

M42d DisplayPort 80G Video Analyzer/Generator

User Guide

Ver. A1



M42d Video Analyzer/Generator - User Guide	Ver. A1

The specifications and information regarding the products in this manual are subject to change without notice. All information, examples and recommendations in this manual are believed to be accurate but are represented without warranty of any kind, express or implied. Users are fully responsible for their application of any products.

See the product page at https://www.quantumdata.com/m42d.html for the most up-to-date User Guide.

Support

For further support on your M42d Instrument, contact Teledyne LeCroy support via https://www.quantumdata.com/support.html.

Please provide the following information in your message to the support team:

- Your location
- ATP Software Version (if applicable)
- Device Model Number
- Device Serial Number
- Firmware Version Installed
- Instrument Information Report .txt file (if available)

Note: All of the device information can be found within the Instrument Information Report .txt file, so these can be substituted with the full Information Report. Instructions for accessing and saving the Instrument Information Report can be found in Section 2.2

M4	2d Vide	eo Analyzer/Generator - User Guide	Ver. A1
1	Get	ting Started with the M42d	
	1.1	About the M42d DisplayPort 80Gbps Video Analyzer/Generator	
		Key Features of the M42d 80G Video Analyzer/Generator	
	1.2	What makes the M42d 80Gbps Video Analyzer/Generator unique?	
	1.3	Scope of this User Guide	
		High-level tasks described in this chapter	
		What is not covered in this user guide	
	1.4	Revisions to this user guide	
	1.5	What kinds of data does the M42d 80 Gbps Video Analyzer/Generator allow	v you to view?
	1.6	What is in the M42d shipping box?	
	17	Getting the M42d up and running	
	1.7	Adjusting M42d Internal Fan Speed	
		Connecting a DisplayPort Source Device Under Test	
		Connecting a DisplayPort Sink Device Under Test	
		Connecting a DisplayPort Source and Sink Device for Passive Monito	ring
	1.8	Connectors and Controls	
		eDP Pin Configurations	
		Important Notes Using External Monitor for ATP Manager	
2	ATF	P Manager GUI Application	
	2.1	Operating the ATP Manager from an external display	
	2.2	Operating the ATP Manager on a host PC	
		Installing and Connecting the M42d ATP Manager GUI Application	
		Saving the Instrument Information Report	
	2.3	ATP Manager Home Screen and Navigator	
		Home	
		Navigator	

2.4 Accessing Device Settings and Information Applying Licenses Setting the Instrument date and time 2.5 Upgrading ATP Manager 2.6 VNC Remote Connection Installing TightVNC Viewer and Connecting to the Device Generator 3.1 Overview 3.2 Selecting DisplayPort Video Format Selecting format using the CTA or VESA Smart Filtering button Selecting format from Library List

Selecting format using custom Lists

Generating format from EDID

Page 3

M42	d Video	Analyzer/Generator - User Guide	Ver. A1
		Configuring the format Settings	46
	3.3	Pattern	48
		Selecting a test Pattern from the Library List Folder	48
		Using Custom List to select a Test Pattern	49
		Configuring Test Patterns Settings	50
	3.4	Testing audio on an audio rendering device	53
	3.5	Tools	57
		Link Train	57
			63
		HDCP Testing	68
		DSC (Display Stream Compression)	69 72
		Importing a DPX	73
			78
	36	Topology and Multi-Stream Transport (Multi-Stream Transport)	80
	5.0	Configuring the number of downstream Multi-Stream Transport nodes	82
		Reading the EDID or DPCD of a downstream Multi-Stream Transport nodes.	86
		Returning to Single-Stream Transport (SST) Mode	86
4	Sour	ce Verification with Basic (Real-time) Analyzer	88
	4.1	Accessing Basic Analyzer Features	88
		Basic Analyzer Dashboard	90
		Main Control Panel	92
	4.2	Controlling the Basic Analyzer	93
		Viewing the Color values	93
		Setting the video image size and aspect ratio	95
		Monitoring transactions using the ACA Utility	97
		Setting the EDID for the Rx port	100
		Setting the DPCD for the Rx port	102
	4.3	Tools Dialog Box	103
	4.4	DSC Analysis	106
		DSC Real-time (Snapshot) Analysis	106
		DSC Test CRC Verification	107
5	Proto	ocol Analyzer with Capture Control	108
		Operational workflow for capturing data with your M42d DP Protocol Analy	zer 108
	5.1	Getting started with the Protocol Analyzer	109
		Configuring the M42d DP Protocol Analyzer with an EDID	109
		Verifying source video	111
	5.2	Capture Control Panel	112
		Capturing Displayport source data	116
		Opening an Existing Capture	119
	5.3	Capture Viewer Panels	121

