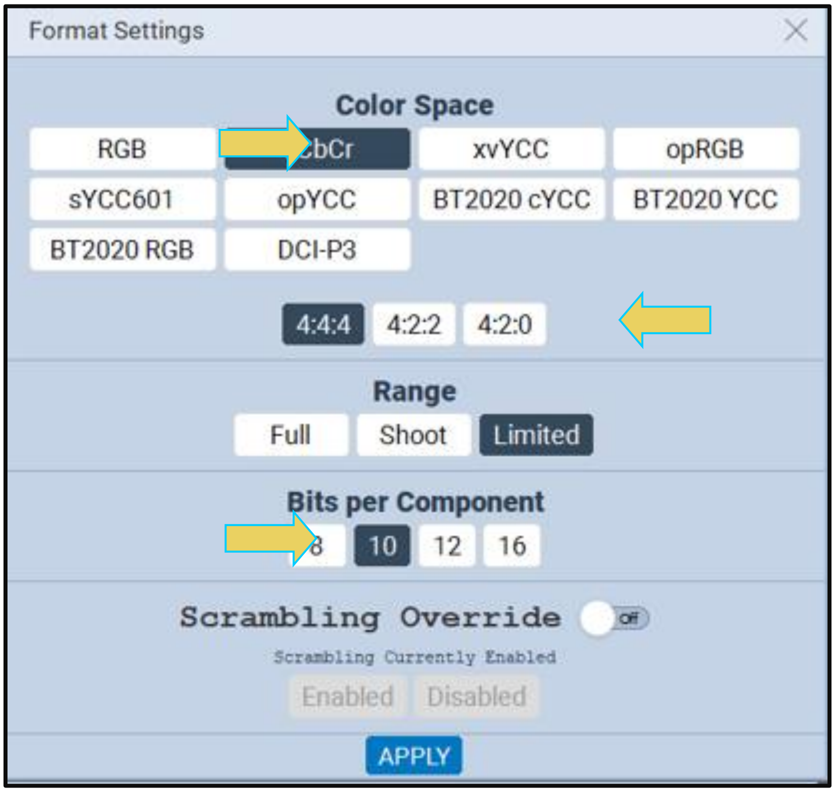
To select test 4:2:0 pixel encoding:

1. From the main window of the M42h 96G Video Analyzer/Generator, access the **Format** tab and select a 4K format such as 2160p as shown below.


Generator
Modes
MODE:FRL FRL:4/12G FMT:1080p59
INTF:HDMI DSC:No IMG:SmpteBar
(16) 1920x1080p @ 60 Hz 16:9
P-Rate:148.35MHz F-Rate:59.94Hz
H-Rate:67.43kHz
Output
1920x1080 Progressive RGB-8bpc
Disconnect
Refresh
Format
Pattern
Audio
Tools
eARC Master TX
48G Generator HDMI
CTA
VESA
Folder
Lists
EDID
Resolution
Vtotal
Frame Rate
Aspect Ratio
2160p60 VIC 97
240p2x
240p4x
288p2x
288p4x
480p
480p2x
480i2x
480p4x
480i4x
576p
576p2x
576i2x
576p4x
576i4x
720p
1080p
1080i
2160p
4320p
262
263
312
313
314
1125
1250
24/1.001
24
25
30/1.001
30
48/1.001
48
50
60/1.001
60
100
120/1.001
120
200
240/1.001
240
4:3
16:9
64:27
256:135
Box
FILL
4:3
16:9
1.85:1
2.39:1
Left to Right
Settings
Edit
Clear Selection
CLOSE

2. Select the **Settings** (refer to screen example above).

The **Settings** dialog box will appear as shown below:



3. Select YCbCr for the Color Space and then select 4:4:4 (above). Note that the pixel rate indication on the top status bar will indicate 297MHz.

15.20 Testing UHD Displays with HDR Lab Test Patterns

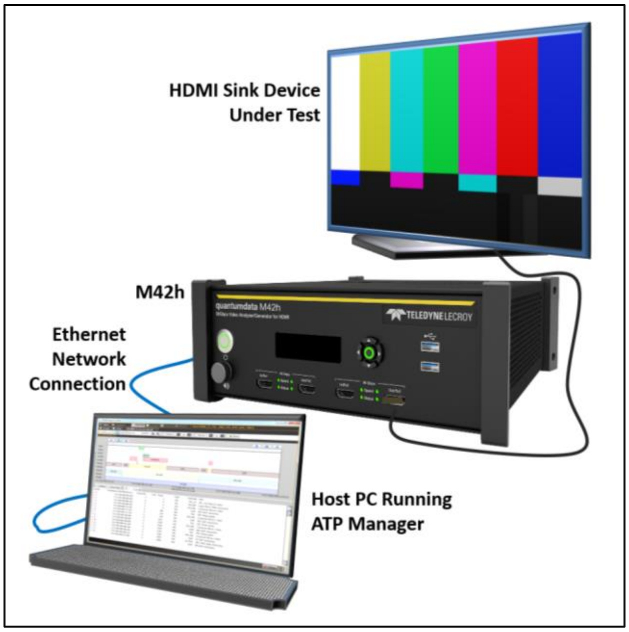
Important Note: This section will be updated with additional 8K HDRLab images when fully supported in the M42h.

To address the HDR needs of the industry from Device Manufacturers to HDR content Post-Production, Teledyne LeCroy has worked together with industry experts Joe Kane of Joe Kane Productions and Florian Friedrich to develop this new test option "HDR Lab." The solutions use the M42h 96G Video Analyzer/Generator. There are two test applications:

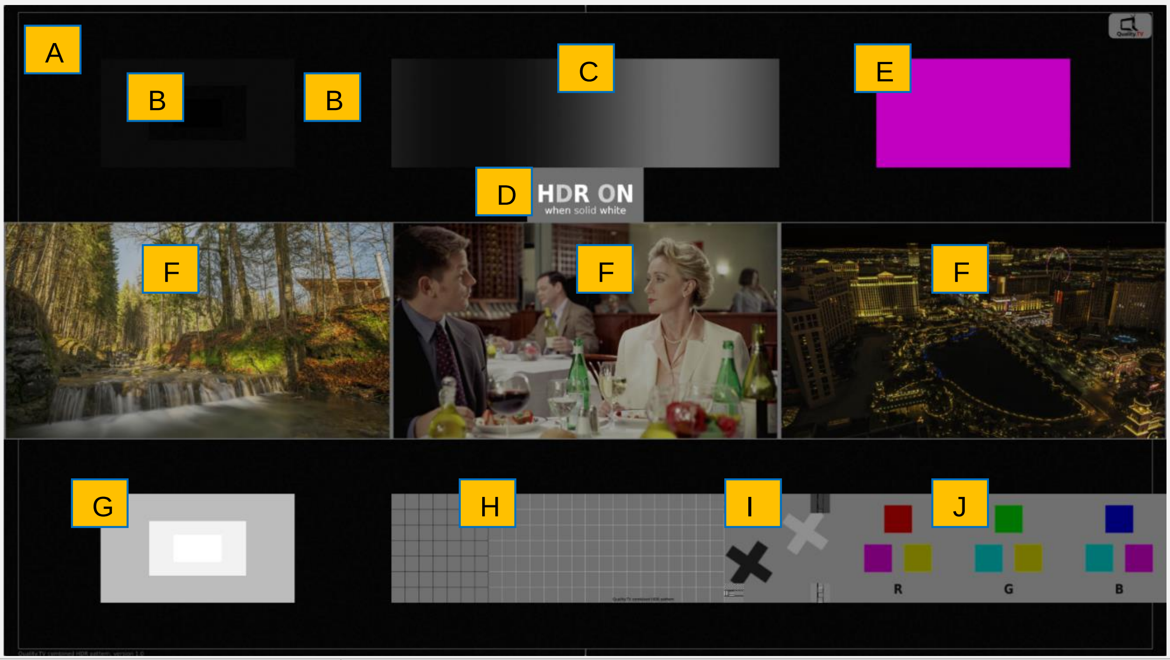
HDR Display Test Suite – Verifies various HDR attributes such as: peak brightness, native contrast, color decoding, signal clipping, and color gamut on an HDR-capable UHD TV using a variety of test patterns (below) while enabling the user to change important signal parameters to test the response of any given HDR display.

HDR End-to-End Validation in Post-Production – Verifies HDR metadata, signal levels and many more relevant parameters throughout the post-production process. Reference images can be compared with HDR workflow outputs.

The HDR Lab utility is supported by the M42h 96G Video Analyzer/Generator. The HDR Lab utility is an optional test pattern pack that requires a license to use. The illustration below depicts the test setup.

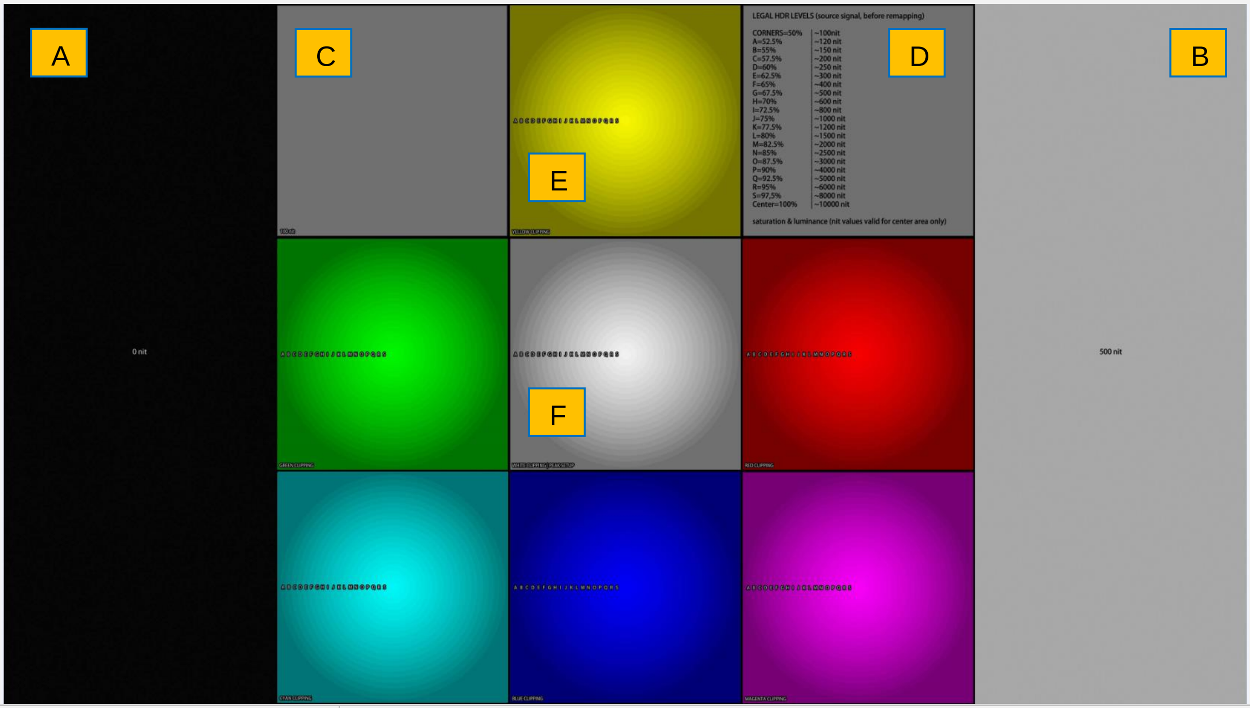


The following table describes just some of the Test Patterns and Reference Images that comprise the HDR Lab utility. Additional test patterns and test images are included and will be described in subsequent versions of this application note.

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Combination Test Pattern 	
Function	The Combination Test Pattern's top and bottom portion provide a quick overview of display conditions for black level, white level, HDR on (status information) in the display, color, gray scale with bit depth, resolution, overscan, color decoding, and a 50% gray level. The three images in the center provide example of images color graded for HDR-10, P3 color in a BT.2020 container, mastered at 1,000 nits.

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Pattern Layout	The patterns at the top of the image deal primarily with the dark part of what can be conveyed in an image while the ones at the bottom deal with resolution color and the bright parts of the image. At the top left [A] we have steps near black. Since the PQ curve is absolute, we will call out specific intensities as light levels instead of signal levels. The center of and outside of the rectangle [B] is at black. The band in between is at 0.1 nits. The top middle contains a sine wave taking us from 0.1 to 100 nits [C]. Just below the gray ramp is our on-screen indication of HDR being on or off. If the letters in ‘HDR ON [D] when solid white, then HDR is on in your set. If there are changing shades of gray, then HDR is off or tone mapping is not working correctly. You can set metadata in the generator to indicate to the display that HDR should be on or should be off. The top right shows patches of primary and secondary colors (red, green, blue, cyan, magenta, and yellow) [E]. They are 75% in luminance level, 100% color saturation. The 75% level was chosen as it is about 1,000 nits, the level at which most of the current HDR content is being mastered. When we say it is 100% saturated, we mean it is a single color with other color channels set to black level. If it is red, it is only red, and the red is at a level of 75%. There is no blue or green content. The center of the combination pattern shows parts of demonstration materials [F]. For the purposes of the generator, they are currently single frames from a motion sequence that may later be available in motion from the generator. The bottom left is a set of rectangles at levels above 1,000 nits [G]. In a 1,000 nit display they should all appear to be one level. The grid in the center varies from dark to light on a 100 nit background [H]. It is used for determining if there are any excessive image enhancement happening in the picture. If you see ringing around the edges of the grid if there is image enhancement. The white in the pattern does not go any higher than 1,000 nits. Just to the right of center are two plus symbols [I], one black and the other at 250 nits. Their edges have been slightly softened so the diagonal edges should not be jagged. Under some circumstances they might trigger streaking in the display. They are against a 100 nit background. In the corners of this section there are references for full and half resolution, vertically, horizontally and in a checkerboard. The bottom right portion of the pattern is a reference for color decoding [J]. The source signal is stored in RGB, while the generator has the capability of converting using the BT 2020 Y Cb Cr equations. Using the red, green, and blue only capability you will be able to inspect how well each of the channels is represented. Details for what you should be seeing are illustrated in the section describing color bars with a gray reference.
Description of Use	This pattern is designed to be fully functional in the HDR mode of a UHD set as levels in it are specific to the PQ based HDR-10. It serves as a quick reference for black and white levels, BT 2020 Y Cr Cb color decoding, sharpness, resolution, and overall image quality. Primary color measurements can be made on the patches in the upper right corner and peak light output capability can be measured in the bottom left of the pattern if there are no image uniformity issues or significant APL limitations.

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Clipping Test Pattern	

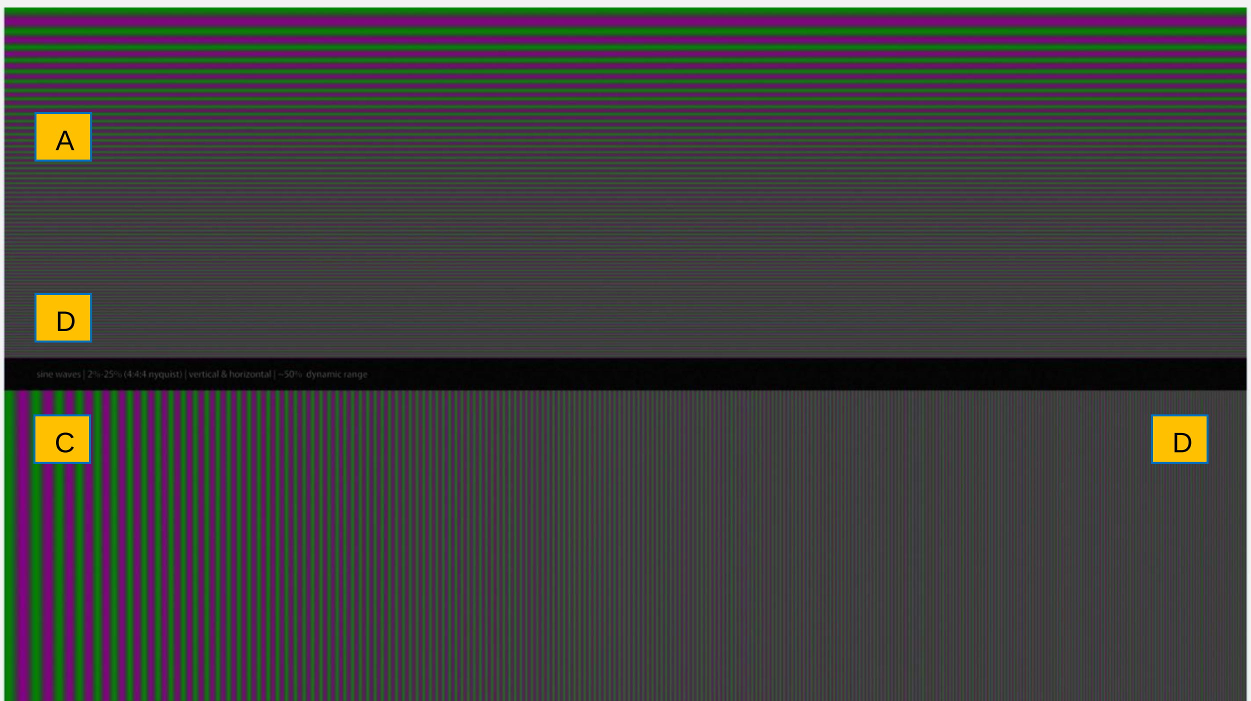


Function	The Clipping pattern is designed to be a quick human inspection pattern to subjectively test for clipping, tone mapping, peak luminance, and adherence to the PQ curve. The clipping and tone mapping can be assessed subjectively by inspection. The measuring and calibration of the luminance can be assessed objectively using a measurement sensor or a professional camera with descent manual exposure. The UHD TV under test should be set in the HDR mode for all tests.
Pattern Layout	The Clipping Test pattern is comprised of the following elements: There is a 0 nit vertical band on left side [A] and the 500 nit vertical band on the right side [B]. There is a set of 9 elements in the center arranged as a 3x3 grid. The upper left box [C] in the 3x3 grid is a 100 nit box. The upper right box [D] in the 3x3 grid is an index indicating the percent luminance for each of the letter gradations in the colored elements in the 3x3 colored box grid. The index also relates the percent luminance to a nit value assuming a display following the absolute PQ EOTF (SMPTE 2084). There are six colored boxes for the primary and secondary colors. These colored boxes are 100% color saturation. Each colored box (example yellow [E]) and the luminance box [F] are concentric bands which have lettered indications on each of the bands that correspond to the percent luminance and the number of nits in each circular band. On a 1000 nit display, with 1000 nit metadata for the maximum luminance of the mastering display, we expect a solid circle in the center reaching out to the 1000 nit indicator (J) +- 5% according to the tone mapping strategy of the display manufacturer.

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Description of Use	The pattern is valid for multiple mastering situations, if the HDR metadata is injected accordingly. 1,000 nit mastering luminance is the default value set for this pattern. The vertical bands on the left [A] and the right [B], and the box at [F] may be used to determine if the display is properly following the Perceptual Quantization (PQ) curve. The 100% saturated primary and secondary colored concentric bands in the 3x3 grid are used to test for clipping according to the mastering luminance set by the HDR metadata (default: 1000 nit). As you move inward on any of these circular bands from A to S, you are increasing the luminance. On a 1,000 nit display and using the 1000 nit mastering luminance metadata, you should be able to distinguish the bands from A to about J (75% luminance on a 1000 nit display) but from about J to S, you should not be able to distinguish the bands, in other words the colors should be clipped from about J (+/- 5%) inward toward the center at S. With 1,400 nit metadata, you should be able to distinguish the bands from A to about L with the remaining bands from L to S indistinguishable. The last band that is distinguishable, example J would represent the peak luminance of the display, which for a 1000 nit display would be 1,000 nits. If the metadata were mastered at 10,000 nit luminance, you would be able to distinguish all the bands because in that case the display would tone map the colors and luminance levels that were beyond to the capabilities of the display to the display's color or luminance capabilities. Alternatively, the display under test is set in the SDR mode, you would expect to be able to distinguish all bands. All luminance levels would be viewable up to 100% which would correspond to 100 nits. In this case tone mapping would occur to reassign color and luminance values that were beyond to the capabilities of the display to the display's color or luminance capabilities. The user could use the M42h HDMI Video Generator InfoFrame Utility to test different metadata scenarios such as 1,000 nit, 4,000 nit and 10,000 nit mastering luminance.

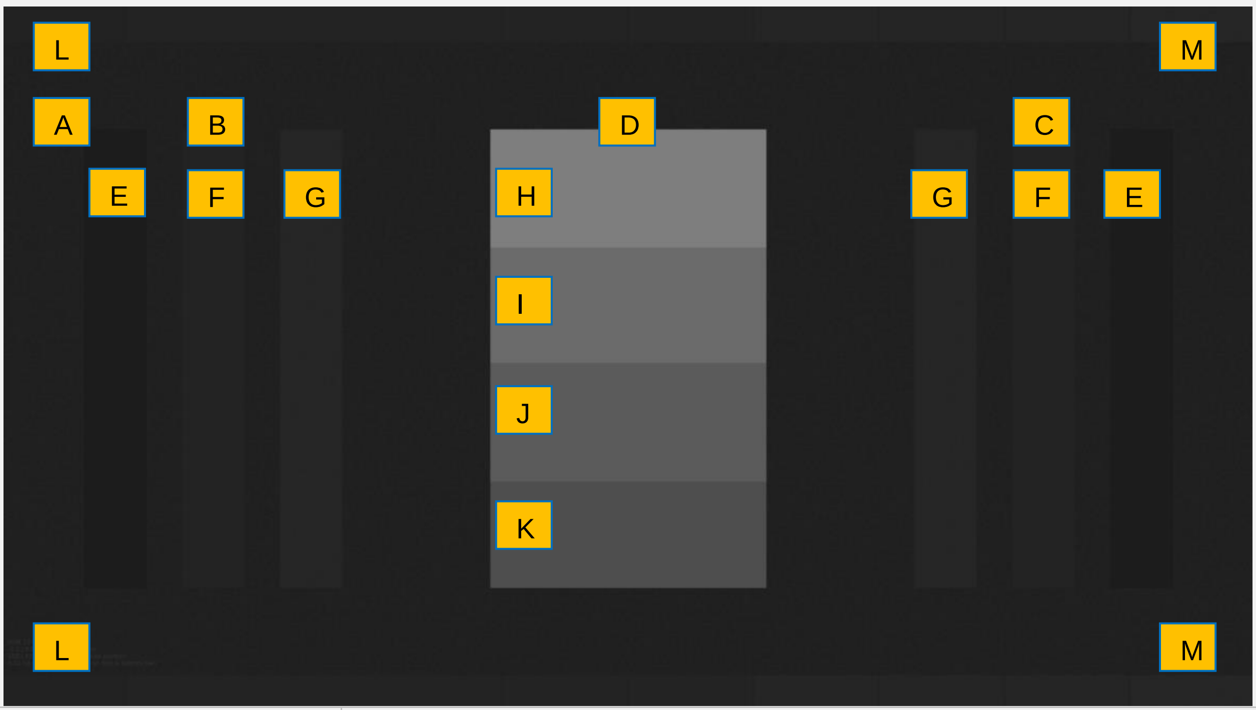
Luma Resolution Test Pattern

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Function	This Luma Resolution pattern is designed to be a quick human inspection pattern to subjectively test for proper handling of resolution without color being involved. It uses 1 to 100 nits in HDR mode to ensure that there should never be any clipping
Pattern Layout	The Luma Resolution Test pattern is comprised of the following elements: A luma sine wave resolution vertical sweep on the top [A] to [B] and a luma sine wave resolution horizontal sweep on the bottom [C] to [D]. The sine waves vary from a luminance of 1 to 100 nits for each cycle and at a frequency that ranges from 2% to 50% of the Nyquist frequency from start to end of each sweep. Both frequency sweeps are linear.
Description of Use	Check the pattern in both RGB and YCbCr in all sampling modes: 4:4:4, 4:2:2 and 4:2:0. Also check for different bit depths. In none of these colorimetry or sampling modes should the observer see any chroma. There should be no loss of resolution; the waves should all be distinguishable. Interferences (ringing) are indicating edge enhancement, masking some of the original information.
Chroma Resolution Test Pattern	



Function	The Chroma Resolution pattern is designed to be a quick human inspection pattern to subjectively test for proper handling of chroma resolution and chroma subsampling.
Pattern Layout	The Chroma Resolution pattern is comprised of the following elements: A chroma sine wave resolution vertical sweep on the top [A] to [B] and a chroma sine wave resolution horizontal sweep on the bottom [C] to [D]. The sine wave's green and magenta colors are fully saturated at their peaks at each frequency but vary in dynamic range only up to 50% throughout each sine wave cycle at their peak. The frequency of sine wave sweep ranges from 2% to 25% of the Nyquist frequency from start to end of each sweep. Both frequency sweeps are linear.

HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Description of Use	Check the pattern in both RGB and YCbCr in all sampling modes: 4:4:4, 4:2:2 and 4:2:0. Also check for different bit depths. In none of these colorimetry or sampling modes should the observer see any chroma other than magenta or green or something in between. The green and magenta at their peaks should look equally saturated. There should be no gray, black or highlighted color between the colors nor should there be any blue or red chroma even in 4:2:2 or 4:2:0. The edges should not be desaturated, i.e. the area between the peaks should not look grayish or black. There should be no loss of resolution; the waves should all be distinguishable. Interferences (ringing) are indicating edge enhancement, masking some of the original information.
HDR Pluge Test Pattern	

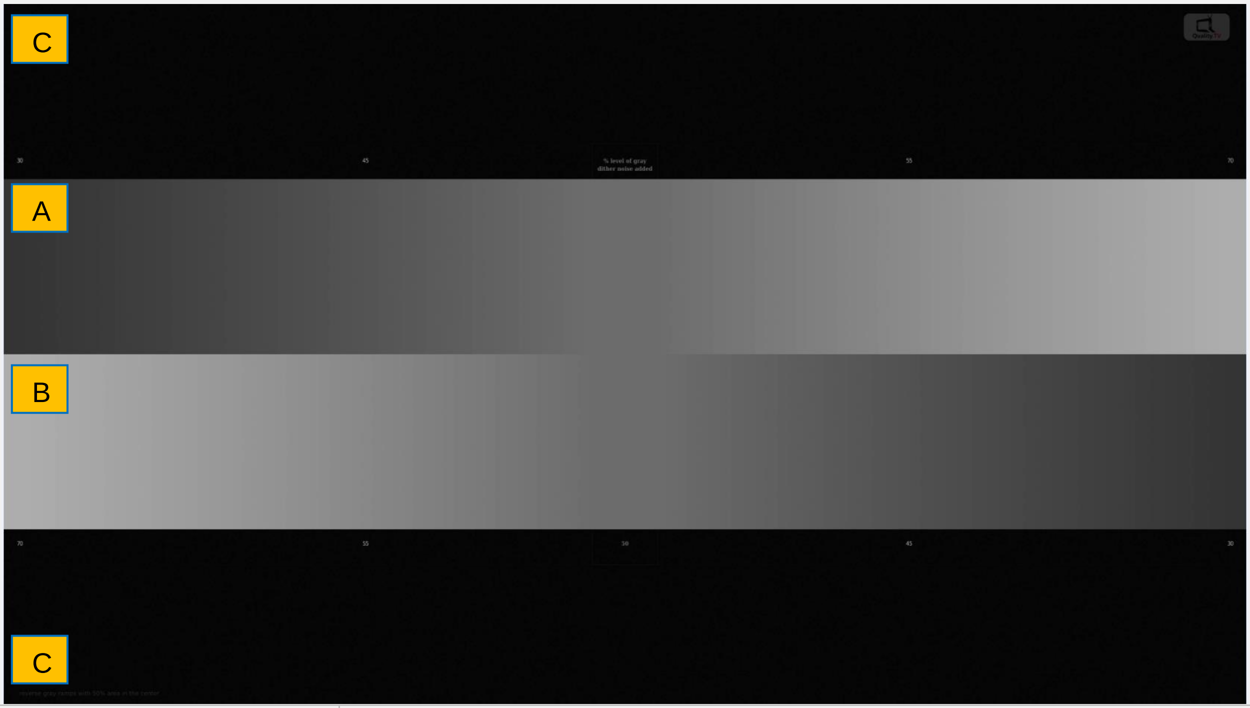


Function	To assess/adjust the brightness of a display in HDR
Pattern Layout	The pattern consists of a background at video black [A] with a symmetrical PLUGE on the left and right sides [B] & [C] of the log gray scale in the middle of the pattern [D]. It is based on a pattern used for adjusting the Brightness control in SDR displays. It has been adapted to meet the needs of adjusting the Brightness control in the HDR mode of a UHD TV display. The outer part of the PLUGE contains three bars: a below black bar -0.1 nit [E], 0.05 nit bar [F], 0.1 nit bar [G] on the video black background. The gray scale in the middle represents steps of 100 nit [H], 50 nit [I], 25 nit [J] and 12.5 nit [K]. These values were chosen based on the Perceptual Quantization (PQ) Electro-Optical Transfer Function (EOTF) of an HDR display. There are 10 rectangles on the top and bottom which range from 0.01 nits [L] to 0.1 nits [M] in 0.01 nit steps.

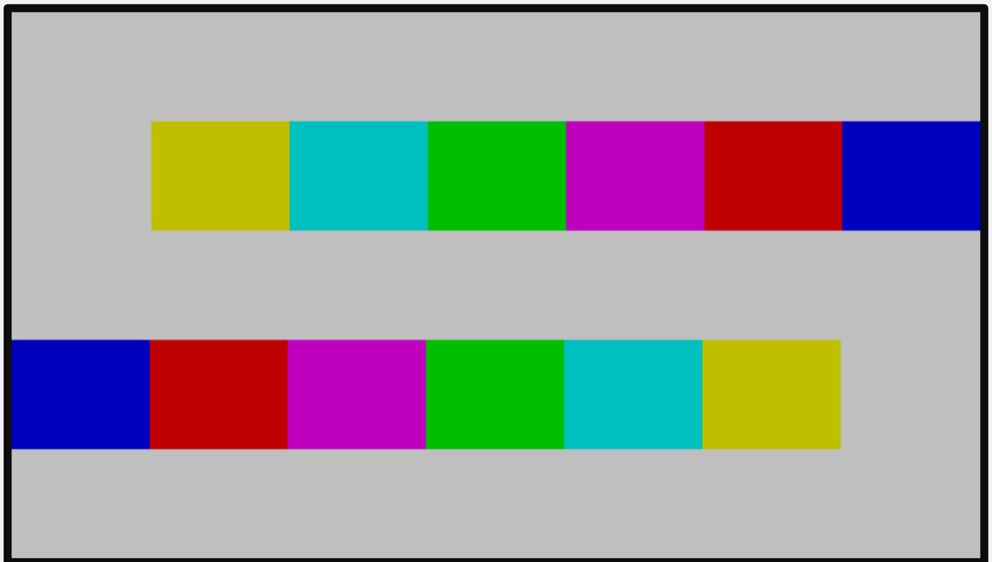
HDR Lab Test Patterns	
Test Pattern Name	**Function, Pattern Layout and Use**
Description of Use	The levels in this PLUGE pattern are specific to the 1,000 nit master using the PQ version of HDR. The pattern has been designed to function the same way as the SDR version of PLUGE but at levels specific to 1,000 nit PQ curve. This particular pattern is not correct for use in the SDR mode of a display. The PLUGE is on both sides of the center to provide a greater opportunity to set black taking image uniformity and viewing angle into account when setting the brightness control. There are two above black steps [F] [G] in the PLUGE, one close to black and the other a little further above it. The step below black may or may not be visible depending on where the individual set clips black. The HDR-10 system we are using assumes nothing useful in picture information will go below black. Some sets will accommodate the below black portion of this signal just to make it easier to properly set the Brightness control. Others will not and there will be nothing lost in the picture if the set clips everything below black. Turn the brightness control up far enough so the strip just above black [G] is clearly visible. Turn the control down to the point where the just above black stripe disappears into the black background. Raise the Brightness control just enough for the strip to reappear. This is the correct setting for black. If the below black stripe is visible when the Brightness control is turned up, turn the control back down to the point where the below black [E] stripe disappears into the background with the just above black strip still being visible. The pattern has a low average picture level (APL). As much as white levels may change in the HDR mode depending on APL black level should remain fixed. In some displays you will never actually reach black, an absence of light. What you reach is a digital cut-off, a point where information in the video signal is no longer displayed. Any information in the signal above black will be displayed, even if it looks slightly washed out because the set cannot make an absence of light. The center grayscale [D] allows for a quick determination of the color of gray. Many calibrators use this pattern as a reference for quickly adjusting a grayscale as it allows one to see what is happening to the entire gray scale as adjustments are being made.

HDR Lab Test Patterns

Reverse Ramp Test Pattern



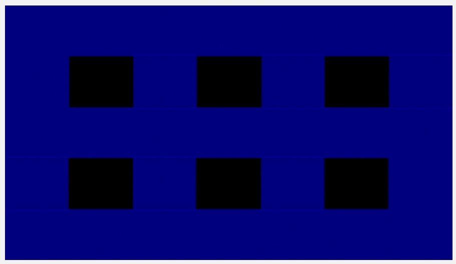
Test Pattern Name	Function, Pattern Layout and Use
Function	The Reverse Dither Ramps test pattern provides a look at how well the display is doing at producing a smooth gray scale with no apparent steps. It helps assess color bit depth handling and gray tracking. Through visual inspection an assessment can be made as to whether the display is handling 10 bit color properly. Also, the bidirectional nature of the ramps enables an assessment as to whether improper bit depth handling or setting is related to a problem at a specific luminance level or a region of the display.
Pattern Layout	The Reverse Dither Ramp test pattern is comprised of two luminance ramps running in the opposite directions [A] and [B]. The top and bottom horizontal bands [C] are at black. There has been some low-level static dither noise added across the entire image to make it easier to discern banding. The ramps are in the center of the image. The top ramp goes from 25% luminance on the left to 75% luminance on the right. The lower ramp goes from 75% luminance on the left to 25% luminance on the right. There are indicators on the ramp to show the luminance level.
Description of Use	The ramps in this pattern should be smooth with no visible stepping (banding) from one level to another which would indicate improper rendering of 10 bit content. The amplitude is limited to 75% reflecting the 1,000 nit mastering level. There should be no chroma artifacts—no color detectable. If color is observed this means that the gray tracking on the display is improper. Switch between 8 bit mode and 10 bit mode on the video generator and verify that there is a difference on the display.

ColorBars Test Pattern	
	
Function	To assess color decoding and or assist in determining the best operating positions of the Color and or Tint control.
Pattern Layout	This pattern is specific to HDR-10 and the PQ EOTF, but also works for SDR. It consists of a 50 % gray background with yellow, cyan, green, magenta, red, and blue rectangles on the top and bottom rows in the image. The colors are 50% in level and are reversed in direction from the top to the bottom. The original signal in the generator is stored as a RGB signal gets converted according to the requirements (for example the ITU 2020 specifications for YCrCb).

Description of Use

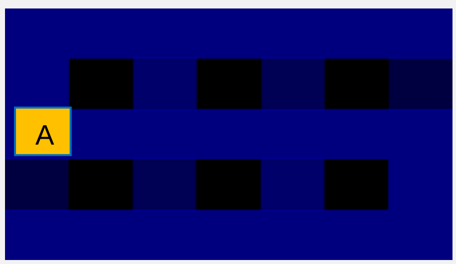
This pattern was designed to better serve the function of checking and adjusting color decoding in all component video systems. Its larger area of reference gray makes it much easier to use, especially when dealing with user menu graphics that often cover just the area you want to see in the conventional color bar pattern. This pattern is particularly useful when trying to evaluate the conditions of the green and red channels after levels have been properly set while looking at the blue channel.

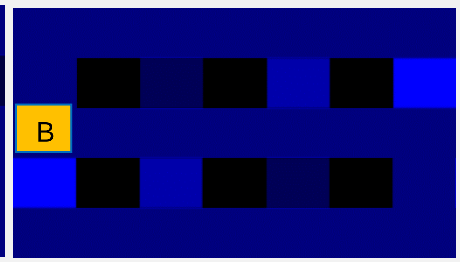
Decoder adjustments should be made looking at the blue channel. You will find a blue only function in the user menu of several brands of TV sets. Alternately you can use the blue filter that comes with some calibration discs. When looking at the blue channel the areas of the blue in the image should be the same intensity.



All areas of blue should be the same intensity (above).

The two images below show the adjustment color control:

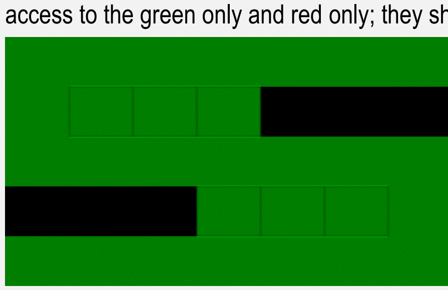


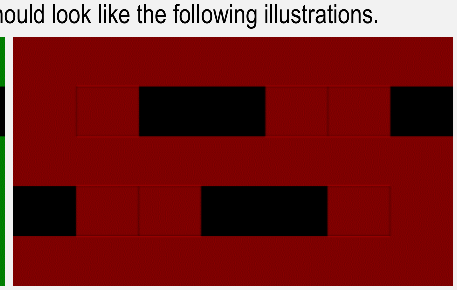


If the color control is low in level some of the areas will be desaturated as shown above [A]. If the color control is high in level some of the areas will look oversaturated as shown above [B].

In a component video system, the Tint control should not be active, but many TV set manufacturers make it active anyway. If it is functional adjusting it will affect the inside squares more than the outside squares. Adjust it so the squares are equal in level with the reference areas. If the Tint control is active it may interact with the Color control making it necessary to go back and forth between the two controls to get the desired results. If the set does not exactly do as it is supposed to do get as close to correct as you can.

Once the blue channel is set properly the other two channels should be checked. Details of how you might do this are covered in the Background on UHD section of this document. If you have access to the green only and red only; they should look like the following illustrations.



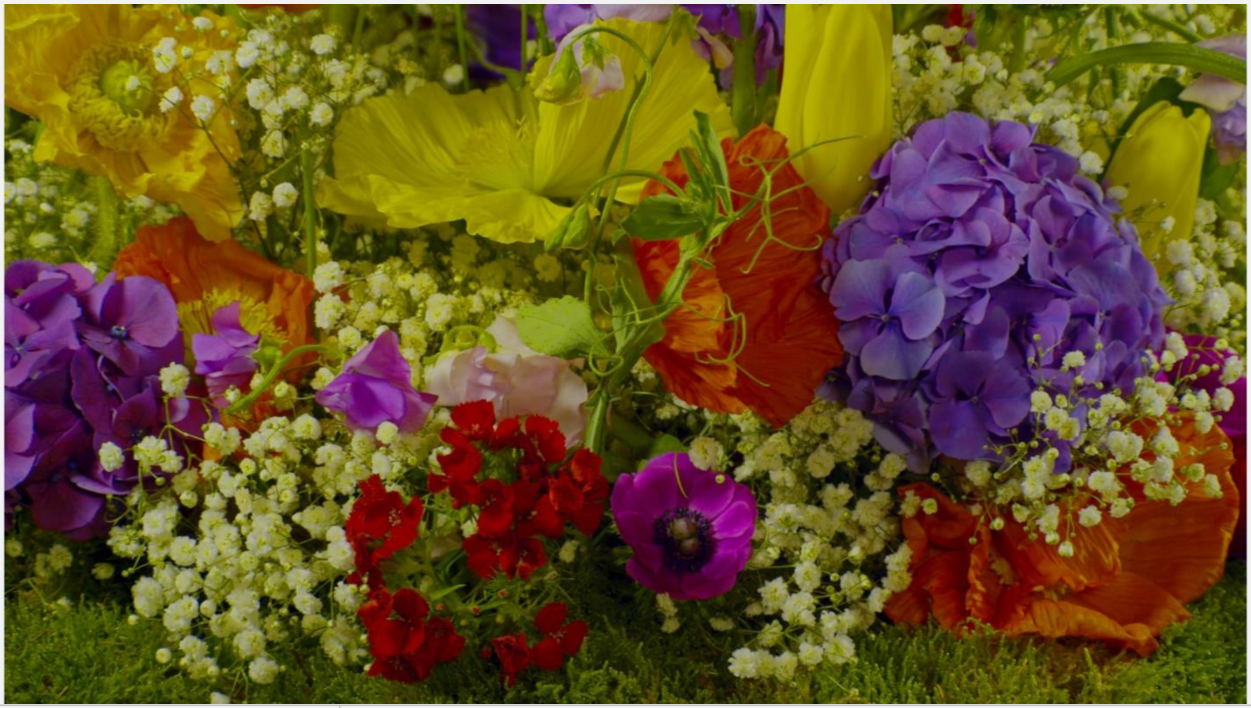


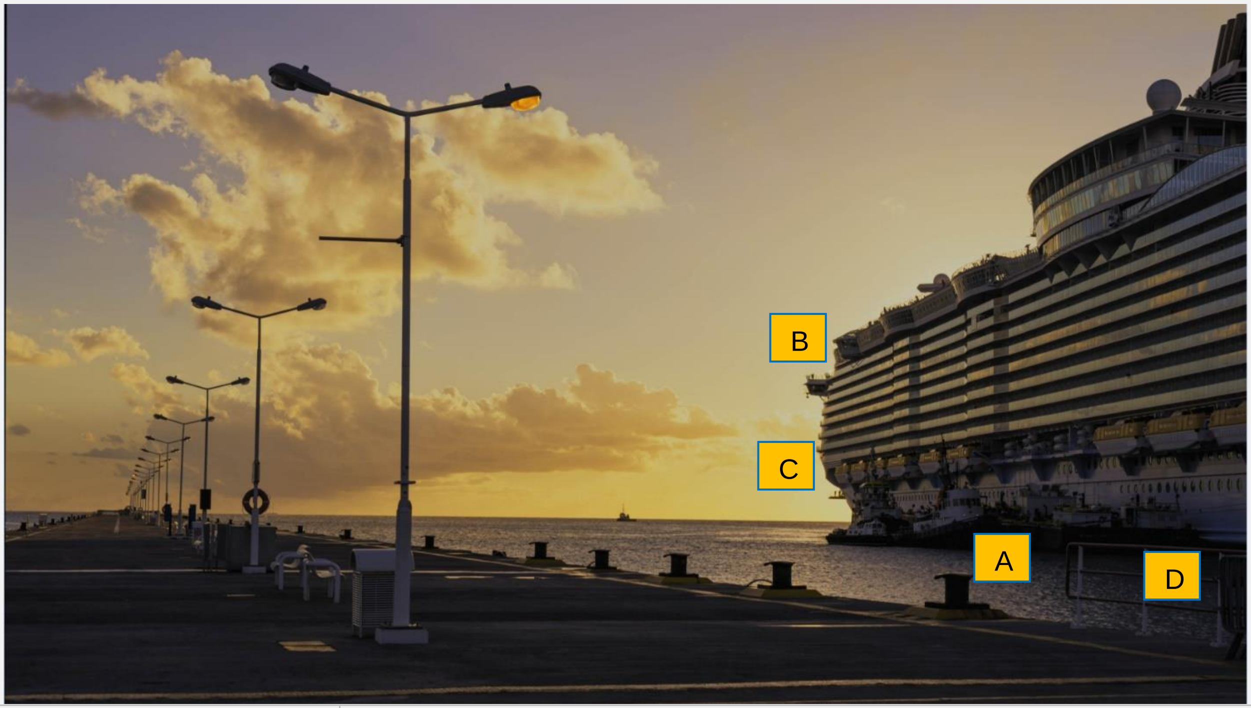
All levels of green and red should be equal.

The decoder is most likely not functioning properly if the blue channel is correct and the red and or green channel is (are) wrong.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Castle Reference Image	

Function	The Castle image is a natural image shot with a Nikon D800E still picture camera. The image offers rich dynamic range and detail that usually is not produced by a motion picture camera. The image is used to gain a subjective assessment of the display's ability to render details in a high dynamic range setting as well as the ability to maintain detail within highly saturated colors.
Pattern Layout	The Castle image offers high dynamic range and color saturation and a high level of detail with maximum resolution where there are single pixel transitions between image elements. The image contains details in the highlights (example e on the left side wall of the castle at [A]) and in the shadows (example on the windows in the roof at [B]). The image also has a lot of highly saturated colors in the greens on the trees in the foreground at [C].
Description of Use	Visually inspect the image for sharpness. The details of the bricks on the left side of the castle wall [A] should be discernable despite the highlights of the wall; in some cases, you should be able to see each individual brick. The wall should not look washed out. The details in the shadows should be discernable as well, for example on the windows of the roof at [B]. You should be able to see the details of the grid on these windows. Check for resolution artifacts such as double edges or loss of chromatic details in the leaves on the trees in the foreground example [C]. The individual leaves should be distinguishable and not desaturated. You should not see a uniformly colored patch of green.

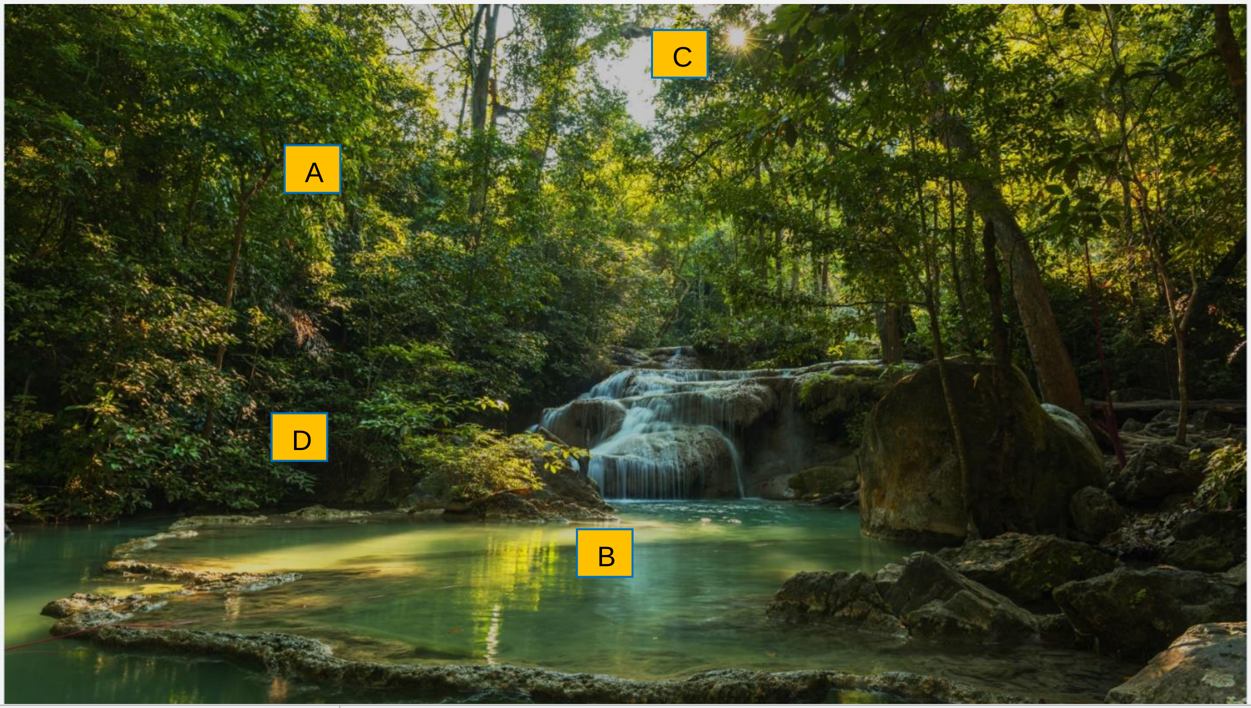
HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Flowers Reference Image	
	
Function	The Montage Flower image is a natural image used to gain a subjective assessment of the displays rendering capabilities with respect to color saturation and maintaining differentiated colors throughout the highly saturated natural flowers.
Pattern Layout	The Montage Flower image contains an arrangement of fully chroma saturated flowers of various hues. The image was shot with a 4K Red ONE Mx digital motion picture camera in a warm ambience light environment ~3000 degrees Kelvin. The warm nature of the image was maintained throughout the color grading process. The image was mastered such that is appears naturally on a P3 color gamut display, while using BT.2020 as a container.
Description of Use	Upon visual inspection the colors in the flowers should be differentiated without any patches of uniform color. The lighter parts of the image especially should not be uniform in color which would indicate that the colors were clipped.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Cruise Ship Reference Image	
	
Function	The Cruise Ship image is a natural image shot in time lapse with a Canon 5D Mark 2 camera. The image is used to gain a subjective assessment of a display's ability to render details in a high dynamic range setting.
Pattern Layout	The Cruise Ship image offers high dynamic range image. The image depicts a sunset with the sun behind a cruise ship at dock. The clouds contain nearly white elements. The sun is behind the ship and the image is graded in such a way that you see the transition from the violet bluish sky a yellowish sunset.
Description of Use	Visually inspect the image for details in the carrier vessels beside. A high level of details in these vessels should be discernable. The lights on these smaller vessels [A] aiming toward the viewer, should appear considerably brighter than the diffuse white parts of the image. Inspect the windows on the navigator's deck on the front of the ship; notice the reflections on the glass [B] which should exhibit some color and should be brighter than the windows adjacent to them. Overall, the image should reveal a dramatic effect exhibiting stark dynamic range transition from the sun light clouds at [C] to the shadows aside the ship [D]. The impression that the sun is behind the ship should be pronounced. This dramatic level of high dynamic range will not be visible when the display is in the SDR mode. There should be a significant difference in the brightness between the outer and inner portions of the cloud nearest the sun at [C]. The yellows in the clouds should be highly saturated.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
OktoberFest Reference Image	

Function	The Oktoberfest Reference Image was shot from atop a Ferris wheel. The image has some challenging elements for an HDR display to test for details in the dark portions against a bright light and for wide color gamut.
Pattern Layout	The main elements to examine are the LED lights in the background [A], the bright white 1000 nit light in the foreground [B] and the people walking in the shadows [C]. Note that the sky in the background should be uniformly black.
Description of Use	The bright 1,000 nit light in the foreground is pointing directly at toward the camera. Ideally, it should appear like a real light. The LED red, green and blue lights in the background are great examples of why a modern HDR display needs to have a wider color gamut than the current BT.709. There are elements of these LEDs that extend into coordinates of the P3 and BT.2020 color space. They are highly saturated and radiate through a very narrow color spectrum. They should appear as modern LED lights. Another challenging element of this image is the abundance of details in the people walking in the shadows. These elements are near black, but a viewer should be able to discern the individuals and differentiate their clothing. Their shadows should also be clearly visible.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Forest and Waterfall Reference Image	



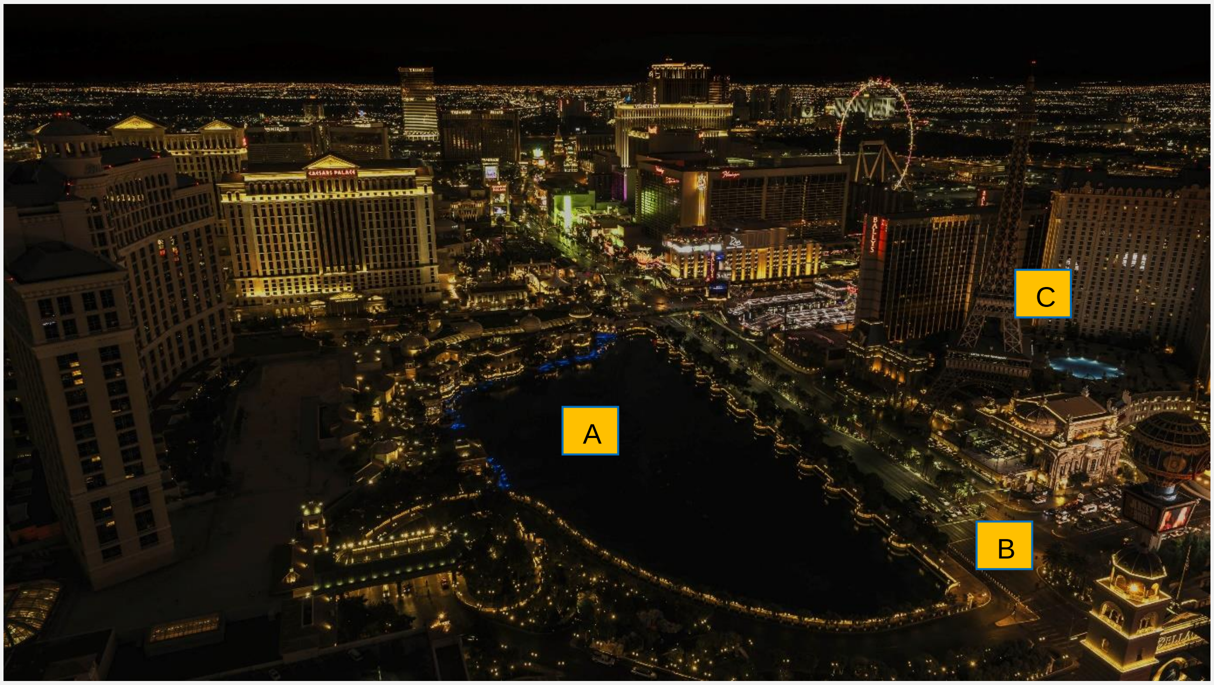
Function	The Forest and Waterfall reference image contains many elements that are ideal for evaluating HDR displays. This is a good representation of what HDR should be able to do. It can show bright highlights differentiation in bright colors and subtle differentiation in the dark portion of the images.
Pattern Layout	The image offers several challenging visual elements with varying levels of bright and highly saturated greens as well as greens in the shadow. The image should show this differentiation in the greens. To accurately represent these colors, it would be necessary to have a display that produces bright colors without losing color information. In a poorly engineered HDR display, the greens would tend to appear the same color.
Description of Use	The leaves should not appear to be the same color throughout the area at [A]. Some are reflecting the sunlight, and some are in the shadows. Some of the leaves are younger and in sunlight, so they should appear with a vivid green. Some are older and should appear less saturation. The same sort of differentiation in the greens should also be apparent in the water [B]. Examination of the water elements should show a variety of blue, cyan and green colors. One element that is challenging is the sun peeking through the leaves [C] and reflecting off the leaves. A well-engineered HDR display should be able to reproduce that these highlights. On an ideal HDR display, it should look like the sun is hitting your eyes. The image also contains some details in the dark elements. Close examination of these elements should reveal some details and differentiation even in the darkest areas [D]. This is what makes a good HDR TV; it should be possible for a viewer to distinguish between the darks. If you see a uniform black area in the picture this means that the HDR display is not representing the visual elements.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Bottles and Glasses Reference Image	
	
Function	The Bottles and Glasses Reference Image is an excellent image for evaluating bit depth artifacts, proper color space, average picture level and tone mapping on HDR displays.
Pattern Layout	This reference image provides some visual elements that are useful for evaluating HDR displays. The white background offers a fine high luminance gradation for evaluating bit depth and proper color space. The colors in the bottles also provide some visual elements which along with the background are useful for assessing how well an HDR display can produce an image with a high average picture level while still maintaining vivid, high saturated colors.

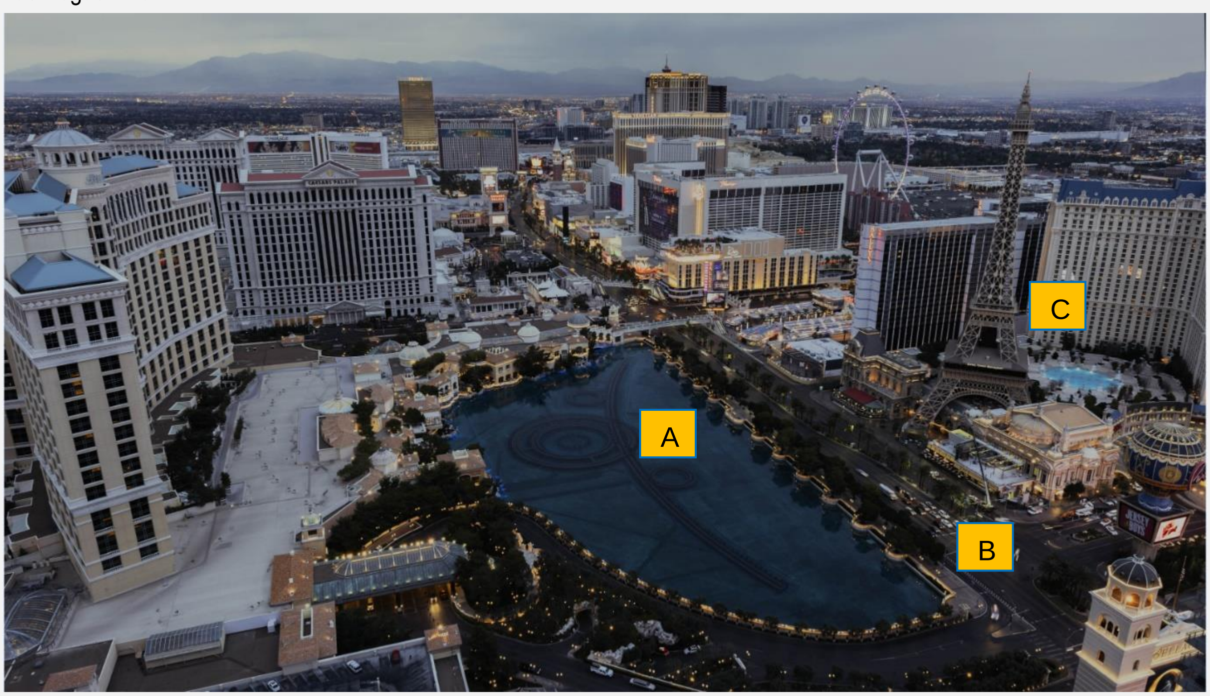
HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Description of Use	Examine the light background behind the bottles and glasses in the foreground. The background should be a smooth gradation from the brightest portion in the center [A] to the slightly darker areas on the edges [B]. There should be no discernable steps or banding. If there is any banding that is an indication that the display is not handling the color depth properly. Also, there should be no chromatic elements apparent in the background. An appearance of greenish or reddish chroma elements in the background would be an indication that the wrong color space standard is being used. For example: If the display would decode YCbCr following the BT.709 matrix coefficients, while the generator created it with BT.2020 matrix coefficients. Examine the bottles. The green [C] on the bottle should pop out; some of the elements should be vivid, highly saturated green. The transitions in the color should look natural with no stark changes. If the colors do not appear highly saturated this is an indication that the HDR display cannot produce an image with a high average picture level and still produce saturated colors. The brightness of the specular highlight on the bottle [D] should be significantly brighter than the white background [A]. The reflections should not appear as diffuse light. If there is not a significant difference between the reflections and the diffuse background, then this is a sign that the display is doing aggressive tone mapping. The round label on the green bottle at [E] has some structural elements. These structural elements should be readily discernable. The bottom of the glasses at [F] and the bottom of the bottle at [G] are near dark, but they should not appear as being completely black. They should appear as a gradation.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**

Las Vegas Dark and Bright Reference Image



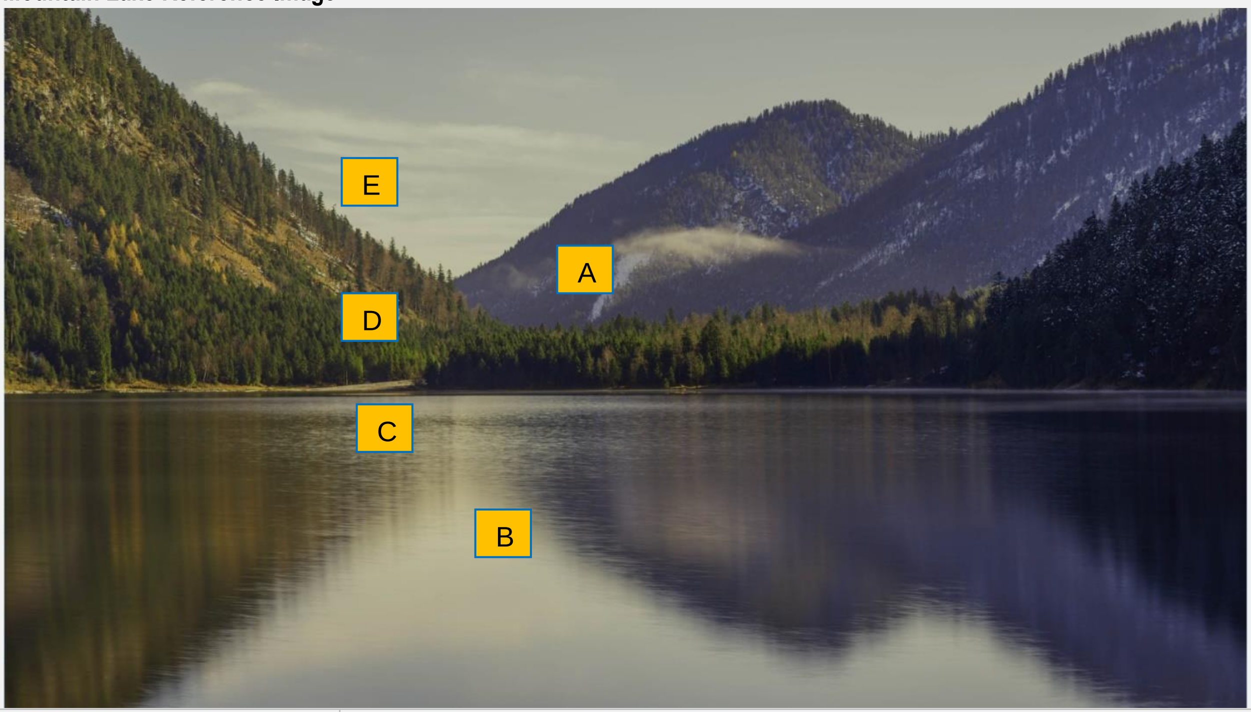
Las Vegas - Dark



Las Vegas - Bright

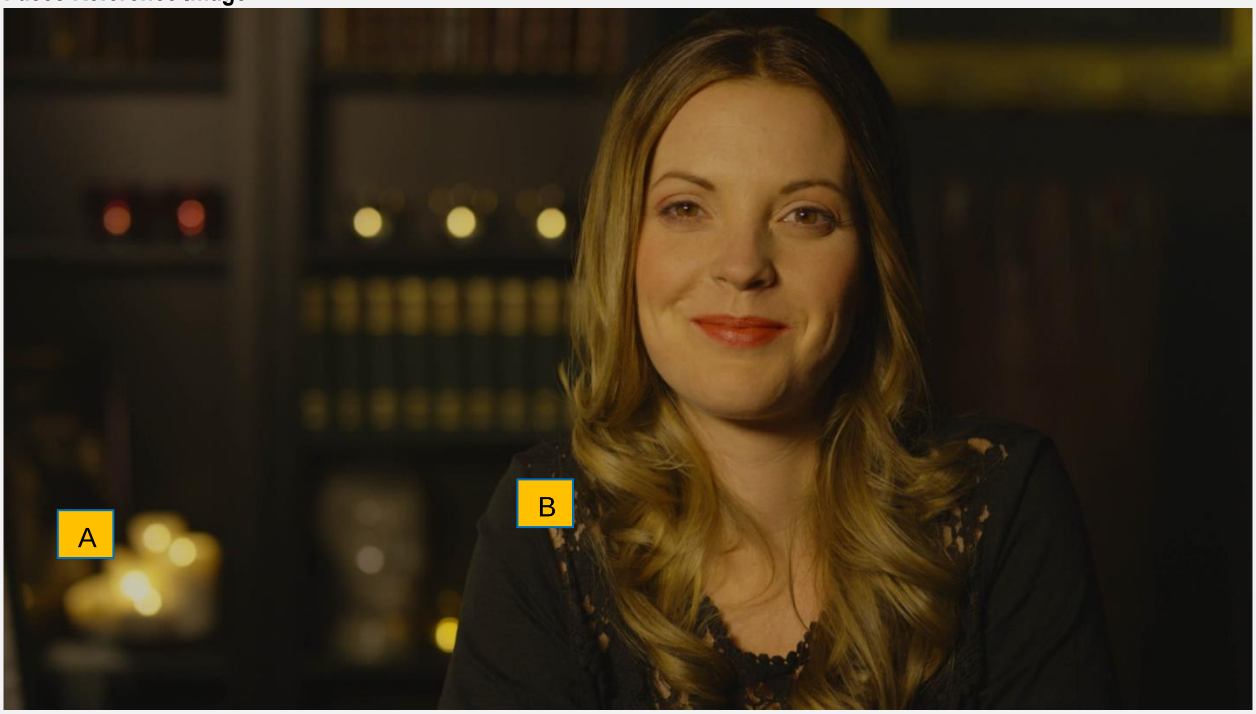
HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Function	This pair of images is good for evaluating how OLEDs and LCDs handle highlights in differing Average Picture Levels of brightness. The set of images is also useful for testing projection system's ability to reproduce black levels or contrast. The pair of images presents different challenges for OLED HDR TVs vs LCD HDR TVs because the highlights remain the same intensity of light but the ambient light changes dramatically. The Las Vegas Dark image starts off with a low Average Picture Level (APL) and the Las Vegas Bright Image has a much higher APL which is challenging an APL dependent TV. Some HDR TVs can produce bright highlights when the whole scene is dark, but they cannot produce these bright highlights when the scene is getting brighter. As a result, some TVs would look less rich in contrast.
Pattern Layout	There are two images of the Las Vegas Strip taking from the Cosmopolitan hotel using time lapse photography. The Las Vegas Dark image was taken in the middle of the night. The Las Vegas Bright image was taken in the early morning hours.
Description of Use	Images with high Average Picture Level are sometimes difficult to reproduce with current OLED TVs. This technology will result in a loss of contrast where an image has highlights with a high APL. Therefore the Las Vegas Bright image is challenging for OLEDs. Images with a low Average Picture Level are sometimes difficult to reproduce with LCD TVs. When subjectively evaluating these images, you should look out for good differentiation in the darkest parts of the image, like the underlying structure in the water in the center of the image [A]. Cars on the street [B] should be individually distinguishable while still providing texture. The individual letters of the Eiffel tower restaurant [C] advertising should be perfectly sharp and separated. In some of these letters, you should be able to see single pixel transitions, where one pixel is white and the next is nearly black. The street and hotel lighting should appear like realistic lights, adding depth to the scene. The image with the higher APL should reveal many more details of the area, while maintaining the intensity of lights in a realistic way, still reasonably differentiated from the background.

HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Mountain Lake Reference Image	



Function	The Mountain Lake reference image German Alps in the early morning contains several useful elements for evaluating HDR displays.
Pattern Layout	There is a low hanging cloud in the foreground floating just above the lake. The cloud should really pop out on good HDR display. The lake gives off a reflection that should appear bright silver almost a metallic surface [B]. The image overall should have a warm appearance and should not look bluish in the clouds or sky. If the color temperature on the display is not adjusted correctly, then the mountains in the background would show an intense blue.
Description of Use	There should be a lot of detail visible in the trees. There is a path [C] that should be discernable. The fresh younger trees on the left of the path [D] are in the sunlight and should show a lot of detail and there should be some differentiation in the green colors. They should really pop out from the duller greens in the shade in front and older trees behind them. An examination of the cloud area just above the horizon [E] where the mountains forming the valley occur should not show banding, nor should they look uniform in color at any point. There should not be any chroma elements in the clouds.

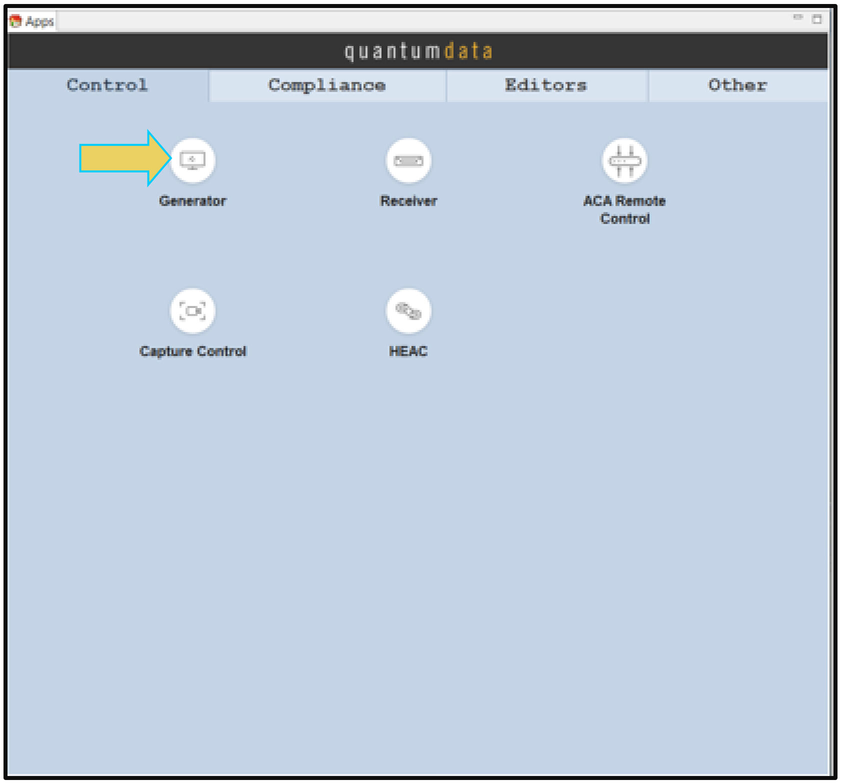
HDR Lab Reference Images	
Reference Image Name	**Function, Pattern Layout and Use**
Faces Reference Image	



Function	The woman's face was shot with a RED Epic Dragon camera. The lighting that was used had a warm color temperature slightly below 3000K to match the candles in the background. The pattern is designed to reveal the TV's capability to reproduce warm skin tones, soft highlights, and clear differentiation in the darkest parts of HDR images. It also shows potential viewing angle issues and halos around bright objects if the display has such issues.
Pattern Layout	The skin tones should look natural and well differentiated in the lights as well as the shadow part below her chin. Hairs should show good structure with no ringing or other artificial edges. The candles in the background [A] should appear with a soft bouquet, while being noticeably brighter than the face itself.
Description of Use	The image should look soft in the background and sharp in the foreground, while the scene light should provide an ambience like in a dinner situation with a lot of near black details. Hair and skin should show shadow details [B]. The system is not set up properly when there are larger areas of uniform black in the image. To test for viewing angle dependencies, you may choose a specific angle like 30 degree or 45 degree relative to the screen and look for luminance and color changes especially in the dark part of the image.

To test your UHD display with HDR Lab:

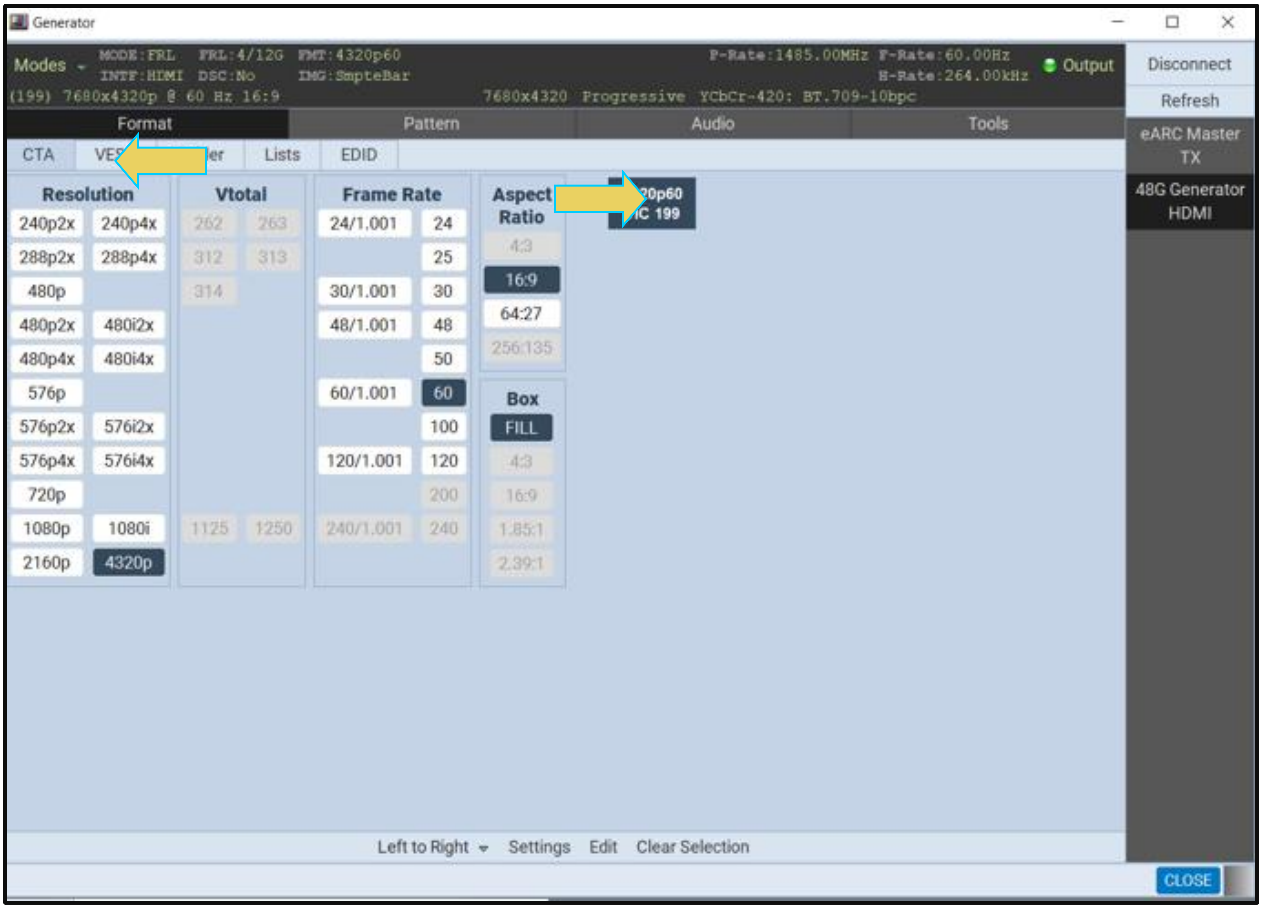
- Make the physical connections as shown in Making the physical HDMI connections.
- Access the **Generator** window from the **Card Control** page.



The Generator window opens.

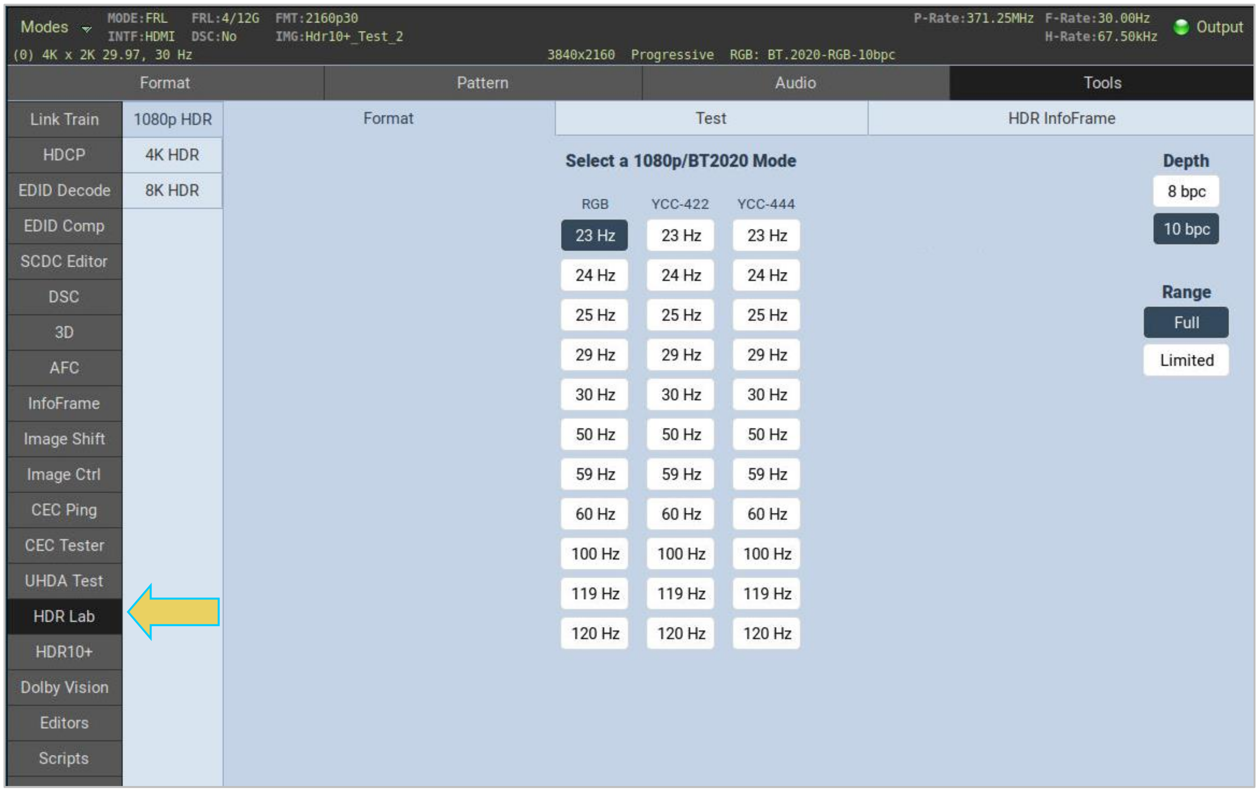
Note: You can access the HDR Lab patterns from the **Patterns** tab individually or use the **HDR Lab** utility. The instructions below use the HDR Lab Utility under the **Tools** menu and this is the recommended way.

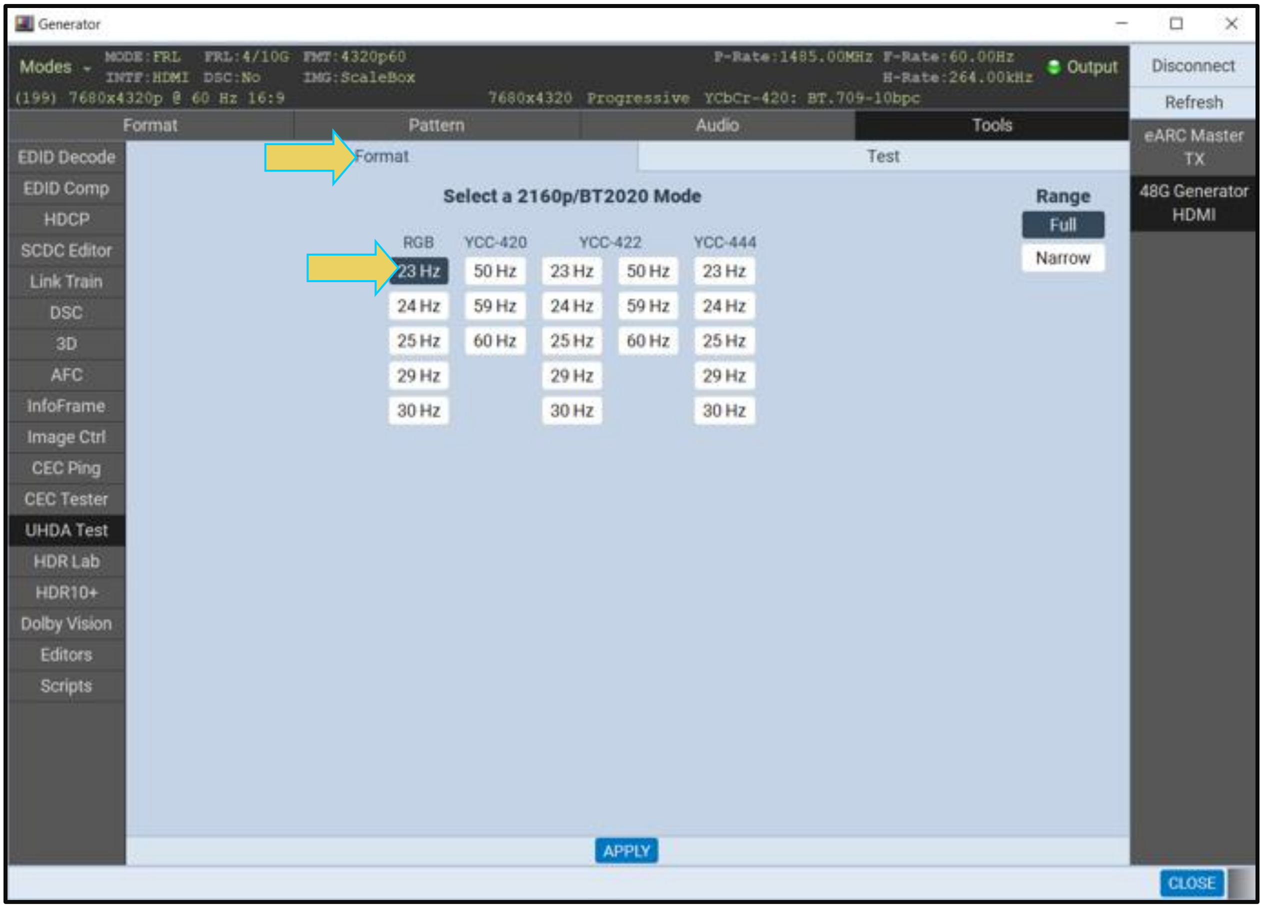
- Select the **Format** tab menu and select 8K at 60Hz format.



- Select the Tools tab and then the **HDR Lab** utility.

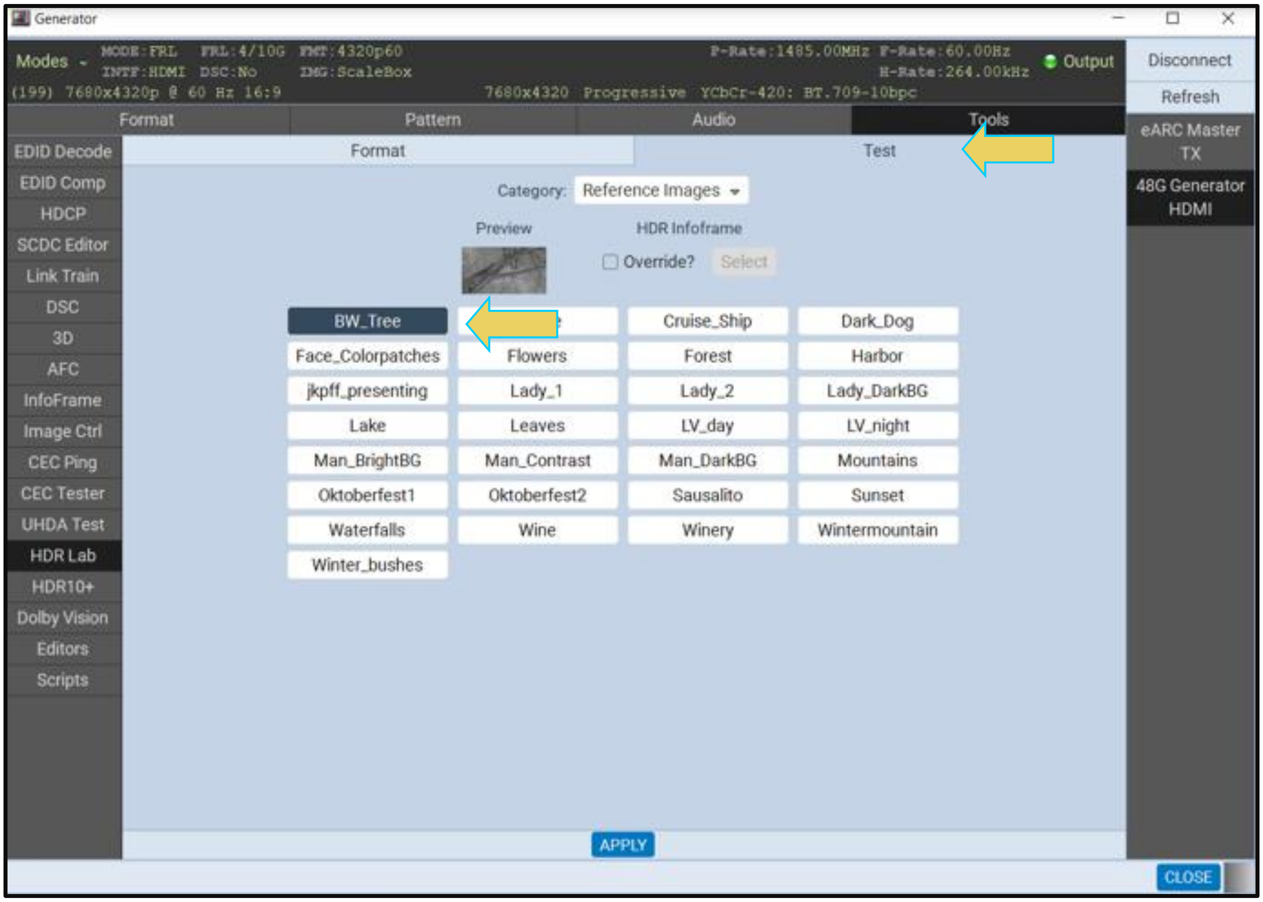
The HDR Lab utility window appears as shown below.



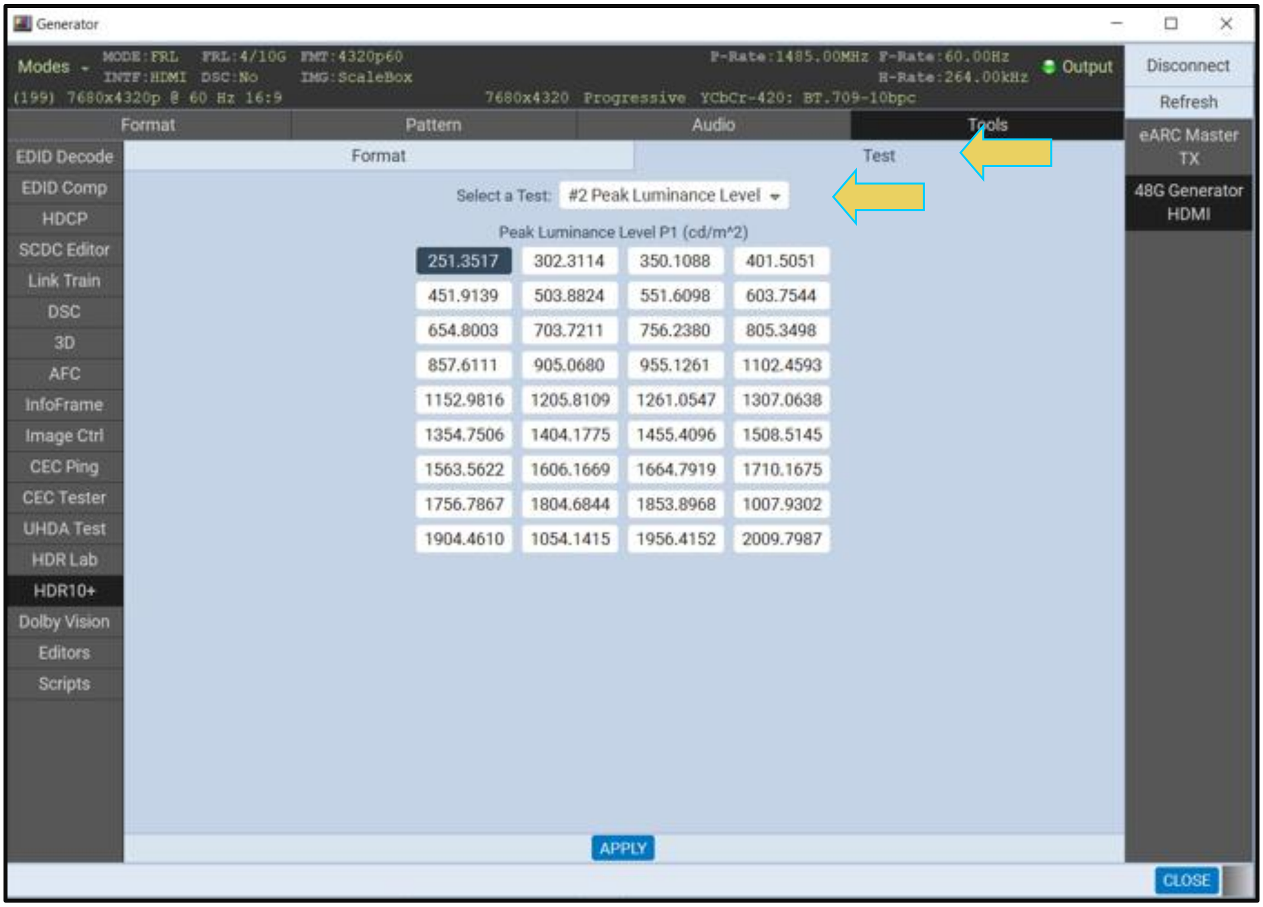


- Select the **Format** button to access the video parameter selection page (above).
- Select the Colorimetry, sampling mode and bit depth in accordance with your specifications.

- Select the **Image** button to access the pull-down menu enabling you to select either the HDR test patterns or the test images (below).

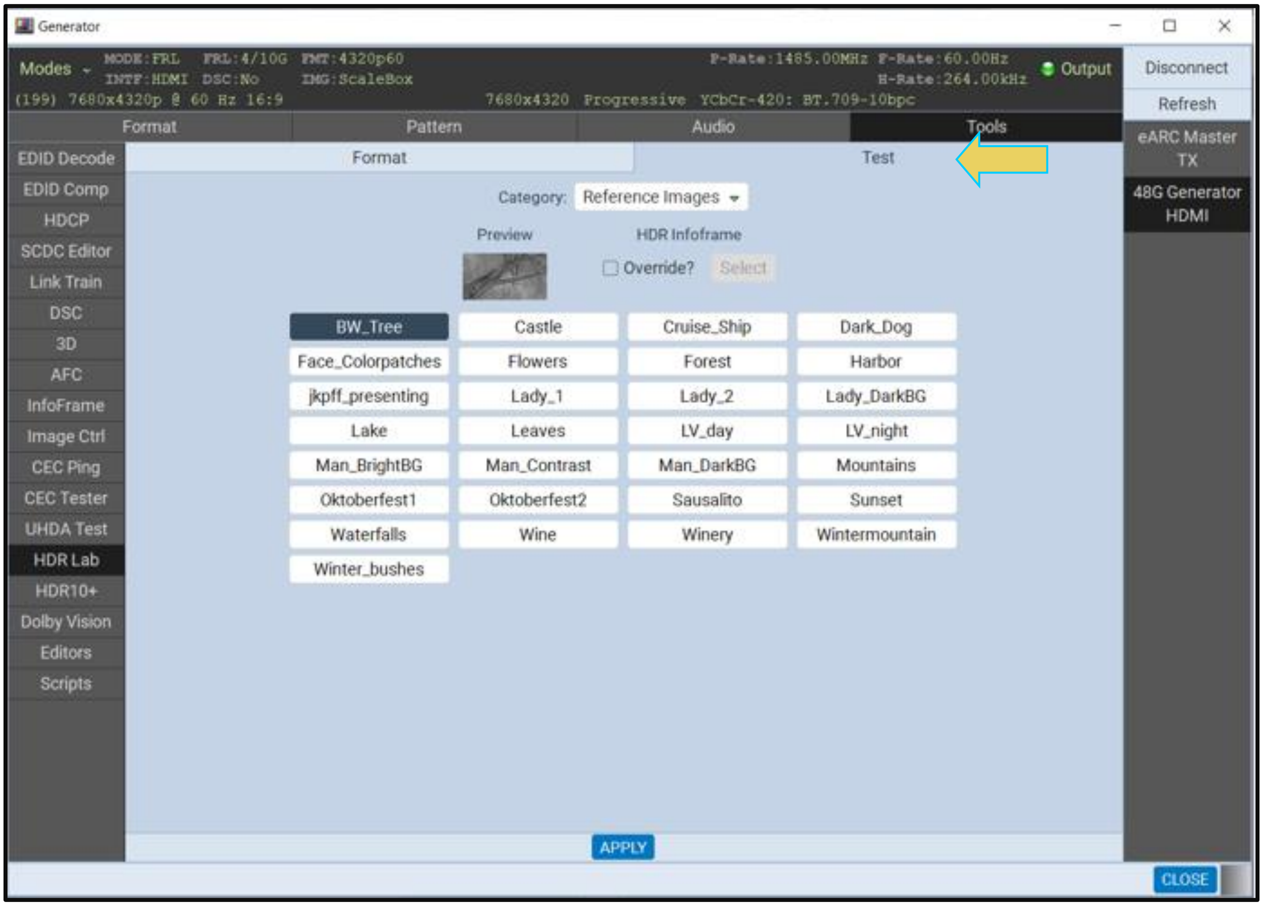


- From the **Category** pull-down menu select either Test Patterns or Test Images (below).



The following pull-down appears:

Test Patterns shown above; Reference images shown below.



- Select a Reference Image or Test Pattern and examine how it is rendered on your HDR display to assess proper rendering in accordance with the table above.

15.21 Testing HDR Displays with HDR Test Patterns

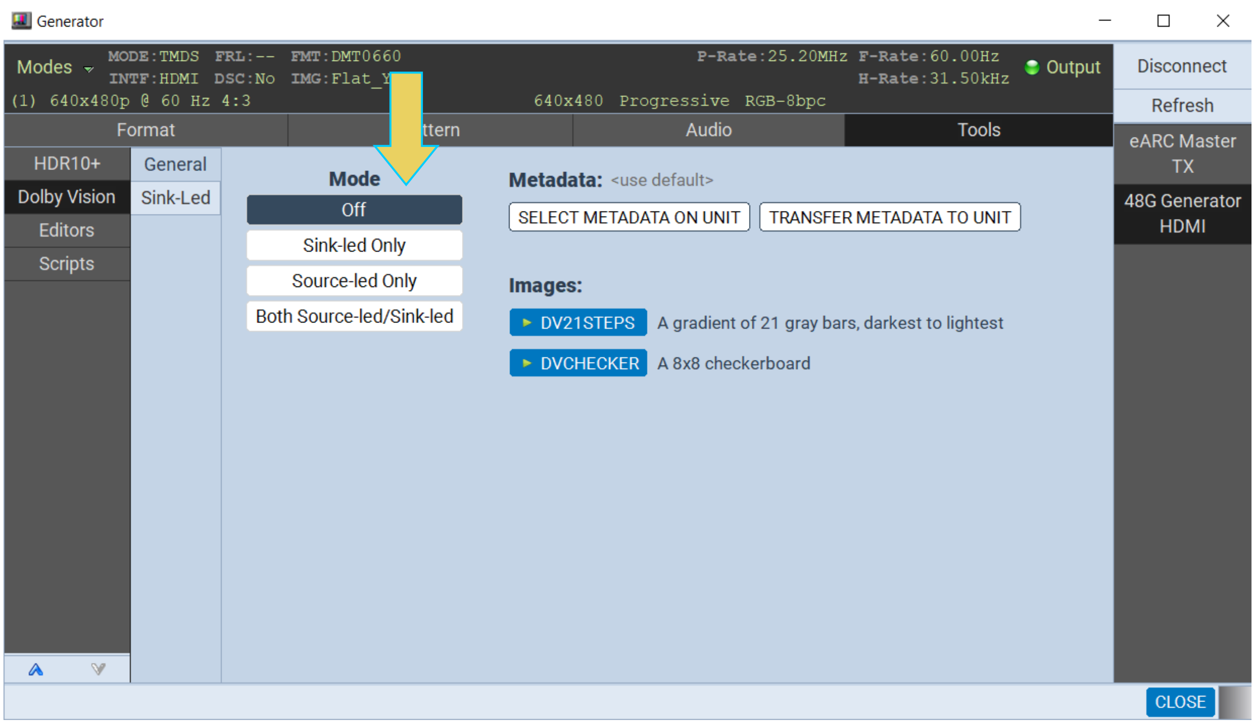
There are HDR related test images and functions that can be used for testing HDR apart from the UHD Alliance test patterns described in the previous subsection. When the patterns are selected, the appropriate metadata is transmitted through the AVI and HDR InfoFrames. These test patterns require separate licenses for use.

Currently there are two specialized HDR test patterns:

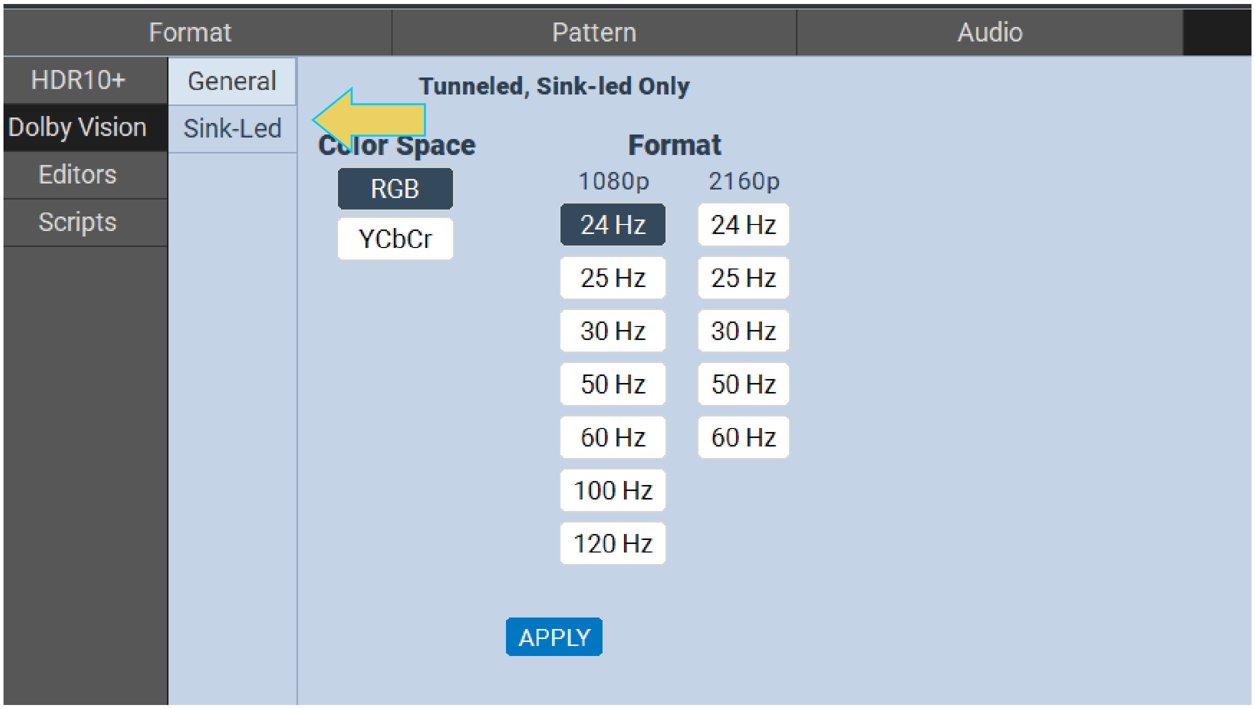
Hybrid Gamma Log – This pattern itself it not useful for checking the video attributes of HLG HDR. Its purpose is to provide assurance that the InfoFrame is not impeding the ability for the display to render the image.

Dolby Vision – The Dolby Vision test image verifies a Dolby Vision display's Dolby Vision-specific EDID data, its response to the Dolby Vision protocol handshake and its handling of the Dolby Vision signal and metadata. The Dolby Vision test image will be rendered with a checkmark in the proper location if the display has properly interpreted the color space, metadata, and checksum correctly.

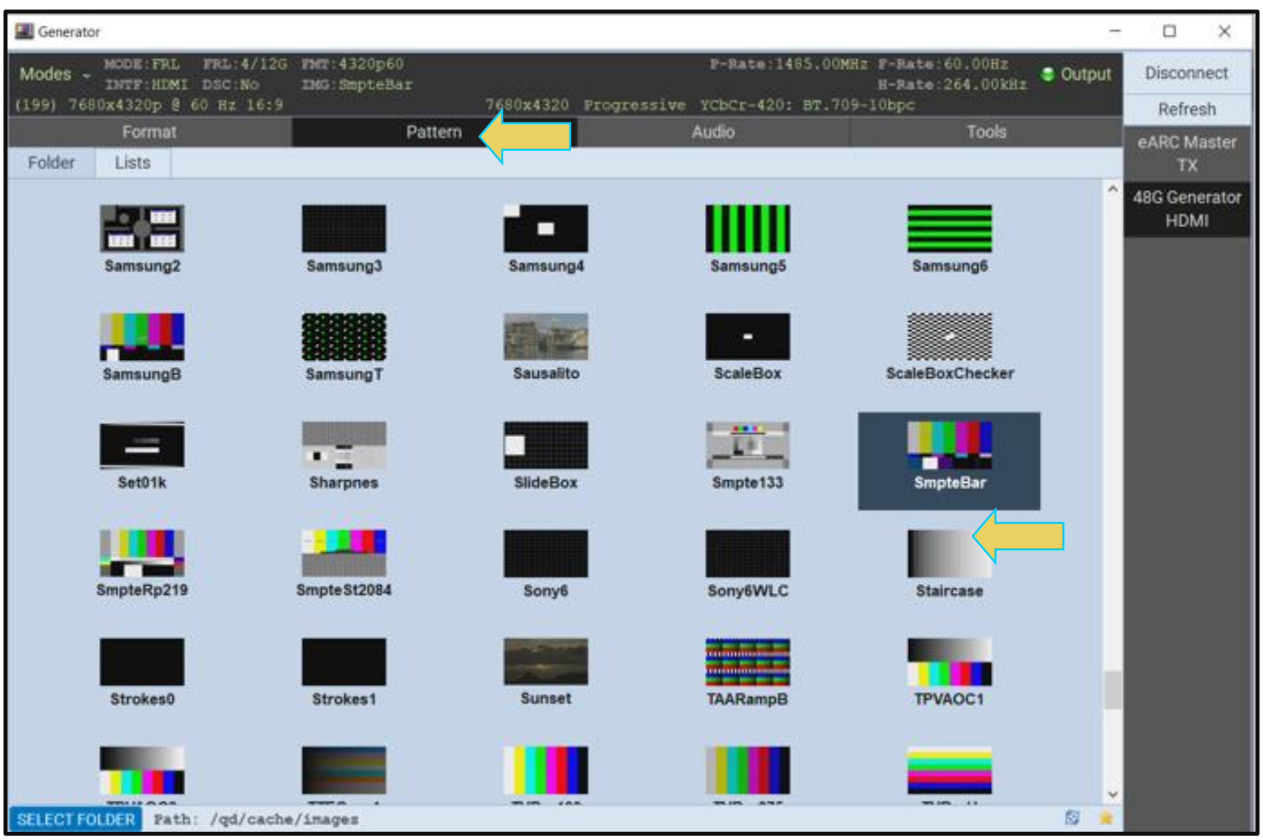
The M42h Dolby Vision Testing Utility offers the ability to select between Sink-led and/or Source-led Mode when testing, as shown below.



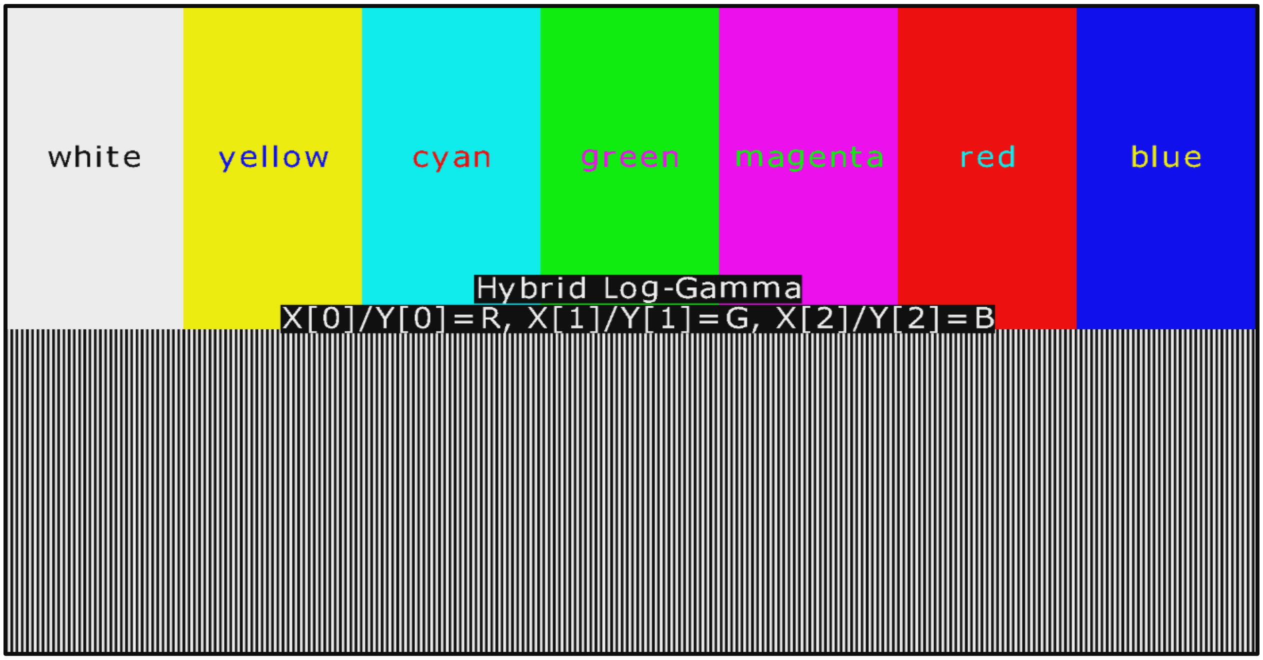
Select the tab on the side-bar labeled **Sink-Led** for additional Sink-led options, as shown below.



You select the pattern (e.g. Hybrid Log Gamma) as you would any other pattern from the **Patterns** tab shown below.

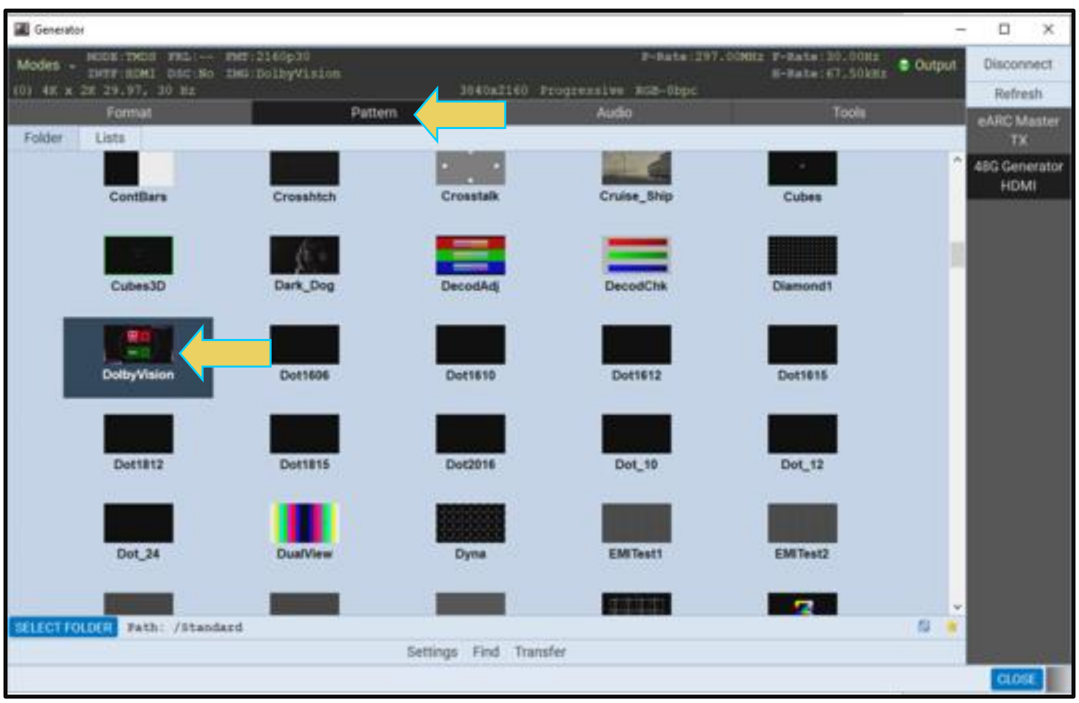


The HLG test pattern is shown below for reference.



Similarly, you can select the Dolby Vision test pattern as shown below.

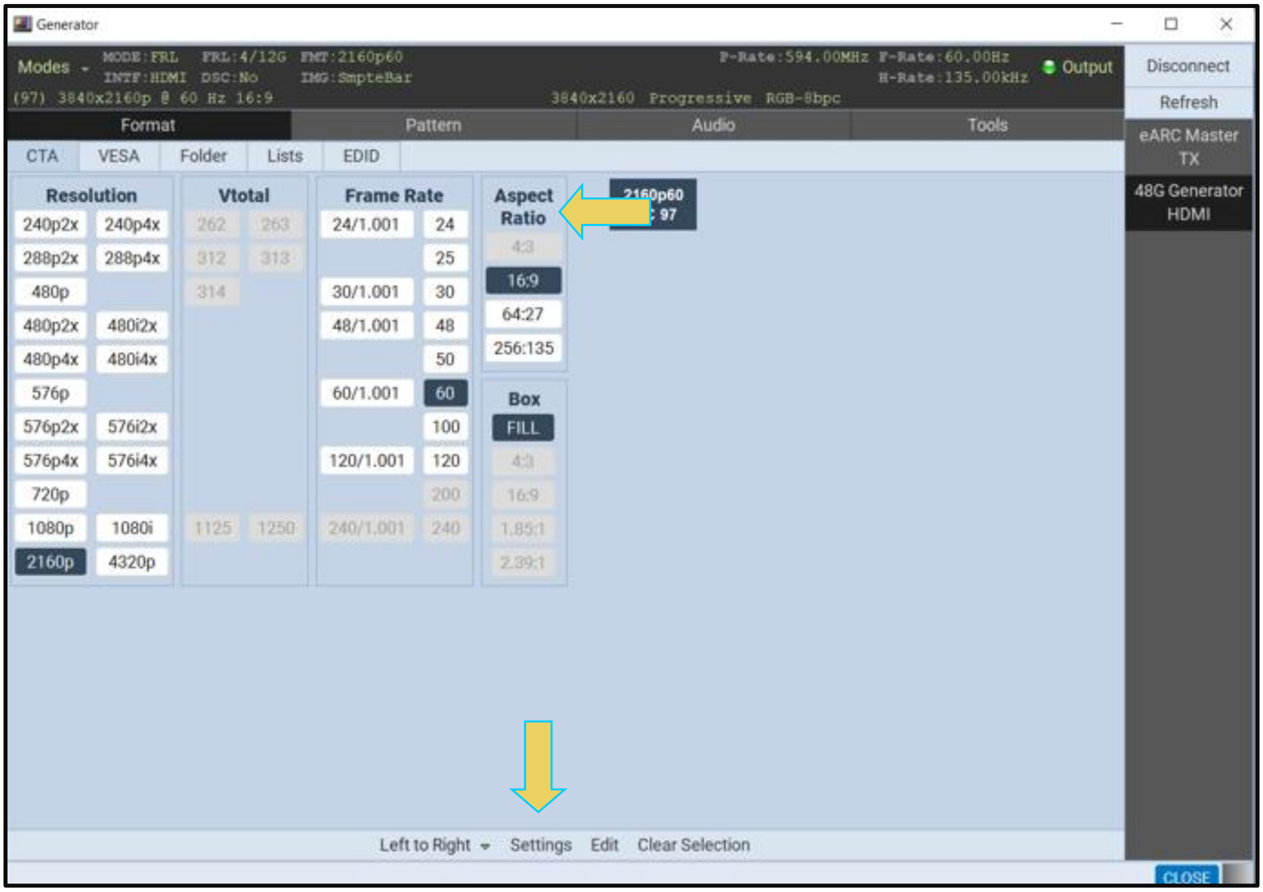
Important Note: The Dolby Vision Source-Led patterns will also be added when supported in the M42h.

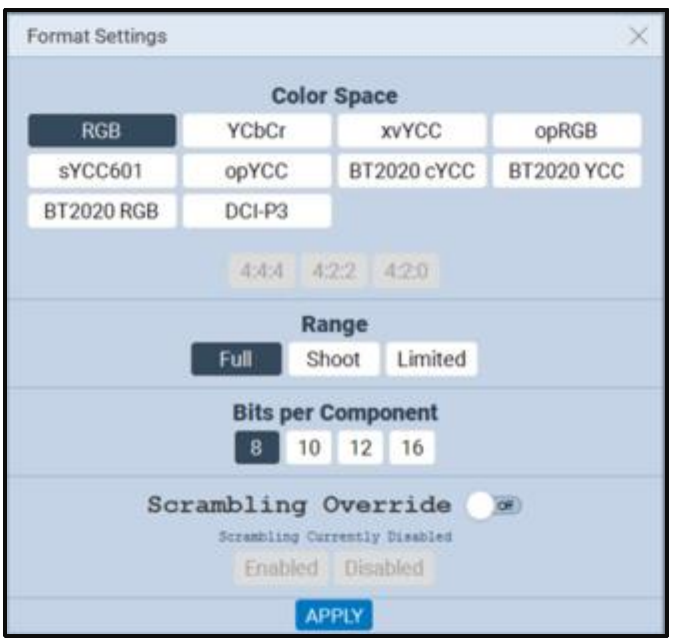


You will set the video format to any 2160p or 1080p image using the following settings:

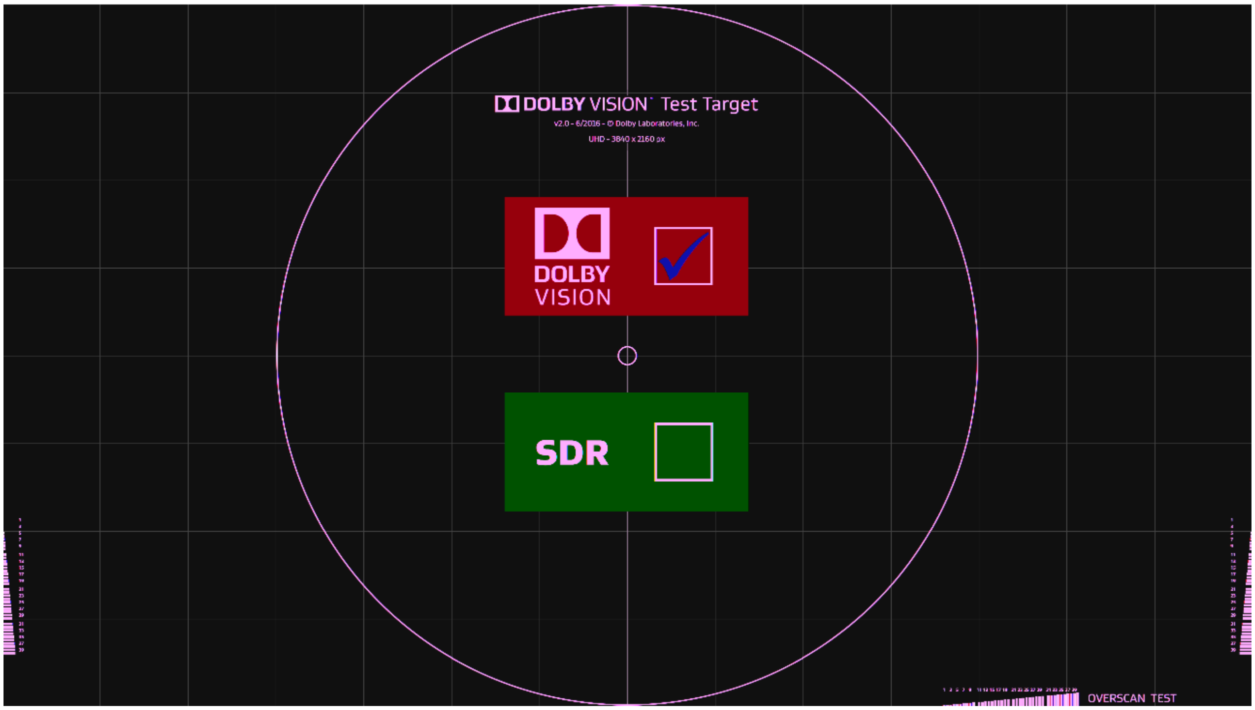
- **Colorimetry: RGB**
- **Range: Full**
- **Bit depth: 8 bits per component**

The format selection and format settings are depicted sample screen examples below.


Generator
Modes
MODE:FRL FRL:4/12G FMT:2160p60
INTF:HDMI DSC:No IMG:SmpteBar
(97) 3840x2160p @ 60 Hz 16:9
P-Rate:594.00MHz F-Rate:60.00Hz
H-Rate:135.00kHz
Output
3840x2160 Progressive RGB-8bpc
Disconnect
Refresh
Format
Pattern
Audio
Tools
eARC Master TX
48G Generator HDMI
CTA
VESA
Folder
Lists
EDID
Resolution
Vtotal
Frame Rate
Aspect Ratio
Box
FILL
Left to Right
Settings
Edit
Clear Selection
CLOSE


Format Settings
Color Space
RGB
YCbCr
xvYCC
opRGB
sYCC601
opYCC
BT2020 cYCC
BT2020 YCC
BT2020 RGB
DCI-P3
4:4:4
4:2:2
4:2:0
Range
Full
Shoot
Limited
Bits per Component
8
10
12
16
Scrambling Override
Scrambling Currently Disabled
Enabled
Disabled
APPLY

The Dolby Vision image provides a check mark in the HDR box when the image is rendered properly.



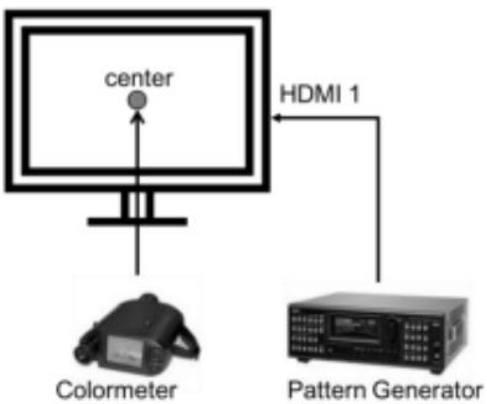
15.22 Testing HDR10+ Capable Displays using HDR10+ Utility

15.22.1 Important Note Regarding HDR10+

This section explains accessing the HDR10+ testing features of the M42h using the ATP Manager. All of the HDR10+ tests are defined in the HDR10+ Technologies, LLC specifications located on their website. You must be a member/adopter to access the test specifications and methods of instruction. HDR10+ should not be equated with “HDR” and/or “HDR10” - it’s a specific standard defined by the LLC.

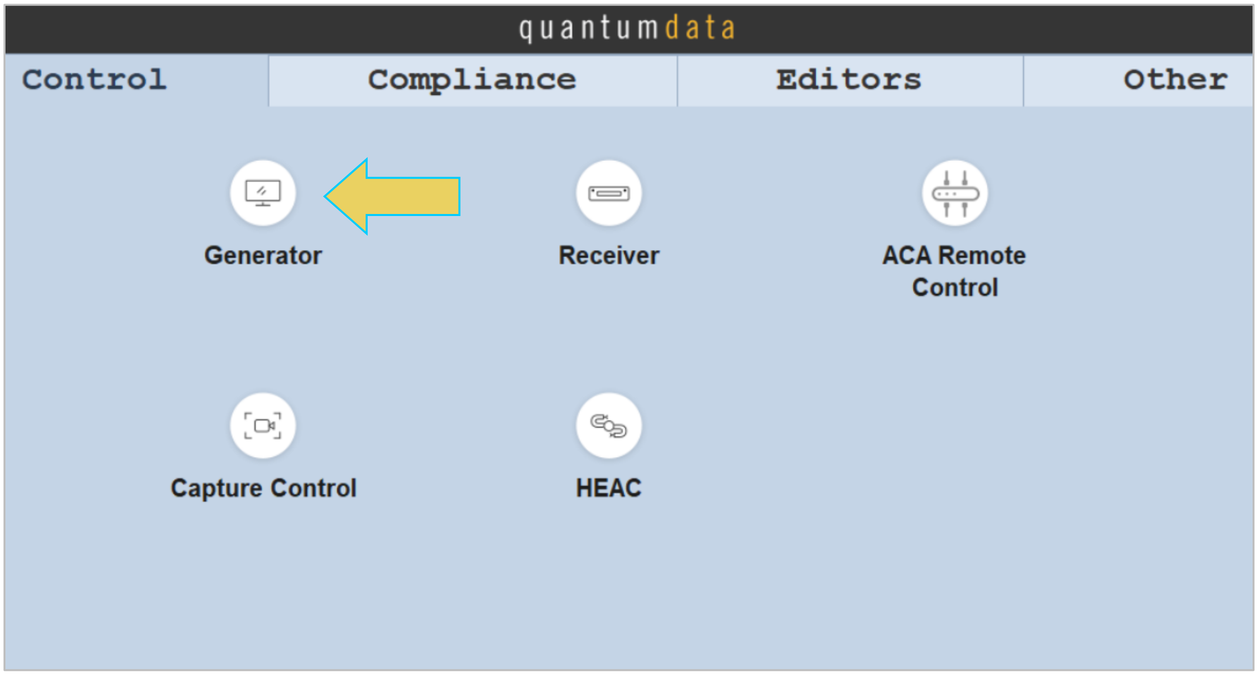
These tests require a separately controlled colorimeter, frustum (focusing device) and qualified HDR10+ display device to test. The part of the equation that we supply is the generator (HDMI 2.1 96G module) output and method of manipulating a predefined set of info frame values via the GUI as required for a portion of the tests outlined in the HDR10+ CTS.

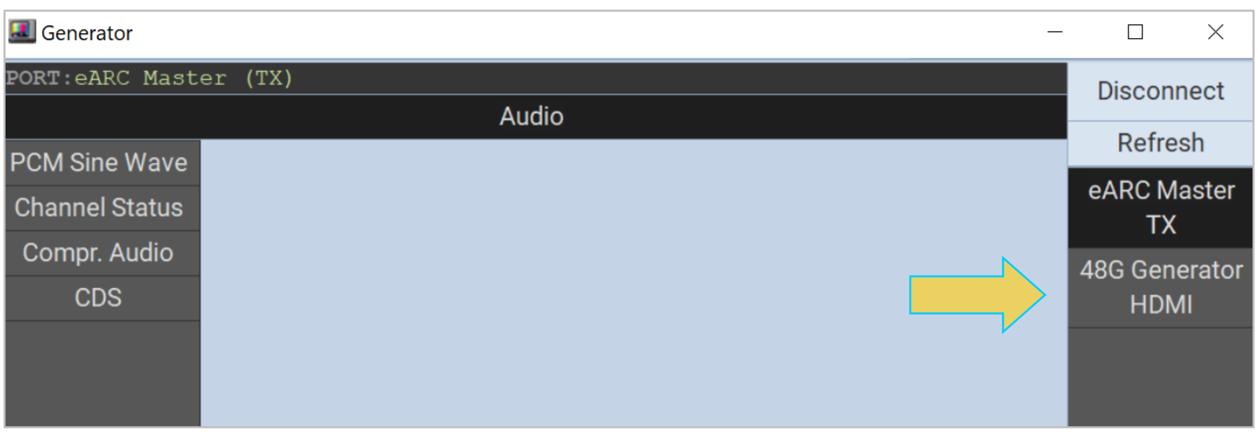
See below diagram for a reference of setting up generator (M42h instrument), colorimeter, and display.



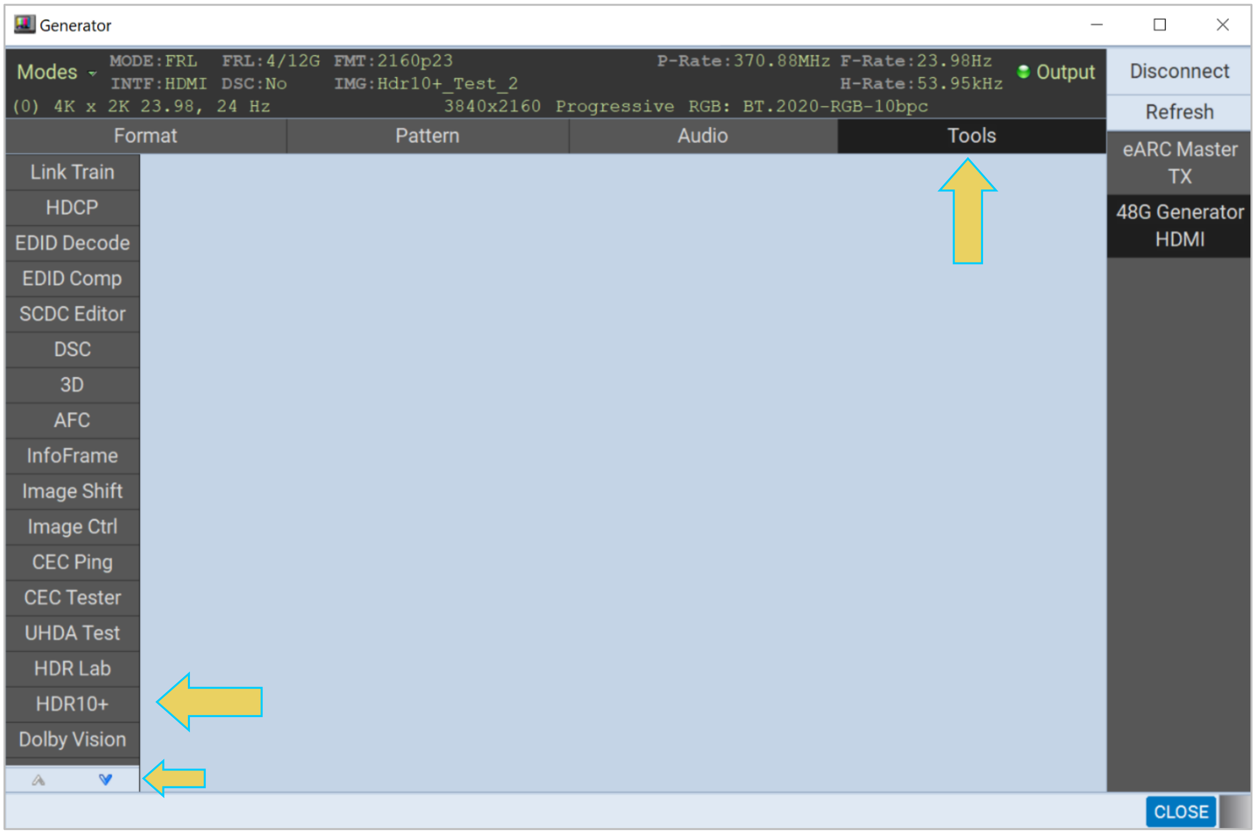
15.22.2Accessing the HDR10+ Utility

Access the utility within the generator by selecting **Generator** from the Home Screen, and selecting **96G Generator HDMI** on the righthand side bar, as shown below.

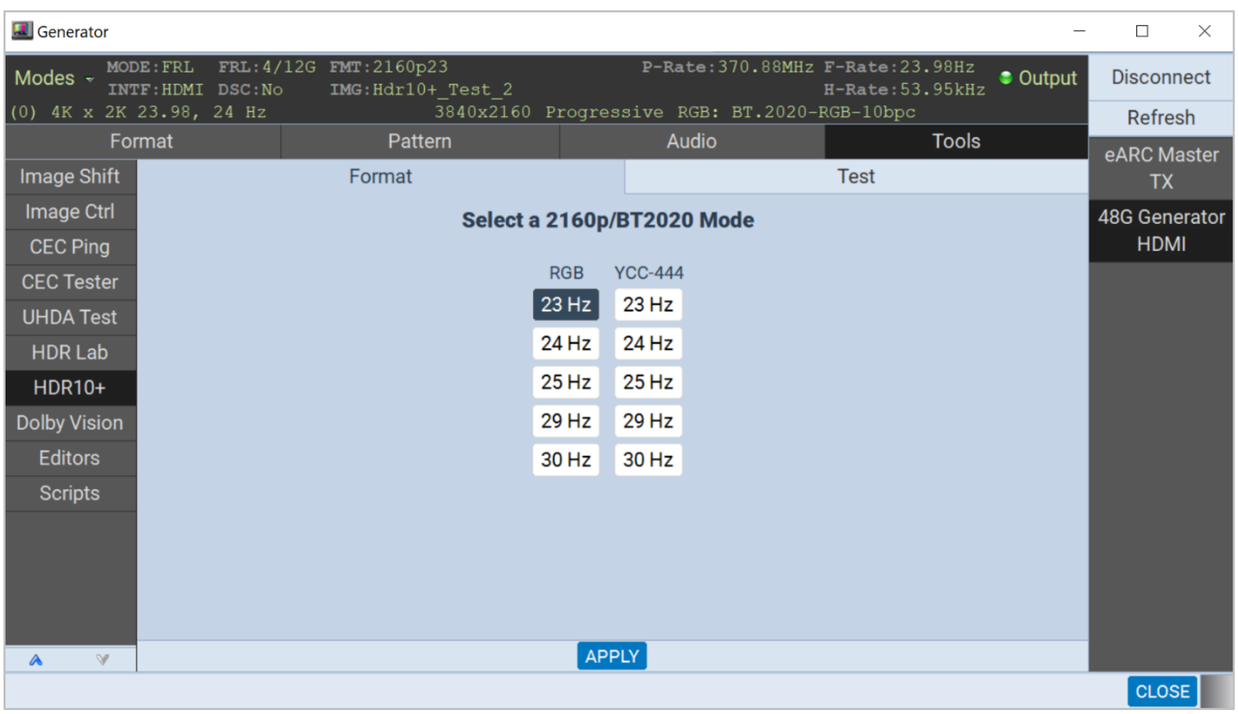




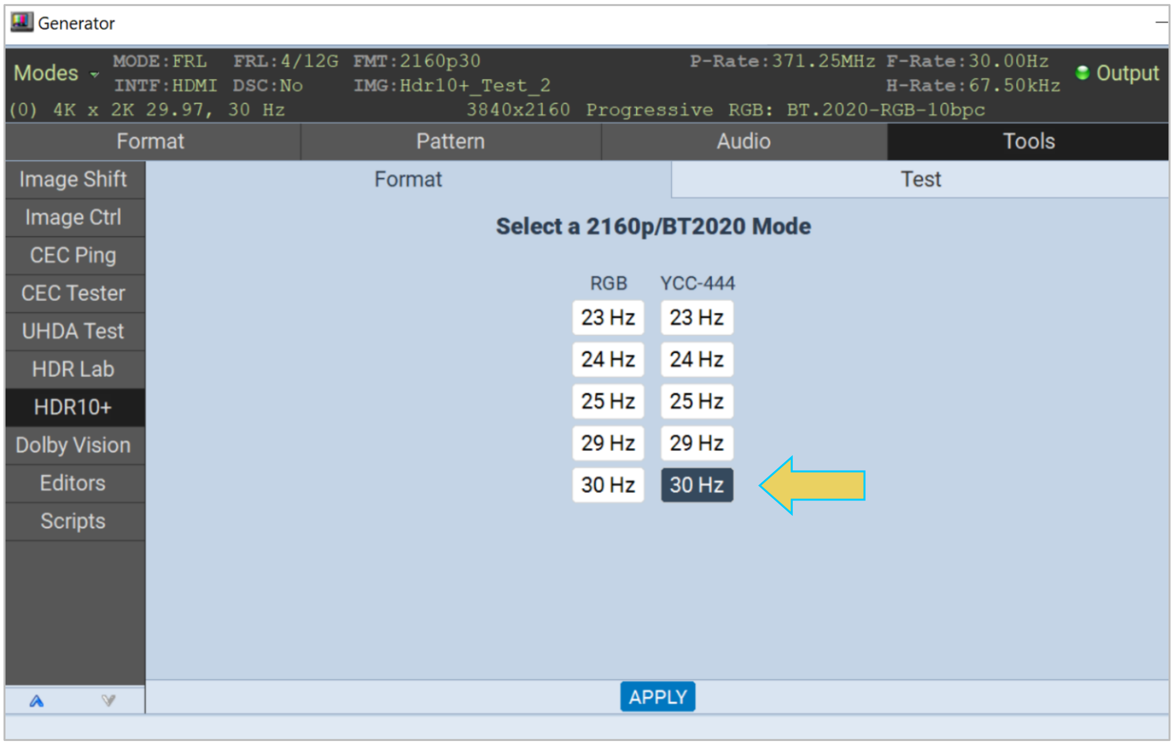
Select the **Tools** tab at the top of the Generator window. Scroll down on the left sidebar if necessary, and select **HDR10+** to open the utility.



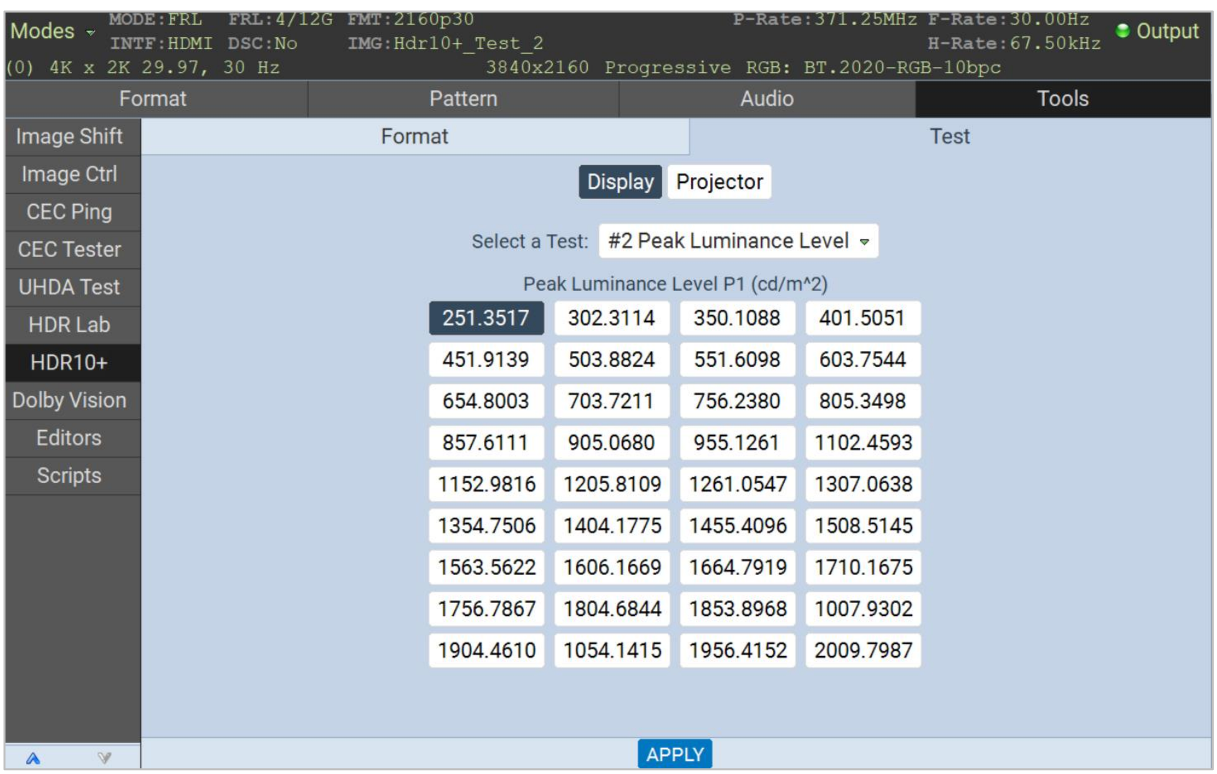
The HDR10+ Utility will appear, as shown below.



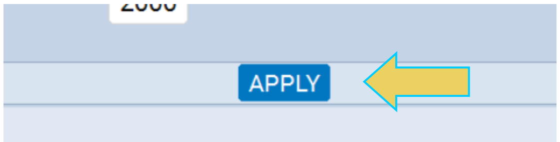
The **Format** tab will be shown, and here you can configure the frame rate and color space for the generated 4k video in accordance with your testing specifications. In the example below, YCbCr 4:4:4 30 Hz has been selected.

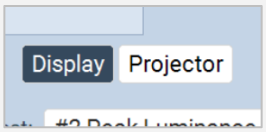


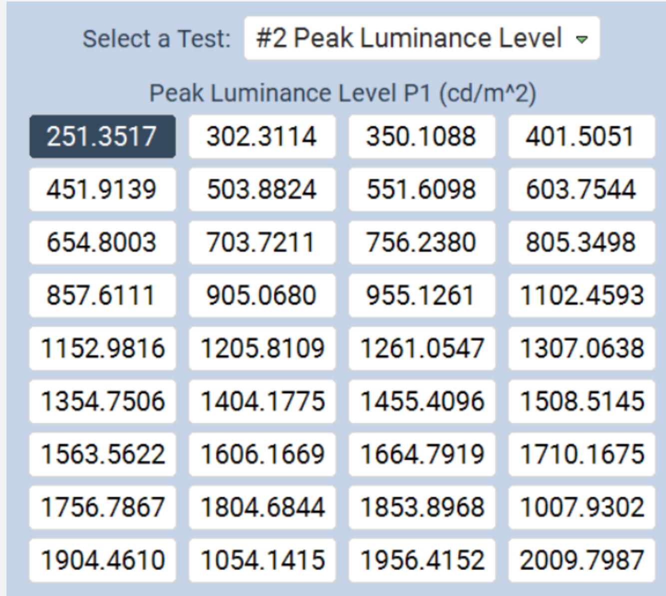
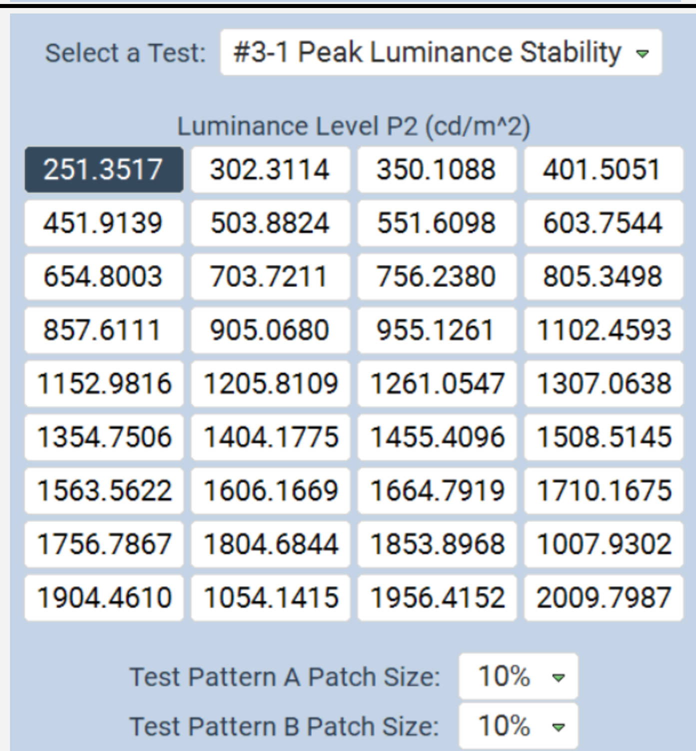
Next, click the **Test** tab at the top right for all available testing options.

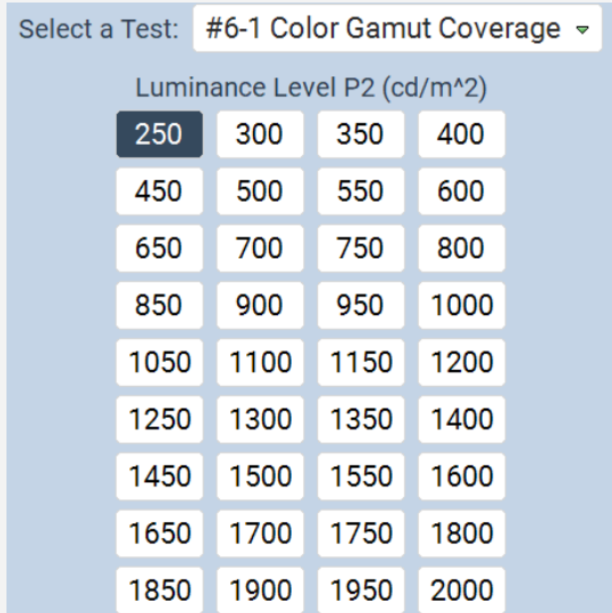
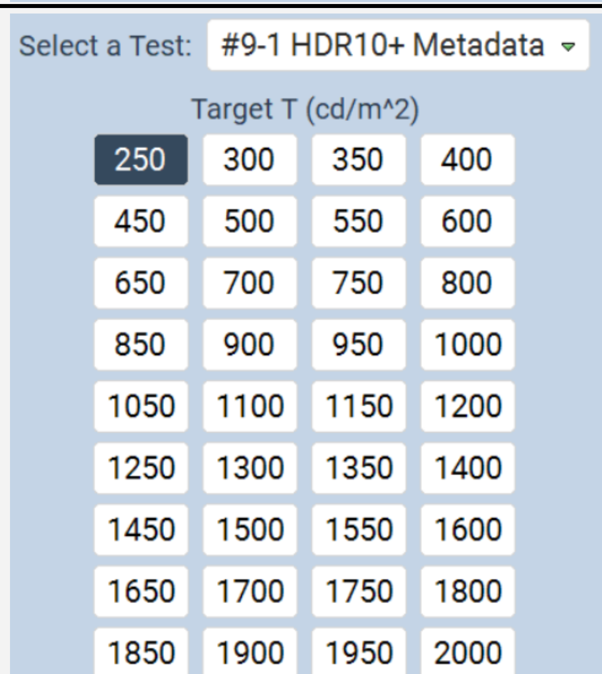


The following table describes the options featured within the **Test** window. Once the desired test and testing options are selected, click **APPLY** at the bottom of the window to begin HDR10+ testing.

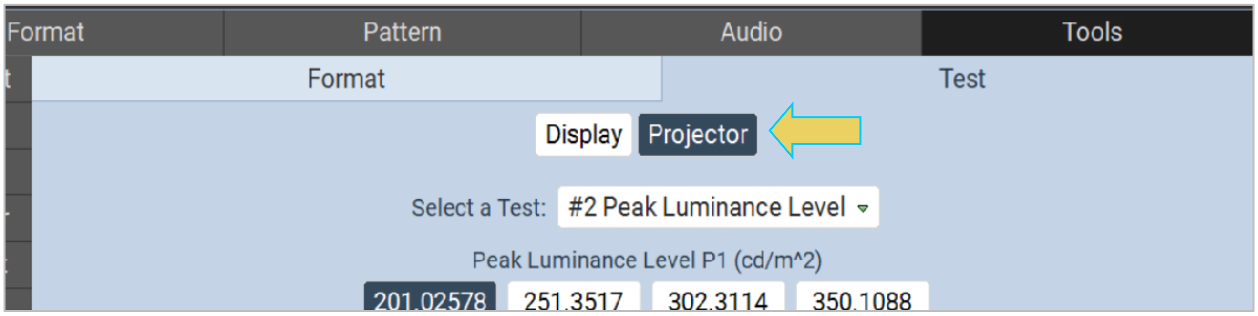


Feature	Description
Display/Projector 	Select the type of sink to be tested. Options vary based on the selection. Testing a projector is covered at the end of this subsection.
Select a Test 	Select the desired test. Available tests are as follows: • **#2 Peak Luminance Level** • **#3-1 Peak Luminance Stability** • **#3-2 Peak Luminance Stability** • **#4 Transfer Curve** • **#6-1 Color Gamut Coverage** • **#6-2 Color Gamut Coverage** • **#8 Target Peak Luminance Measurement** • **#9-1 HDR10+ Metadata** • **#9-2 HDR10+ Metadata** • **#10 Bypass** • **#11 Clipping** • **#12 Monotonic Increase** • **#13 Shadow Preservation**

Test/Options	**Available Testing Options**
Tests: • **#2 Peak Luminance Level** • **#3-2 Peak Luminance Stability** **Options:** • **Peak Luminance Level P1 (cd/m^2)**	
Test: • **#3-1 Peak Luminance Stability** **Options:** • **Peak Luminance Level P1 (cd/m^2)** • **Test Pattern A Patch Size** • **Test Pattern B Patch Size**	

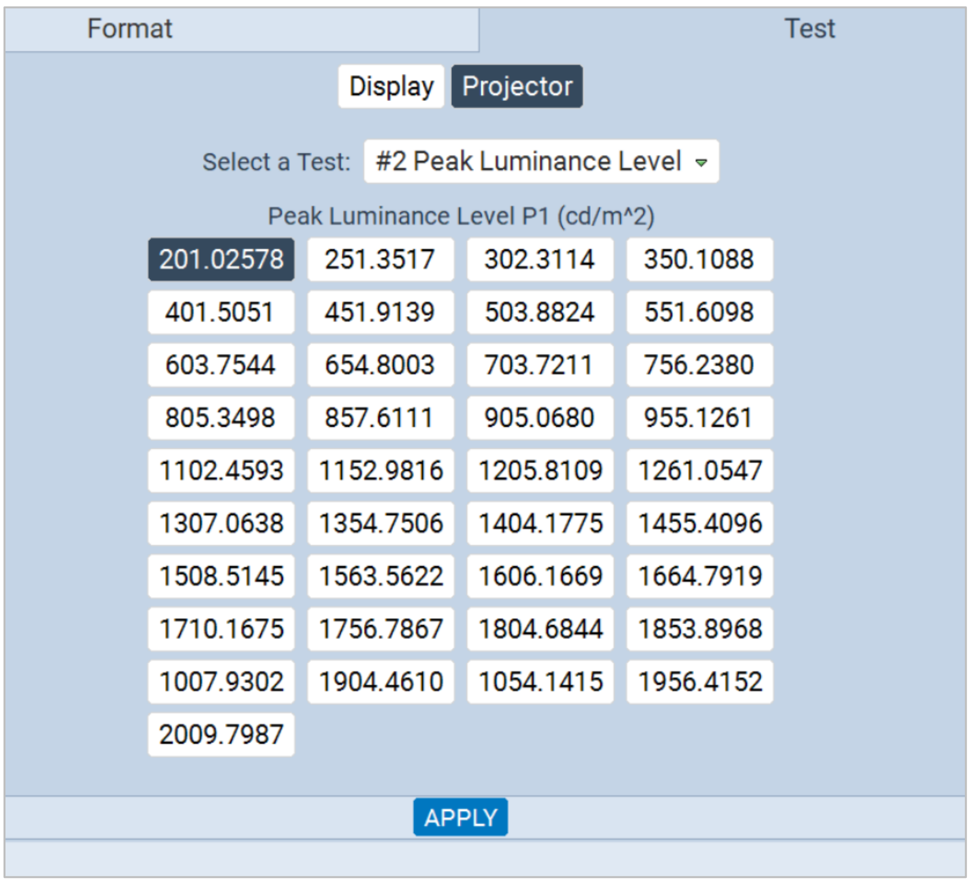
Test/Options	Available Testing Options
Tests: • **#6-1 Color Gamut Coverage** • **#6-2 Color Gamut Coverage** **Options:** • **Peak Luminance Level P2 (cd/m^2)**	
Tests: • **#9-1 HDR10+ Metadata** • **#9-2 HDR10+ Metadata** **Options:** • **Target T (cd/m^2)**	
• **#4 Transfer Curve** • **#8 Target Peak Luminance Measurement** • **#10 Bypass** • **#11 Clipping** • **#12 Monotonic Increase** • **#13 Shadow Preservation**	No Configurable Options

The M42h also offers the ability to test projectors using the HDR10+ utility. Simply select the **Projector** option at the top of the **Test** window, as shown below.

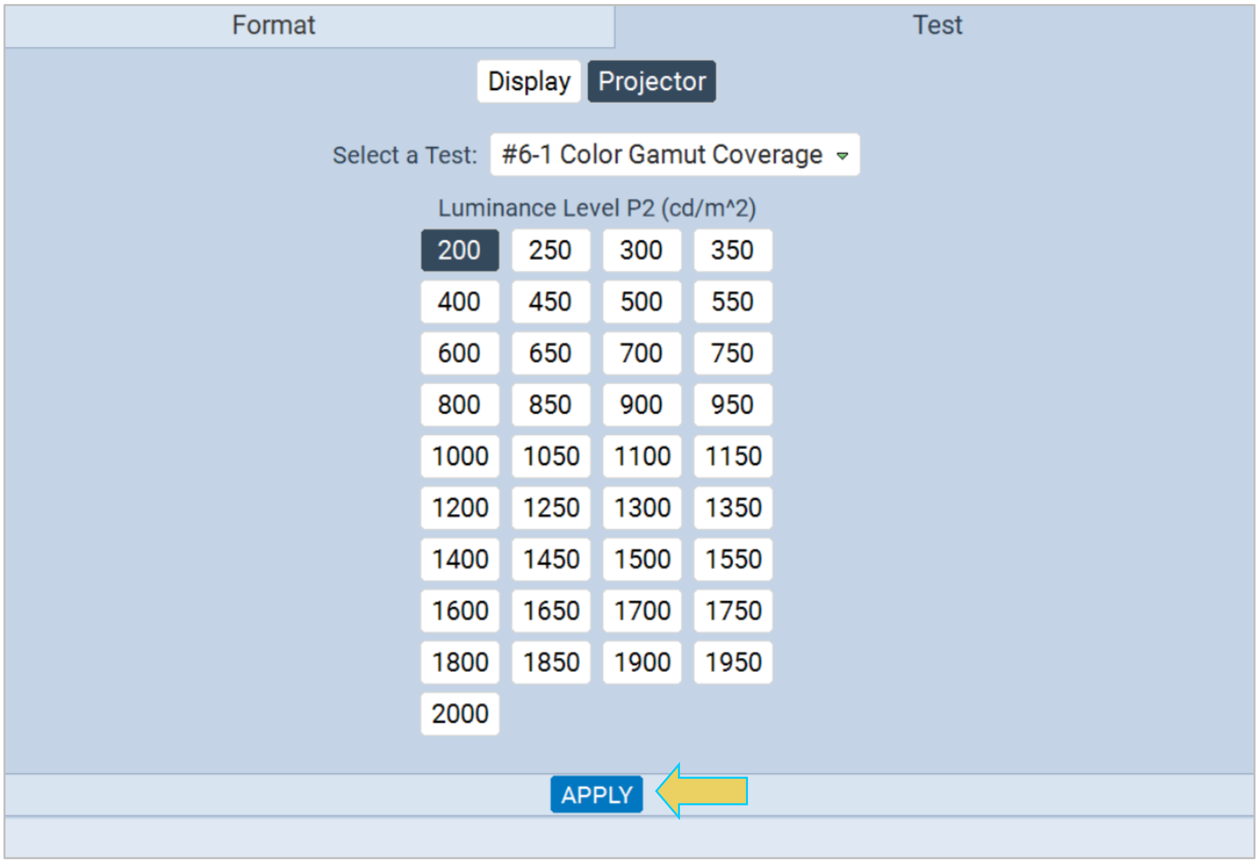


A few additional options are available to suit testing needs for a Projector, with examples below.

#2 Peak Luminance Level testing options for a projector:



#6-1 Color Gamut Coverage test for a projector:

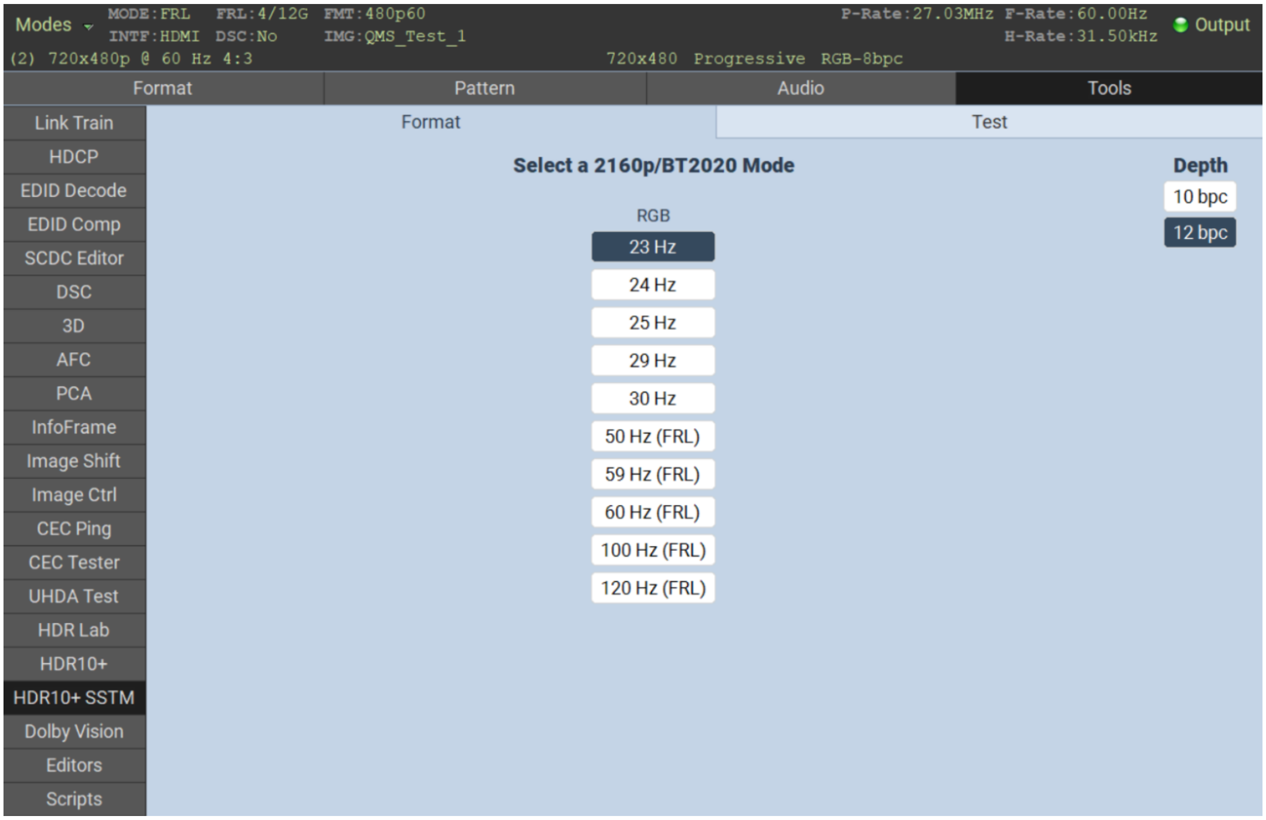


As with testing a display, select **APPLY** to begin testing the projector.

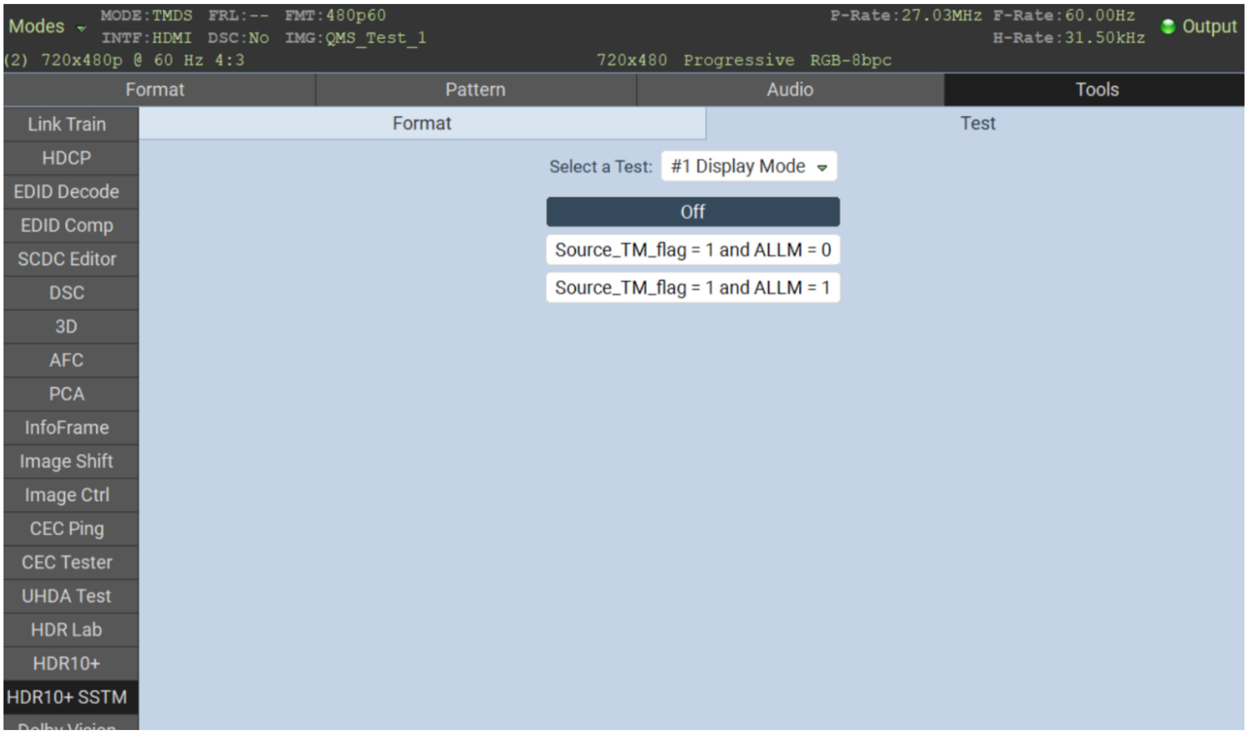
15.23 Testing SSTM of HDR10+ Capable Displays

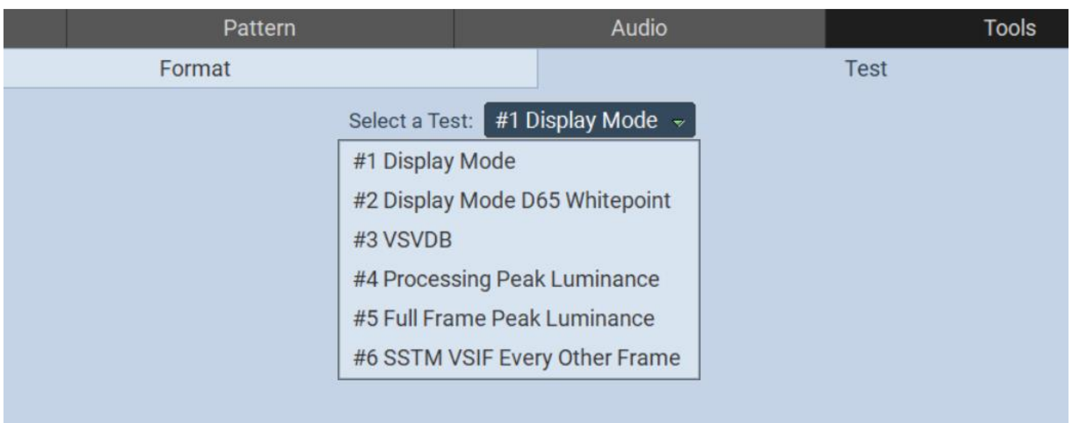
The M42h offers support for HDR10+ Source Side Tone Mapping (SSTM). Use the following procedure to test HDR10+ SSTM in a capable sink display.

1. Access the utility via the **Tools** tab within the 96G HDMI Generator, as shown below.



2. Select the format (as shown in the above screen), and select a test, as demonstrated on the screens below.





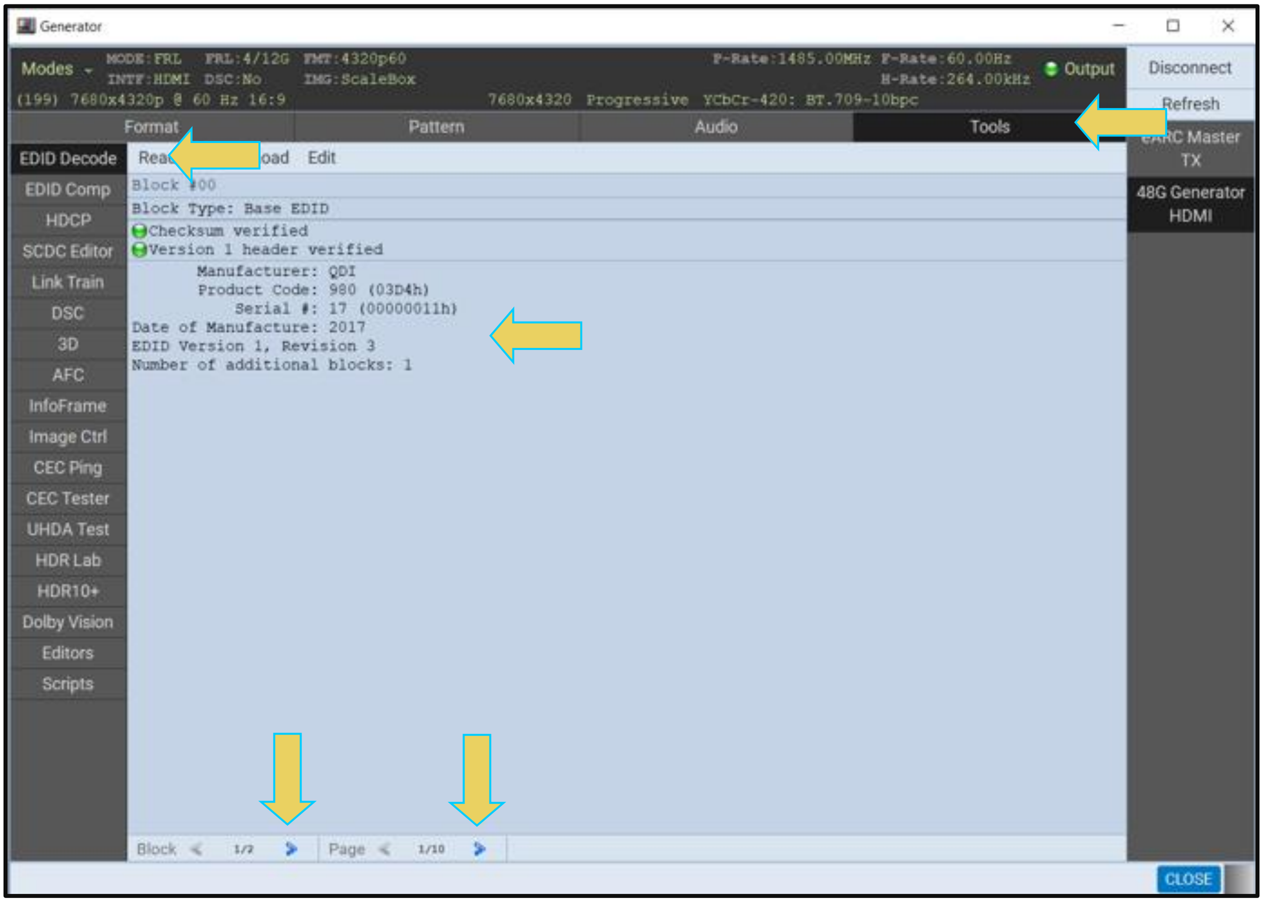
15.24 Viewing the EDID of a connected display

Use the following procedures to view the EDID of the connected display. This procedure assumes that you have an HDTV or other sink device connected to the Tx port.

To view the EDID of a connected display:

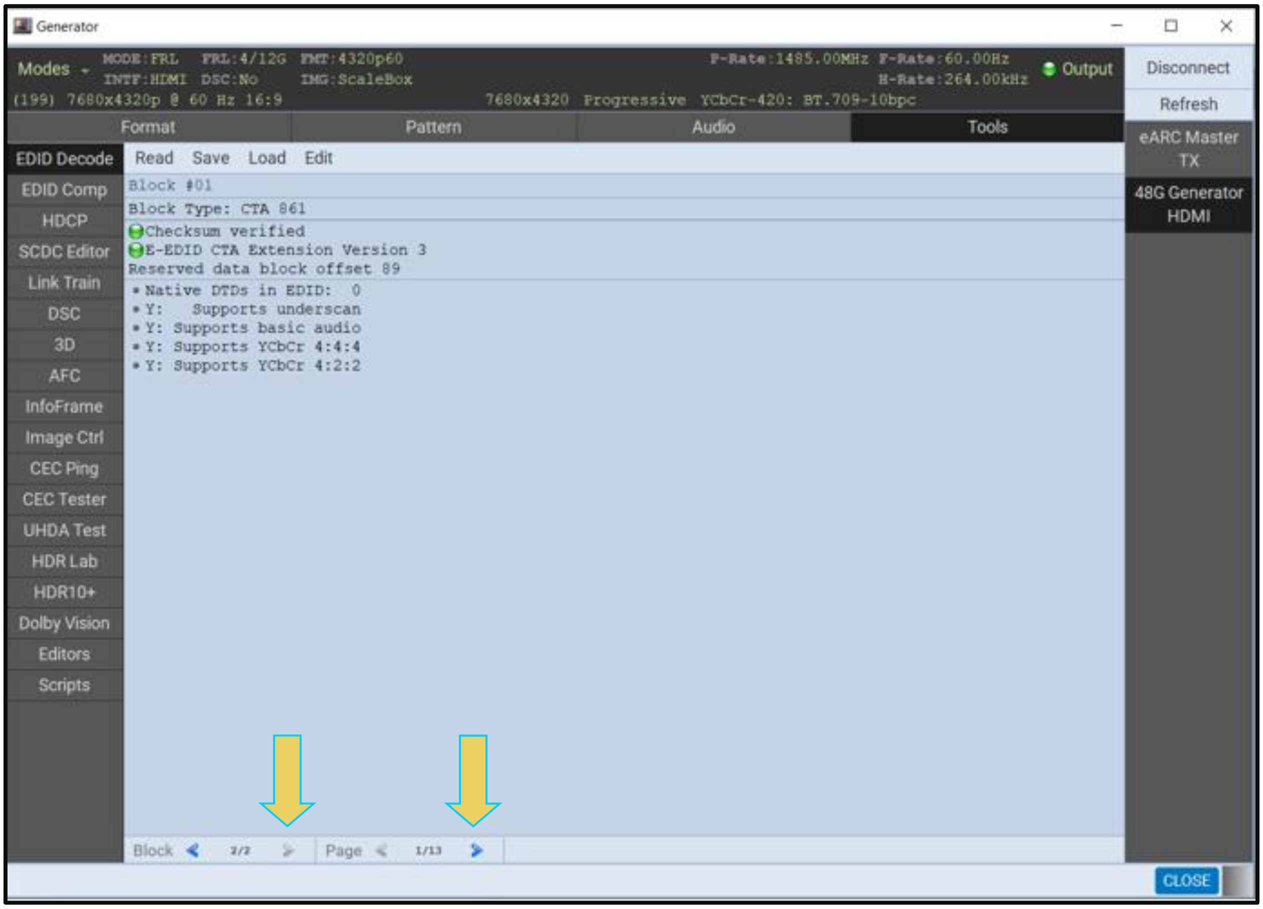
1. From the main window of the M42h 96G Video Analyzer/Generator, select the Tools tab.
2. Activate the **EDID Decode** button on the upper left (indicated below).

Contents of the initial data in the first block of the EDID will be displayed (below).

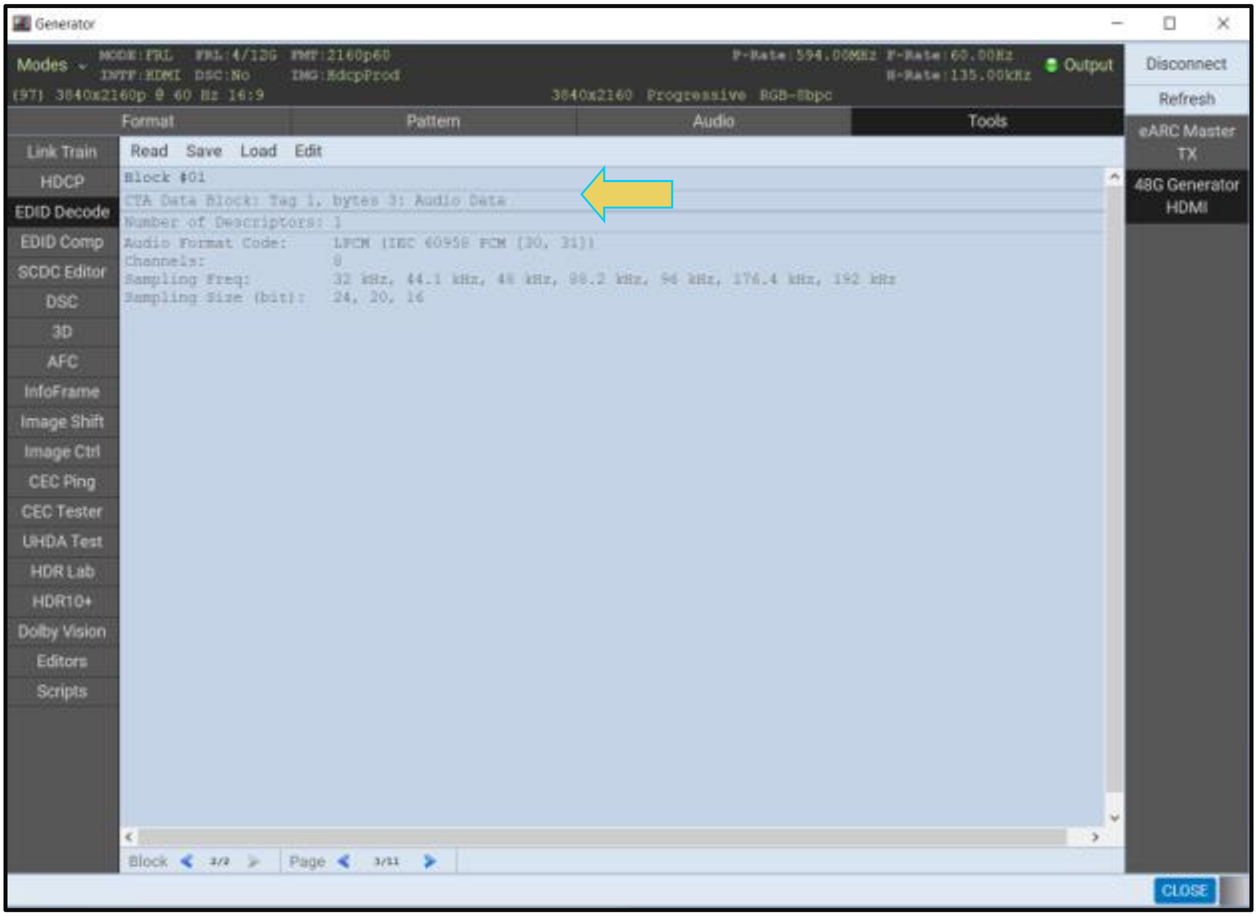


Navigate through the blocks and pages of the EDID using the arrow buttons on the lower panel (indicated above).

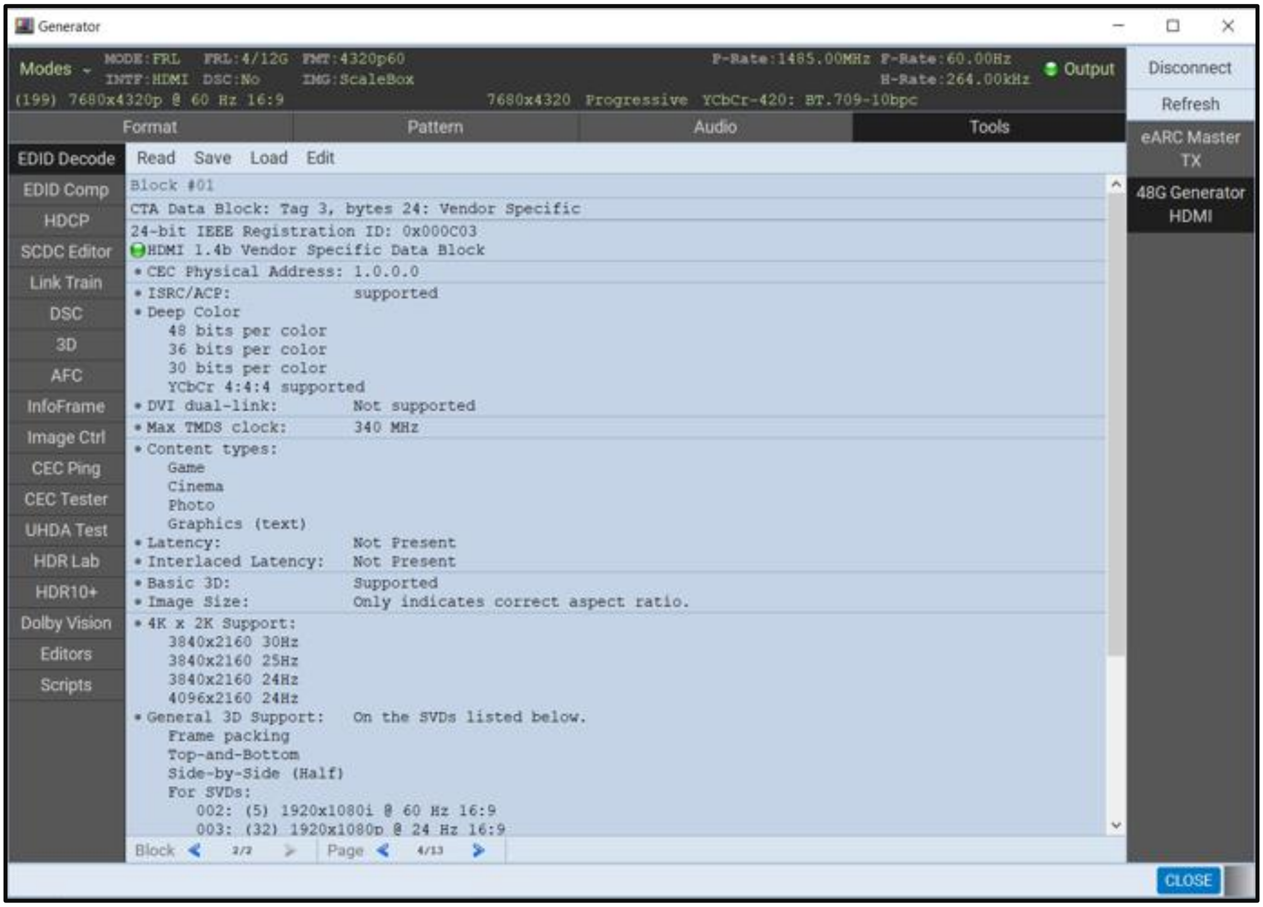
Examples of the **EDID Decode** content are shown in the following screens.



The CEA Audio Block is shown below.



The CEA Vendor Specific Data Block is shown below.

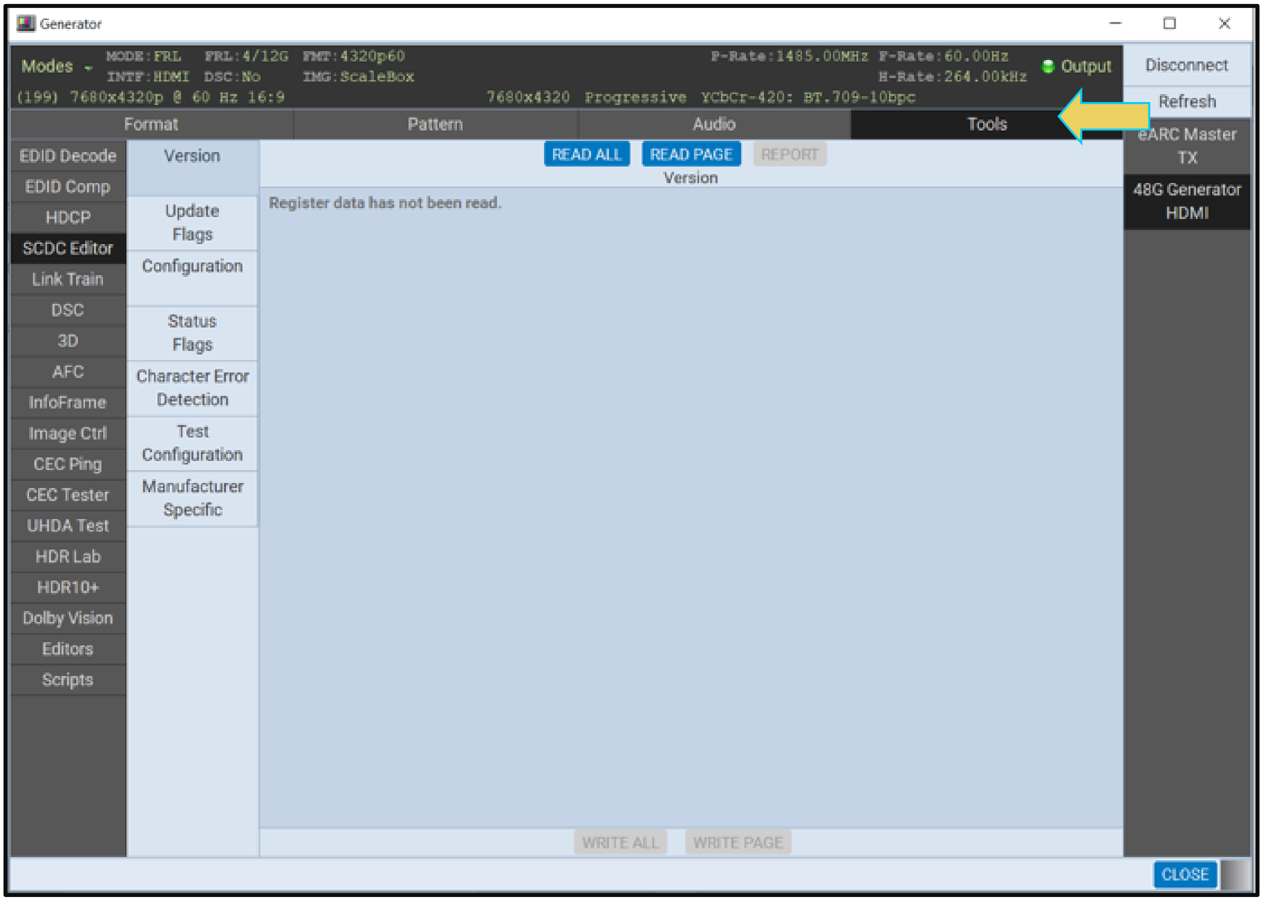


15.25 Viewing the SCDC register contents of a connected display

Use the following procedures to view the SCDC register contents of the connected display. These procedures assume that you have connected the HDMI 2.1 HDTV to these Tx port.

To view the SCDC register contents of a connected display:

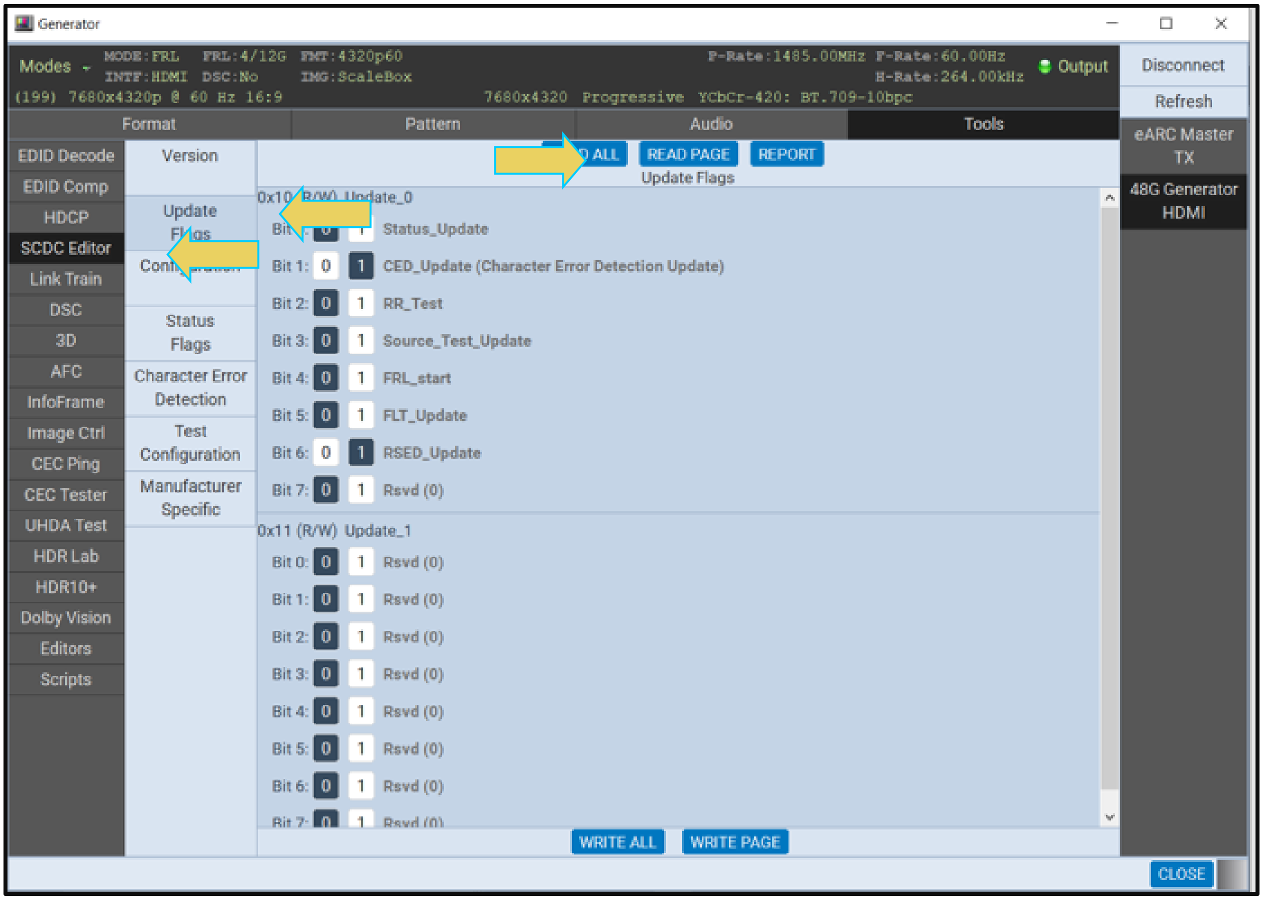
1. From the main window of the M42h 96G Video Analyzer/Generator, select the **Tools** tab.



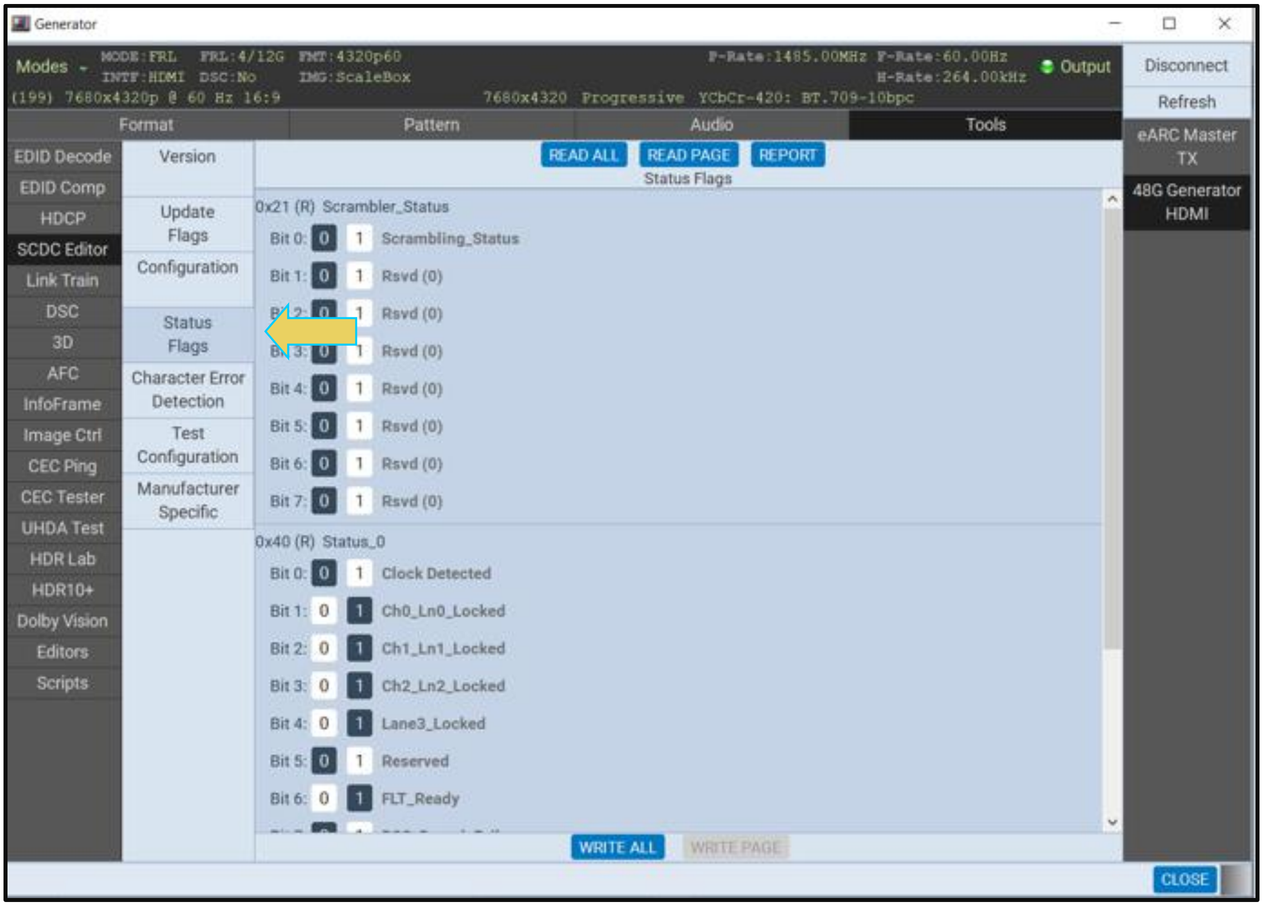
Make sure the M42h 96G Video Analyzer/Generator is selected.

2. Activate the **SCDC Editor** button on the upper left (indicated below).
3. Select a register set to view (example Update Flags)
4. Select Read All or Read Page.

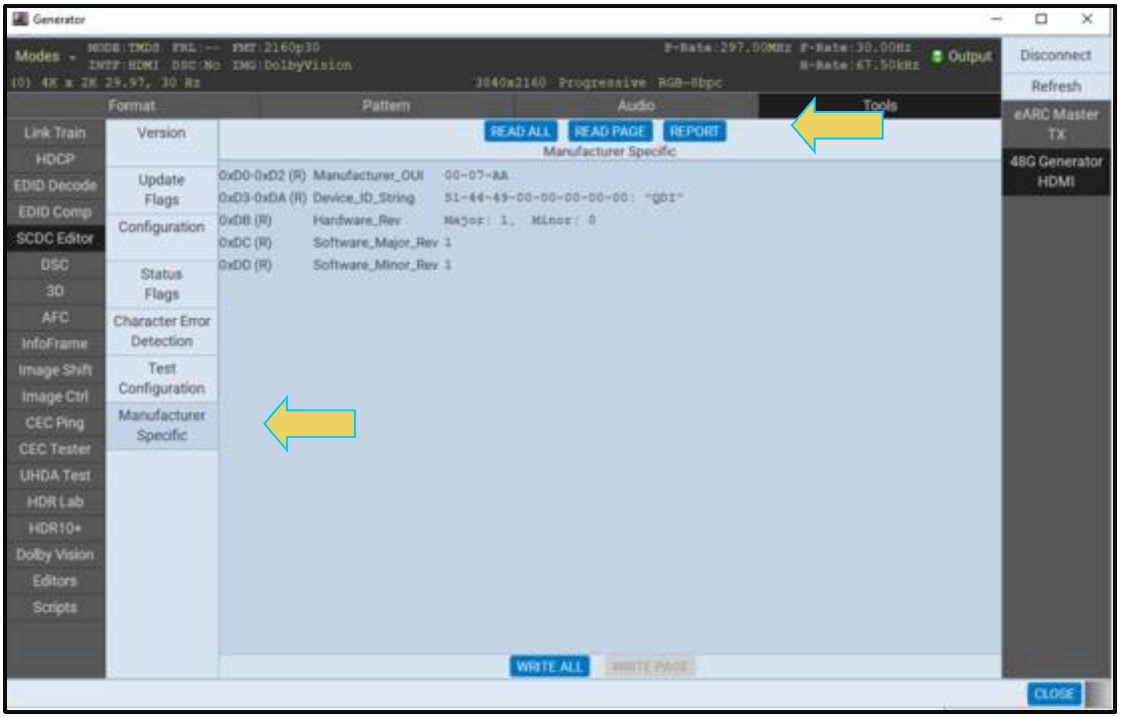
The following screen example shows the SCDC Update Flags. (No data is shown in the following screen example.)



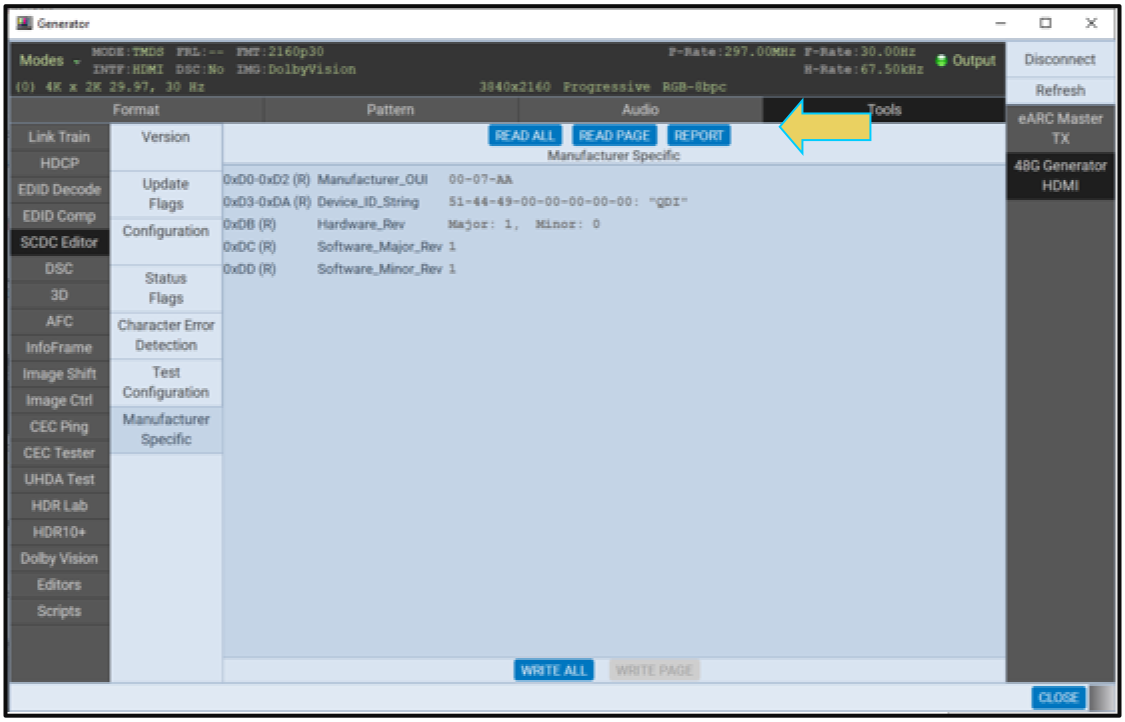
The following screen example shows the SCDC Status Flags. (No data is shown in the following screen example.)



The following screen example shows the SCDC Manufacturing Specific data.



5. (Optionally) issue an HTML report with the Report activation button as shown below.



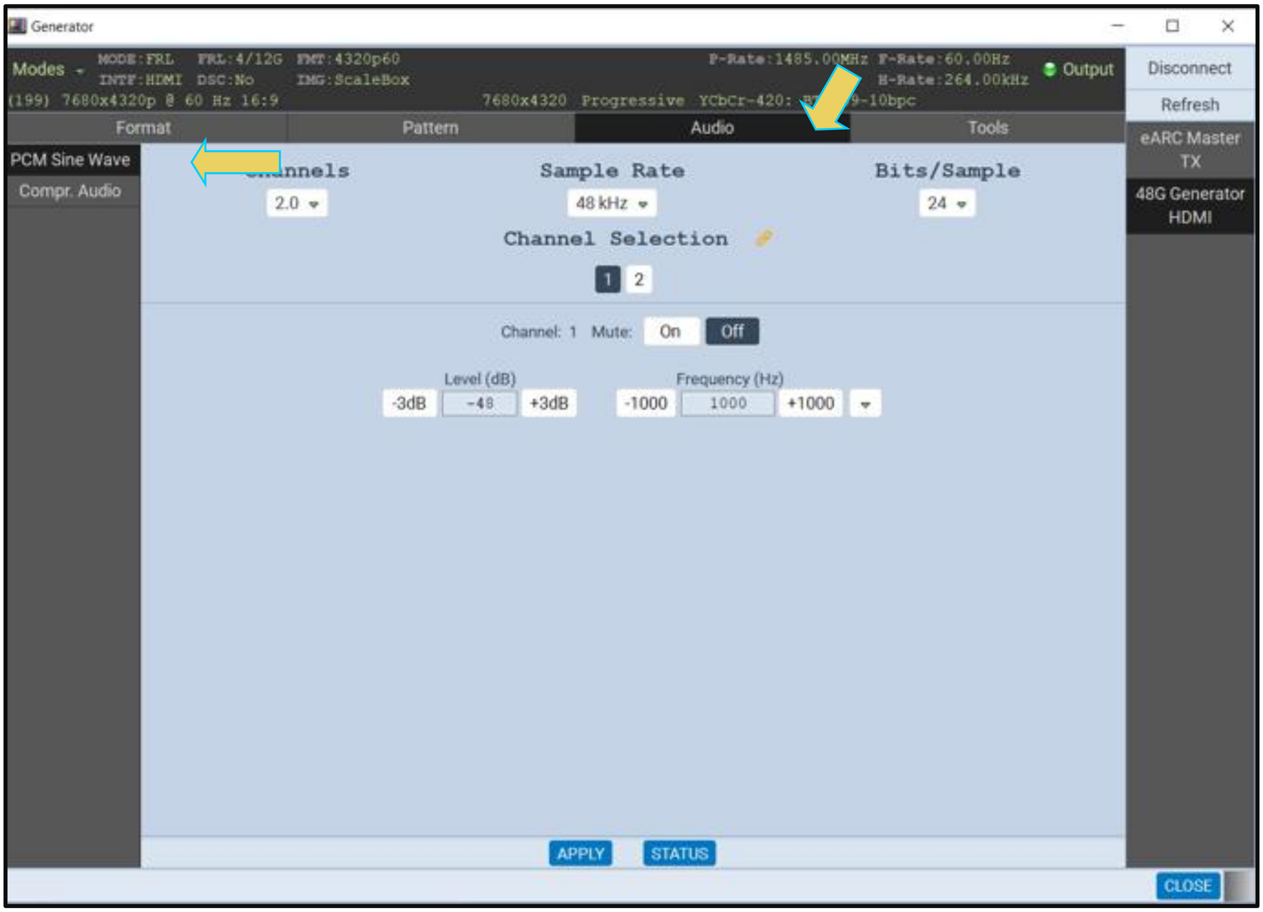
15.26 Selecting audio formats

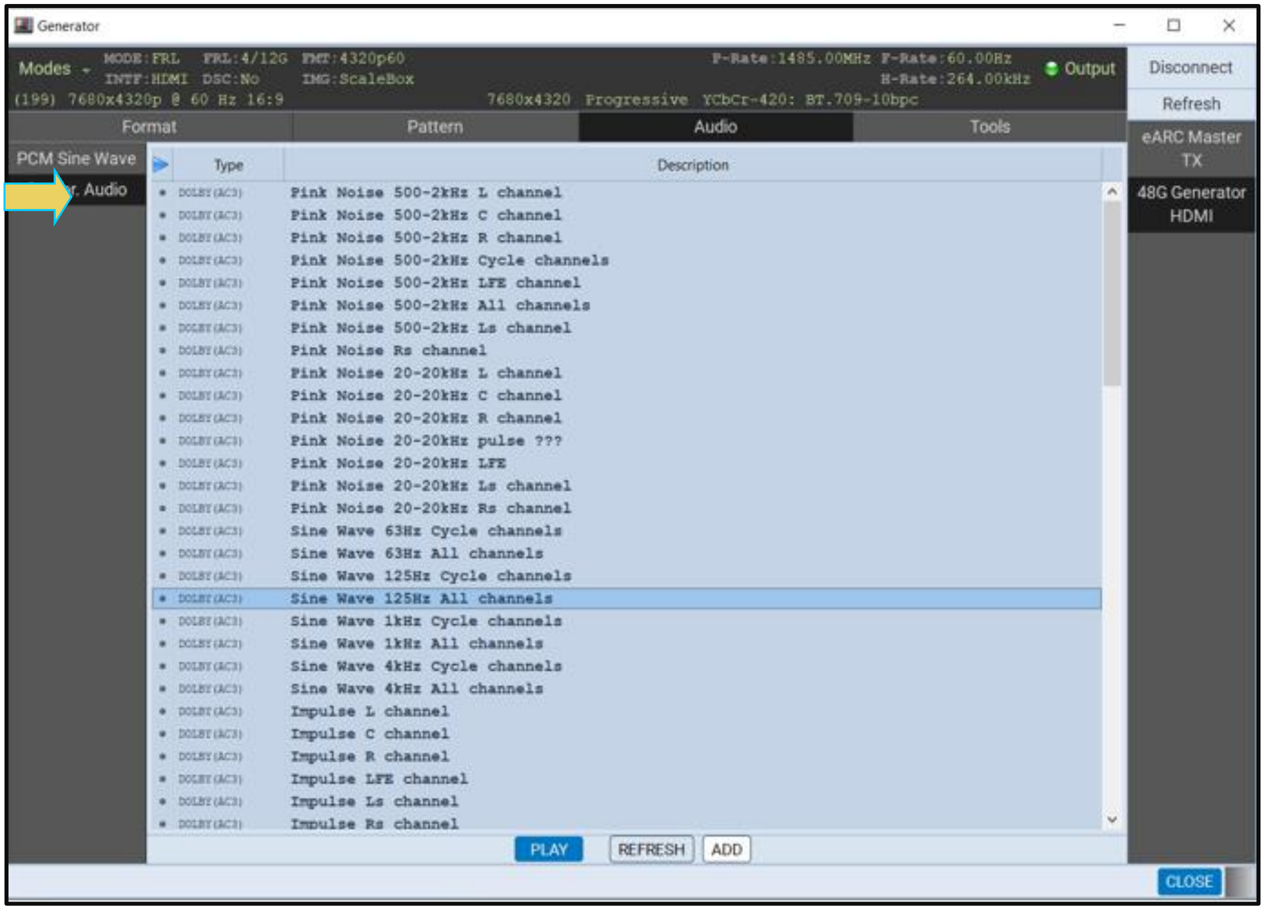
Use the following procedures to select HDMI formats.

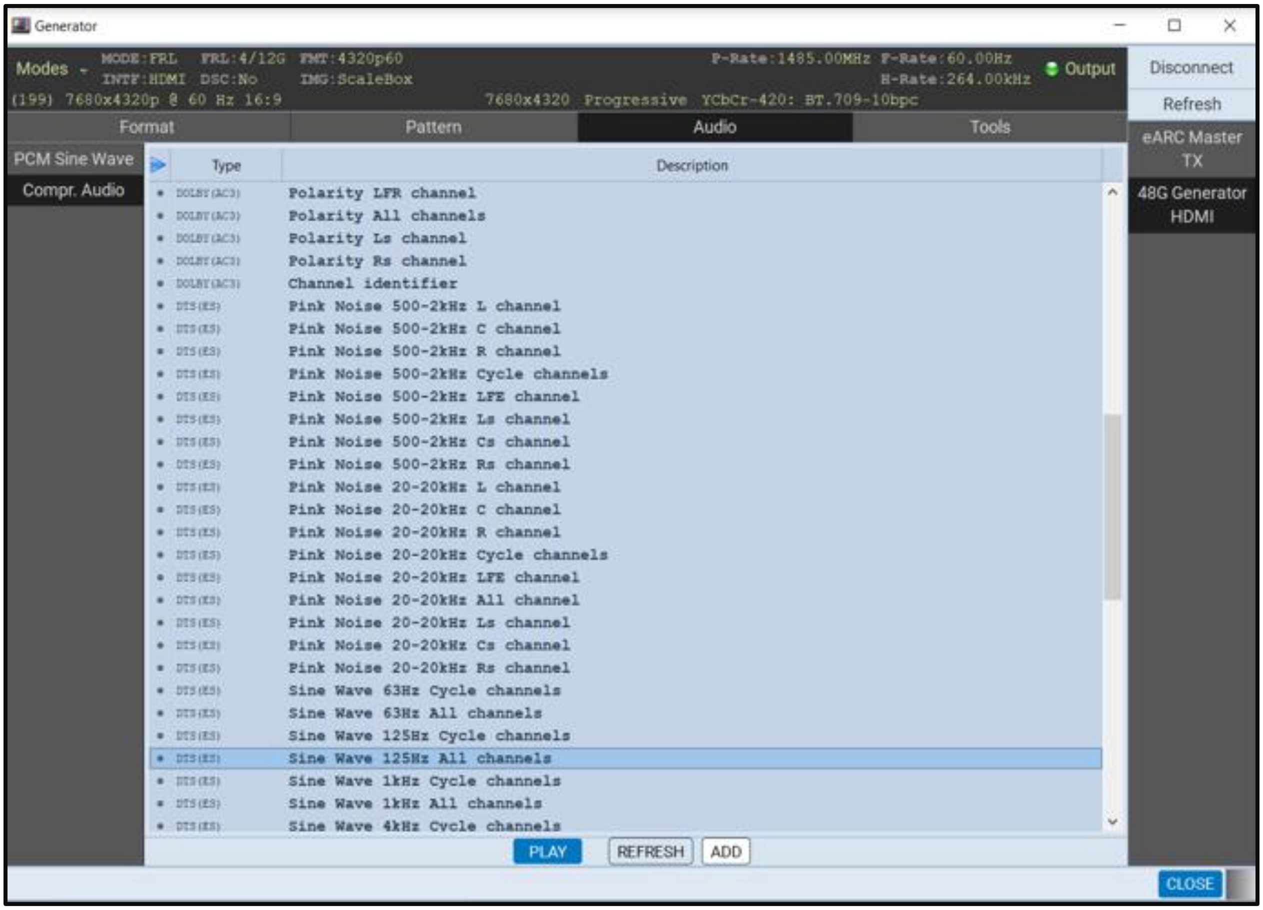
To select an audio format:

1. From the main window of the M42h 96G Video Analyzer/Generator, select the **Audio** tab indicated below.

The following example shows LPCM selection. The second slide shows selection of compressed audio formats.




Generator
Modes
MODE:FRL FRL:4/12G FMT:4320p60
INTF:HDMI DSC:No IMG:ScaleBox
(199) 7680x4320p @ 60 Hz 16:9
P-Rate:1485.00MHz F-Rate:60.00Hz
H-Rate:264.00kHz
7680x4320 Progressive YCbCr-420: BT.709-10bpc
Output
Disconnect
Refresh
Format
Pattern
Audio
Tools
eARC Master TX
48G Generator HDMI
PCM Sine Wave
Type
Description
Pink Noise 500-2kHz L channel
Pink Noise 500-2kHz C channel
Pink Noise 500-2kHz R channel
Pink Noise 500-2kHz Cycle channels
Pink Noise 500-2kHz LFE channel
Pink Noise 500-2kHz All channels
Pink Noise 500-2kHz Ls channel
Pink Noise Rs channel
Pink Noise 20-20kHz L channel
Pink Noise 20-20kHz C channel
Pink Noise 20-20kHz R channel
Pink Noise 20-20kHz pulse ???
Pink Noise 20-20kHz LFE
Pink Noise 20-20kHz Ls channel
Pink Noise 20-20kHz Rs channel
Sine Wave 63Hz Cycle channels
Sine Wave 63Hz All channels
Sine Wave 125Hz Cycle channels
Sine Wave 125Hz All channels
Sine Wave 1kHz Cycle channels
Sine Wave 1kHz All channels
Sine Wave 4kHz Cycle channels
Sine Wave 4kHz All channels
Impulse L channel
Impulse C channel
Impulse R channel
Impulse LFE channel
Impulse Ls channel
Impulse Rs channel
PLAY
REFRESH
ADD
CLOSE



The table below summarizes the M42h 96G Video Analyzer/Generator uncompressed LPCM programmable audio test tones.

LPCM Programmable Sine Wave options		
Parameter	**Description**	**Options**
Channels	This is the number of channels in the audio sine wave test tone.	2.1 2.1 5.1 6.1 7.1
Sampling Rate	This is the sampling rate of the audio sine wave test tone.	32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz

LPCM Programmable Sine Wave options		
Parameter	**Description**	**Options**
Bits per Sample	This is the number of bits per channel of the audio sine wave test tone.	16 20 24
Channel Selection	Indicates the channels that are active. Also indicates the channel that is configured for the Level, Mute and Frequency Parameters.	FL – Front Left FR – Front Right LFE – Low Frequency Effects FC – Front Center RL – Rear Left RR – Rear Right RLC – Rear Left Center RRC – Rear Right Center
Level (dB)	This is the amplitude of the audio sine wave test tone.	Increments in 3dB throughout a range of – 0dB to -99dB (per channel).
Mute	Mutes or unmutes the audio for a particular channel.	On Off
Frequency (Hz)	The frequency of the audio sine wave test tone.	Programmable throughout a range of – -0.01kHz to 20kHz (per channel) in increments of: 1Hz 10Hz 100Hz 1kHz

15.26.1AV Mute Commands

The HDMI 96G Generator provides the option to configure the AVMUTE Flag via the command line, as well. The AV Mute Commands will immediately configure the 2 AVMUTE flags in the transmitted General Control Packet:

- **Clear AVMUTE flag**
- **Set AVMUTE flag**

For instructions on accessing the command line of the M42h, see the chapter in this user guide titled **Command Line Interface**

The following three commands can be used to configure the AVMute flags.

```
mute 0
```

This sets the flags to their default state:

- **Clear AVMUTE Flag = 1**
- **Set AVMUTE Flag = 0**

```
mute 1
```

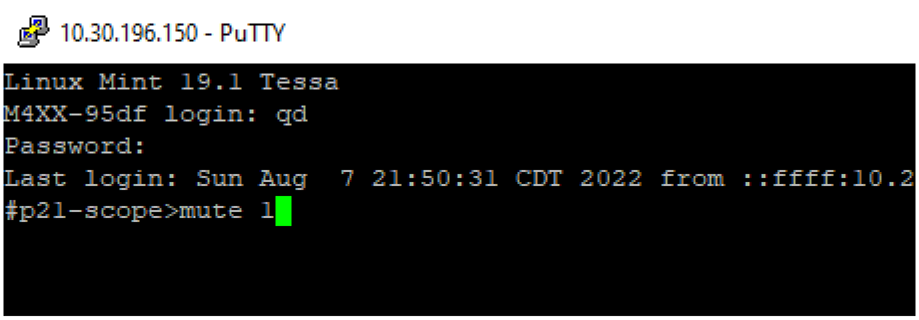
This sets the flags to muted state:

- **Clear AVMUTE Flag = 0**
- **Set AVMUTE Flag = 1**

```
mute 2
```

This clears the flags, leaving no AVMUTE information:

- **Clear AVMUTE Flag = 0**
- **Set AVMUTE Flag = 0**



Command to set AVMUTE flags to muted state

15.27 Testing HDCP 2.2 on a connected display

Use the following procedures to test HDCP authentication on a connected display. HDCP 2.2 is tested using a special test image called HDCP2.2. This test images are selectable through the **Pattern** tab.

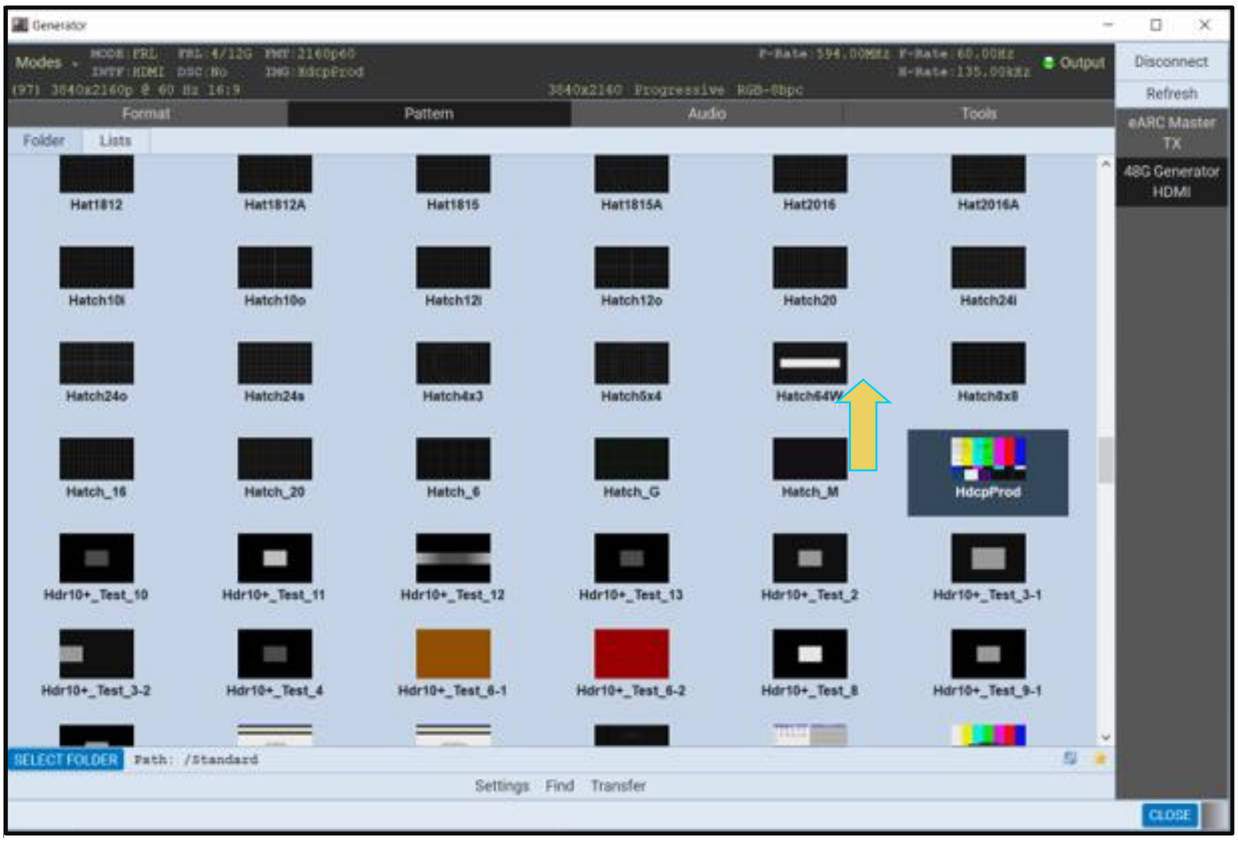
Note that you can view the HDCP 2.2 authentication transations using the Auxiliary Channel Analyzer (ACA) utility. Please refer to Auxiliary Channel Analyzer (ACA) for more details.

15.27.1Running the HDCP 2.2 test

You can enable HDCP 2.2 in one of two ways: 1) Using the HDCP2.2 test image and 2) Using the Tx Control dialog box. Use the procedures below to run an HDCP 2.2 test on a connected display.

To test HDCP on a connected display (HDCP2.2 Test Image):

1. Access the **Pattern** tab to view the test patterns.



Select the HDCP2.2 test image (above).

A typical result is shown below.

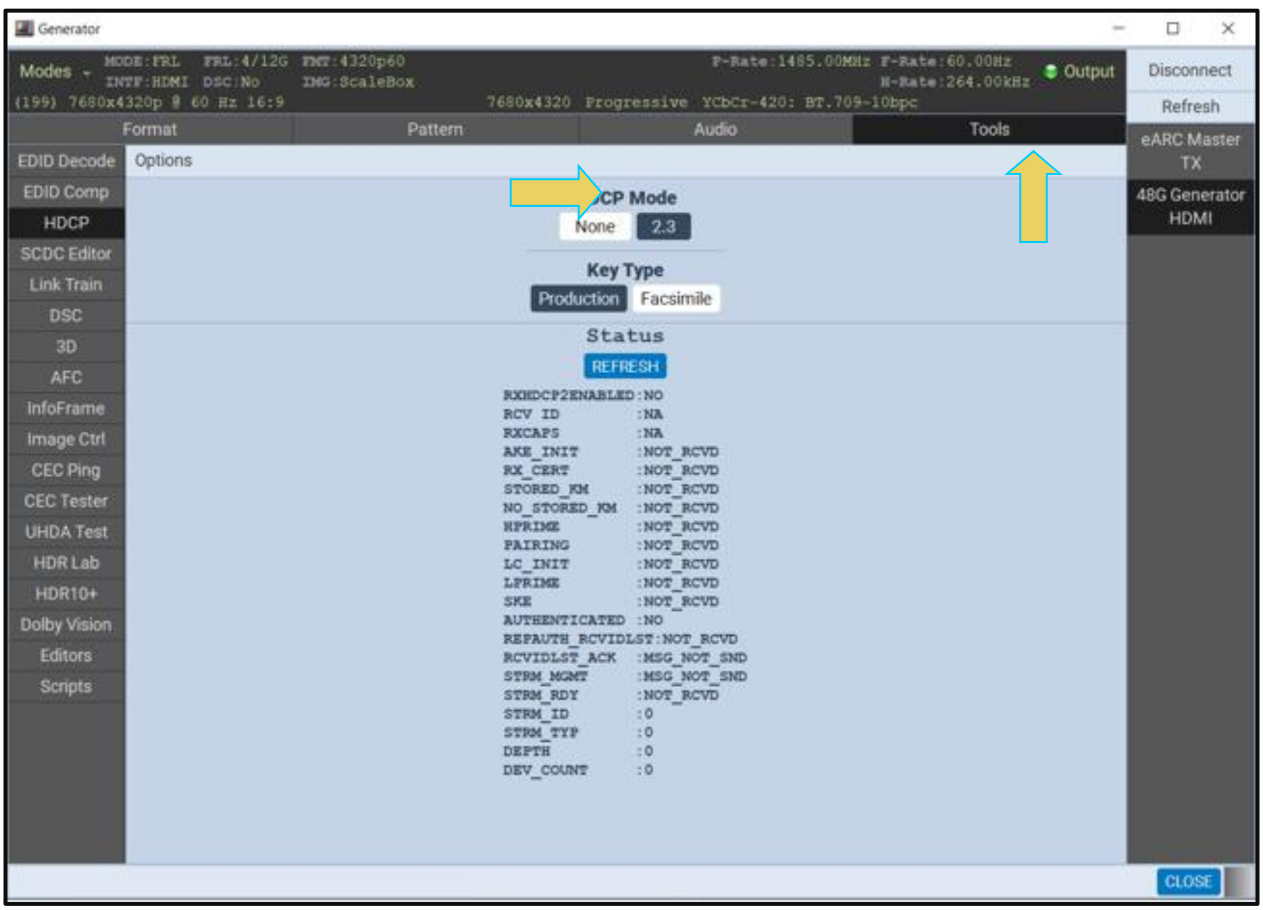
Note that you can view the HDCP 2.2 authentication transations using the Auxiliary Channel Analyzer (ACA) utility. Please refer to Auxiliary Channel Analyzer (ACA) for more details.

To test HDCP on a connected display (HDCP Tx Control Dialog Box):

1. From the **View** menu, select the **Generator** item.

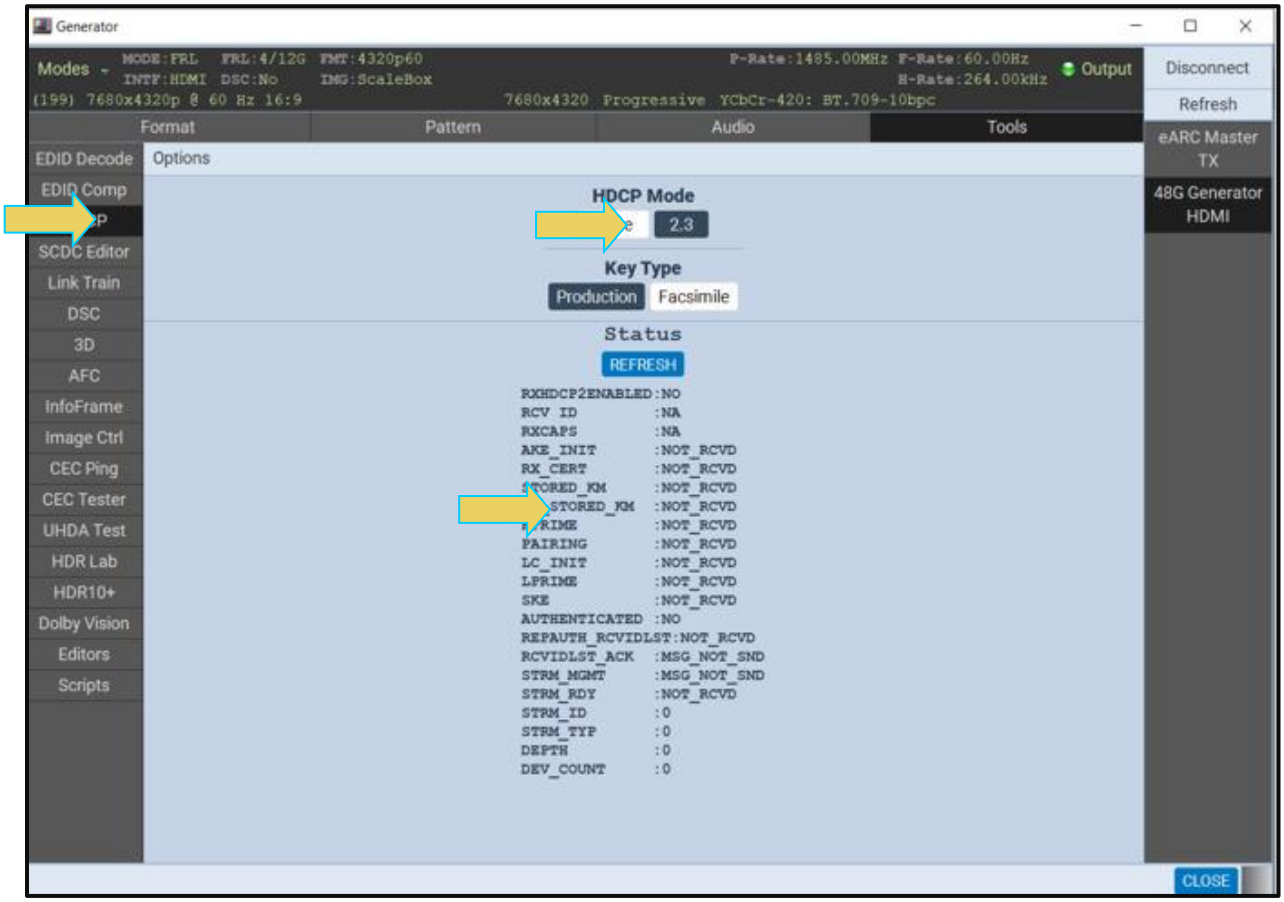
The **Generator** panel will be populated as shown below.

2. Select the **Tools** tab (indicated below).



3. Select the **HDCP** button (indicated below).
4. Enable HDCP 2.2 using the radio button as indicated on the screen examples below.

The status is shown in the center portion of the panel. Hit the refresh button when any changes are made to refresh the view.



Note that you can view the HDCP 2.3 authentication transations using the Auxiliary Channel Analyzer (ACA) utility. Please refer to Auxiliary Channel Analyzer (ACA) for more details.

15.28 Configuring and Transmitting Custom Metadata Values with the InfoFrame Utility

Use the following procedures to configure and transmit custom metadata over the HDMI interface. You can use the InfoFrame Utility to configure and disable/enable the transmission of the following types of metadata:

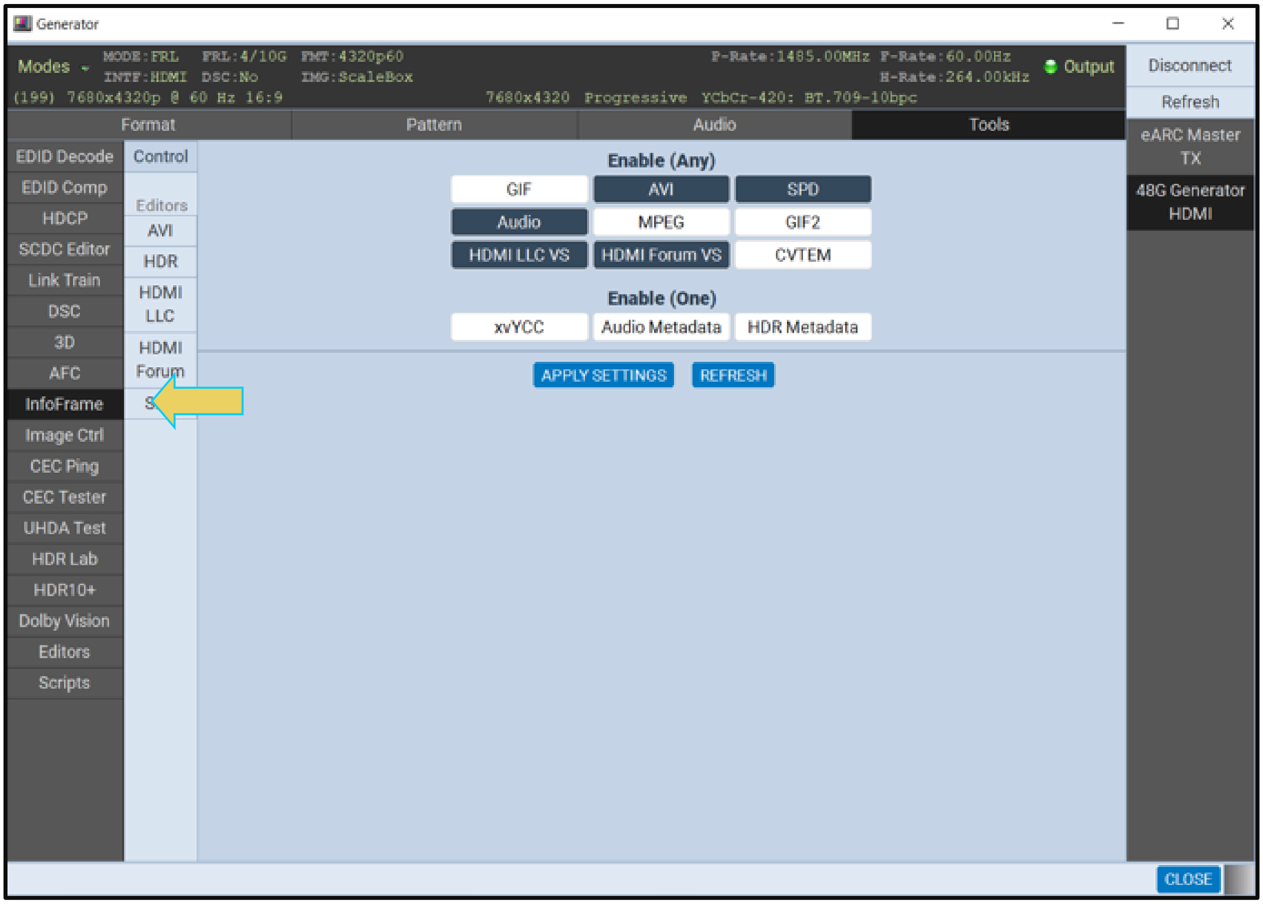
Auxiliary Video InfoFrame (AVI) – Enable or disable transmission and configure custom values.
Audio InfoFrame – Enable or disable transmission of this InfoFrame.
Source Product Descriptor (SPD) – Enable or disable transmission of this InfoFrame.
Vendor Specific InfoFrame (VSIF) – Enable or disable transmission and configure custom values.
HDMI 2.1 Forum Vendor Specific InfoFrame (HF-VSIF) – Enable or disable transmission and configure custom values.
MPEG – Enable or disable transmission of this InfoFrame.
GIF – Enable or disable transmission of this InfoFrame.
GIF2 – Enable or disable transmission of this InfoFrame.
Gamut Metadata Packet (xvYCC) – Enable or disable transmission of this data island.
High Dynamic Range (HDR) – Enable or disable transmission and configure custom values.
Audio Metadata – Enable or disable transmission of this metadata for 3D audio and multi-stream audio.

15.28.1 Configuring Metadata for Transmission

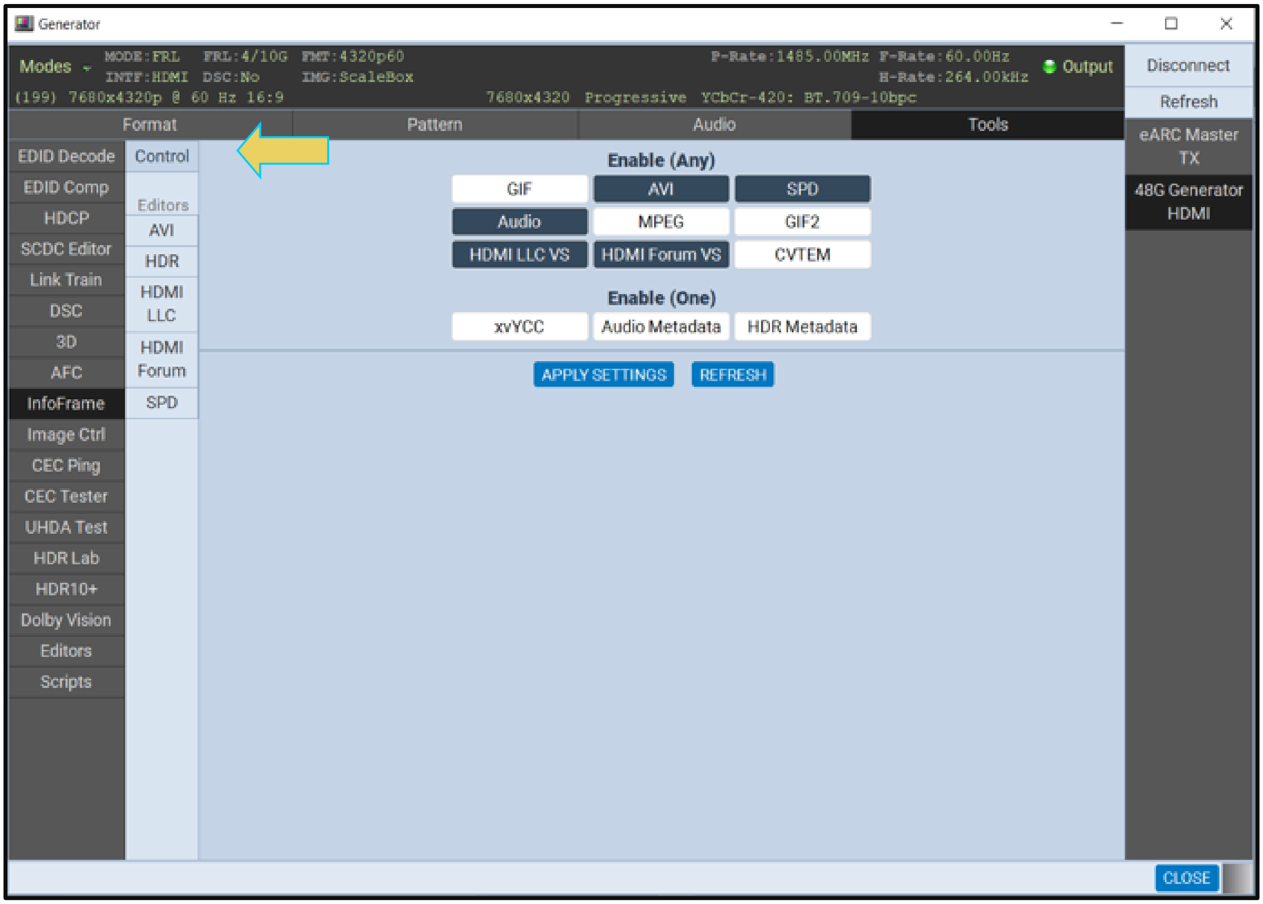
Use the procedures below to enable/disable the transmission of metadata and configure custom metadata values.

To enable/disable transmission of specific metadata types:

1. Access **InfoFrame** Utility from the **Tools** tab (below).



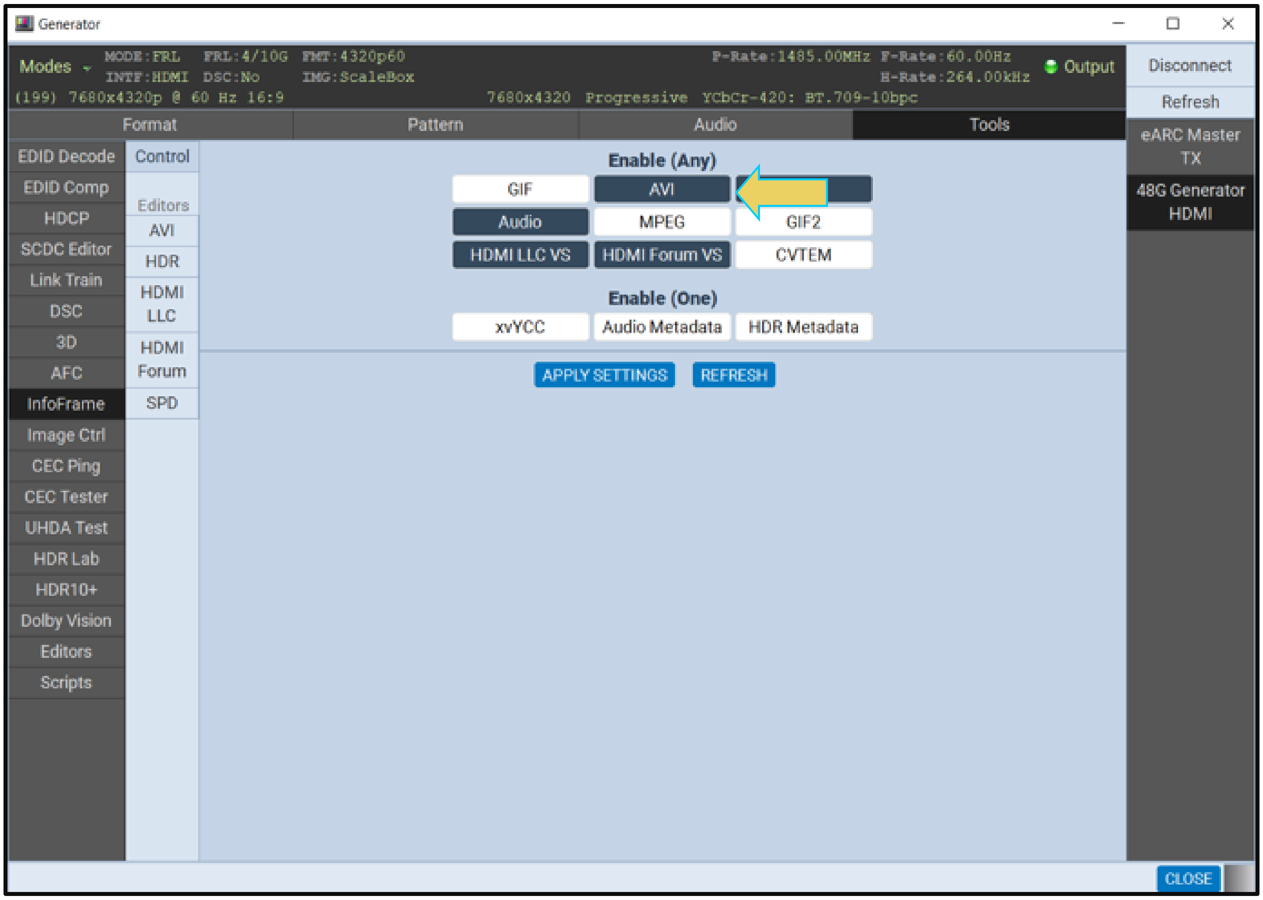
2. Select the **Control** button on the left side as indicated below.



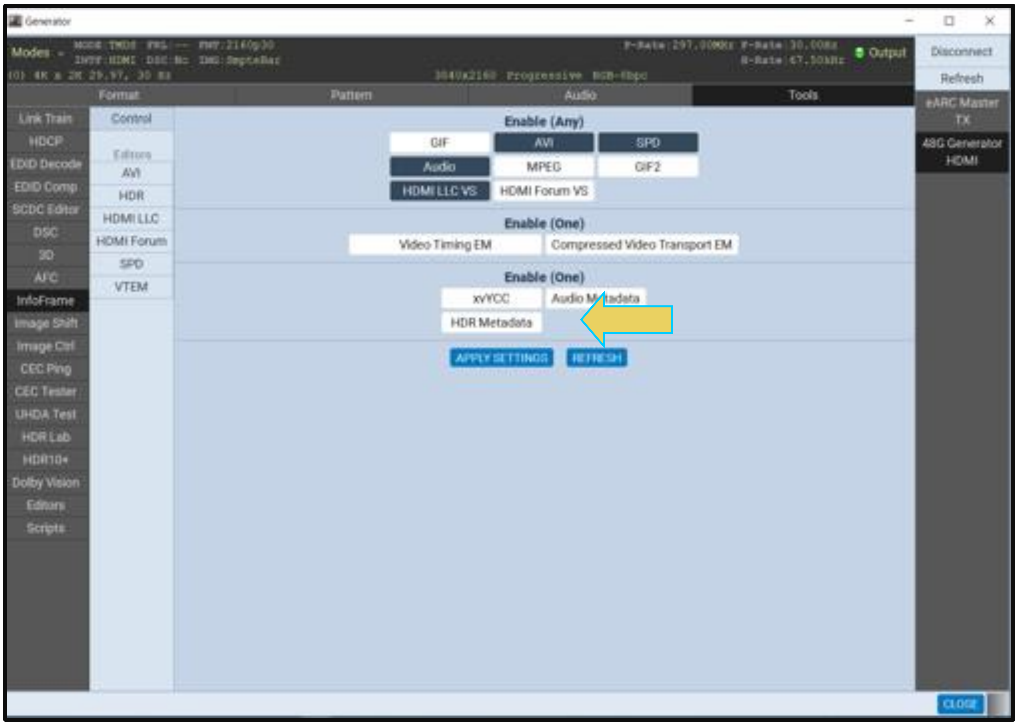
3. Select the metadata types that you wish to enable or disable using the check boxes under the **Enable (Any)** area of the **InfoFrame** Utility window.
4. Click on the **Apply Settings** activation button APPLY SETTINGS to initiate the change.

Note: The **Refresh** button REFRESH reasserts the default state with all applicable metadata transmitted.

The example below shows a configuration where AVI, HDMI LLC VSIF and SPD metadata are enabled for transmission but Audio InfoFrames are not transmitted.



You can specifically enable only a single type of metadata for a particular set of types under the **Enable (One)** area. The **Enable One** operates as a one or none case. If you select one type, for example HDR Metadata (below), transmits and the other two types (xvYCC and Audio Metadata) will not.

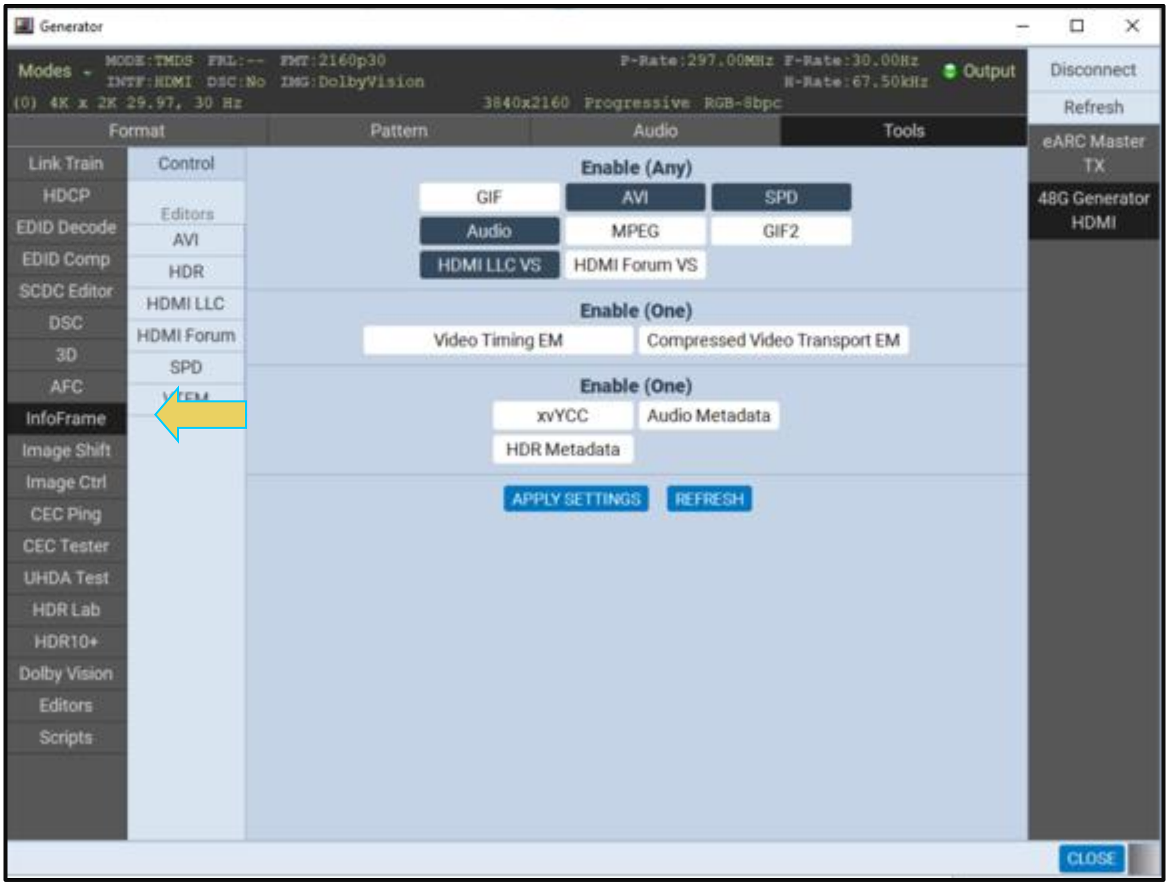


5. Click on the **Apply Settings** activation button APPLY SETTINGS to initiate the change.

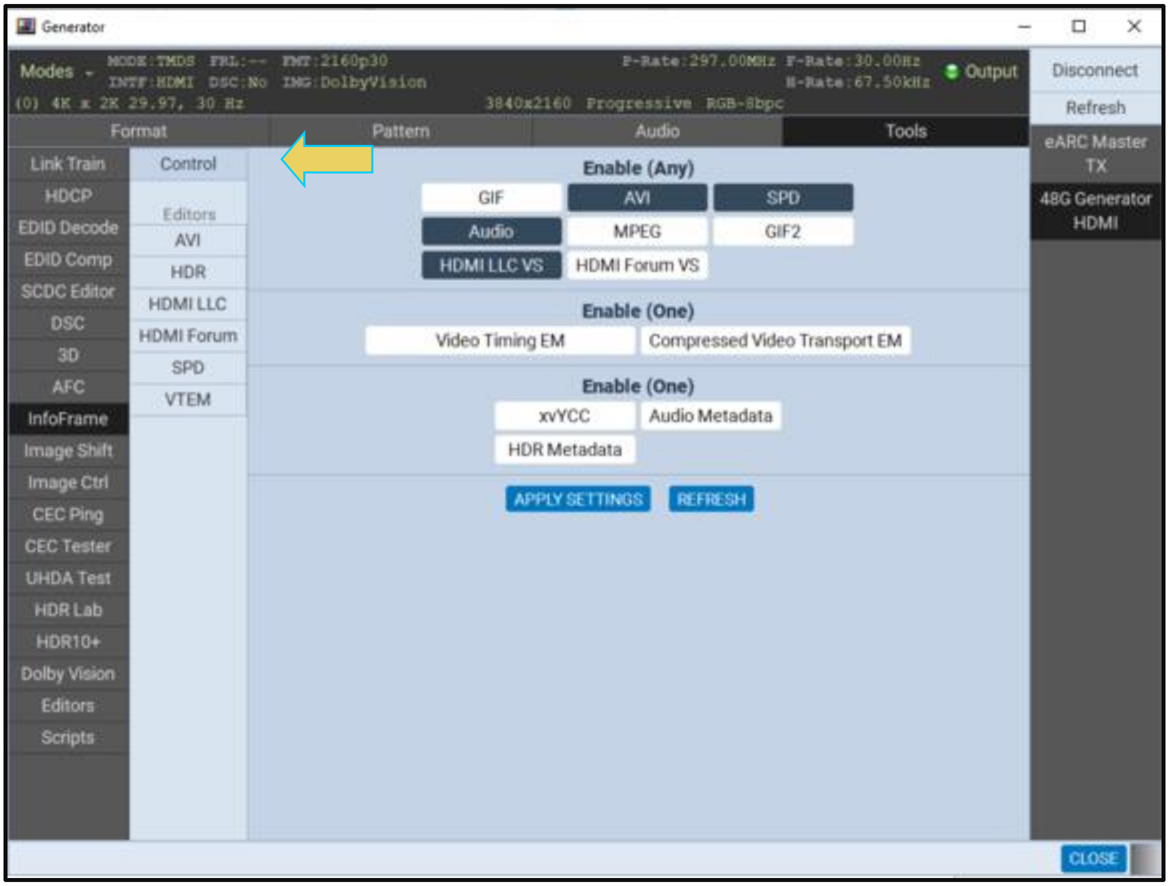
Note: The **Refresh** button REFRESH reasserts the default state with all applicable metadata transmitted.

To configure InfoFrame and metadata parameter values:

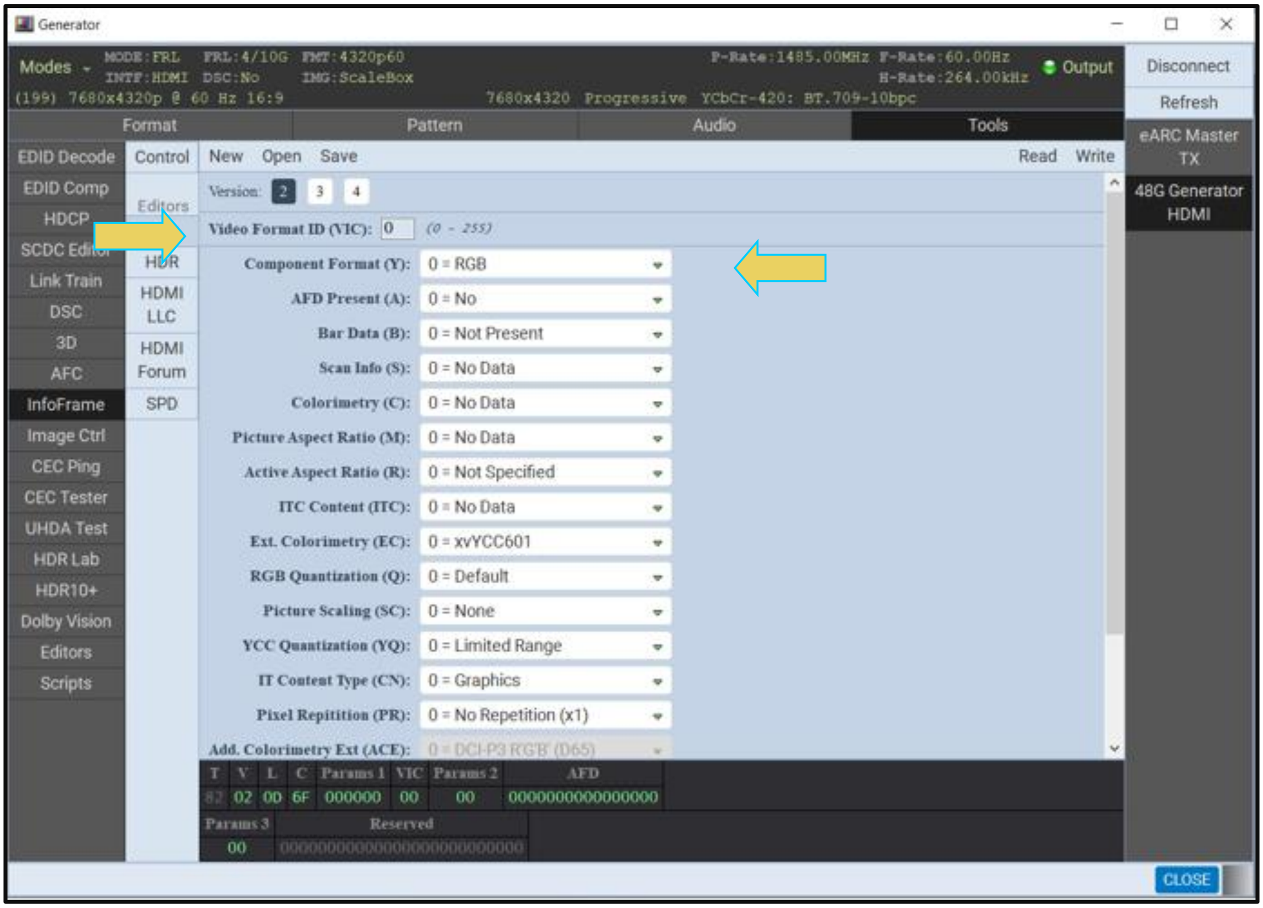
1. Access **InfoFrame** Utility from the **Tools** tab (below).



2. Select the **Control** button on the left side as indicated below.


Generator
Modes
MODE:TMDS FRL:-- FMT:2160p30
INTF:HDMI DSC:No IMG:DolbyVision
(0) 4K x 2K 29.97, 30 Hz
P-Rate:297.00MHz F-Rate:30.00Hz
H-Rate:67.50kHz
3840x2160 Progressive RGB-8bpc
Output
Disconnect
Refresh
eARC Master TX
48G Generator HDMI
Format
Pattern
Audio
Tools
Link Train
HDCP
EDID Decode
EDID Comp
SCDC Editor
DSC
3D
AFC
InfoFrame
Image Shift
Image Ctrl
CEC Ping
CEC Tester
UHDA Test
HDR Lab
HDR10+
Dolby Vision
Editors
Scripts
Control
Editors
AVI
HDR
HDMI LLC
HDMI Forum
SPD
VTEM
Enable (Any)
GIF
AVI
SPD
Audio
MPEG
GIF2
HDMI LLC VS
HDMI Forum VS
Enable (One)
Video Timing EM
Compressed Video Transport EM
Enable (One)
xvYCC
Audio Metadata
HDR Metadata
APPLY SETTINGS
REFRESH
CLOSE

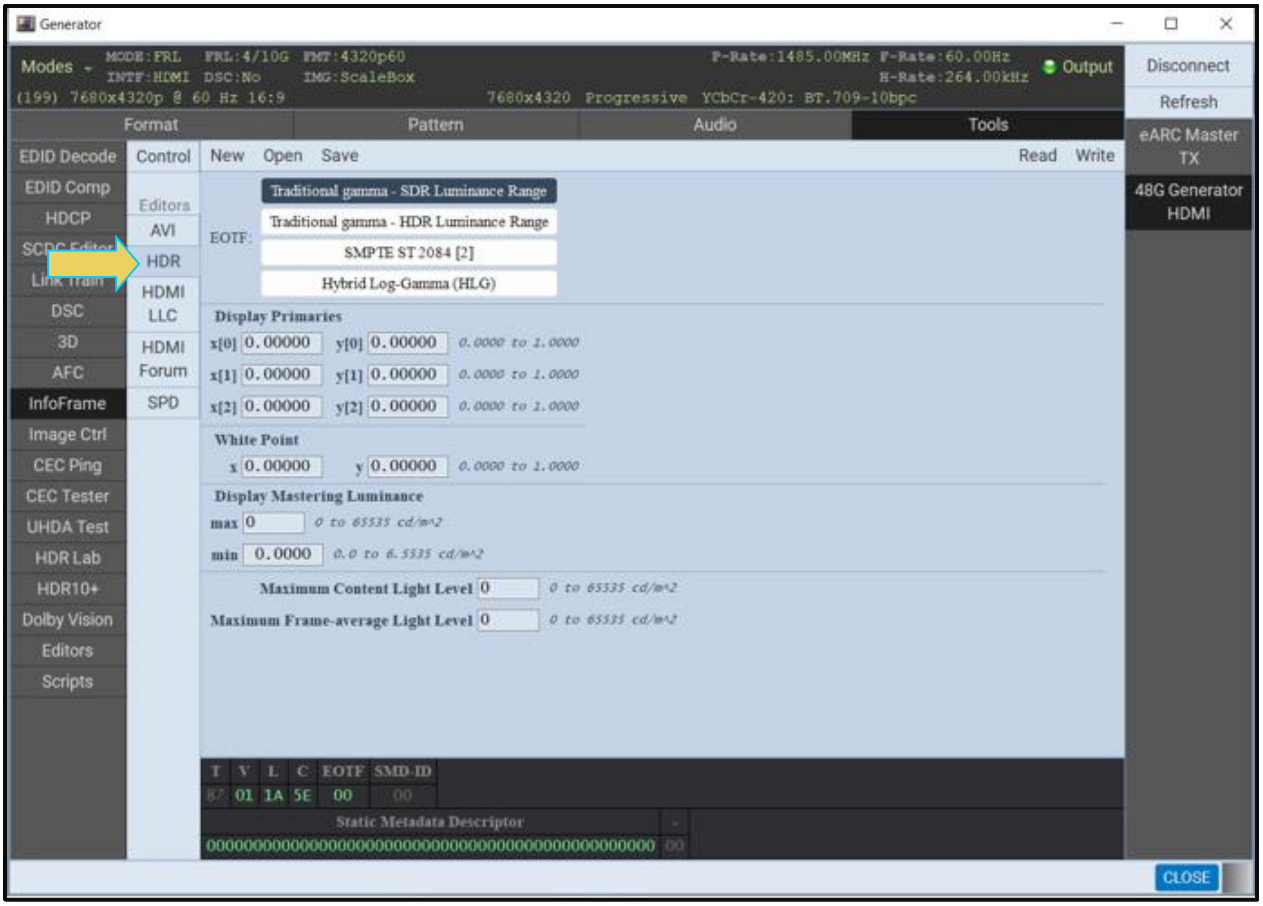
In the example below, the AVI InfoFrame is being configured.

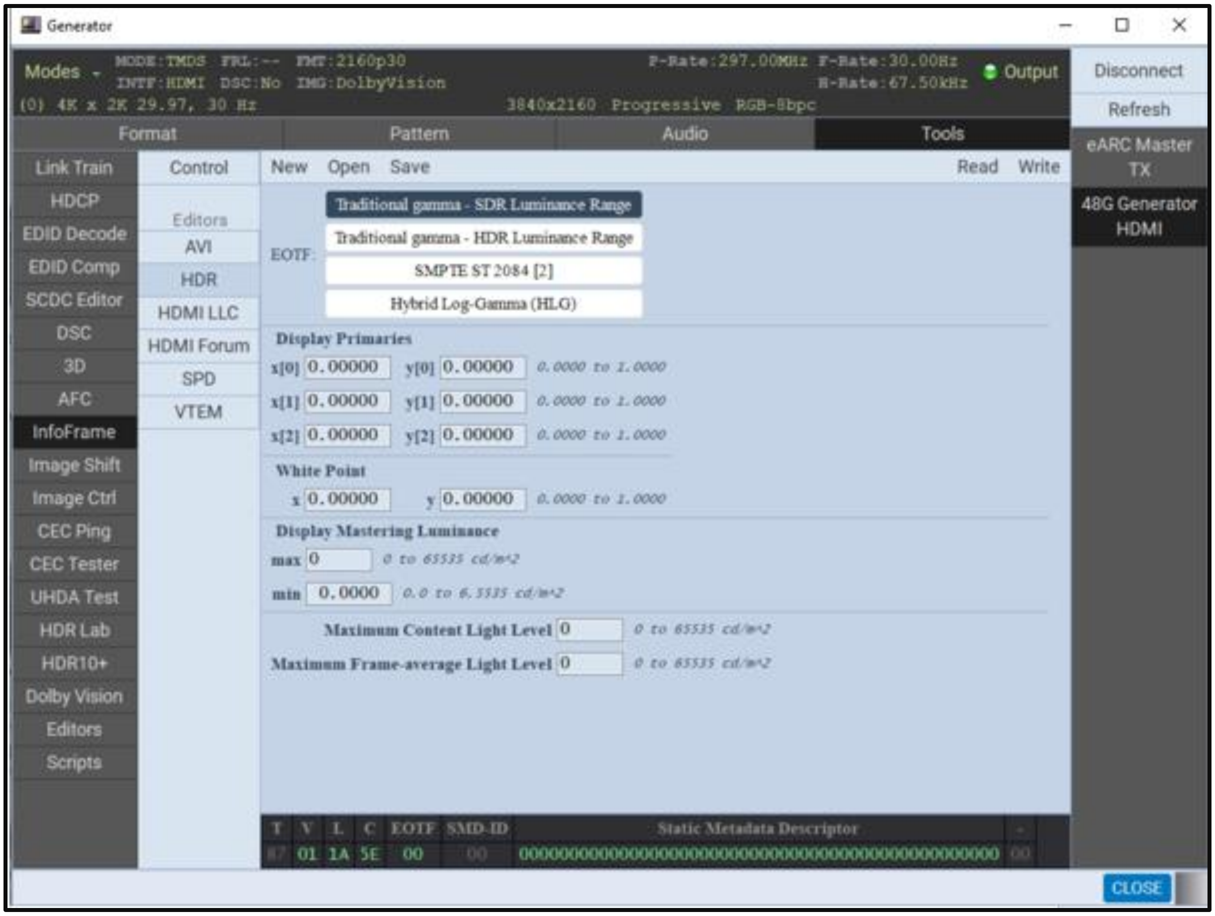


The drop-down menu for the Component Format is visible in the above screen.

3. Select RGB for example.
4. Click on the **Write** activation button Write to initiate the change and the transmission. The Reset button Read re-establishes the default configuration.

In the second example, the HDR InfoFrame is being configured with appropriate values (screens below).


Generator
Modes
MODE:FRL FRL:4/10G FMT:4320p60
INTF:HDMI DSC:No IMG:ScaleBox
(199) 7680x4320p @ 60 Hz 16:9
P-Rate:1485.00MHz F-Rate:60.00Hz
H-Rate:264.00kHz
7680x4320 Progressive YCbCr-420: BT.709-10bpc
Output
Disconnect
Refresh
eARC Master TX
48G Generator HDMI
Format
Pattern
Audio
Tools
EDID Decode
EDID Comp
HDCP
DSC
3D
AFC
InfoFrame
Image Ctrl
CEC Ping
CEC Tester
UHDA Test
HDR Lab
HDR10+
Dolby Vision
Editors
Scripts
Control
Editors
AVI
HDR
HDMI LLC
HDMI Forum
SPD
New
Open
Save
Read
Write
EOTF:
Traditional gamma - SDR Luminance Range
Traditional gamma - HDR Luminance Range
SMPTE ST 2084 [2]
Hybrid Log-Gamma (HLG)
Display Primaries
x[0] 0.00000 y[0] 0.00000 0.0000 to 1.0000
x[1] 0.00000 y[1] 0.00000 0.0000 to 1.0000
x[2] 0.00000 y[2] 0.00000 0.0000 to 1.0000
White Point
x 0.00000 y 0.00000 0.0000 to 1.0000
Display Mastering Luminance
max 0 0 to 65535 cd/m^2
min 0.0000 0.0 to 6.5535 cd/m^2
Maximum Content Light Level 0 0 to 65535 cd/m^2
Maximum Frame-average Light Level 0 0 to 65535 cd/m^2
T V L C EOTF SMD-ID
87 01 1A 5E 00 00
Static Metadata Descriptor
000000000000000000000000000000000000000000000000 00
CLOSE



5. Click on the **Write** activation button Write to initiate the change and the transmission of the new HDR values. Click on the **Reset** button Read to re-establish the default configuration.

15.29 Viewing Metadata Packets Transmitted to a Connected Display

Use the following procedures to view the HDMI metadata packets transmitted to your display under test. The test image used to view the metadata is selectable through the **Pattern** tab.

15.29.1Viewing Metadata Packets

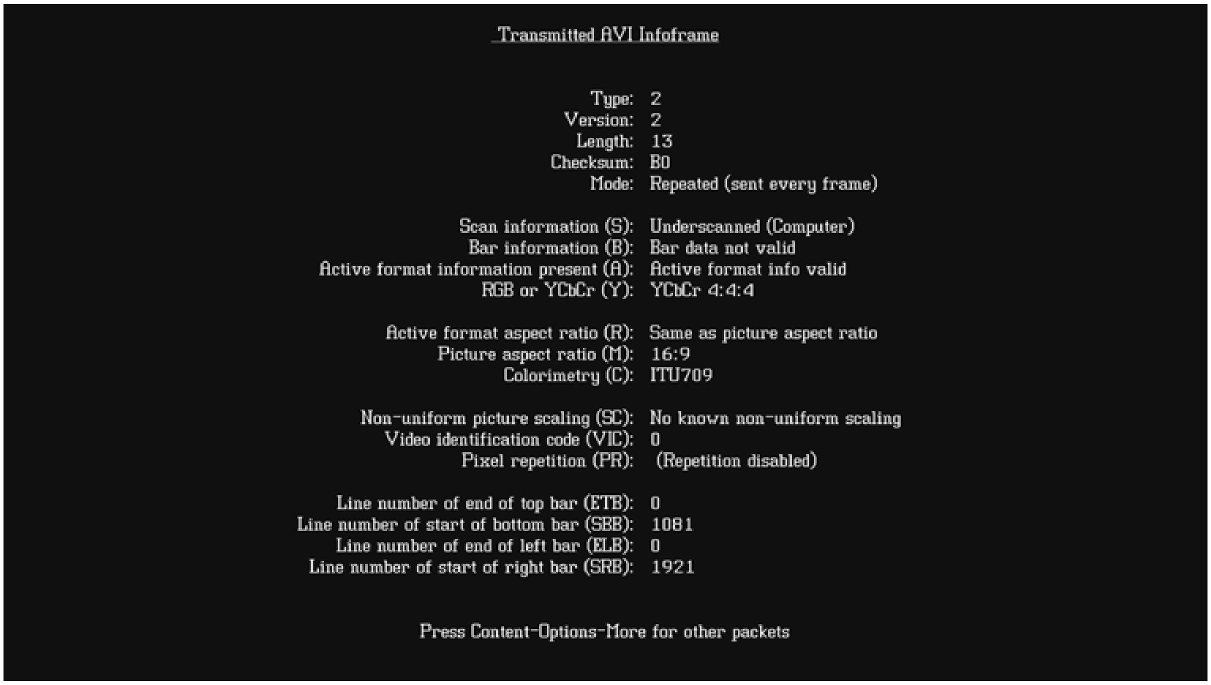
Use the procedures below to view metadata packets transmitted to a connected display. These procedures assume that you have an HDMI HDTV connected to M42h's Tx port.

To view the metadata packets transmitted to a connected display:

1. Access the **Pattern** tab to view the test patterns.

2. Select the **PacketTx** test.
3. View the results on the connected display. A typical example of the first packet type (AVI InfoFrame) is shown below. The following is a list of packet types viewable through the PacketTx test image:
   - AVI InfoFrame.
   - Audio InfoFrame.
   - Source product descriptor InfoFrame.
   - Other packets:
   - Audio Clock Regeneration packets
   - Channel Status bits
   - Vendor Specific InfoFrame.

The image below is the first page of the multi-page test image. This screen shows the AVI InfoFrame.



To advance to the next metadata packet type, access the **Renditions** dialog box through the **Settings** activation button as shown below.

16 Testing HDMI Sources and Distribution Networks for Pixel Errors

Important Note: This functionality is not currently implemented in the M42h. This section is for future reference only.

The M42h enables you to test the video quality of an HDMI® TMDS stream. Using the Pixel Error test feature. This test is only available through the Receiver application in the “Real Time” mode on the embedded ATP GUI Manager display. The test is not available on the external ATP GUI Manager.

The Pixel Error test can also be run through the command line. The commands necessary for running these tests are included in this chapter.

The Pixel Error test (Frame Compare) checks for pixel errors in the HDMI stream from an upstream source device through a cable or distribution network. The Pixel Error test enables you to verify either the source or distribution network. For example, if your application is to test distribution network components such as splitters, switches, and extenders then you would use the high-quality HDMI cable provided with the M42h.

For testing a source, you would use the Pixel Error test with a short known-good HDMI cable (**Note**: Use the high-quality HDMI cable provided with the M42h.)

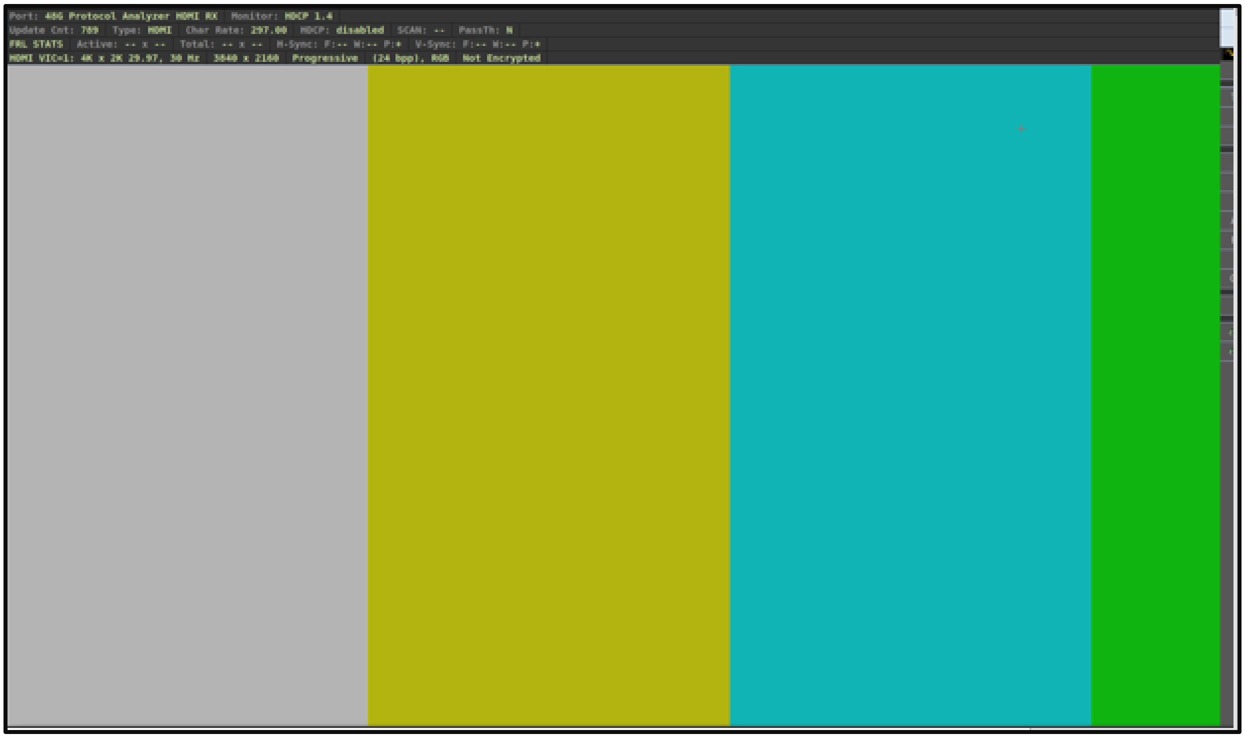
16.1 Accessing the Real Time Mode

To access the Real Time mode:

1. Select **Receiver** on page 1 of the **Apps** panel on the embedded ATP GUI Manager:

Note: The Real Time viewing windows are not available on the PC-based external GUI Manager.

The Receiver "Real Time" panel appears as shown below:


Port: 48G Protocol Analyzer HDMI RX
Monitor: HDCP 1.4
Update Cnt: 789
Type: HDMI
Char Rate: 297.00
HDCP: disabled
SCAN: --
PassTh: N
FRL STATS
Active: -- x --
Total: -- x --
H-Sync: P:-- W:-- P:+
V-Sync: P:-- W:-- P:+
HDMI VIC=1: 4K x 2K 29.97, 30 Hz
3840 x 2160
Progressive
(24 bpp), RGB
Not Encrypted

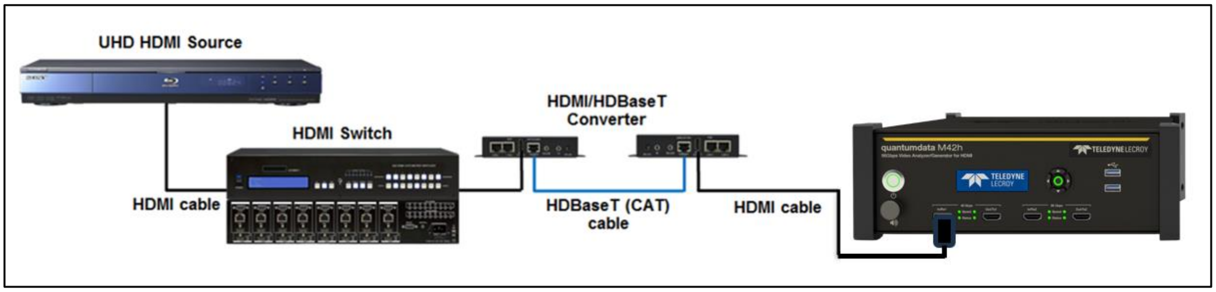
16.2 Testing HDMI Distribution Network Components with the Pixel Error Test

Use the following procedures to setup and test HDMI Distribution Network components. This procedure assumes that you are in the Real Time mode through the **Receiver** application panel.

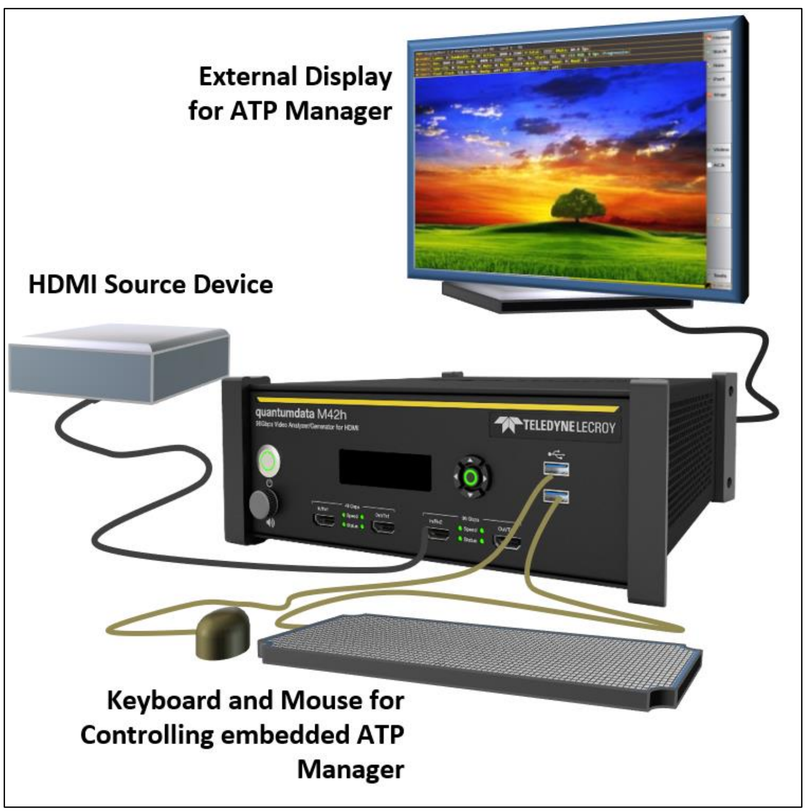
To Run the Pixel Error test:

1. Connect the source and HDMI distribution network to the M42h Rx port as shown below. The diagrams below depict the connections with the M42h.

   Note: Use the high-quality HDMI cable provided with the M42h.

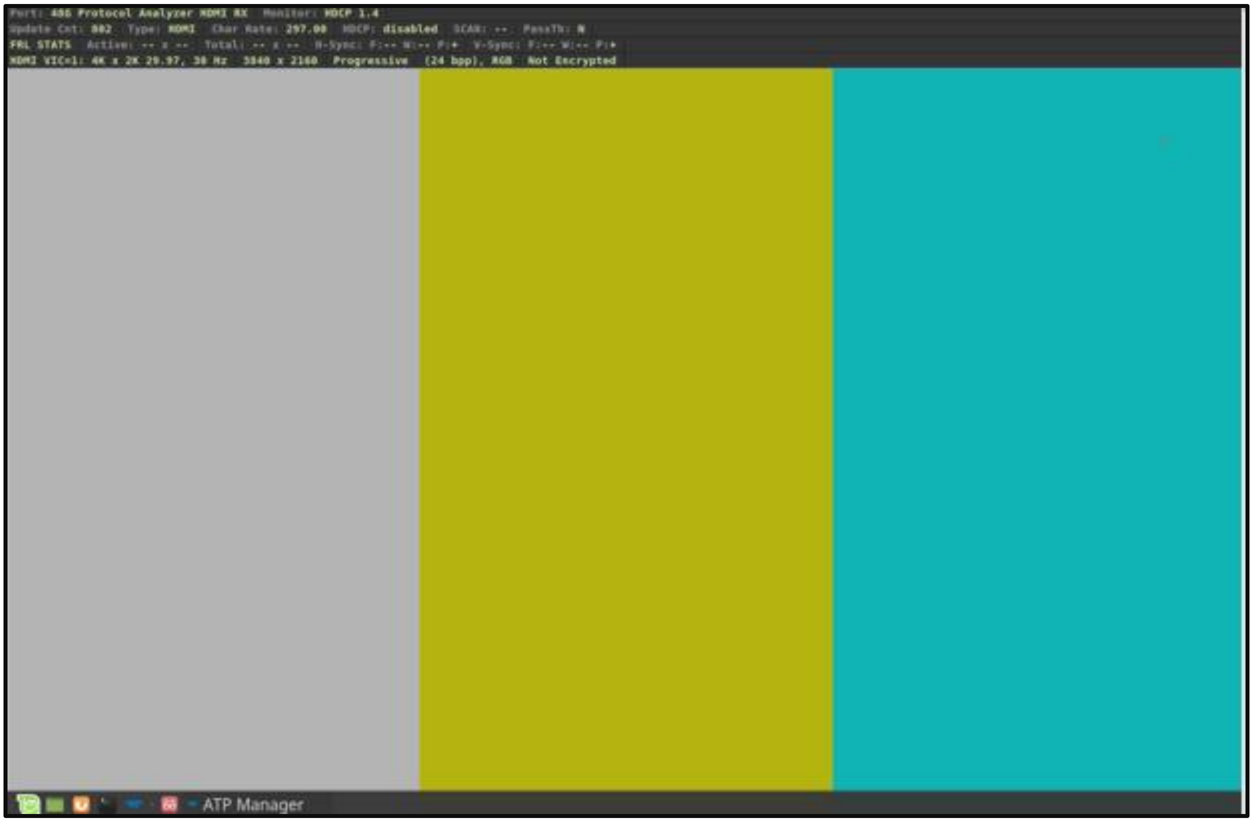


Connection for running pixel error test on HDMI distribution network

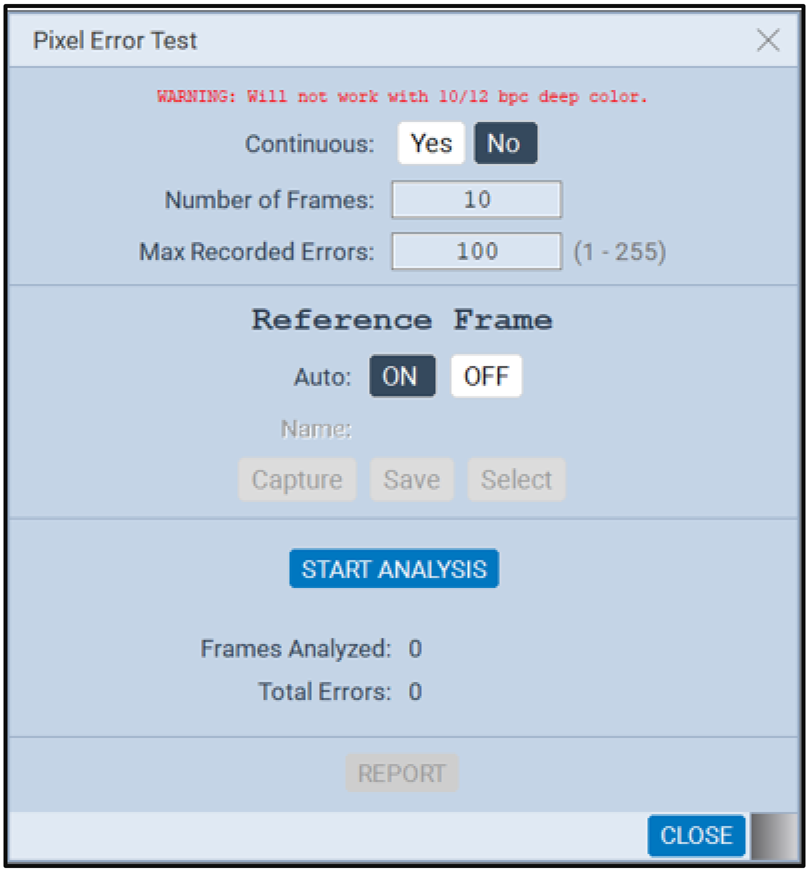


Connection for HDMI source analysis

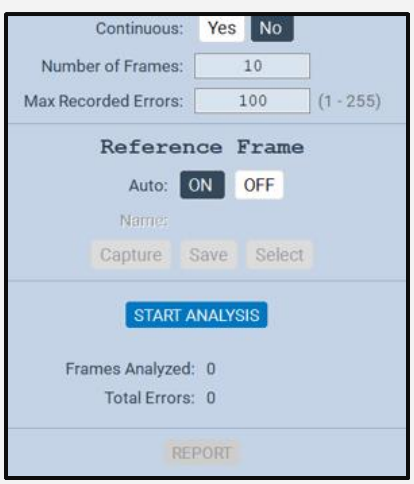
2. From the Real Time window select the **Tools** menu as shown below:



The **Pixel Error** test dialog box appears as shown below:



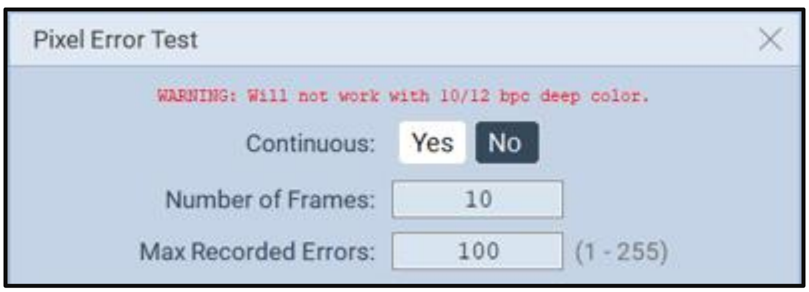
The table below describes the fields and buttons on the Pixel Error Test dialog box.

Pixel Error test dialog box - Item	Information / Function
	The following is a description of the items on the Pixel Error Test dialog box: **Number of Frames** – This is the number of frames to test when Continuous is deselected. **Max Recorded Errors** – This is the maximum number of errors that can be recorded and presented in the Report. Enter in the range of 1 top 256; default 100. **Continuous** – A check box indicating whether the test runs continuously and requires manual intervention to stop or unchecked with the test stopping after the number specified in Number of Frames. **Reference Frame**; **Auto** – Radio buttons indicating whether the test will use a reference frame video image generated from the source as the test in initiated (ON) or if the test will use a reference frame video image stored on the PC (OFF). **Path** – This field is used only if Reference Frame; Auto is disabled. The field indicates the file name and path where the reference frame is obtained from.

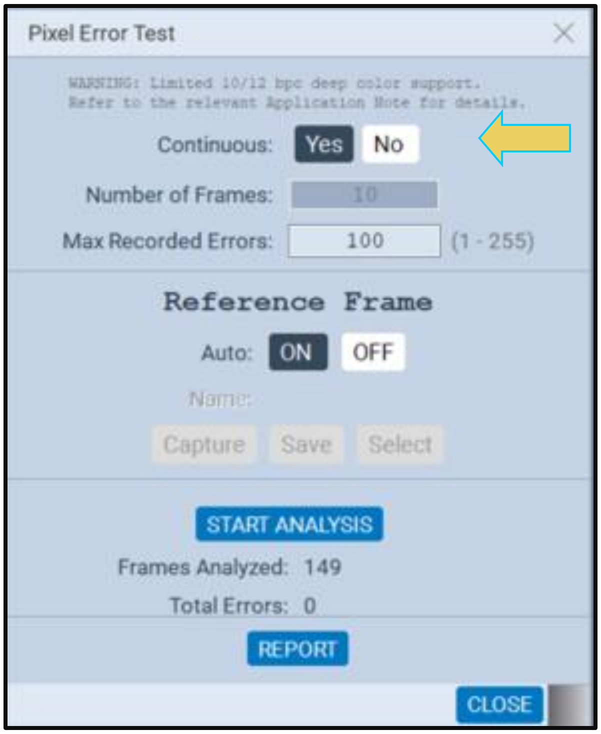
Pixel Error test dialog box - Item	Information / Function
	Capture – Used only when using a video reference frame stored on the M42h (Auto=OFF). Enables you to capture a video reference frame from a source to use a reference frame in subsequent testing. **Save** – Saves the captured reference frame to the 980. **Select** – Enables you to browse for a video reference frame stored on the M42h for testing. **View** – Enables you to view the reference frame captured from the source or loaded from the 980. **Start Analysis** – Activation button to initiate the test. Turns to a Stop Analysis when running in the Continuous mode. **Frames Analyzed** – Indicates the number of frames currently analyzed or completed in the analysis once the test completes. **Total Errors** – Indicates the number of errors currently identified or the total errors determined when the test is completed. **Report** – Enables you to view an HTML report of the test results.

3. Use the **Continuous** check box to specify whether you wish to run the test manually for an arbitrary number of frames or for a specific number of frames.

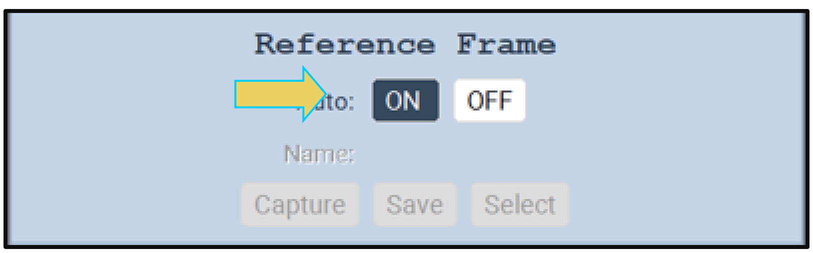
   - For testing with a specific number of frames deselect the **Continuous** check box and enter the number of frames.



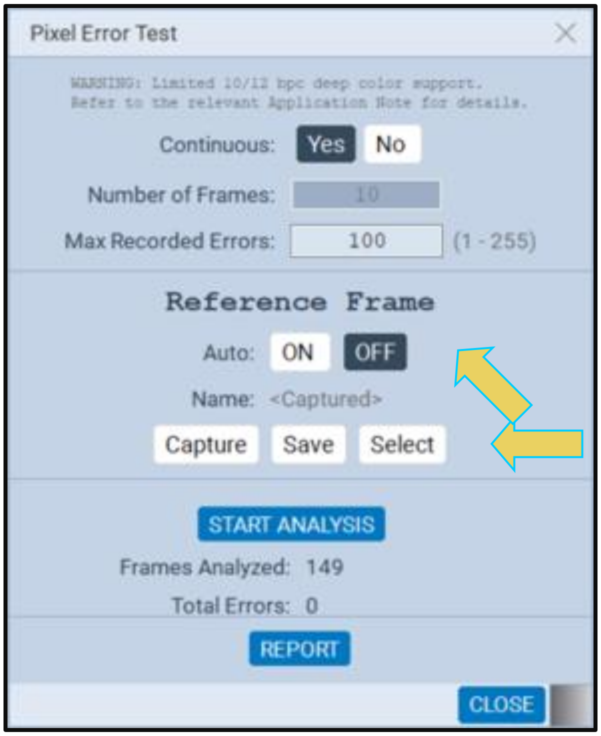
   - For testing in the continuous mode select the **Continuous** check box.



4. Specify whether you wish to run the test using a reference frame generated dynamically from the source under test or use a reference (“golden frame”) stored on your M42h.
   - For testing with a reference frame generated from the source during the test, select the Auto ON radio button.



   - For testing with a reference frame obtained from the file stored on your M42h, select the **Auto OFF** radio button and then activate the **Select** button to browse for a file on the M42h.

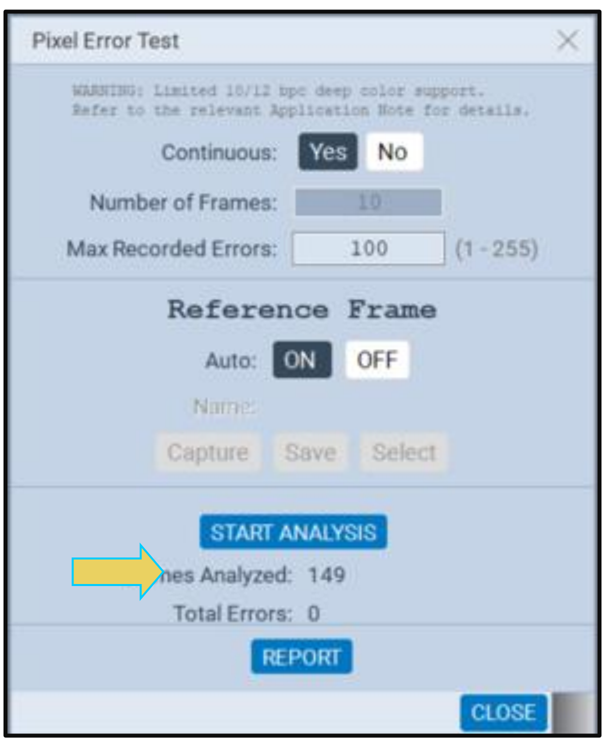


5. Activate the **Start Analysis** button to initiate the test.

The **Frames Analyzed** and the **Total Errors** fields will indicate the progress and status of the test.

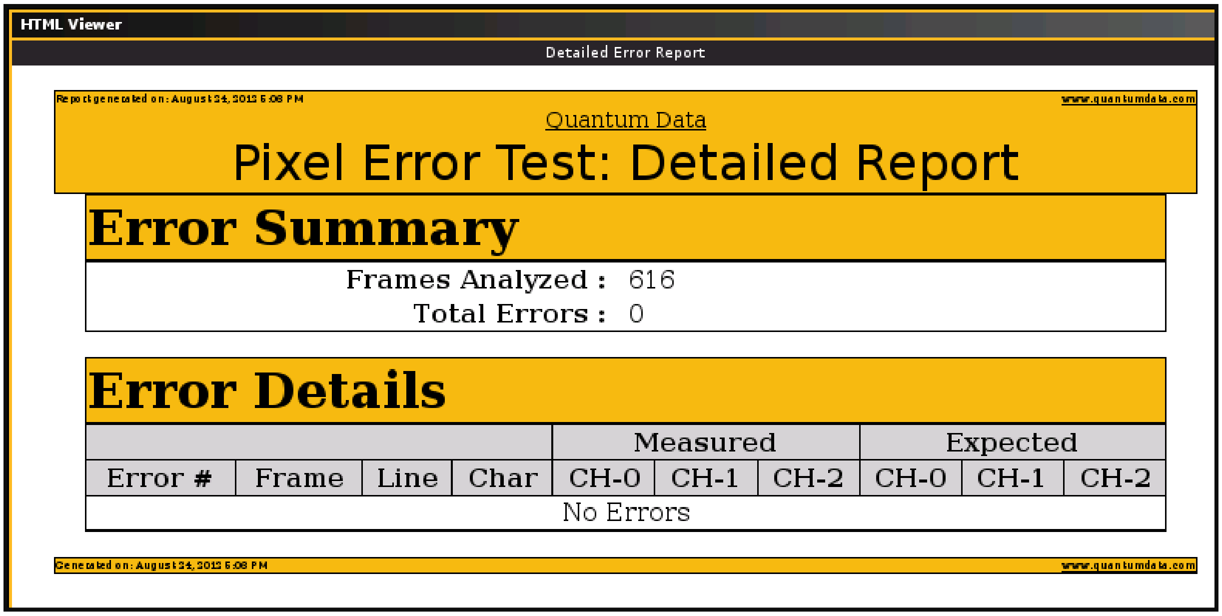
6. If you are running the test non-continuously, then the test will stop automatically when the number of frames specified in the **Number of Frames** field is reached.

The **Frames Analyzed** and the **Total Errors** fields will indicate the progress and status of the test.



7. Select the **Report** button to obtain a report of the results.

In the example shown below there are no errors. The second example shows a report with many errors.


HTML Viewer

Detailed Error Report

Report generated on: August 24, 2012 5:08 PM www.quantumdata.com

Quantum Data

Pixel Error Test: Detailed Report

Error Summary

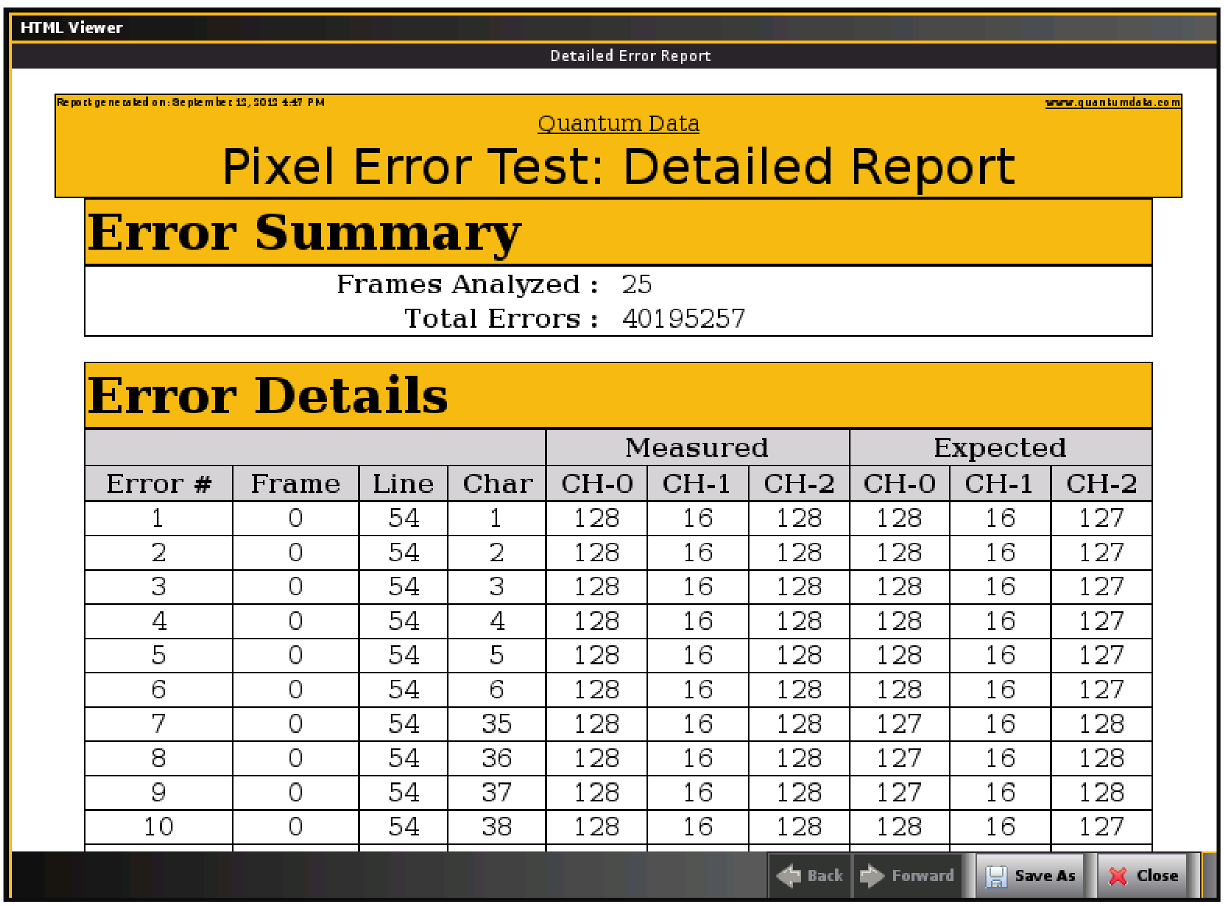
Frames Analyzed : 616

Total Errors : 0

Error Details

				Measured			Expected		
Error #	Frame	Line	Char	CH-0	CH-1	CH-2	CH-0	CH-1	CH-2
No Errors									

Generated on: August 24, 2012 5:08 PM www.quantumdata.com


HTML Viewer

Detailed Error Report

Report generated on: September 12, 2012 4:47 PM www.quantumdata.com

Quantum Data

Pixel Error Test: Detailed Report

Error Summary

Frames Analyzed : 25

Total Errors : 40195257

Error Details

				Measured			Expected		
Error #	Frame	Line	Char	CH-0	CH-1	CH-2	CH-0	CH-1	CH-2
1	0	54	1	128	16	128	128	16	127
2	0	54	2	128	16	128	128	16	127
3	0	54	3	128	16	128	128	16	127
4	0	54	4	128	16	128	128	16	127
5	0	54	5	128	16	128	128	16	127
6	0	54	6	128	16	128	128	16	127
7	0	54	35	128	16	128	127	16	128
8	0	54	36	128	16	128	127	16	128
9	0	54	37	128	16	128	127	16	128
10	0	54	38	128	16	128	128	16	127

Back Forward Save As Close

16.3 Running the Pixel Error Test Through the Command Line

You can run the Pixel Error test through the command line. Refer to the Chapter Command Line Interface for Capturing Data for information on how to establish a command line session with the M42h.

Commands for Pixel Error Test **Note:** Commands are not case sensitive.			
Command	**Description**	**Syntax**	**Command Example**
PDAX:NFRS	Set number of frames to analyze in pixel data analysis test or sets test to continuous mode requiring user intervention to terminate.	PDAX:NFRS < *frames* > Where <*frames*> is the number of frames to capture and compare during the test. Set to 0 for continuous mode which requires user interaction to stop test.	To set number of frames to analyze in pixel data analysis test to 50: >PDAX:NFRS 50
PDAX:CAPF	Capture a reference frame for pixel data analysis test	PDAX:CAPF	To capture a reference frame for pixel data analysis test: >PDAX:CAPF
PDAX:GFCA	Saves a captured frame to a file. This is used as a reference frame (“golden” frame) for comparison with subsequent captured frames.	PDAX:GFCA <*path*> Where <*path*> is the directory path and file name of the stored reference frame. If the path is omitted the default path is used.	To save a captured frame to a file to use as a reference frame: >PDAX:GFCA /user/cap1 or: >PDAX:GFCA cap1
PDAX:GFCL	Load a captured reference frame from a file.	PDAX:GFCL <*path*> Where <*path*> is the directory path and file name of the reference frame to load. If the path is omitted the default path is used.	To load a captured reference frame from a file: >PDAX:GFCL /user/cap1 or: >PDAX:GFCL cap1
PDAX:MXER	Set maximum number of detailed errors to record in pixel data analysis test.	PDAX:MXER <*errors*> Where <*errors*> is maximum number of errors to provide a detailed report for up to 256 errors.	To set maximum number of detailed errors to record in pixel data analysis test to 100: >PDAX:MXER 100

Commands for Pixel Error Test **Note:** Commands are not case sensitive.			
Command	**Description**	**Syntax**	**Command Example**
PDAX:ERRQ	Get recorded detailed error records. Returns the following: Frame number that an error occurred X,Y coordinate that the error occurred. The measured red component value. The measured green component value. The measured blue component value. The reference expected red component value. The reference expected green value. The reference expected blue value.	PDAX:ERRQ	To get recorded detailed error records: > PDAX:ERRQ 007: [1450:0000:0006] 0xb4b4b4 0xebebeb 008: [1450:0000:0007] 0xb4b4b4 0xebebeb 009: [1450:0000:0008] 0xb4b4b4 0xebebeb 010: [1450:0000:0009] 0xb4b4b4 0xebebeb 011: [1450:0000:0010] 0xb4b4b4 0xebebeb 012: [1450:0000:0011] 0xb4b4b4 0xebebeb 013: [1450:0000:0012] 0xb4b4b4 0xebebeb
PDAX:NERR	Get number of errors during a pixel data analysis test.	PDAX:NERR	To obtain the number of errors during a pixel data analysis test: > PDAX:NERR 21879466
PDAX:PDAU	Initiates the pixel data analysis test.	PDAX:PDAU	To initiate the pixel data analysis test: > PDAX:PDAU
PDAX:STOP	Stops the pixel data analysis test.	PDAX:STOP	To stop a pixel data analysis test: > PDAX:STOP
PDAX:STAT	Returns the test status including running or done, frames analyzed, errors detected, etc. Can be run either during a test or after a test is terminated. Provides results from the last test.	PDAX:STAT	To obtain the test status: > PDAX:STAT pdax: in progress frames: 1659 threshold 0 errors: 21879466. threshold 0
Note: The commands are not case sensitive.			

To Run the Pixel Error test for a specified number of frames from the command line:

1. Set the number of frames to use during the test.

```
#p-scope>pdax:nfrs 255
pdax:nfrs 255
```

2. Capture a reference frame for the test:

```
#p-scope>pdax:capf
pdax_capf: capture buffer size 179MB bs=128
INFO: Capture Trigger condition is satisfied
END: pcap_capture_start Capture complete
END: pcap_info info request type=118 complete
```

3. Save the captured frame to a file:

```
#p-scope>pdax:gfca myrefrm2
pdax:gfca myrefrm2
```

4. Load the captured frame:

```
#p-scope>pdax:gfcl myrefrm2
pdax:gfcl myrefrm2
pdax_gfcl: Loading Reference frame: [myrefrm2]
```

5. Run the pixel error test (will run for 255 frames)

```
#p-scope>pdax:pdau
pdax:pdau
```

6. Get statistics for the test:

```
#p-scope>pdax:stat
pdax:stat
pdax: stopped
frames: 255 threshold 255
errors: 0. threshold 255
```

To Run the Pixel Error test continuously from the command line:

1. Set the pixel error test to run continuously:

```
#p-scope>pdax:nfrs 0
pdax:nfrs 0
```

2. Initiate the test

```
#p-scope>pdax:pdau
```

```
pdax:pdau
```

3. Query statistics for the test:

```
#p-scope>pdax:stat
pdax:stat
pdax: in progress
frames: 1071 threshold 0
errors: 47004766. threshold 255
```

4. Stop the test:

```
#p-scope>pdax:stop
pdax:stop
```

5. Get the number of errors.

```
#p-scope>pdax:nerr
pdax:nerr
84974760
```

6. Get a detailed list out of the 255 errors:

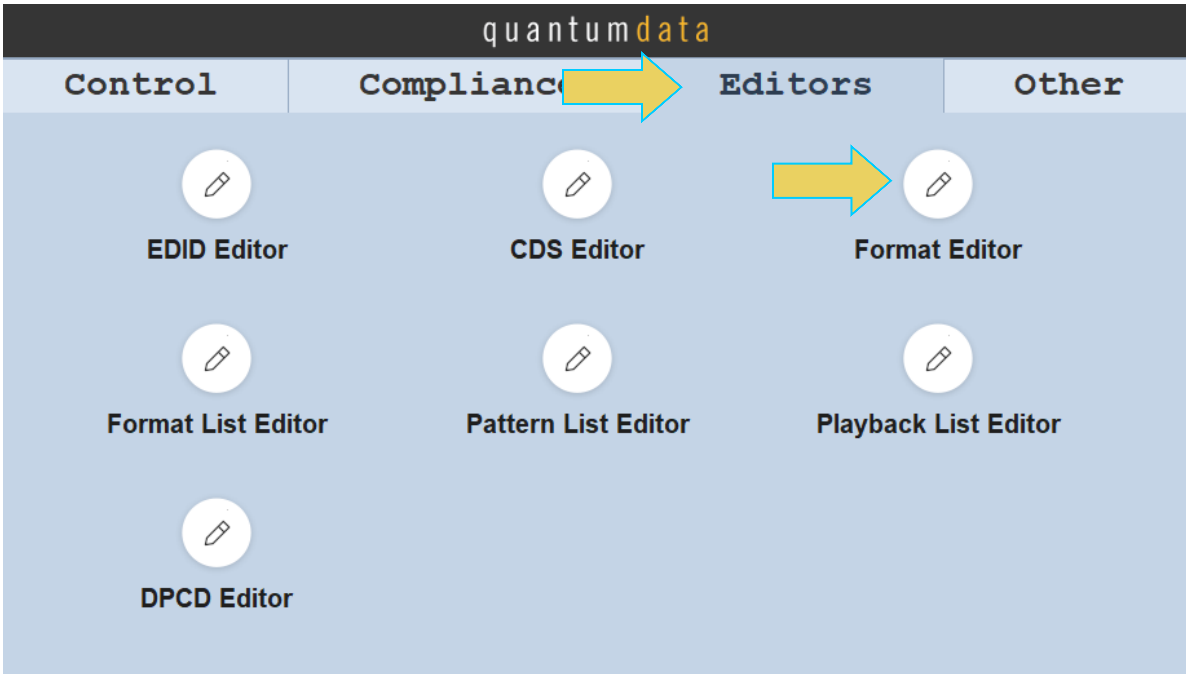
```
#p-scope>pdax:errq
0x090909 0x101010
008: [0699:0646:0742] 0x090909 0x101010
009: [0699:0646:0743] 0x090909 0x101010
010: [0699:0646:0744] 0x090909 0x101010
. . .
253: [0699:0646:1170] 0x171717 0x101010
254: [0699:0646:1171] 0x171717 0x101010
255: [0699:0646:1172] 0x171717 0x101010
```

17 Format Editor

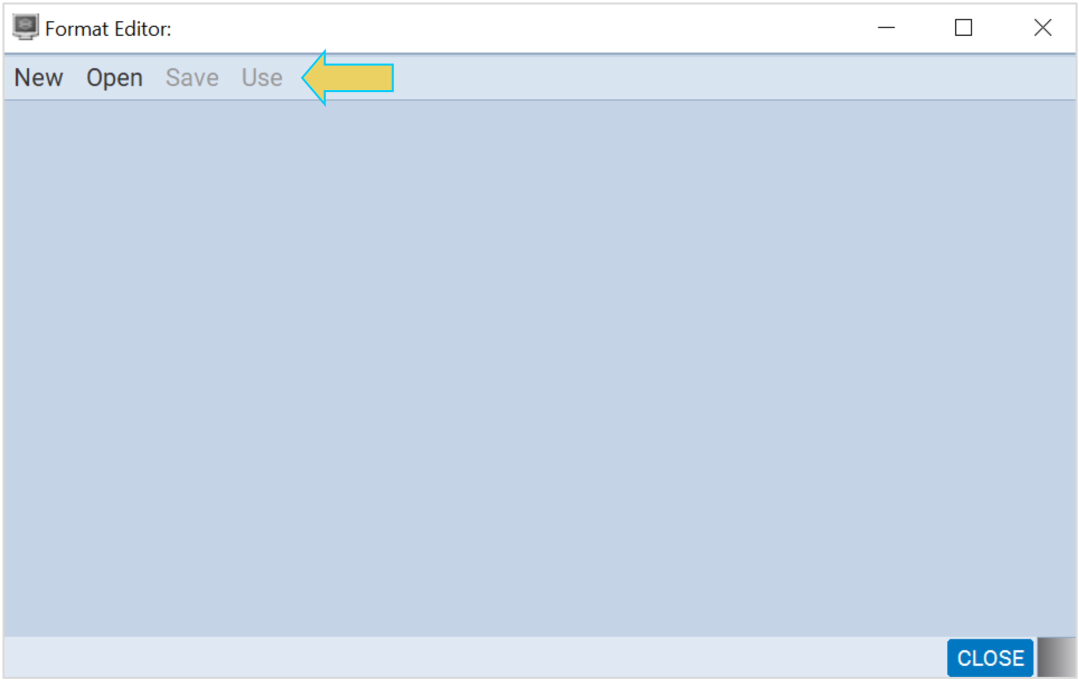
The **Format Editor** provides a graphical user interface for modifying existing HDMI® formats, creating custom formats and viewing format parameters. The **Format Editor** can be run on the embedded ATP GUI Manager or on the external ATP GUI Manager.

17.1 Accessing the Format Editor

Access the **Format Editor** through the **Editors Page** of the **Apps** panel as shown below.



When you first open the **Format Editor**, the window will be blank as shown below. There are a set of activation buttons on the bottom of the screen that enable you to load, save and create formats.



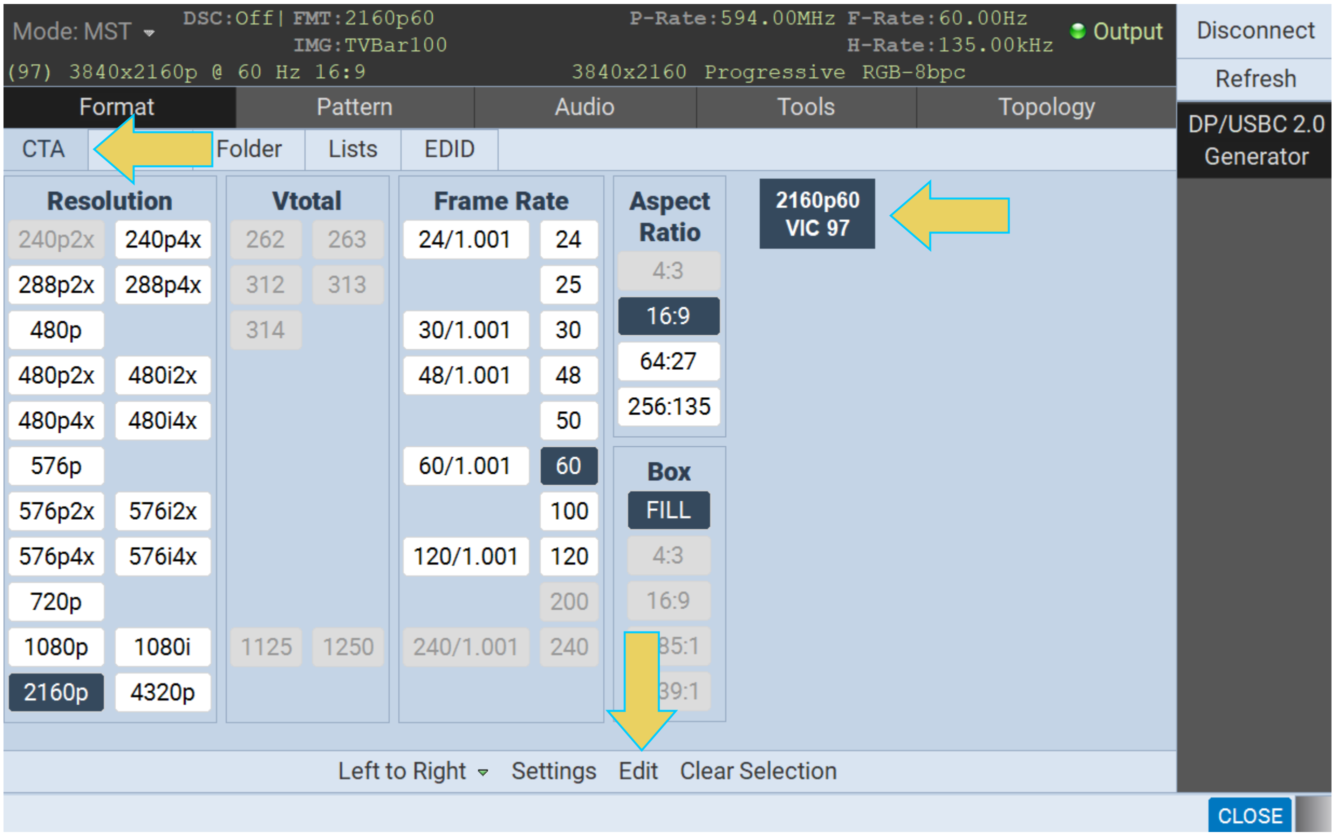
You can resize the window using the silver square area on the lower right side (indicated below).

Format Editor – Top Toolbar Activation Buttons

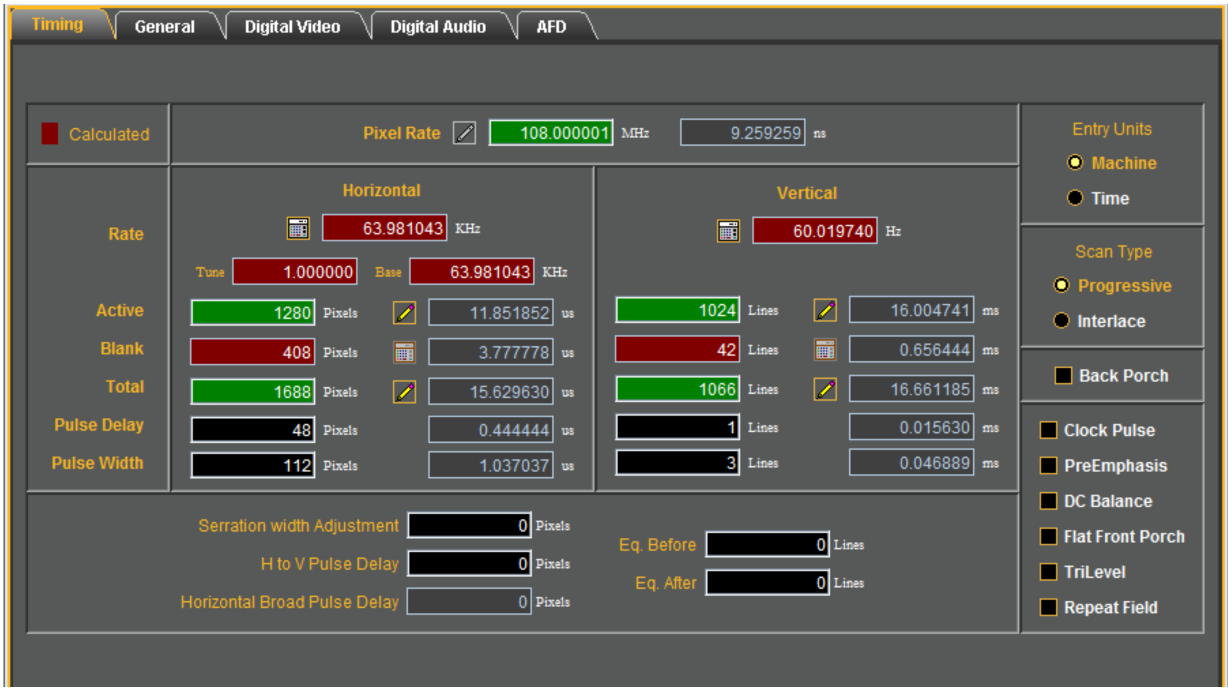
The following table describes the **Format Editor** menu buttons.

Button	Description
Use	Activates the custom format you create/modify within the Editor
New Format	Opens up the New Format at the Timing tab. Enables you to create new formats
Open	Enables you to browse to and open an xml format file on your PC
Save	Enables you to save an xml format file on your PC

(Optionally) access the **Format Editor** through the **Format** tab by selecting a format and using the **Edit** button on the bottom of the window (indicated below).

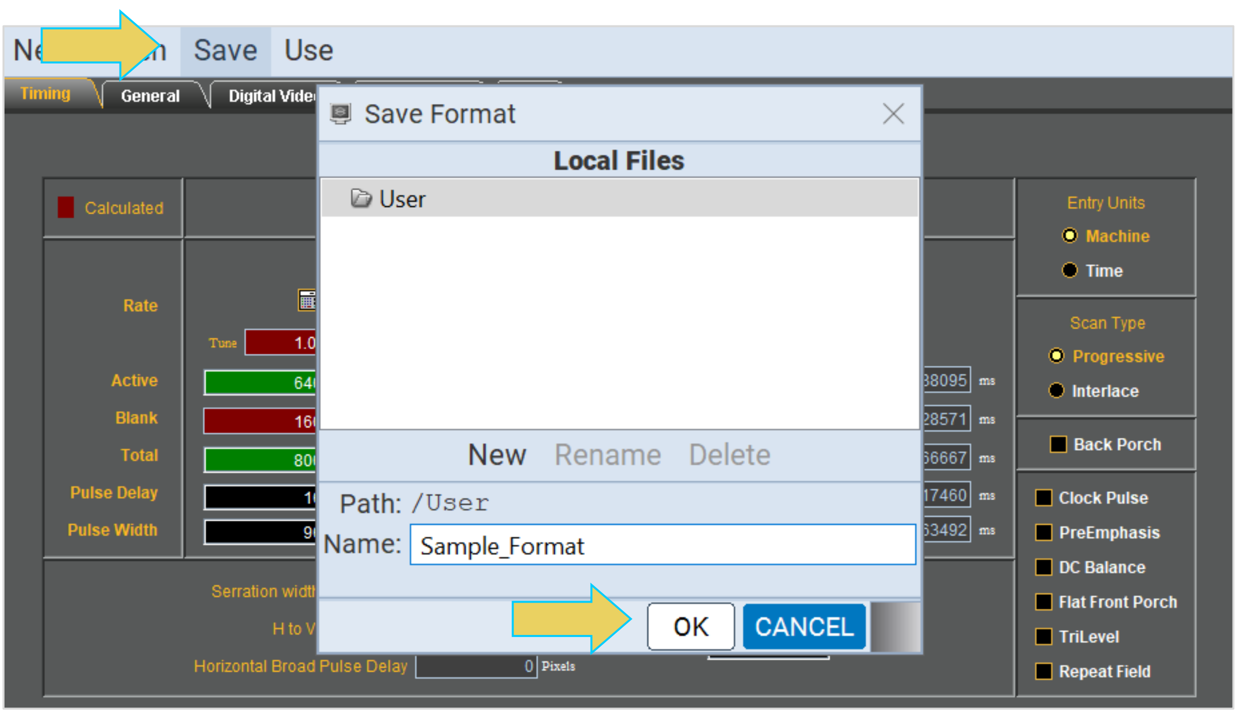

Mode: MST
DSC:Off| FMT:2160p60
IMG:TVBar100
P-Rate:594.00MHz F-Rate:60.00Hz
H-Rate:135.00kHz
Output
(97) 3840x2160p @ 60 Hz 16:9
3840x2160 Progressive RGB-8bpc
Disconnect
Refresh
DP/USBC 2.0 Generator
Format
Pattern
Audio
Tools
Topology
CTA
Folder
Lists
EDID
Resolution
240p2x 240p4x
288p2x 288p4x
480p
480p2x 480i2x
480p4x 480i4x
576p
576p2x 576i2x
576p4x 576i4x
720p
1080p 1080i
2160p 4320p
Vtotal
262 263
312 313
314
1125 1250
Frame Rate
24/1.001 24
25
30/1.001 30
48/1.001 48
50
60/1.001 60
100
120/1.001 120
200
240/1.001 240
Aspect Ratio
4:3
16:9
64:27
256:135
Box
FILL
4:3
16:9
2160p60
VIC 97
Left to Right
Settings
Edit
Clear Selection
CLOSE

In this case the Format Editor is provisioned with the format timing settings of the format that had been selected in the Format tab window. This is shown below.



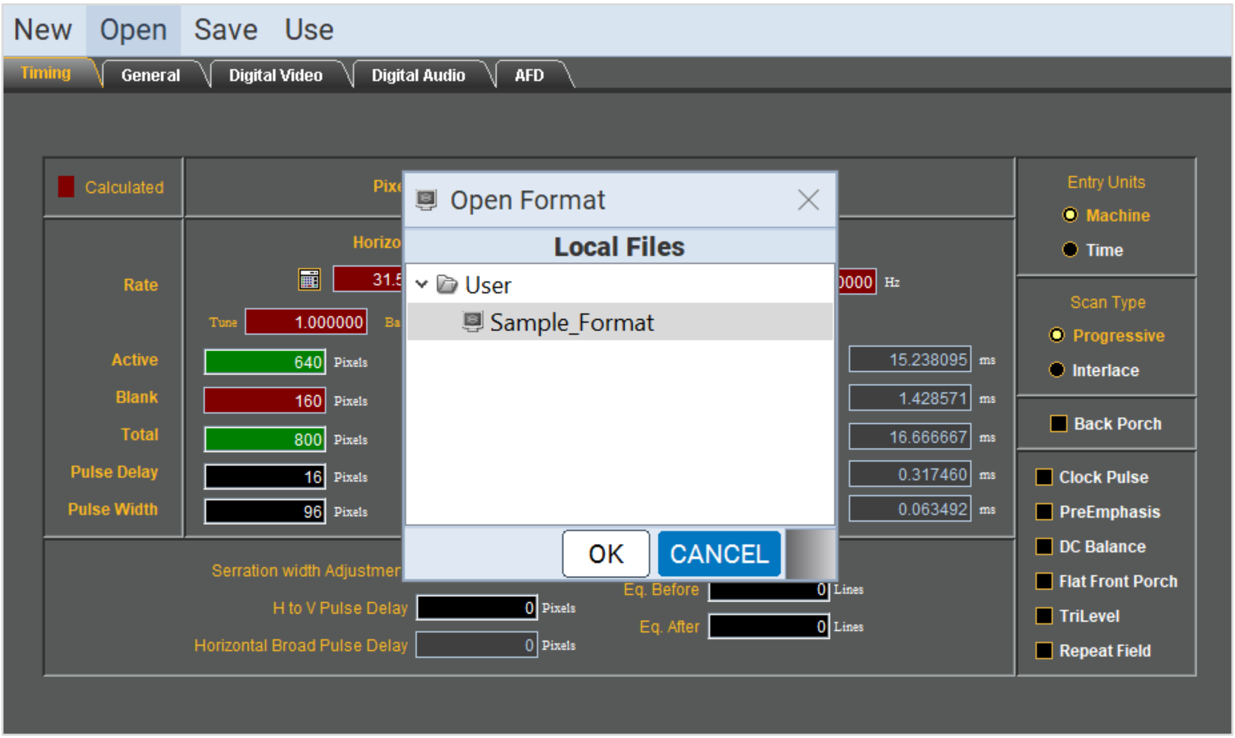
17.1.1 Saving and Opening a Format

To save a format, simply click the **Save** activation button in the top toolbar. A dialog box will pop up as shown below. Select a folder, enter a name and click **OK**.



Opening a Previously Saved or Imported Format

Similarly, to open a format, click the **Open** activation button in the top toolbar, select the desired format, and click **OK**. Example shown below.

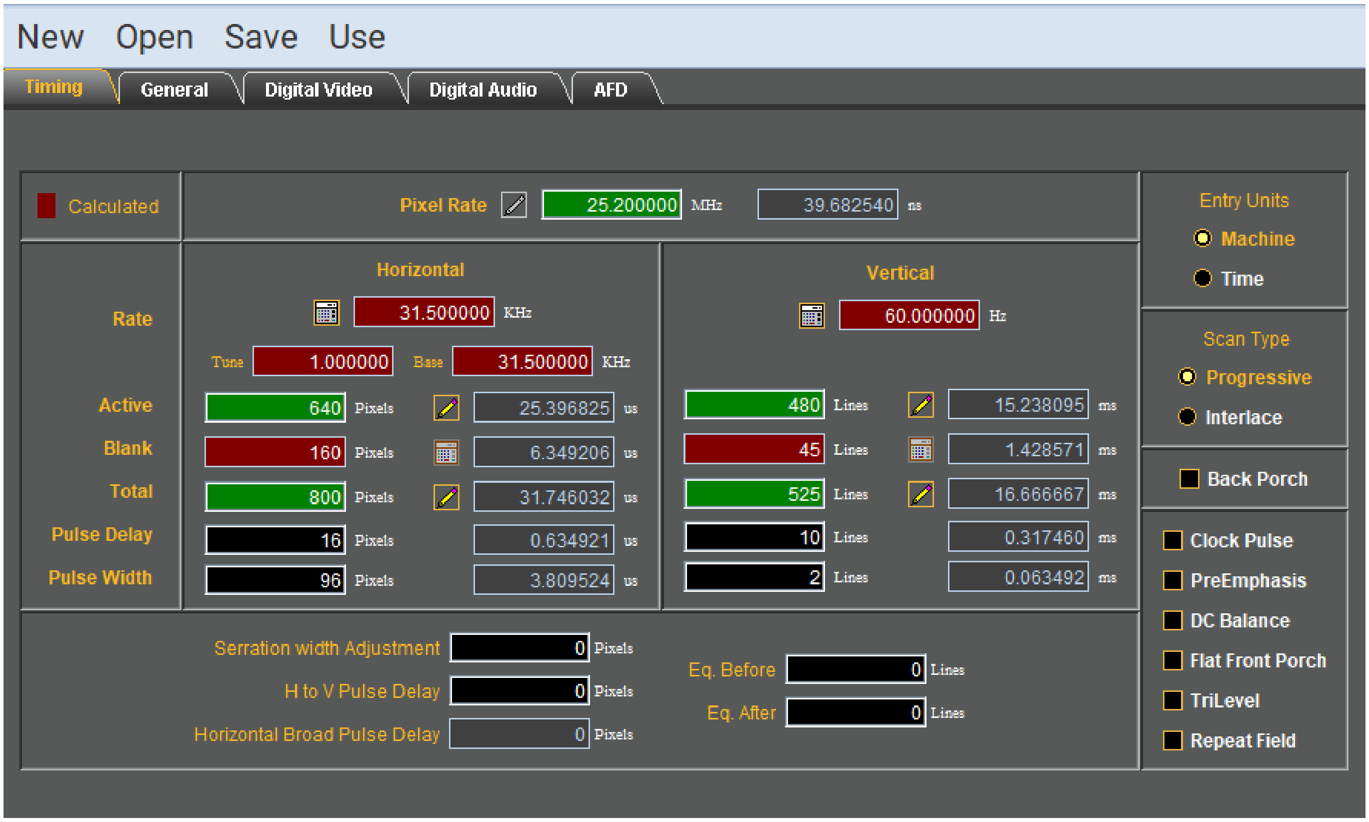


17.2 Format Editor- Top Level Tabs

This subsection defines the tabs and status panels available with Format Editor.

Important Note: Many of the settings and parameters in the Format Editor screens apply only to HDMI or analog, while some apply only to DisplayPort and are not relevant for the M42h instrument.

When you select the New activation button a populated window will appear as shown below.



There are a series of tabs on the top as shown below.

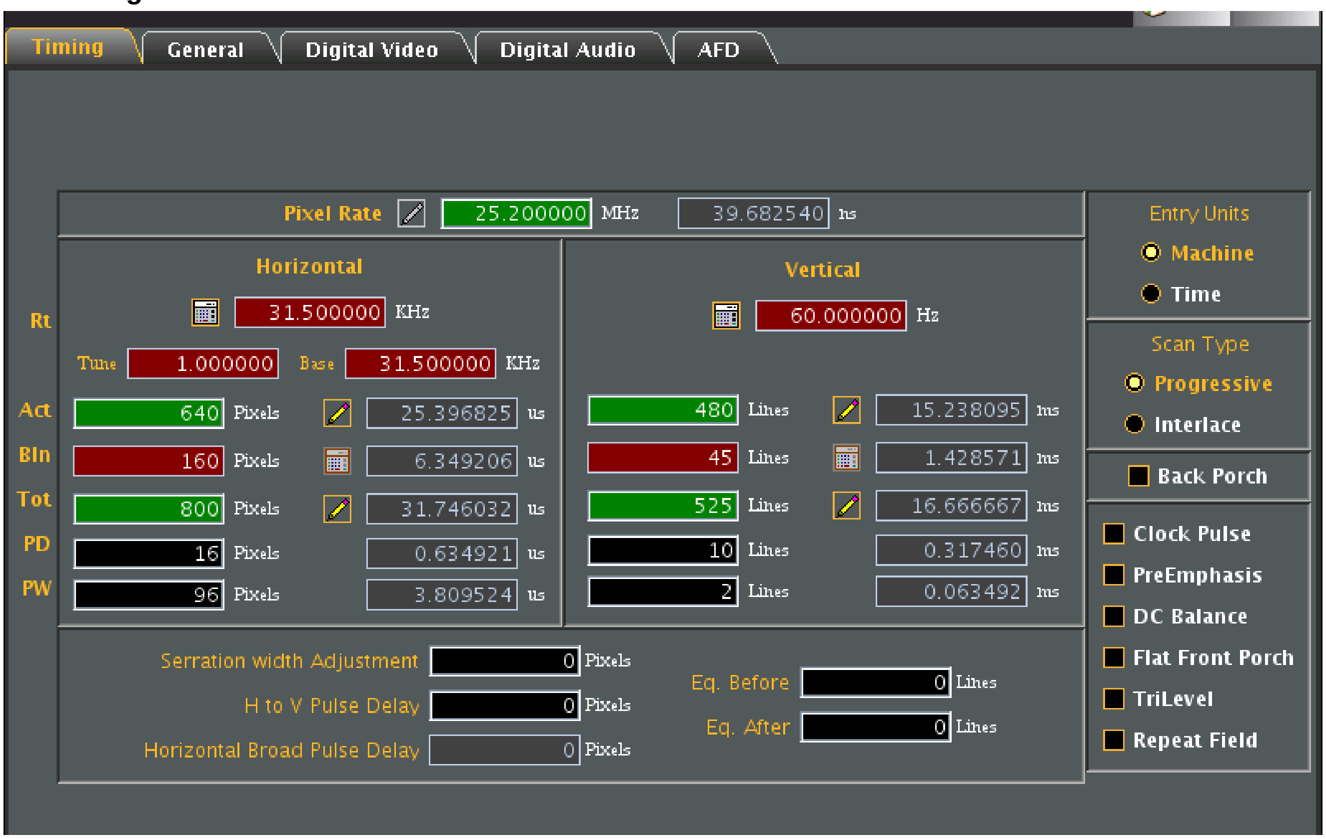
The following table describes the top-level tabs in the Format Editor.

Tab	Description / Function
Timing	Selecting the Timing tab opens up an application screen that enables you to define the timing parameters for a custom format or modify the timing parameters of an existing format.
General	Selecting the General tab opens up an application screen that enables you to define the sync, level, pixel depth, gamma and pedestal parameters for a custom format or modify these parameters of an existing format.

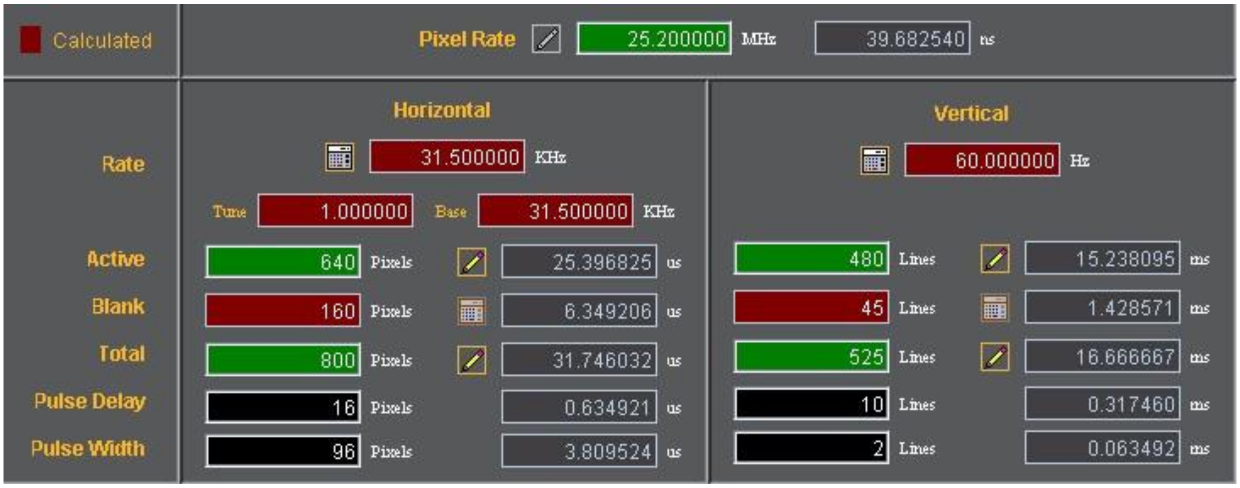
Tab	Description / Function
Digital Video	Selecting the Digital Video tab opens up an application screen that enables you to define the digital video parameters for a custom format or modify these parameters of an existing format.
Digital Audio	Selecting the Digital Audio tab opens up an application screen that enables you to define the digital audio parameters for a custom format or modify these parameters of an existing format.
AFD	Selecting the AFD tab opens up an application screen that enables you to define the AFD parameters for a custom format or modify these parameters of an existing format.

17.2.1 Timing Tab

The **Timing** window of the **Format Editor** is shown below. This window is activated by pressing the **Timing** tab.



The main panel of the **Timing** tab is shown below.



The table that follows describes each of the fields in the main panel of the **Timing** tab.

Tab	Field	Description / Function
Pixel Rate		Sets the pixel rate in pixels (Machine) or microseconds (Time) of the format.
Horizontal	**Rate**	The horizontal line rate of the format. The HRAT is the fundamental frequency in the 882. Parameter: HRAT.
	Tune	The tunning value of the base frame rate (base/tune) for NTSC color broadcast compatibility. The tuning value is base/1.001
	Base	The base frame rate.
	Active	The number of active pixels (machine) or microseconds (Time) of the horizontal video. Parameter: HRES.
	Blank	The number of active pixels (Machine) or microseconds (Time) of the horizontal video. This parameter is calculated.
	Total	The total number of active pixels (Machine) or microseconds (Time) of the horizontal video. The total is the sum of the Active and Blanking. Parameter: HTOT.
	Pulse Delay	The number of pixels (Machine) or microseconds (Time) in the blanking preceding the horizontal sync pulse. Parameter: HSPD.
	Pulse Width	The number of pixels (Machine) or microseconds (Time) of the horizontal sync pulse. Parameter: HSPW.
Vertical	**Rate**	The vertical frame rate of the format. Parameter: VRAT.
	Active	The number of active lines (machine) or milliseconds (Time) of the vertical video. Parameter: VRES.
	Blank	The number of active lines (Machine) or milliseconds (Time) of the vertical video. This parameter is calculated.
	Total	The total number of active lines (Machine) or milliseconds (Time) of the vertical video. The total is the sum of the Active and Blanking. Parameter: VTOT.
	Pulse Delay	The number of lines (Machine) or milliseconds (Time) in the

Tab	Field	Description / Function
		blanking preceding the vertical sync pulse. Parameter: VSPD.
	Pulse Width	The number of lines (Machine) or milliseconds (Time) of the vertical sync pulse. Parameter: VSPW.
 (green calculator)		Indicates that the value in the field is calculated by the Format Editor.
 (red calculator)		Indicates that the value in the field is calculated by the Format Editor, and that the new value has replaced the value previously in the field.
		Indicates that the values in this field are settable in the current configuration.
Red Field		Indicates that the fields are in the read only mode. These fields will show a change in value when the value in a field affecting these fields is modified.
Green Field		Indicates that the fields are in the read/write mode. When you make a change and hit the enter key new values will be calculated.
Black Field		Indicates that the fields can be modified directly and are calculated when other related fields are modified.
Grey Field		Indicates that the fields are disabled because the Entry Units are selected such that the fields are not used. However these fields will show a change when the value in a field affecting these fields is modified.

The right side panel of the **Timing** tab in the Format Editor is shown below. The table that follows describes each of the fields in the panel.

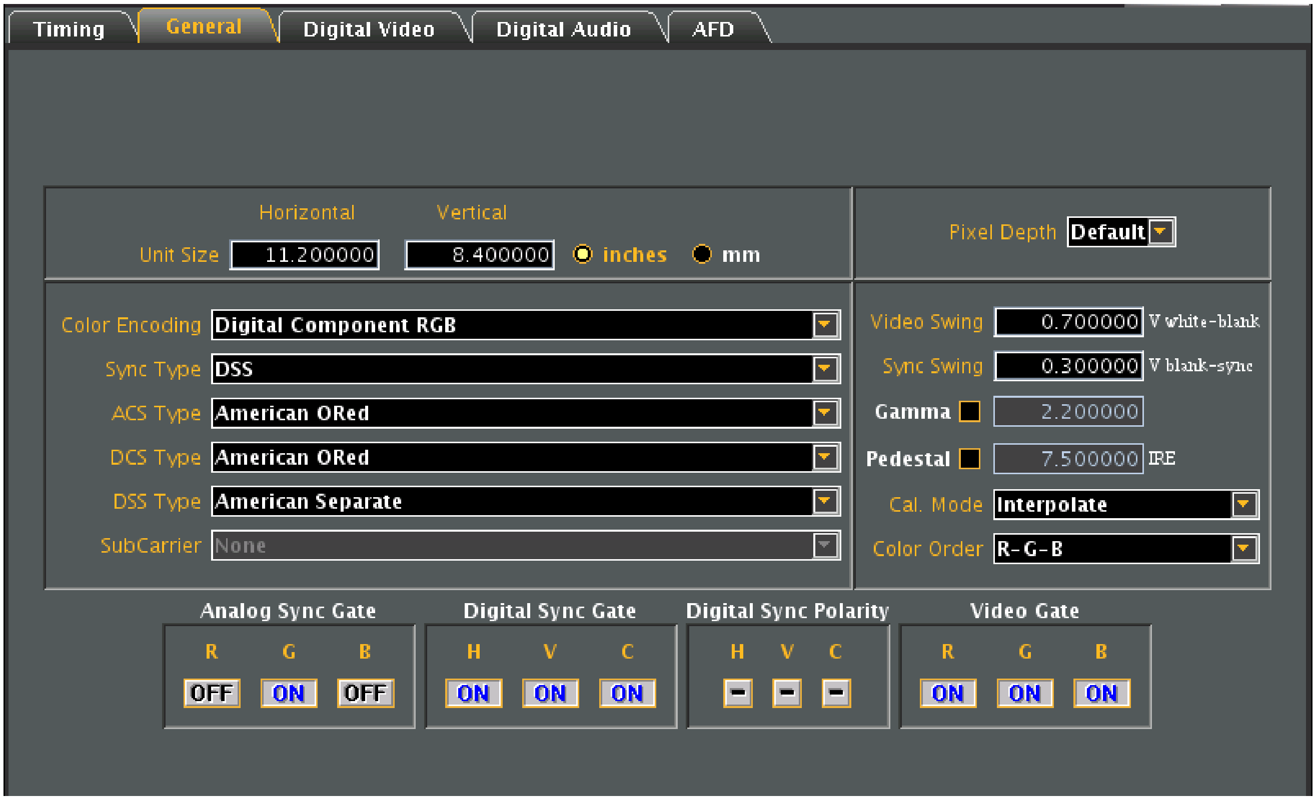
This table describes each of the fields in the main panel of the **Timing** tab.

Tab	Field	Description / Function
Pixel Rate	Machine	Activates the fields in the timing tab window such that the timing parameter values are expressed and settable in terms of pixels and lines.
	Time	Activates the fields in the timing tab window such that the timing parameter values are expressed and settable in terms of time increments such as milliseconds and microseconds.
Scan Type	Progressive	Sets the format scan type to Progressive. Parameter: SCAN = 2
	Interlace	Sets the format scan type to Interlaced. Parameter: SCAN = 1
Check boxes	Back Porch	Toggles the Pulse Delay field so that the value is provided for the back porch rather than the front porch.
	Clock Pulse	Enables and disables the pixel clock pulse output on generators that have a pixel clock output available.

Tab	Field	Description / Function
		The pixel clock output appears on the special sync BNC connector.
	Pre-Emphasis	Enables and disables adding pre-emphasis to the Open LVDI digital outputs on generators that support LVDI outputs.
	DC Balance	Not used.
	Flat Front Porch	Determines if composite sync will have all equalization pulses removed in the vertical sync front porch (delay) period as required by certain military HOBO and Maverik video formats.
	Tri-Level Sync	Enables or disables Tri-Level sync.
	Repeat Field	Determines if identical video information is output for each field of an interlaced (SCAN = 2) format.

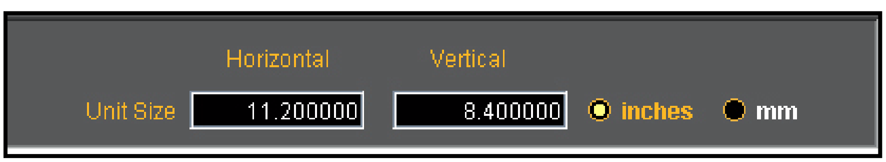
17.2.2 General Tab

The **Format Editor General** tab is shown below. The table that follows describes each of the fields in the tab.



New Format - General Tab (Top Left Panel)

The top left panel of the General tab in the Format Editor is shown below.

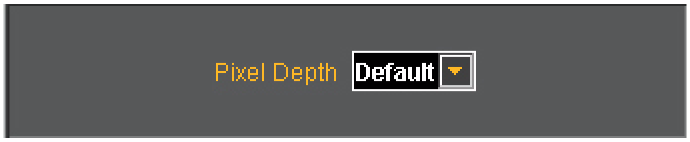


The table that follows describes each of the fields in the top left panel of the General tab.

Field / Entity	Type	Description / Function
Horizontal	Entry field	The horizontal aperture of the display under test.
Vertical	Entry field	The vertical aperture of the display under test.
Unit Size	**Radio Buttons:**	
	inches	Selects the unit size of the Horizontal and Vertical Size entities to be expressed in inches.
	mm	Selects the unit size of the Horizontal and Vertical Size entities to be expressed in millimeters.

New Format - General Tab (Top Right Panel)

The top right panel of the **General** tab in the **Format Editor** is shown below.

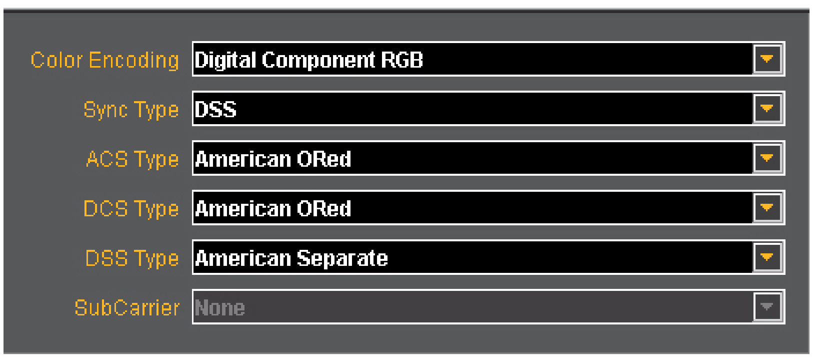


The table that follows describes each of the fields in the top right panel of the **General** tab.

Field / Entity	Type	Description / Function
Pixel Depth	Pull-down menu	Establishes the number of data bits that represent each active pixel in video memory (frame buffer). Parameter: PELD. There are three settings: • Default - uses the generator default • 8 - 8 bits-per-pixel (256 colors) • 24 - 24 bits-per-pixel (16,777,216 colors)

New Format – General Tab (Center Panel)

The center panel of the **General** tab in the **Format Editor** is shown below.



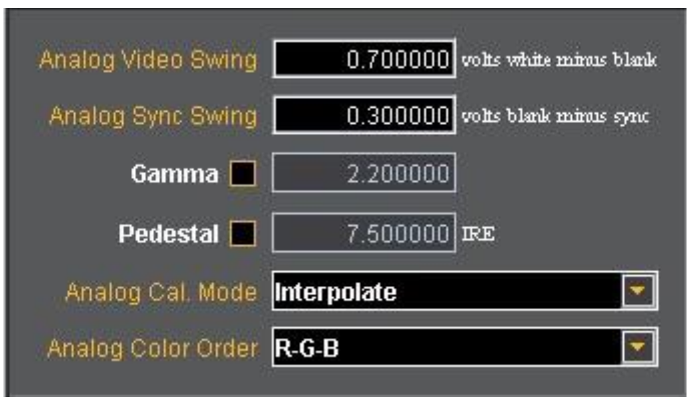
The table below describes the pull-down menus in the center panel of the **General** tab.

Field / Entity	Description / Function
Color Encoding	Sets the colorimetry of the format. The parameter is AVST or DVST. The following are the selections: • Digital Component RGB • Digital Component YCbCr SDTV (ITU-R BT.601-5) • Digital Component YCbCr HDTV Legacy (SMPTE 240M) • Digital Component YCbCr HDTV Modern (ITU-R BT.709-5) • Digital BT.601 xvYCC • Digital BT.709 xvYCC **Note**: Several options are not shown and are not applicable to HDMI.
Sync Type **Not used for HDMI**	Sets the sync type of the format. The following are the selections: • (0) None • (1) DSS - Digital Separate Sync

Field / Entity	Description / Function
	• (2) DCS - Digital Composite Sync • (3) ACS - Analog Composite Sync • (4) ACS, DSS - Analog Composite Sync, Digital Separate Sync • (5) ACS, DCS - Analog Composite Sync, Digital Composite Sync • (6) ACS, DCS, DSS - Analog Composite Sync, Digital Composite Sync and Digital Separate Sync • (7) DPMS OFF • (8) DPMS Suspend • (9) DPMS Standby • (10) DPMS ON **Note**: Several options are not shown and are not applicable to HDMI.
ACS Type (Not used)	
DCS Type (Not used)	
SubCarrier (Not used)	

New Format - General Tab (Right Panel)

The right panel of the General tab in the Format Editor is shown below.



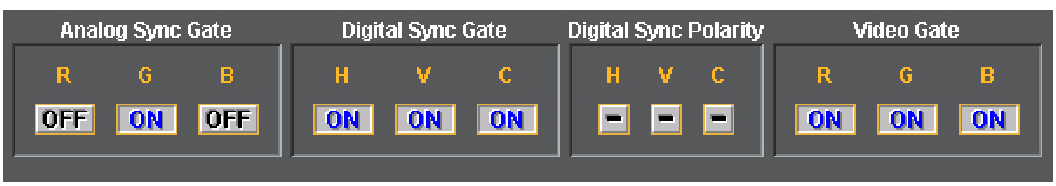
The table below describes the entities and fields of the right-side panel of the **General** tab.

Field / Entity	Entity Type	Description / Function
Analog Video Swing Not used for HDMI	Entry field	Sets the analog video swing.
Analog Sync Swing Not used for HDMI	Entry field	Sets the analog sync swing.
Gamma Not used for HDMI	Check box	Enables or disables Gamma. Used with the entry field below.
	Entry field	Enables you to set the Gamma once the Gamma check box above is enabled (checked). The allowable ranges of values is 0.1 to 10.0.

Field / Entity	Entity Type	Description / Function
Pedestal **Not used for HDMI**	Check box	Enables or disables the Pedestal. Used with the entry field below. Pedestal is only supported on NTSC format types.
	Entry field	Enables you to set the Pedestal once the Pedestal check box above is enabled (checked). The allowable ranges of values is 0 IRE to 100 IRE.
Analog Cal. Mode **Not used for HDMI**	Pull-down select	Sets the analog calibration mode. Determines how the generator tests and calibrates its analog video outputs. The following are the selections: • Interpolate • Measure Interpolate • Measure Set Absolute • Test Levels
Analog Color Order **Not used for HDMI**	Pull-down select	Sets the mapping of the analog video colors to the video output connections. Parameter: AVCO. The following are the selections: • RGB - R to R, G to G, B to B (default) • RBG - R to R, B to G, G to B • GRB - G to R, R to G, B to B • GBR - G to R, B to G, G to B • BRG - B to R, R to G, G to B • BGR - B to R, G to G, R to B

New Format - General Tab (Bottom Panel)

The bottom panel of the **General** tab in the **Format Editor** is shown below.



The table below describes the gating functions of the right-side panel of the **General** tab.

Field / Entity	Entity Name	Description / Function
Analog Sync Gate **Not used for HDMI**	Select buttons	Enables you to put the analog composite sync on one of the components when analog composite sync is selected as the sync type . Multiple selections can be made.
	R	Puts the analog composite sync on the Red component.
	G	Puts the analog composite sync on the Green component.
	B	Puts the analog composite sync on the Blue

Field / Entity	Entity Name	Description / Function
		component.
Digital Sync Gate Not used for HDMI	Select buttons	
	H	Enables and disables the digital horizontal sync output.
	V	Enables and disables the digital vertical sync output. To use digital vertical sync, the digital separate H and V sync must be selected.
	C	Enables and disables the digital vertical sync output.
Digital Sync Polarity Not used for HDMI	Select buttons	
	H	Determines whether the digital horizontal sync pulse polarity is positive going or negative going.
	V	Determines whether the digital vertical sync pulse polarity is positive going or negative going.
	C	Determines whether the digital composite sync pulse polarity is positive going or negative going.
Video Gate	Select buttons	Enables you to gate ON or OFF any of the video components. More than one can be selected.
	R	Gates ON or OFF the Red component. Parameter: REDG
	G	Gates ON or OFF the Green component. Parameter: GRNG.
	B	Gates ON or OFF the Blue component. Parameter: BLUG.

17.2.3 Digital Video Tab

The **Format Editor Digital Video** tab is shown below.

The table that follows describes each of the fields in the **Digital Video** tab.

Field / Entity	Entity Type	Description / Function
Range	Entry field	Specifies the quantization range for the digital video. Parameter: DVQM. The values available are described in CIA-861E: • 0 - Full Range for computer applications. • 1 – for testing the undershoot/overshoot signal code margins. • 2 – Limited range for reduced range required by television standards.
Clocks per Pixel	Entry field	Specifies the number of clocks per pixel (double clocking factor for whole line. Parameter: NCPP. This parameter is used to boost the clock rate to the minimum supported by TMDS interface. Allowable values are: • 1 - one clock per pixel. • 2 - two clocks per pixel.

Field / Entity	Entity Type	Description / Function
Pixels per Pixel	Entry field	Specifies the number of pixels per pixel. This parameter specifies the pixel repetition factor for the active portion of the line. Allowable values are: • 0 - disables repetition mode • 1 to 10 - enables pixel repetition (inserts extra left and right pixel repetition bars) Parameter: NPPP.
AVI Video Identification Code	Entry field	The digital video code corresponding to the EIA/CEA-861 standard. Parameter: DVIC.
Number of Links	Radio button	
	1	Sets the number of links to 1 by the DVI output.
	2	Sets the number of links to 2 for the DVI output
Protocol Type	Pull-down select	Specifies which digital output is active through the HDMI interface. Allowable values are: • DVI - Enables DVI mode out the DVI output or the HDMI output. • HDMI - Enables HDMI mode out the HDMI output. Parameter: XVSI
Sampling Mode	Pull-down select	Specifies the digital sampling mode. Allowable values are: • Default - RGB 4:4:4. • 4:2:2 - Color difference components are sampled at half the pixel rate. Luminance is sampled at the full pixel rate. Requires that the YCbCr color mode be selected with the DVST command. • 4:4:4 - Color difference components and luminance component is sampled at the full pixel rate. Requires that the YCbCr color mode be selected with the DVST command. Parameter: DVSM
Bits per Color Component	Pull-down select	Specifies the number of bits per component. Allowable values are: • Default - Use the default setting in the generator. • 6 - Six bits per component. • 8 - Eight bits per component. • 10 - Ten bits per component. • 12 - Twelve bits per component. Parameter: NBPC

17.2.4 Digital Audio Tab

The **Format Editor Digital Audio** tab is shown below. The table that follows describes each of the fields in the tab.

The table below describes each of the fields in the **Digital Audio** tab.

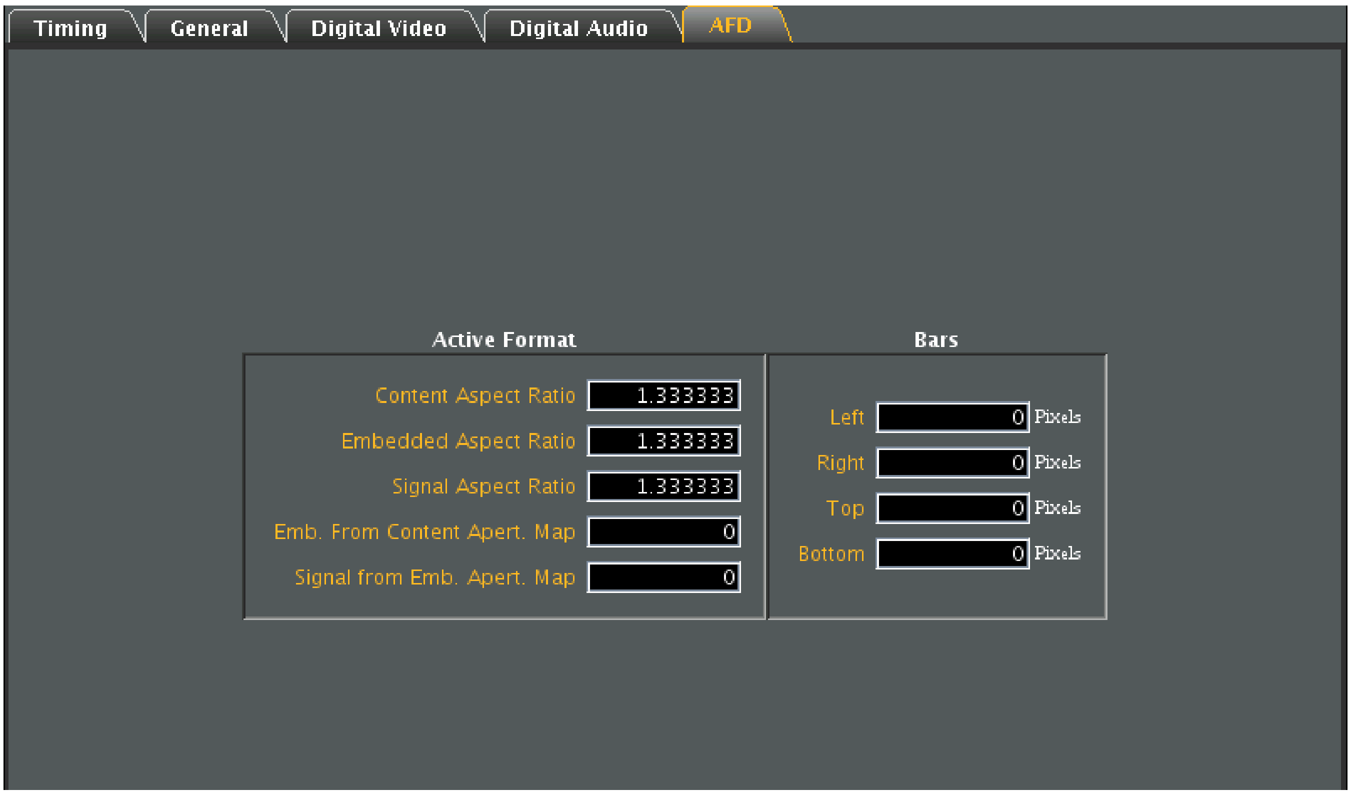
Field	Type	Description / Function
Signal Interface	Pull-down select	Sets the digital audio signal interface. The valid values are: • None - Use DP. • SPDIF. • AES3 (not used). • AESid (not used). • TOSlink optical (not used). • MiniPlug (not used).
Signal Type	Pull-down select	Sets the digital audio signal interface. The valid values are: • None • IEC 60958-3 Consumer LPCM. • IEC 60958-4 Professional LPCM. • IEC 61937 w/AC-3 (Dolby Digital). • MP2 (Video CD) (not used).

Field	Type	Description / Function
		• MP3 (MPEG1 Layer 3) (not used). • MPEG2 5.1 channels Advanced Audio Coding (AAC) • MPEG2 7.1 channel CBR or VBR • IEC 61937 w/'DTS • ATRAC
Level Shift	Entry field	Sets the digital audio level shift value for linear PCM. The valid values are: 0 - 15 dBFS. Parameter is: DALS
Sampling Rate	Entry field	Sets the digital audio sampling rate for linear PCM. The valid values are: • 32.0kHz • 44.1kHz • 48.0kHz • 88.2kHz • 96.0kHz • 176.4kHz • 192.0kHz Parameter is: ARAT
Number of Streams	Entry field	Sets the digital audio streams. The valid value is: 1. Parameter is: NDAS.
Number of Channels	Entry field	Sets the digital audio sampling rate for linear PCM. The valid values are: 2 through 8 Parameter is: NDAC.
Bits per Sample	Pull-down select	Sets the digital audio sampling rate for linear PCM. The valid values are: • 16 • 20 • 24 Parameter is: NBPA.
Contents Gated	Entry field	Sets the digital audio content gate. The valid values are: 0 through 4095. Refer to EIA/CEA-861-x.
Contents Available	Entry field	Sets the digital audio content available. The valid values are: 0 through 4095. Refer to EIA/CEA-861-x.
Mix Down Gate Not applicable	Check box	Sets the digital audio down-mix gate. The valid values are: enabled (0) or disabled (1).
Channels Available	Entry field	Sets the digital audio channels available. The valid values are: 0 through 255. Refer to EIA/CEA-861.

Field	Type	Description / Function
Channels Gated	Entry field	Sets the digital audio channel gate. The valid values are: 0 through 255. Refer to EIA/CEA-861.

17.2.5 AFD Tab

The **Format Editor AFD** tab is shown below. The table that follows describes each of the fields in the tab.



The table that follows describes each of the text entry fields in the **AFD** tab.

Heading	Field	Description / Function
Active Format	**Content Aspect Ratio**	Sets the aspect ratio of the source image content. The valid parameter range is: 0.75 to 2.39.
	Embedded Aspect Ratio	Sets the aspect ratio of the extended image content. The valid parameter range is: 0.75 to 2.39.
	Signal Aspect Ratio	Sets the aspect ratio of the video signal image content. The valid parameter range is: 0.75 to 2.39.
	Extended From Content Apert. Map	Enables you to set the mapping type for mapping CXAR-shaped image content into the extended EXAR-shaped aperture.
	Signal from Extended Apert. Map	Enables you to set the mapping type for mapping EXAR-shaped image content into the SXAR-shaped signal interface.
Bars	**Left**	Sets the left side letterbox bars in pixels.
	Right	Sets the right side letterbox bars in pixels.
	Top	Sets the top letterbox bars in pixels.
	Bottom	Sets the bottom letterbox bars in pixels.

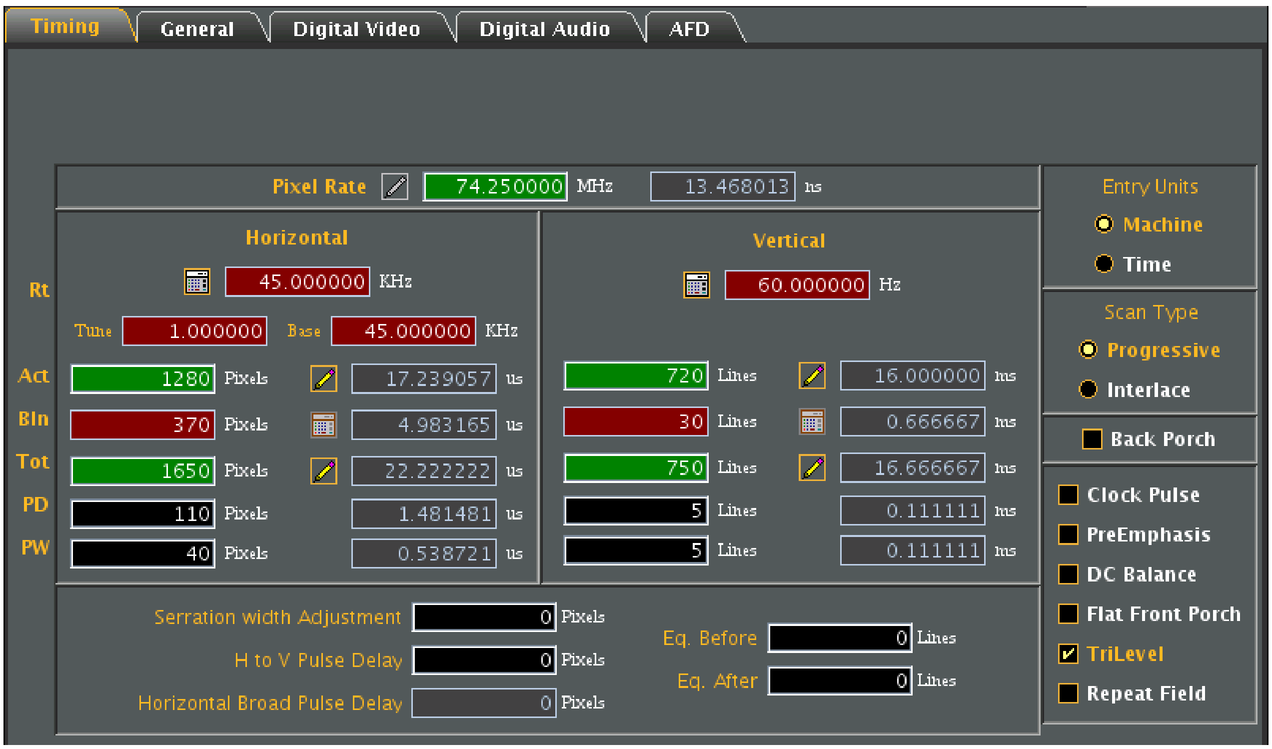
17.3 Modifying an Existing Format Using the Format Editor

The procedure below describes how to make a few changes on an existing format using the **Format Editor**. This enables you to quickly run tests a display by tweaking a few timing parameters at a time.

Optionally, you can save these modified formats to easily recall later, and add them to a **Format List** to quickly access your preferred custom or standard formats.

To modify an existing format with the Format Editor:

Use the procedure in the previous subsection to **Open** an existing format. The format parameters of the selected format will appear in the new format **Timing** window as shown below.

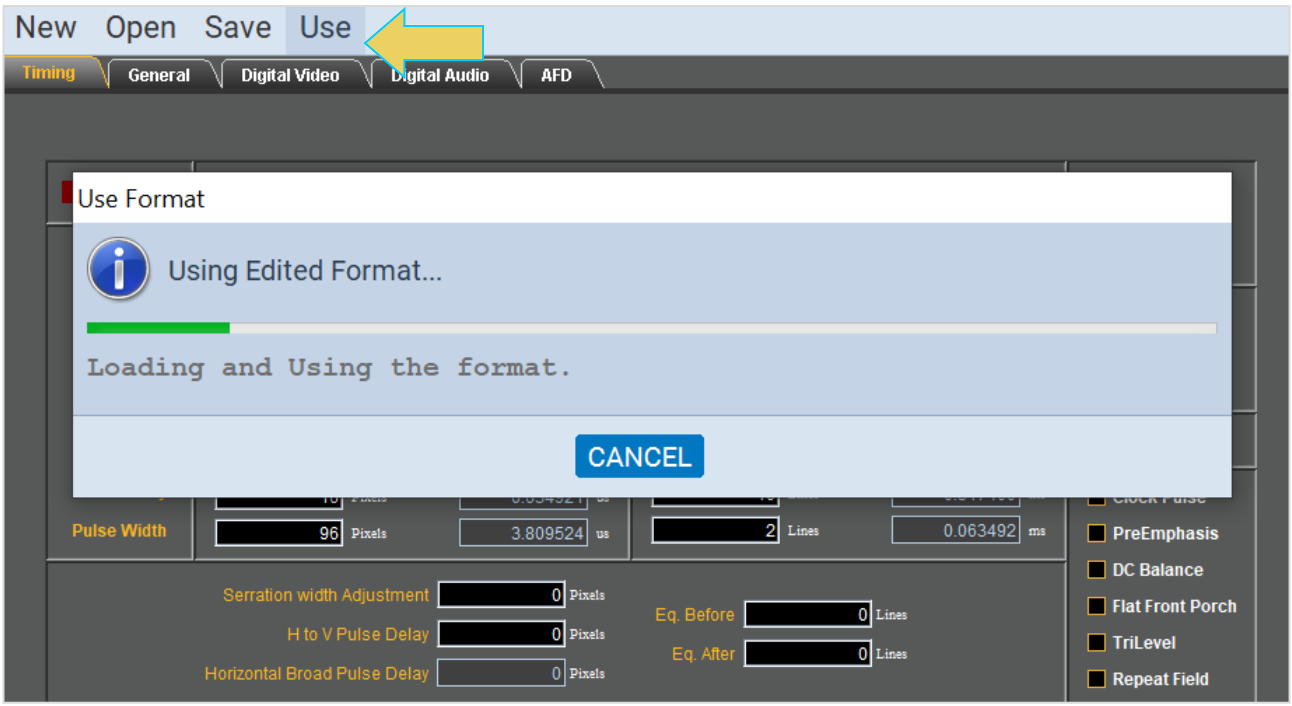


Modify the parameters as required for the new format. The following guidelines will help you modify the format parameters.

- When selecting a parameter to modify on the **Timing** tab, ensure that the value is editable. To be editable, the field either needs to have a pencil icon next to it or a black field background. Gray fields are disabled for editing. Fields in red (with the calculator icon) cannot be modified. However you can change whether a field can be modified by clicking on the calculator icon which will cause it to change to a pencil icon allowing you to change its value.
- Upon modifying a format value hit the enter key to invoke the change. The **Format Editor** applies the new value to the timing algorithm and updates any values dependent on the value you entered (or changed).
- For example, to change the horizontal resolution to 660, enter the value in the **Active** field under Pixels in the Horizontal area.

- You will notice that the Format Editor has calculated and written values to the **Blank** and **Period** fields as indicated by the red calculator () symbol. Although the Period value has not changed, the **Format Editor** still indicates it is a calculated value by displaying the red calculator.

Apply the modified format by clicking on the **Use** activation button on the bottom of window, as shown below. Optionally, save the format to add to a **Format List** (Format List Editor described in the next section).



18 Compliance Testing

Important Note: The compliance tests are not yet supported on the M42h. This section is for future reference only.

18.1 Overview

The Teledyne LeCroy quantumdata M42h 96Gbps Video Analyzer / Generator for HDMI® can be easily extended from an entry level functional tester to a full certified compliance tester. The M42h also supports the full suite of FRL source and sink compliance tests as well as Enhanced Audio Return Channel (eARC) compliance testing for both Tx and Rx devices.

Below is a summary of the various suites of compliance tests that the M42h offers:

Fixed Rate Link (FRL) Source Compliance Test – Run compliance tests on your Fixed Rate Link-capable source device. Test suite includes Protocol, Link Training, Video Encoding, Video Timing, Audio, InfoFrame, EDID, etc.

Fixed Rate Link (FRL) Sink Compliance Test – Run compliance tests on your Fixed Rate Link-capable sink device. Test suite includes Character Error Detection, Reed Solomon, Video Decoding, Video Timing, Audio, InfoFrame, EDID, etc.

Display Stream Compression (DSC) Sink Compliance Test – Run compliance tests on your Display Stream Compression (DSC)-capable sink device. The test patterns and formats necessary to run the DSC sink compliance tests are precached for fast rendering.

Display Stream Compression (DSC) Source Compliance Test – Run compliance tests on your Display Stream Compression (DSC)-capable source device.

eARC Compliance Test – The M42h enables developers of HDMI eARC Tx and Rx devices to run compliance tests on their eARC-capable. The compliance tests run with little or no human interaction. Detailed results are provided for each test to help identify the root cause of failures.

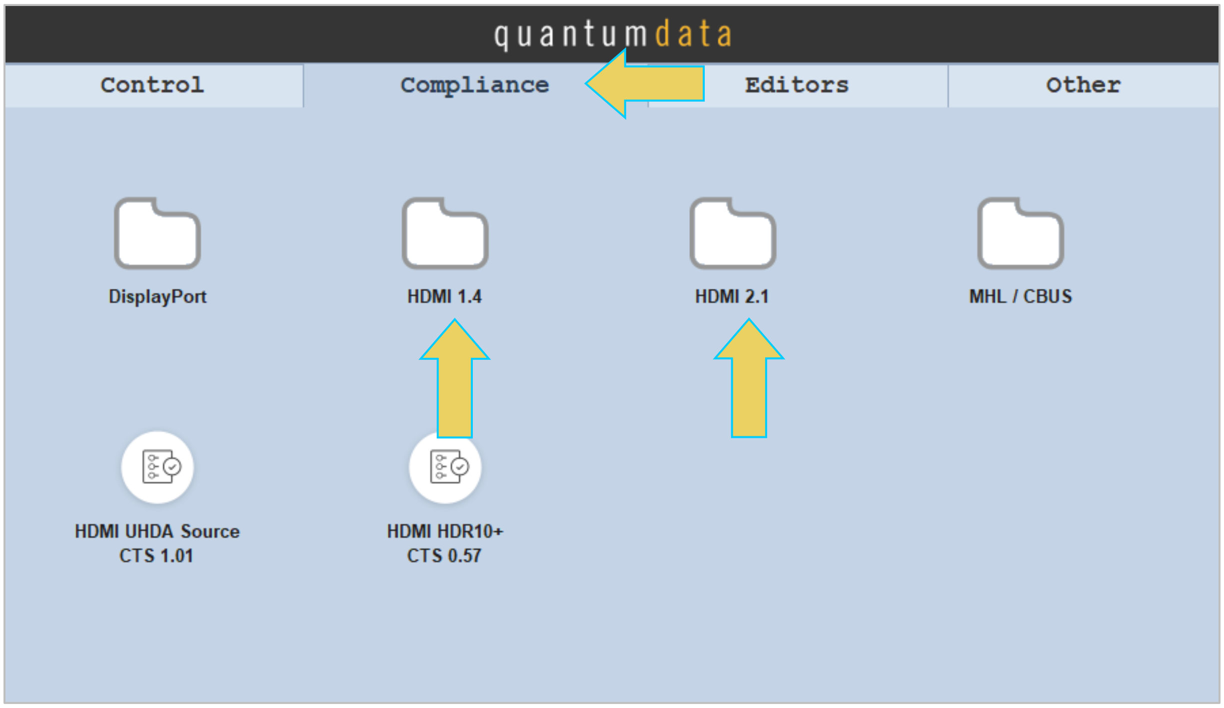
HDMI TMDS Source Compliance Test – The M42h for HDMI Testing enables developers of HDMI source devices and silicon makers to run compliance tests on their TMDS source devices on streams at up to 4K video resolutions.

HDMI TMDS sink Compliance Test – The M42h for HDMI Testing enables developers of HDMI sink devices and silicon makers to run compliance tests on their TMDS sink devices at up to 4K video resolutions.

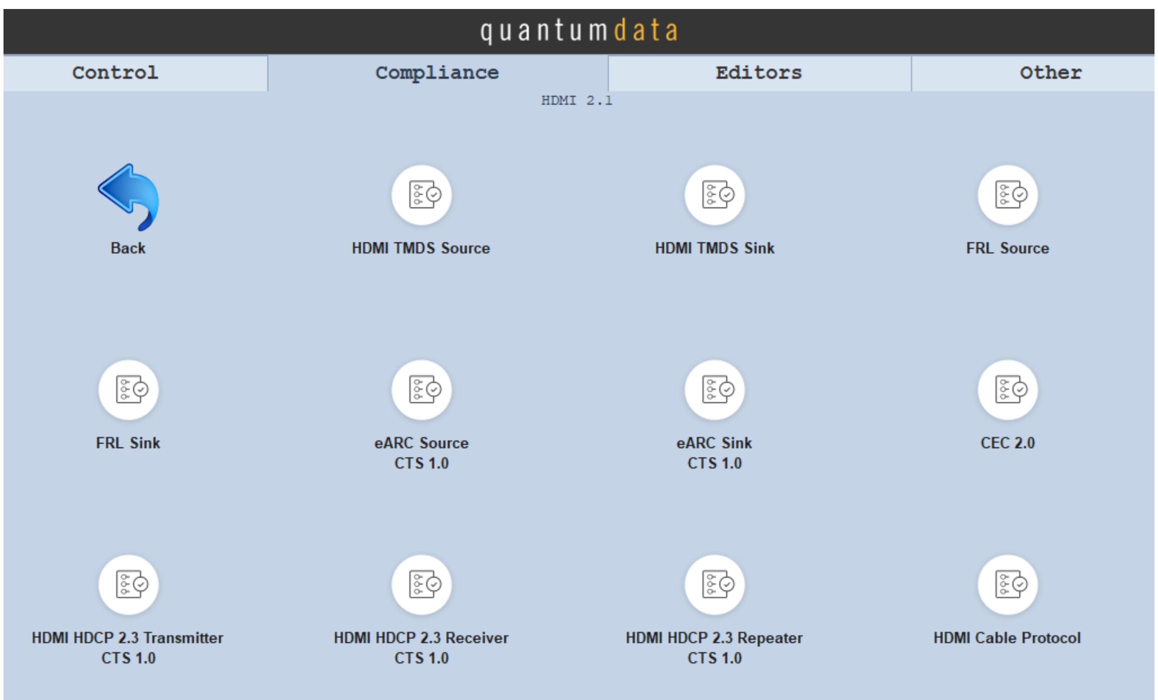
HDCP 2.2 Compliance (Source and Sink) Test – The M42h HDCP 2.2 compliance tests are ideal for pretesting your HDMI source, sink or repeater product prior to submission to an Authorized Test Center for approval. Pretesting provides assurance that your product will pass at the ATC when submitted. The compliance tests enable you to view the auxiliary channel analyzer traces logged during the test to help diagnose the cause of compliance test failures.

18.2 Accessing the Compliance Test Suites

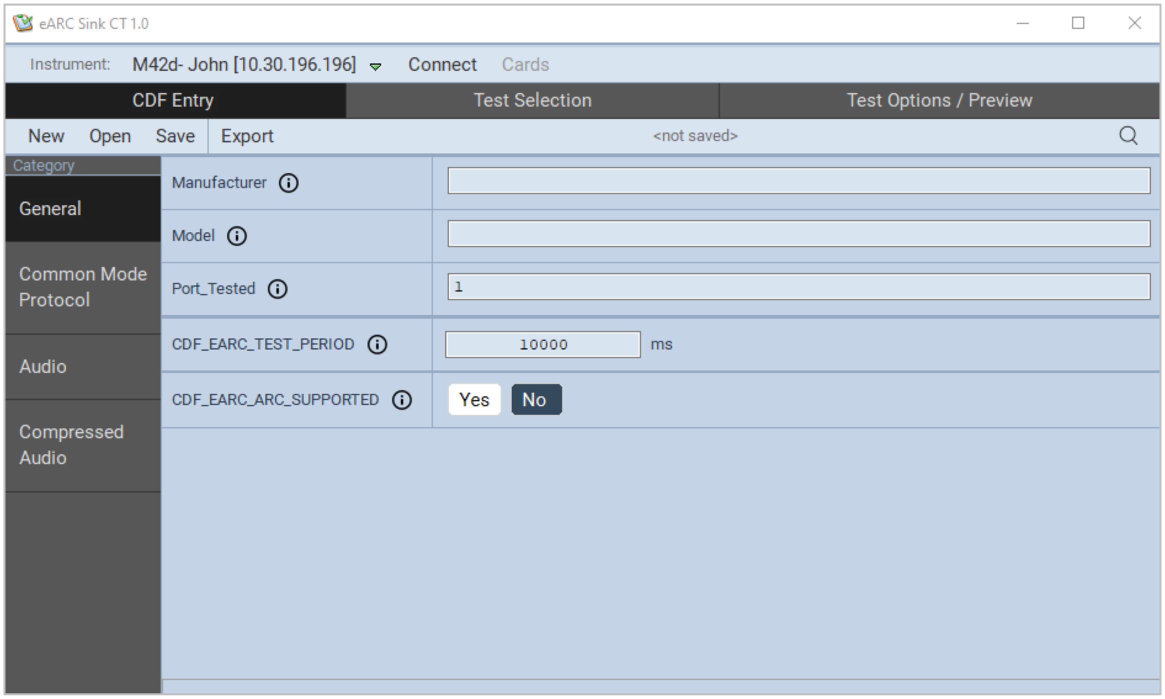
To access all of the Compliance Tests, navigate to the **Compliance** tab of the home screen and select **HDMI 1.4** or **HDMI 2.1**, according to your testing requirements, as shown below.



The below screen is the list of available HDMI 2.1 Compliance Test Suites (often referred to as CTS).



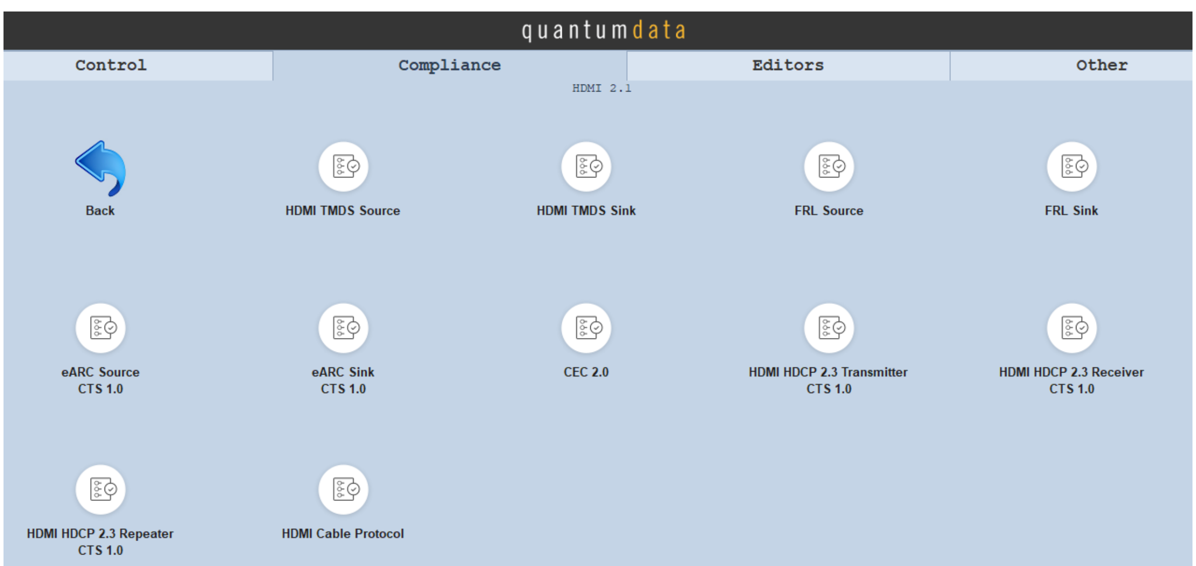
Click on a CTS to access the compliance testing utility. On the remote ATP Manager this will be a pop up; on the embedded instrument GUI it is in the same window. See below for an example of the eARC Sink CT 1.0 testing screen.



Operation of the CTS will be discussed in a later section, but all follow the specifications of the MOI.

18.3 Compliance Tests Available

Refer to the screen below to see the available Compliance Test Suites. A brief description of each follows.



HDMI TMDS Source Compliance Test – The M42h for HDMI Testing enables developers of HDMI source devices and silicon makers to run compliance tests on their TMDS source devices on streams at up to 4K video resolutions.

HDMI TMDS sink Compliance Test – The M42h for HDMI Testing enables developers of HDMI sink devices and silicon makers to run compliance tests on their TMDS sink devices at up to 4K video resolutions.

Fixed Rate Link (FRL) Source Compliance Test – Run compliance tests on your Fixed Rate Link-capable source device. Test suite includes Protocol, Link Training, Video Encoding, Video Timing, Audio, InfoFrame, EDID, etc. Includes Compliance Testing for DSC-Capable Source Devices.

Fixed Rate Link (FRL) Sink Compliance Test – Run compliance tests on your Fixed Rate Link-capable sink device. Test suite includes Character Error Detection, Reed Solomon, Video Decoding, Video Timing, Audio, InfoFrame, EDID, etc. Includes Compliance Testing for DSC-Capable Sink Devices

eARC Source and Sink Compliance Tests – The M42h enables developers of HDMI eARC Tx and Rx devices to run compliance tests on their eARC-capable. The compliance tests run with little or no human interaction. Detailed results are provided for each test to help identify the root cause of failures.

Consumer Electronic Control (CEC) Compliance Tests – The M42h allows the user to execute compliance testing to ensure that the HDMI feature Consumer Electronic Control (CEC) is compliant with spec.

HDCP 2.2 Compliance (Source and Sink) Test – The M42h HDCP 2.2 compliance tests are ideal for pretesting your HDMI source, sink or repeater product prior to submission to an Authorized Test Center for approval. Pretesting provides assurance that your product will pass at the ATC when submitted. The compliance tests enable you to view the auxiliary channel analyzer traces logged during the test to help diagnose the cause of compliance test failures.

18.3.1 Important Note Regarding HDCP Compliance Test Formats

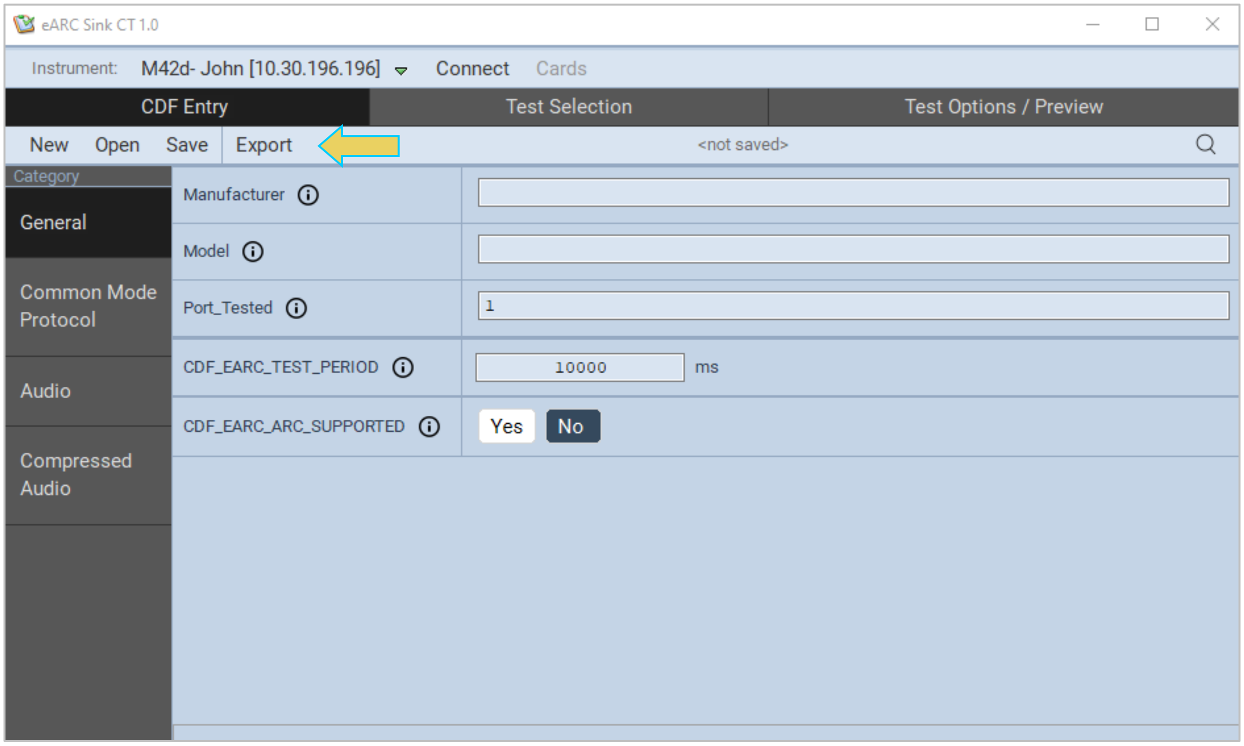
HDCP Compliance Tests on our products are limited to standard definition formats such as 480p60 and 576p50. Devices can pass compliance testing by using only 480p60 or 576p50.

A suggested way to validate HDCP operation in the Device Under Test is to pass the HDCP compliance tests, and also to pass HDCP functional testing with any other supported formats.

18.4 Executing Compliance Tests

18.4.1 CDF Entry

Upon opening a Compliance Test Suite, the first window displayed is the **CDF Entry** tab, as shown below.



The **Capabilities Declaration Form** is similar but ***not*** interchangeable with the HDMI Forum's CDF. There will be several tabs on the lefthand side within the **CDF Entry** tab. The screen example above is of eARC Sink CTS, and the subtabs at left are as follows:

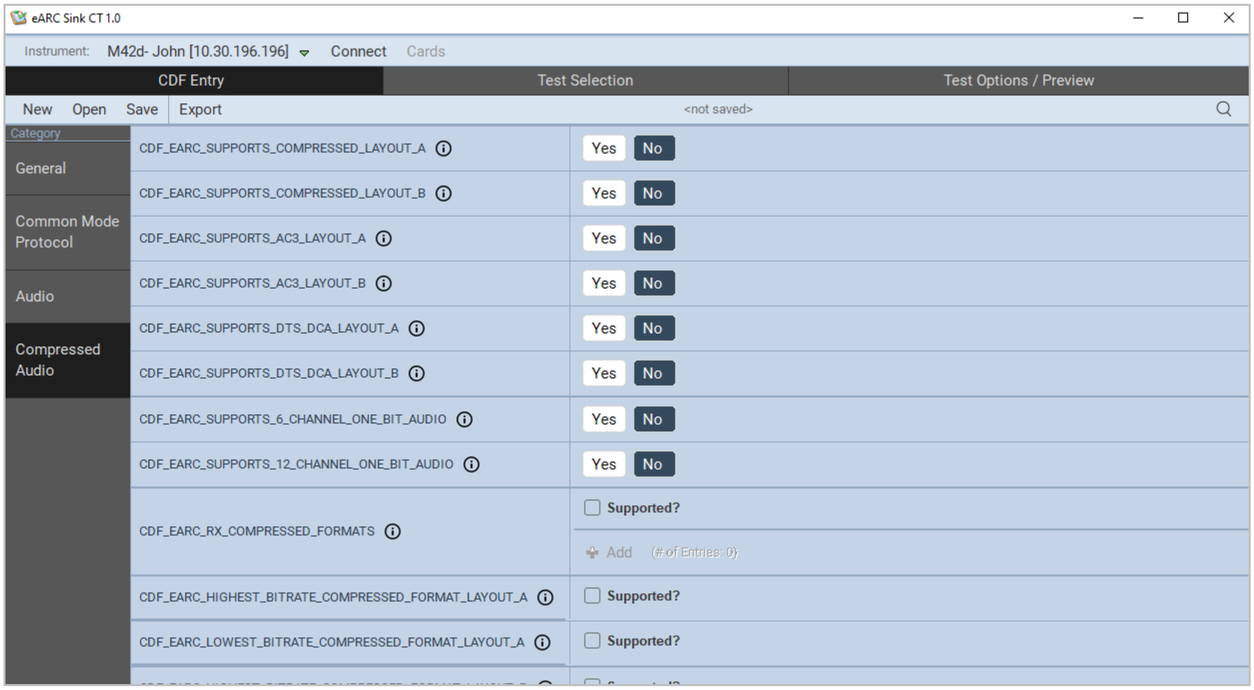
- **General**
- **Common Mode Protocol**
- **Audio**
- **Compressed Audio**

Depending on the Compliance Tests that are being executed, the **CDF Entry** window will have more or less categories on the left. Examples follow on the next page.

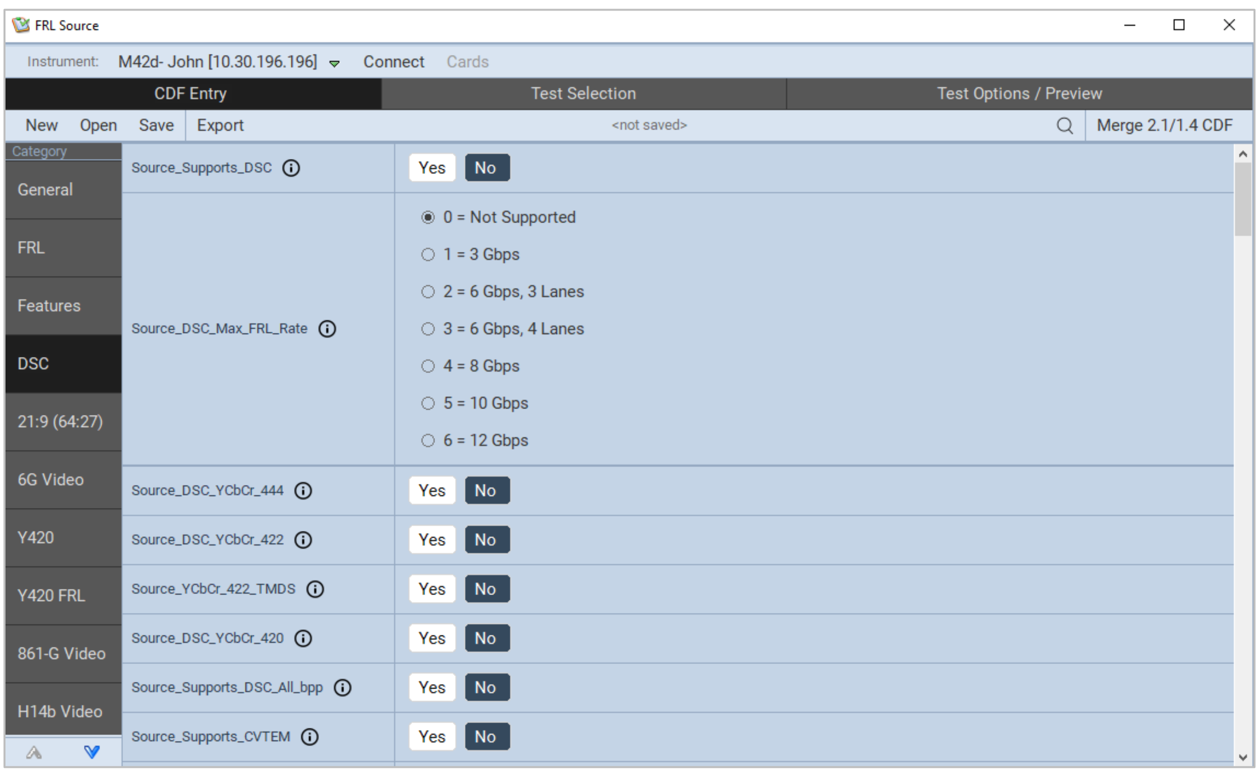
Complete the CDF Entry per your testing specifications.

Once CDF Entry is complete, you may **Save** or **Export** the entry for later use or dissemination to colleagues. Additionally, you may **Open** a previously saved CDF Entry. These options can be found at the top toolbar underneath the CDF Entry tab, as shown in the above image.

Use these subtabs to enter the capabilities of the DUT. A few screen examples of subtabs are below.



Compressed Audio CDF Entry within eARC Sink CT 1.0



Display Stream Compression (DSC) CDF Entry within FRL Source CTS

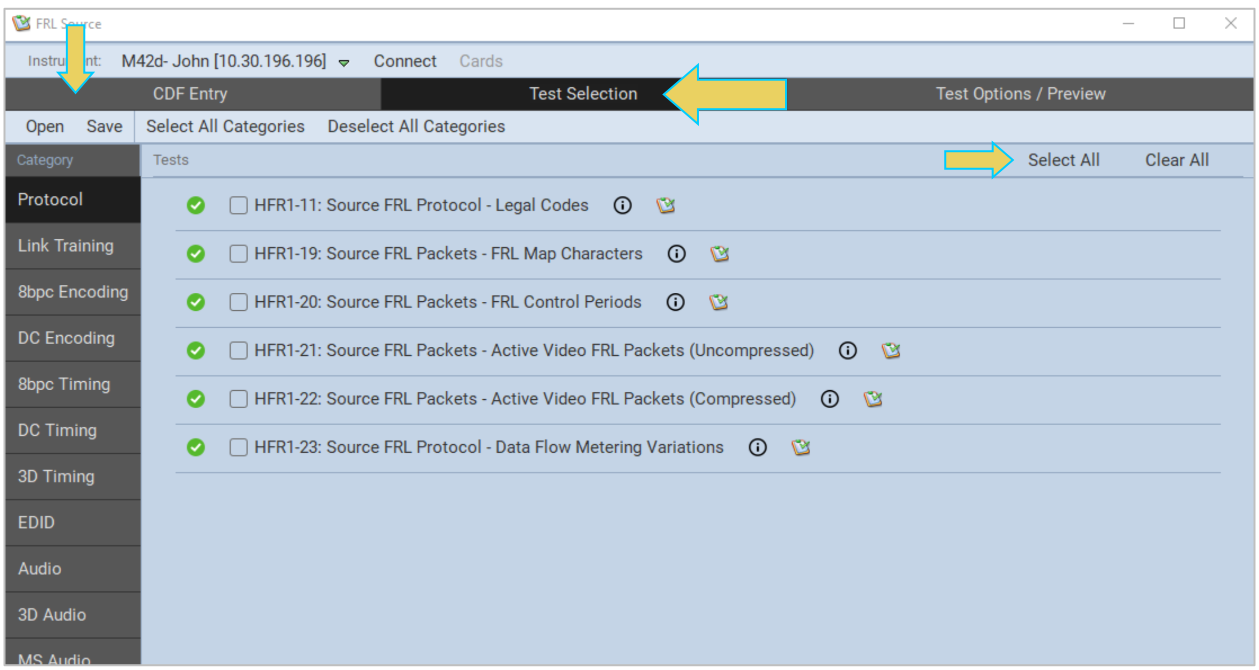
18.4.2 Test Selection

The **Test Selection** tab is directly to the right of the CDF Entry tab at the top of the window. The default window when clicking this tab will be the first **Category** listed as subtabs on the left. The screen below demonstrates what a user would see when selecting **Test Selection** in the FRL Source CTS.

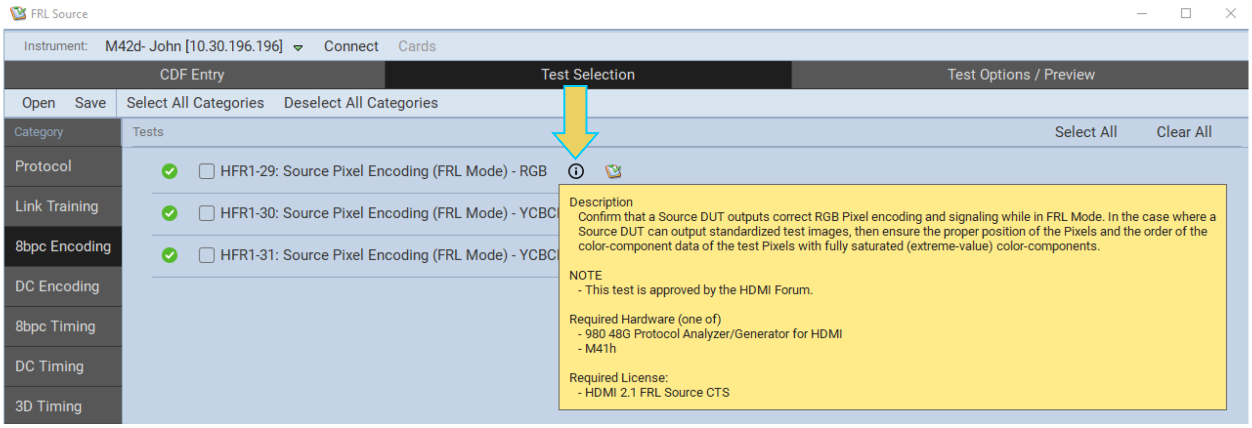
Easily **Select All** or **Clear All** selected tests within a category using the options at the top right.

Additionally, you can select every test in every category or deselect the same using the **Select All Categories** or **Deselect All Categories** buttons in the toolbar at the top left.

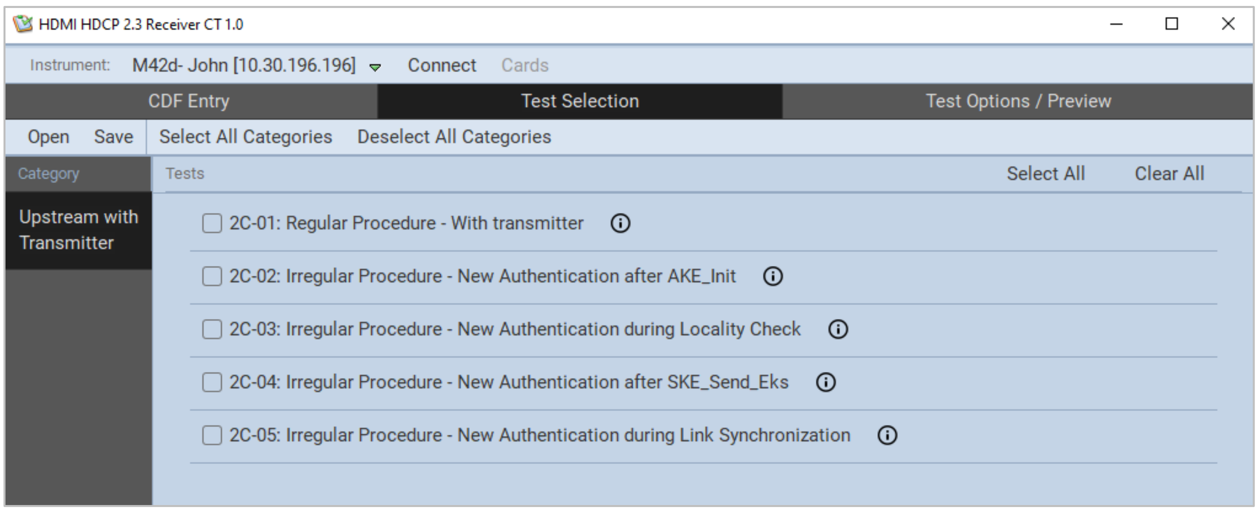
Similar to the CDF Entry tab, you may **Save** a selection of tests or **Open** a previously saved set of selections using the buttons at the top left as well, as demonstrated below.



Select the required Compliance Tests within each category according to your testing specifications. A brief description of a test can be seen by clicking the small ⓘ icon to the right of the test name, as shown below.

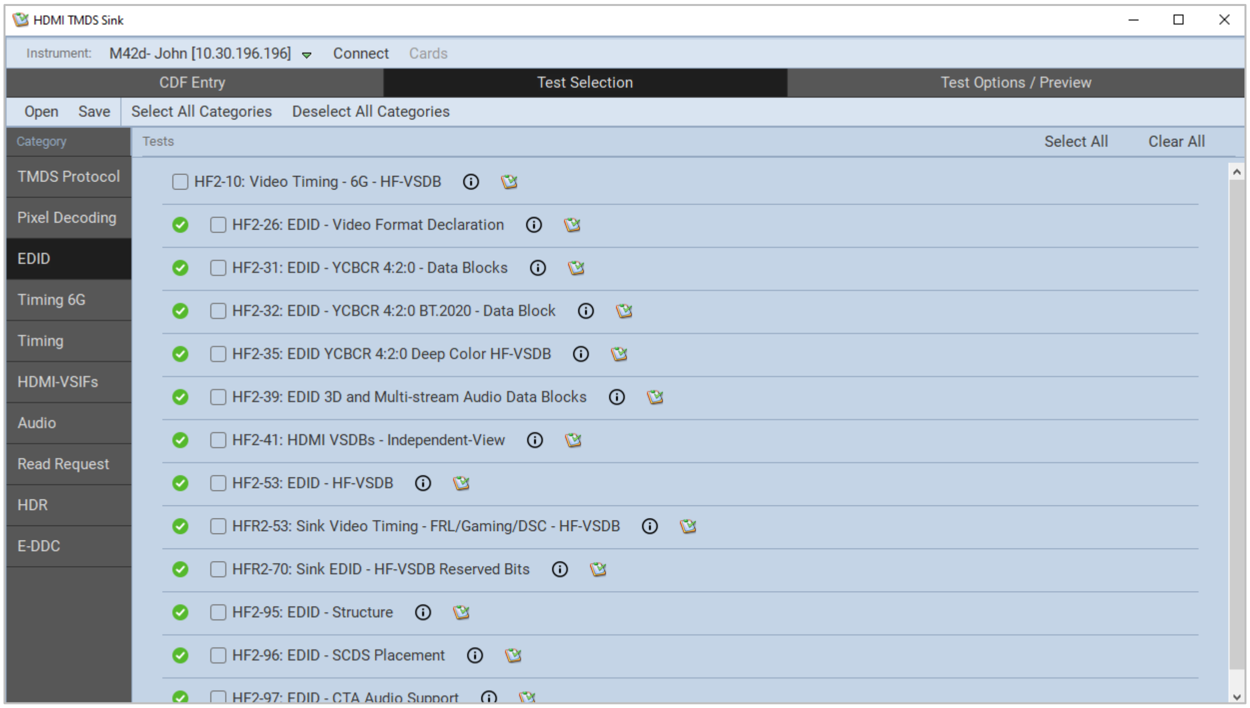


Below are some examples of Test Selection listings within various categories of different CTS.



Upstream with Transmitter Category within HDMI HDCP 2.3 Receiver CT 1.0

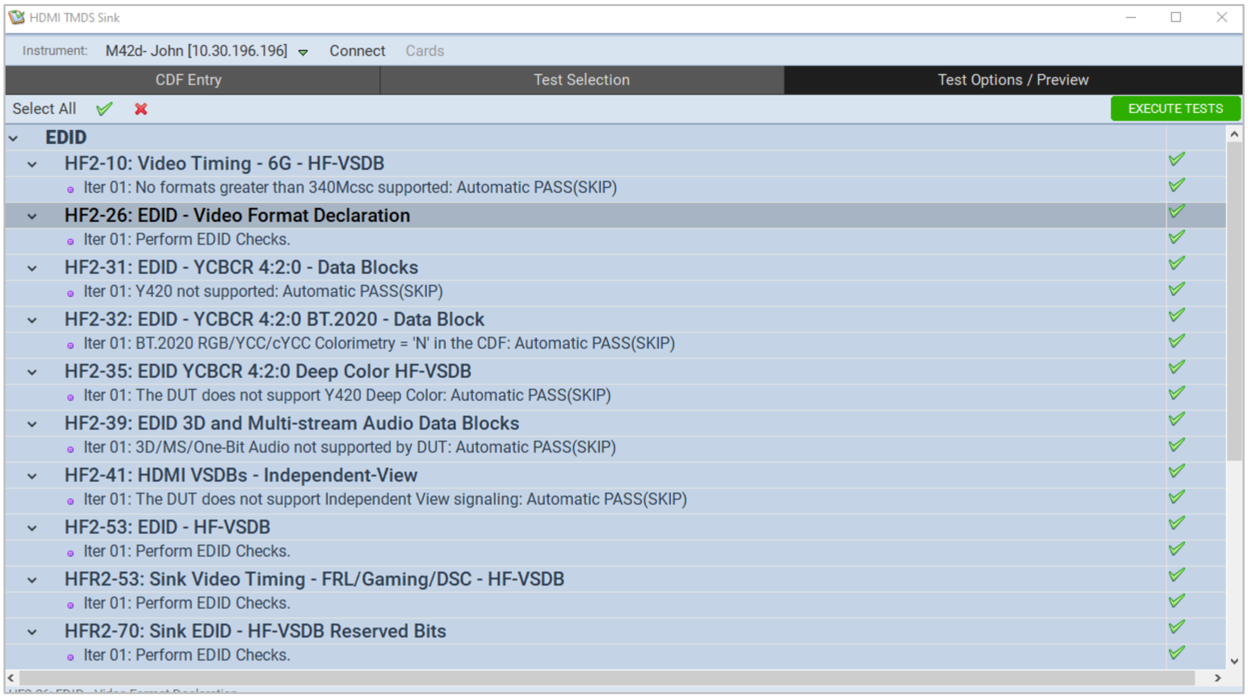
****Important note:** HDMI HDCP 2.3 Compliance Tests require standard definition formats such as 480p60 and 576p50. Devices can pass compliance testing by using only 480p60 or 576p50****



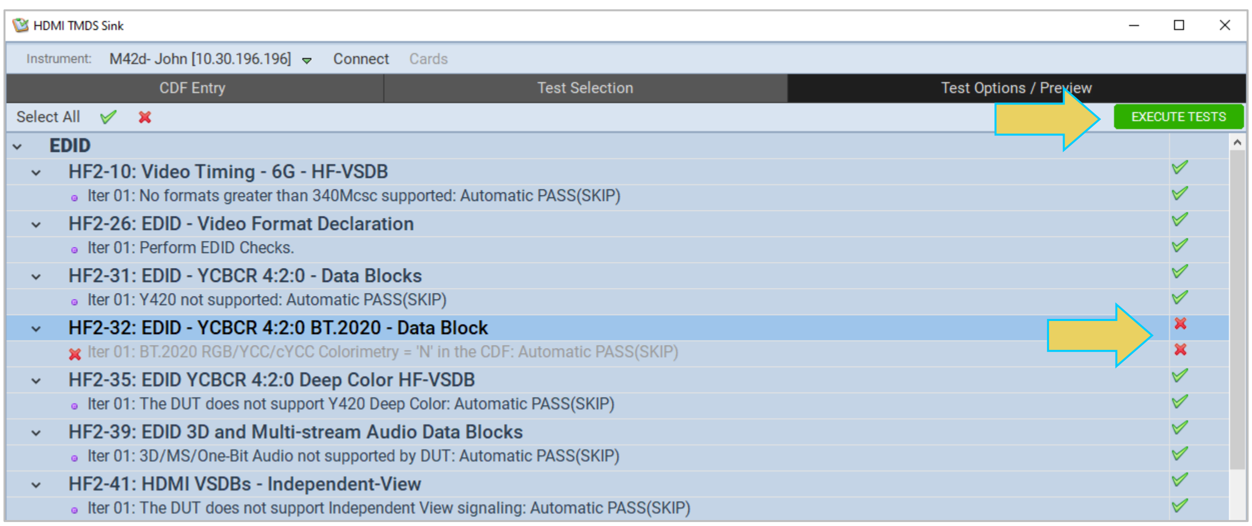
EDID Category within HDMI TMDS Sink CTS

18.4.3 Test Options / Preview

The last tab within the Compliance Test Suite is the **Test Options / Preview** tab, as shown below.



Here you will have the option of disabling/enabling certain tests by clicking the green check or red x on the righthand side of the window, as shown below.



Once all final selections are made, execute the Compliance tests by clicking the green **EXECUTE TESTS** button at the top right. Results will be available and displayed on screen as soon as the tests are complete.

18.5 API Compliance Test Execution

The following subsections provide whether or not a particular compliance test is compatible with the API.

Important Note: The Compliance tests and API are not yet supported in the M42h.

18.5.1 HDMI Source TMDS Tests

API-compatible HDMI Source TMDS compliance tests:

HF1-10	HF1-18	HF1-27	HF1-41	HF1-52
HF1-11	HF1-20	HF1-28	HF1-43	HF1-53
HF1-12	HF1-21	HF1-29	HF1-44	HF1-66
HF1-13	HF1-22	HF1-31	HF1-45	HF1-71
HF1-14	HF1-23	HF1-32	HF1-47	HF1-72
HF1-15	HF1-24	HF1-33	HF1-48	HF1-74
HF1-16	HF1-25	HF1-34	HF1-49	HF1-75
HF1-17	HF1-26	HF1-35	HF1-51	

API non-compatible HDMI Source TMDS compliance tests:

HF1-54	HF1-55	HF1-67	HF1-73

18.5.2 HDMI Sink TMDS Tests

API-compatible HDMI Sink TMDS compliance tests:

HF2-5	HF2-10	HF2-30	HF2-40	HF2-71
HF2-6	HF2-23	HF2-31	HF2-41	HF2-72
HF2-7	HF2-24	HF2-32	HF2-43	HF2-94
HF2-8	HF2-25	HF2-35	HF2-53	HFR2-53
HF2-9	HF2-26	HF2-39	HF2-54	HFR2-70

API non-compatible HDMI Sink TMDS compliance tests:

HF2-12	HF2-37	HF2-66	HF2-95	HF2-55
HF2-16	HF2-38	HF2-74	HF2-96	HF2-56
HF2-34	HF2-44	HF2-76	HF2-97	HF2-57
HF2-36	HF2-50	HF2-86	HF2-98	HF2-58

18.5.3 FRL Source Tests

API-compatible FRL Source compliance tests:

HFR1-10	HFR1-14	HFR1-18	HFR1-22	HFR1-26
HFR1-11	HFR1-15	HFR1-19	HFR1-23	HFR1-27
HFR1-12	HFR1-16	HFR1-20	HFR1-24	HFR1-28
HFR1-13	HFR1-17	HFR1-21	HFR1-25	HFR1-29

HFR1-30	HFR1-37	HFR1-45	HFR1-69	HFR1-65
HFR1-31	HFR1-38	HFR1-46	HFR1-80	HF1-57
HFR1-32	HFR1-39	HFR1-50	HFR1-81	HF1-58
HFR1-33	HFR1-40	HFR1-51	HFR1-82	HF1-60
HFR1-34	HFR1-41	HFR1-52	HFR1-83	
HFR1-35	HFR1-43	HFR1-58	HFR1-84	
HFR1-36	HFR1-44	HFR1-68	HFR1-85	

API non-compatible FRL Source compliance tests:

HFR1-79	HFR1-67	HF1-56	HF1-59	HFR1-73

18.5.4 FRL Sink Tests

API-compatible FRL Sink compliance tests:

HFR2-17	HFR2-21	HFR2-49	HFR2-53	HFR2-82
HFR2-18	HFR2-22	HFR2-50	HFR2-70	HFR2-83
HFR2-19	HFR2-23	HFR2-51	HFR2-80	HFR2-84
HFR2-20	HFR2-48	HFR2-52	HFR2-81	HFR2-85

API non-compatible FRL Sink compliance tests:

HFR2-11	HFR2-16	HFR2-33	HFR2-69	HF2-61
HFR2-12	HFR2-24	HFR2-40	HFR2-73	HF2-63
HFR2-13	HFR2-30	HFR2-43	HFR2-86	HF2-73
HFR2-14	HFR2-31	HFR2-61	HFR2-94	
HFR2-15	HFR2-32	HFR2-66	HF2-60	

18.5.5 eARC Source Tests

API-compatible eARC Source compliance tests:

HFR5-1-20	HFR5-1-25	HFR5-1-33	HFR5-1-38	HFR5-1-55
HFR5-1-21	HFR5-1-26	HFR5-1-34	HFR5-1-39	HFR5-1-56
HFR5-1-22	HFR5-1-28	HFR5-1-35	HFR5-1-50	HFR5-1-58
HFR5-1-23	HFR5-1-29	HFR5-1-36	HFR5-1-51	HFR5-1-59
HFR5-1-24	HFR5-1-32	HFR5-1-37	HFR5-1-52	

API non-compatible eARC Source compliance tests:

HFR5-1-27	HFR5-1-31	HFR5-1-41	HFR5-1-60	HFR5-1-62
HFR5-1-30	HFR5-1-40	HFR5-1-57	HFR5-1-61	

18.5.6 eARC Sink Tests

API-compatible eARC Sink compliance tests:

HFR5-2-20	HFR5-2-22	HFR5-2-24
HFR5-2-21	HFR5-2-23	HFR5-2-25

API non-compatible eARC Sink compliance tests:

HFR5-2-26	HFR5-2-31	HFR5-2-36	HFR5-2-50	HFR5-2-56
HFR5-2-27	HFR5-2-32	HFR5-2-37	HFR5-2-52	
HFR5-2-28	HFR5-2-33	HFR5-2-39	HFR5-2-53	
HFR5-2-29	HFR5-2-34	HFR5-2-40	HFR5-2-54	
HFR5-2-30	HFR5-2-35	HFR5-2-41	HFR5-2-55	

19 Command Line Interface for Capturing Data

Important Note: Not all of the commands listed in this section are supported but will in a future release.

19.1 Overview

This chapter describes the command line interface for captured data.

The command line enables you to capture data and search through captures for specific subsets of data. You can control the M42h 96G Video Analyzer/Generator through the command line via a telnet session or from the M42h Manager Console panel. When searching through the captured data, Teledyne LeCroy recommends that you use Telnet or some other terminal program such as Putty because there is a limited set of Linux commands supported through the M42h Console.

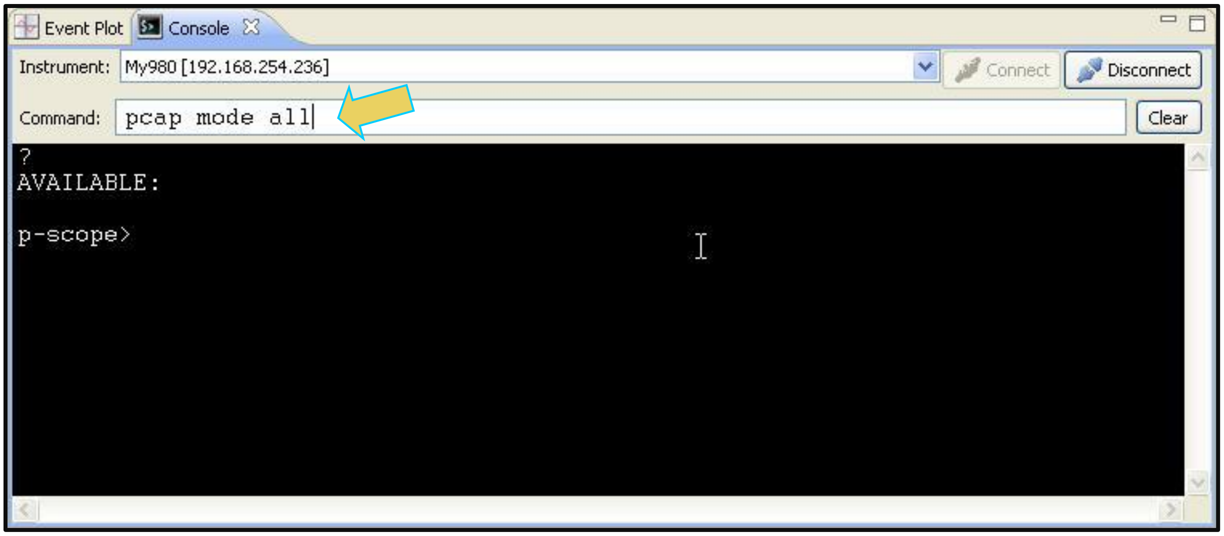
There are M42h-based commands that enable you to initiate commands to capture data. Once you capture data, you can conduct searches either on your host PC or the M42h itself. To conduct searches on your PC, transfer the captured data to your host PC using an FTP utility. This procedure is described in the section: Transferring Capture Files from the M42h to a PC.

The M42h 96G Video Analyzer/Generator is based on the Linux operating system; therefore, to conduct searches directly on the M42h you use the Linux search and filter utilities such as grep.

You can access the Linux prompt from the p-scope prompt available from the **Console** panel or through a separate telnet window. Procedures for both are shown below.

To establish a command line session through the M42h Console window:

1. Establish an Ethernet connection between the M42h 96G Video Analyzer/Generator using the procedures defined in: Connection Scenarios for external ATP Manager.
2. Highlight the M42h that you want to execute commands on.
3. Activate the **Console** tab to access the **Console** panel interface.
4. Click on the **Open Connection** activation button to establish a telnet session with the M42h 96G Video Analyzer/Generator.



The **p-scope>** prompt will appear allowing you to enter commands.

Note: You enter commands in the **Command** field above the terminal area.

The primary command for setting up and initiating the capture data is the **PCAP** command (not case sensitive). There are several arguments of the PCAP and these are explained in the table in the procedures below.

To quit out of the M42h Console window session:

1. To quit out of the console session enter the following sequence:

```
p-scope>quit      // Takes you to the Linux shell prompt.
qd@spcope:~$
```

7. Enter the following to exit out of the console session:

```
qd@spcope:~$ exit
```

To establish a command line session through a telnet session:

1. Launch the Command Prompt utility from the Windows Accessories.

8. Establish a telnet session with the M42h using the following command. Note you will enter in the IP address of the M42h (192.168.254.001 in example below):

>**telnet** 192.168.254.001

The M42h login prompt will then appear as shown below. The M42h login and password are **qd.**

Pscope login: qd

Password: qd // you will not be able to see the entry.

The **p-scope>** prompt will appear allowing you to enter commands.

The primary commands for setting up and initiating the capture data is the **PCAP** command (not case sensitive). There are several arguments of the PCAP and these are explained in the table and procedures below.

List of PCAP Commands

Note: Commands are lower case.

Command	Description	Syntax	Command Example
pcap size	Defines the Buffer Size in percent of total (2GB).	pcap size < *size* > Where <*size*> can be 0 to 100 percent.	To set the Buffer Size to 50% of the total buffer capacity: >pcap size 50 Captures data up to 50% of the capacity of the buffer.
pcap mode	Defines the data that is captured. In other words, determines if video and data islands	pcap mode <*data*> Where <*data*> can be: all - video & data di – data islands only tmds – raw protocol data	To set the mode: >pcap mode di Captures only data island information (not video).
pcap trig	Defines the trigger mechanism	pcap trig <*type*> <*pos*> Where <*type*> can be: vsync – when a vsync event occurs encr- – encryption enable pulse is disabled (not detected in window of opportunity) encr+ - encryption enable pulse occurs in – external trigger input prat – a change in the pixel rate match – matched values in the data islands Where <*pos*> can be a percent in the range of: 0 to 100	To set the trigger criteria: >pcap trig vsync 50 This example would set the trigger event to the occurrence of vsync and the position such that the trigger event would be midway between the data accumulated in the capture buffer.
pcap start	Initiates the capture of video stream.	pcap start	To initiate a capture: > pcap start
pcap decode	Decodes an existing capture in the capture buffer and creates a decode file.	pcap decode	To a decode of a capture: > pcap decode Creates a file using the default name of pdecode.log on the M42h

List of PCAP Commands Note: Commands are lower case.			
Command	**Description**	**Syntax**	**Command Example**
pcap stat	Obtain a list of the video format timing statistics.	pcap stat	To obtain a list of the video format timing information: > pcap stat
Note: The commands are not case sensitive.			

19.2 Command Line Examples

The following is an example of how to use the command line. You use the capture control commands at the p-scope prompt. Once you have captured data you can transfer into the Linux shell and run typical Unix commands.

Note: You can run Linux commands on a capture file (decode.log) that either resides in the M42h instrument or that resides on your PC. However, the method is different. For captures that reside on the M42h, you must run the capture through the command line either through a telnet session or through the M42h Manager Console.

19.2.1 Searching Through Captured Text

This example shows you how to search through captured text. The primary capture utility in Linux is grep. Consult the man pages for the grep filter to determine how best to use this command.

To search through the captured text:

1. Enter the following commands to capture the data:

```
p-scope> pcap size 25         // Sets the capture buffer to 25%
                                 of its maximum size
p-scope> pcap mode di         // Only captures data islands (no video
is captured)
p-scope> pcap trig vsync 10   // Initiates the capture when vsync
                                 is detected
p-scope> pcap start           // Initiates the capture
p-scope> pcap decode          // Decodes the hex file into human
                                 readable text and stores in
                                 default directory:
                                 /home/qd/pdecode.log
```

Note: If you want to recapture and save a decode file you will have to move the existing decode file to another directory or rename it.

2. To run the Timing Analyzer utility enter the following:

```
p-scope> pcap timing  // Creates the timing analysis file
```

3. To run the Audio Analyzer utility enter the following:

```
p-scope> pcap auda    // Creates the audio analysis file
```

4. Quit out of the pscope command line to access the Linux utilities in the bash shell:

```
p-scope> quit         // quits out of the pscope shell to the bash
                         shell where you enter linux command
```

Here you can navigate to the proper directory or use the full directory path and enter any Linux shell command to search through the data.

```
qd@spcope:~$ cd /home/qd/workspace/captures/2010_05_27_17_15_28
```

Where “2010_05_27_17_15_28” is the name of a capture directory.

```
qd@spcope:~$ grep “CTS = 74250” pdecode.log
```

The command above will return all lines in the captured data where CTS is equal to the value specified.

```
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
audio clock regeneration N = 6144, cycle time Stamp CTS = 74250
```

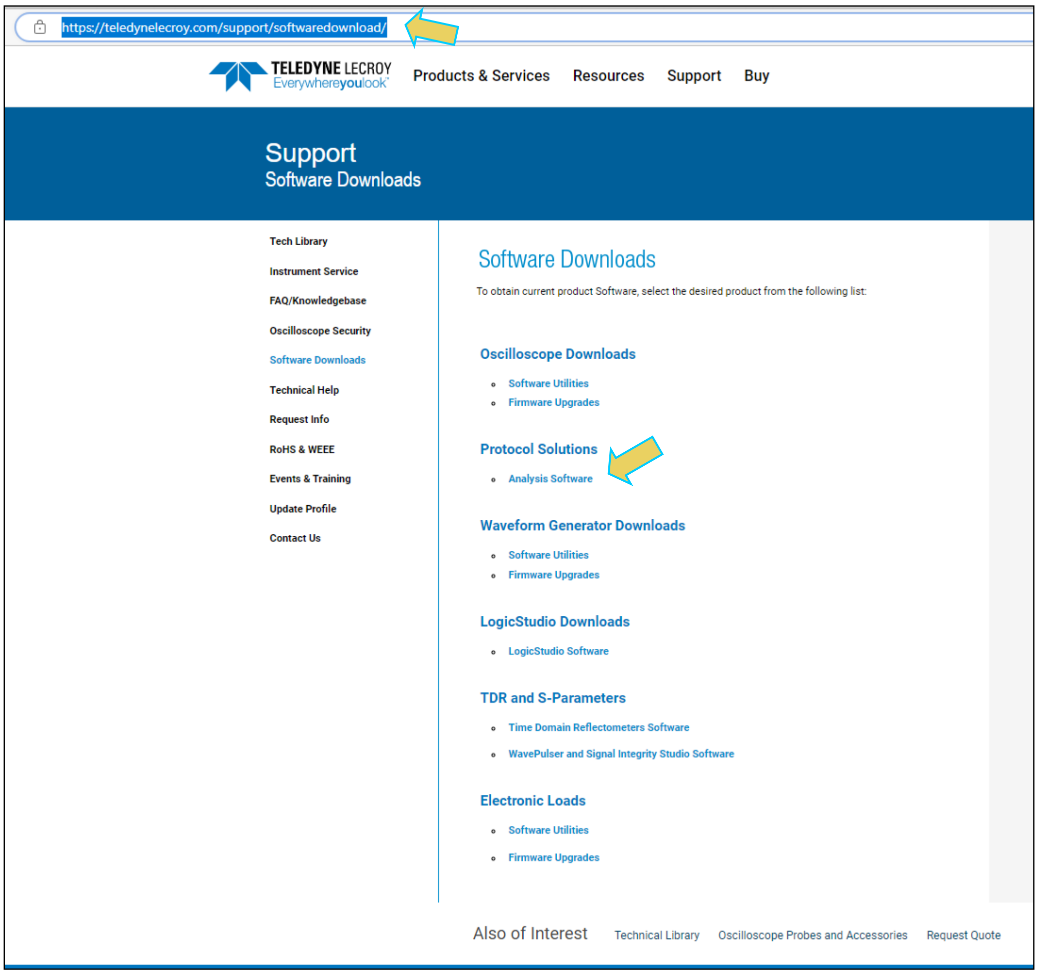
5. To return to the p-scope prompt: **qd@pscope:~$** `sudo /qd/ptalk`

20 Upgrading the M42h Manager and M42h

This Chapter provides information about upgrading your M42h and ATP Manager. Detailed procedures are not provided in this document. ***Please be sure to refer to the Release Notes for a specific release for detailed upgrade instructions.***

Teledyne LeCroy periodically provides maintenance release of software and firmware. The most recent versions are available on the downloads page of the Teledyne LeCroy website.

Download the ATP Manager GUI application from the Teledyne LeCroy downloads page: https://teledynelecroy.com/support/softwaredownload/.



Two software packages are available for upgrading the M42h:

Embedded firmware and gateware packages for the M42h instrument. This is a Debian software package for installation in the Linux-based instrument. (The file extension is .deb.) This package also includes the embedded Graphical User-interface that will be installed for the Touch Screen User-interface. The M42h software package includes the firmware and gateware for all available.

Graphical User-interface for Windows PCs. This is the M42h Manager GUI that can be used to control all M42h instruments from a Windows PC.

Notes:

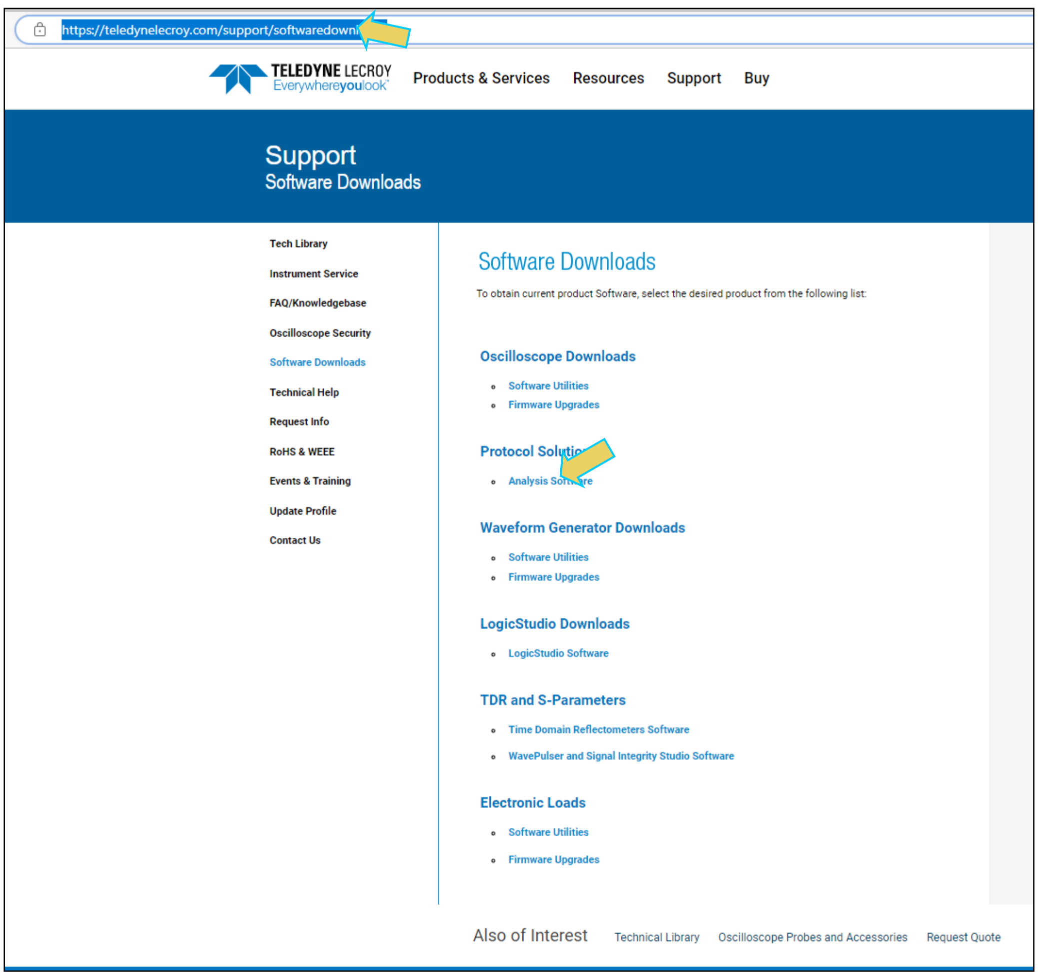
1. If the Windows-based M42h Manager GUI and the embedded firmware are both being upgraded, you will need to upgrade the M42h Manager first, and then upgrade the embedded firmware.
2. Be sure to check the release notes associated with the download files. Any special installation instructions will be noted in the release notes.
3. In some cases, if your M42h is not at the most recent version, you may have to first upgrade to the most current version and then to the new version.

20.1 Workflow for Upgrading M42h Firmware/Gateware

This section describes the workflow of the upgrade process. It is not intended to be a detailed procedure. ***Please refer to the Release Notes for detailed upgrade procedures***.

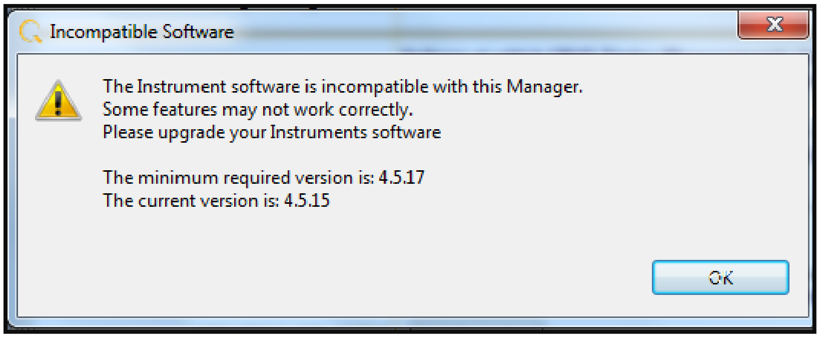
Please note that you must upgrade the ATP Manager before using the ATP Manager to upgrade the M42h firmware and gateware.

1. Download the ATP Manager and M42h Firmware/Gateware files from the Teledyne LeCroy website downloads page: https://teledynelecroy.com/support/softwaredownload/.



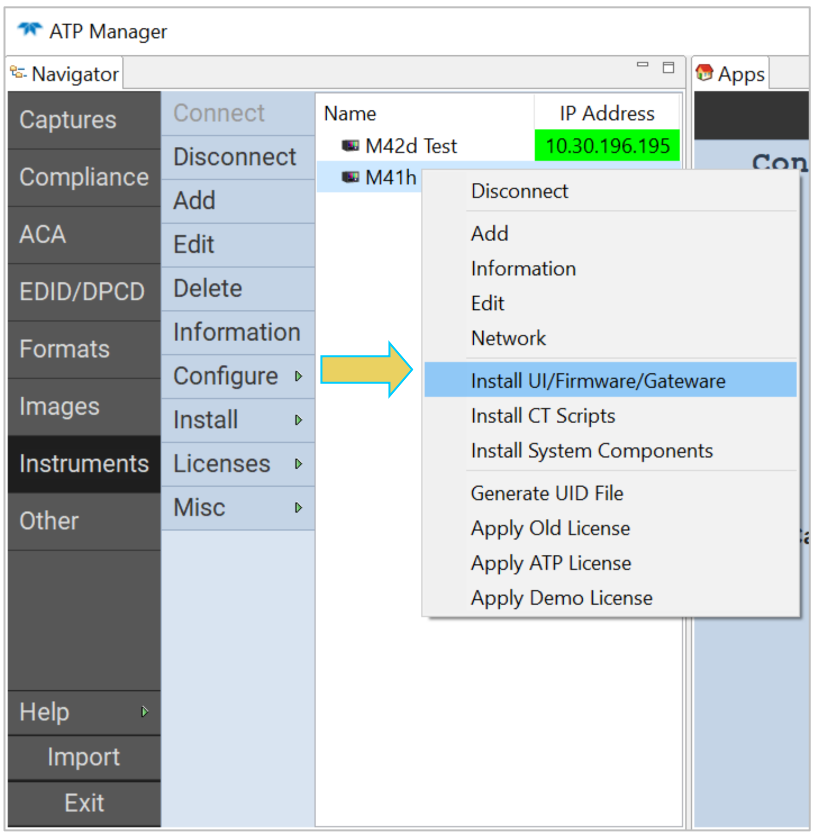
2. Upgrade the ATP Manager and restart.

Note: You may receive the following error indicating that you must update the M42h firmware/gateware.



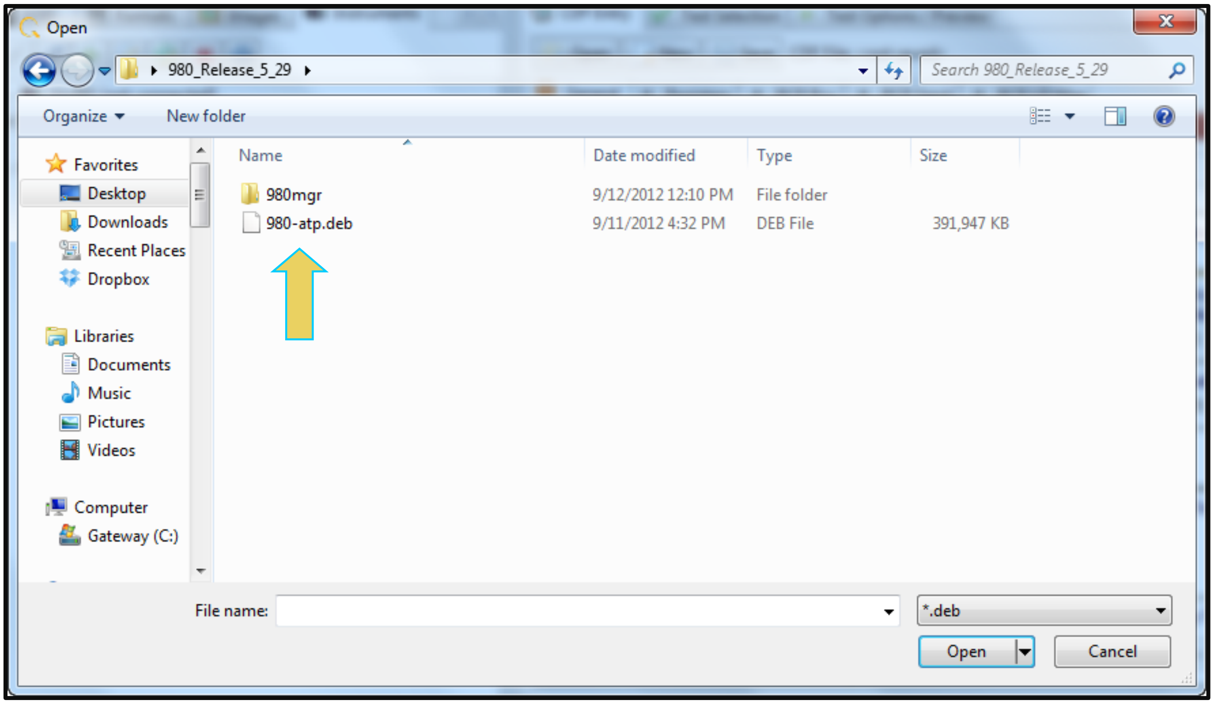
3. Connect to the M42h that you wish to upgrade.

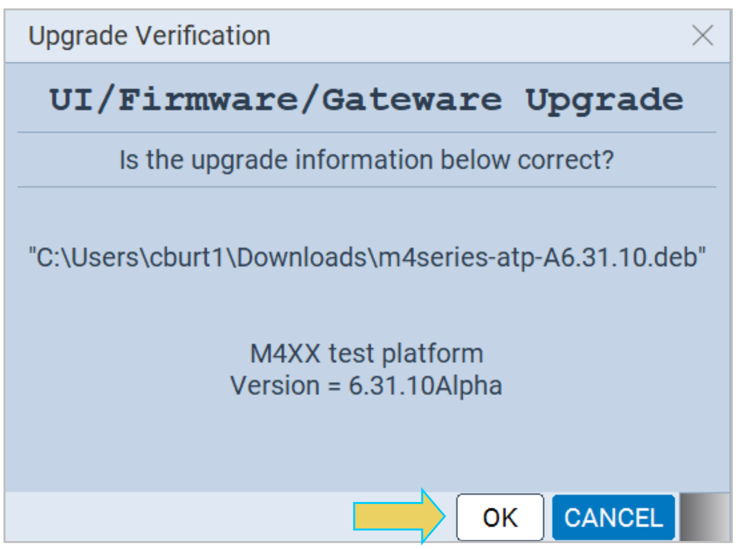
4. Access the Upgrade Firmware/Gateware option from the Instrument pull-down.

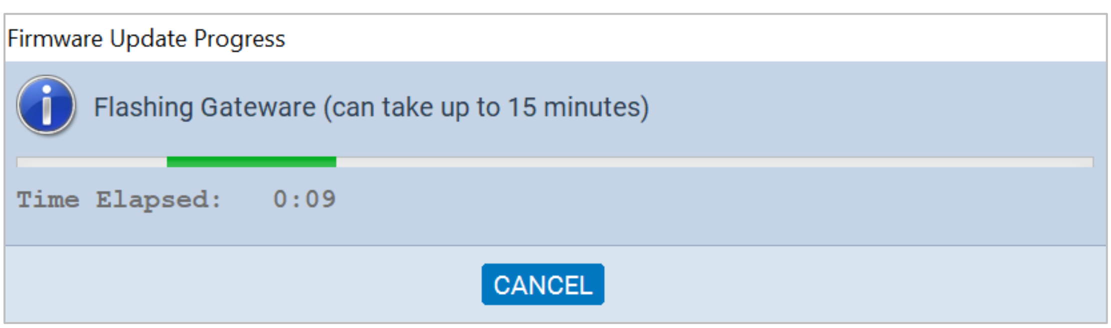


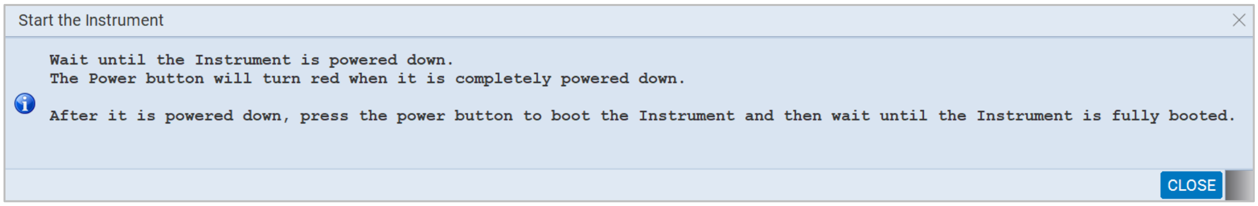
5. Update the M42h Firmware/Gateware.

6. Browse to the Deb file and select it. Follow the on-screen prompts.


Open
980_Release_5_29
Search 980_Release_5_29
Organize
New folder
Favorites
Desktop
Downloads
Recent Places
Dropbox
Libraries
Documents
Music
Pictures
Videos
Computer
Gateway (C:)
Name
Date modified
Type
Size
980mgr
9/12/2012 12:10 PM
File folder
980-atp.deb
9/11/2012 4:32 PM
DEB File
391,947 KB
File name:
*.deb
Open
Cancel


Upgrade Verification
UI/Firmware/Gateware Upgrade
Is the upgrade information below correct?
"C:\Users\cburt1\Downloads\m4series-atp-A6.31.10.deb"
M4XX test platform
Version = 6.31.10Alpha
OK
CANCEL


Firmware Update Progress
Flashing Gateware (can take up to 15 minutes)
Time Elapsed: 0:09
CANCEL



7. Reconnect the ATP Manager to the M42h.

20.2 Workflow for Adding License for optional feature

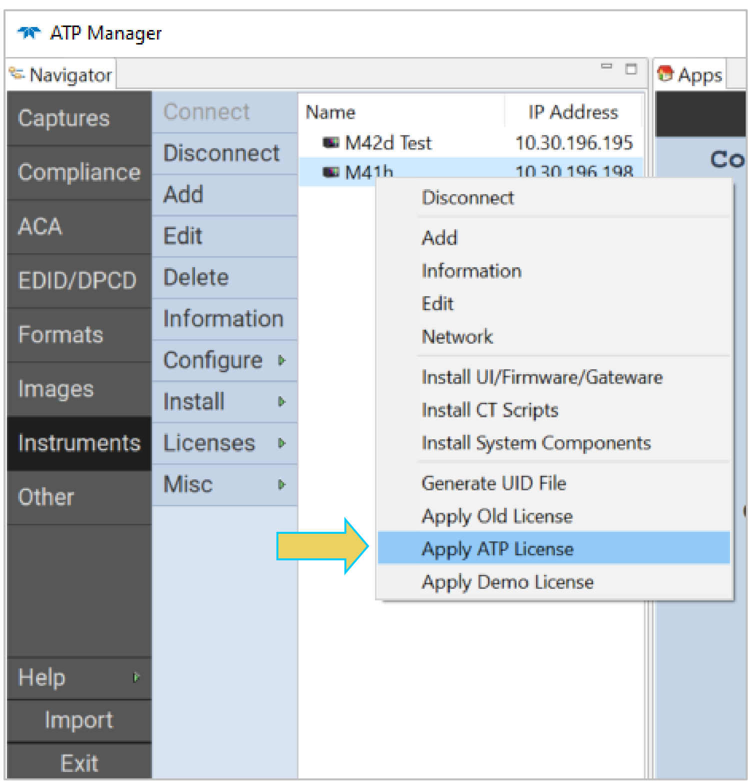
This section describes the workflow of the upgrade for the M42h Protocol Analyzer with an optional feature using a license key. It is not intended to be a detailed procedure. ***Please consult Teledyne LeCroy Customer Support for details***.

Note: You must have purchased the optional feature through the normal channels of your Quantum Data representative or distributor.

1. Purchase optional feature from Teledyne LeCroy distributor or representative.
2. Call Teledyne LeCroy customer support.
3. Generate UID text file from the **Instrument** pull-down menu (below) and convey to Teledyne LeCroy customer support.

Teledyne LeCroy will provide a QDATP.lic file. Store this on your host PC.

4. From the **Instrument** pull-down menu (below) select Apply ATP License.



END OF USER GUIDE