Ver. A1

	Capture Viewer Overview	121
	Capture Viewer Toolbar	122
	Event Plot Panel	127
	Data Decode Panels	132
	Link Symbol Panel	133
	UHD/Multi-Stream Transport Captures	135
5.4	Searching and Filtering for Specific Data Elements	137
	Event Search	137
	Filtering Specific Data Elements	142
5.5	Importing, Exporting, and Transferring Capture Files	145
	Exporting a Capture File	145
	Importing a Capture File	147
	Transferring a Capture File Between Instrument and Remote PC.	150
Aux	iliary Channel Analyzer (ACA)	153
6.1	Accessing the Auxiliary Channel Analyzer (ACA)	153
	Accessing the Auxiliary Channel Analyzer on the embedded M42d GUI	153
	Accessing the Auxiliary Channel Analyzer Remote Control on a PC	156
6.2	Monitoring Auxiliary Channels with Aux Channel Analyzer Utilities	157
6.3	ACA Window and Panel Description	163
6.4	ACA Data Viewer	166
	ACA Data Viewer – Panel Description	166
	Exporting ACA Data as Text or HTML File	169
	Using the ACA Filter Feature	170
	Using the ACA Find Feature	175
6.5	Importing, Exporting, and Transferring ACA Data	182
	Exporting an ACA Data File	182
	Importing a Capture File	184
	Transferring and ACA Data File Between Instrument and Remote PC.	186
Pas	sive Monitoring	190
7.1	Connecting a DisplayPort Source and Sink Device Under Test	190
	Enable Passive Probing	192
7.2	Passively Viewing Video Data in Real Time	193
	Accessing Basic Analyzer Features	193
7.3	Passively Monitoring ACA Transactions	196
	Passively Monitoring the Auxiliary Channel Transactions	196
	ACA Window and Panel Description	199
7.4	Passively Analyzing Video Data using Capture Control	203
	Verifying Source Video	203
	Capture Control Panel	204
	Capturing Passed-through Displayport Video Data	208

6

7

M42	d Vide	o Analyzer/Generator - User Guide	Ver. A1			
0			044			
ð						
	8.1		211			
	8.2	LTTPR Emulation for Testing Source Devices	212			
	8.3	Modifying LTTPR Capability Registers	216			
		Saving and Opening/Reapplying Saved LTTPR Configurations	222			
	8.4	Testing LTTPR Devices with M42d as DPTX	226			
		Monitoring Link Training Negotiations with LTTPR(s)	226			
		Reading DPCD Registers with LTTPR(s) Present	229			
9	Pane	el Replay Testing	230			
	9.1	Overview	230			
	9.2	Emulation through the DPCD	230			
	9.3	Viewing Panel Replay VSCs in Basic Analyzer window	231			
	9.4	Capturing Panel Replay VSC Packets	233			
	9.5	Viewing Panel Replay Auxiliary transactions	235			
10	eDP					
		eDP Pin Configurations	236			
	10.1	eDP Testing Connections	236			
	10.2	Fast Link Training	237			
		Fast Link Training – Source Tests	237			
		Fast Link Training – Sink Tests	239			
		Fast Link Training – Monitoring the Fast Link Training Transactions on the	Aux Channel			
			242			
	10.3	Advanced Link Power Management (ALPM)	243			
		ALPM – Source Tests	243			
		ALPM – Sink Tests	244			
		Fast Link Training – Monitoring the ALPM Transactions on the Aux Channe	el 246			
	10.4	Alternate Scrambler Seed	247			
	10.5	Backlight Control	250			
		Backlight Control Test Connections	250			
		Backlight Control – Sink Tests	251			
Арр	pendio	ces	253			
	Appe	ndix A. Licenses	253			
		Applying Licenses	253			
		Verifying Current Licenses	255			
		License Listing	258			
	Appendix B. Configurable LTTPR Capability Registers					

1 Getting Started with the M42d

1.1 About the M42d DisplayPort 80Gbps Video Analyzer/Generator

This chapter provides an overview of features of the M42d DisplayPort 80Gbps Video Analyzer/Generator. The M42d is a compact, versatile test instrument offering entry level functional testing that can be extended through software licenses to full compliance testers with sophisticated analysis and diagnostic capabilities.

The M42d supports video pattern testing and audio testing of DP 2.0 capable displays with 1, 2, or 4 lanes at 20 Gb/s link rates per lane, for an 80 Gbps max link rate. It is also backward compatible with DP 1.4 and includes all functionality of the M41d. It is equipped with two (2) Tx ports and two (2) Rx ports—one each for standard DisplayPort and USB-C with DP alt mode support. Only one of the Tx ports and one of the Rx ports can be active at any one time.

The M42d is operated through the Advanced Test Platform (ATP) Manager. The ATP Manager is a GUI application that can run either on a Windows host PC or an external display connected to the HDMI port on the back of the M42d. **Chapter 2 is dedicated entirely to the ATP Manager**.



Key Features of the M42d 80G Video Analyzer/Generator

Note: Certain features and functions of the M42d require licensing. More information on licensing can be found in **Chapter 2 (Applying Licenses)** or **Appendix A: Licenses**.

- Equipped with both DP standard and USB-C ports for Tx and Rx functions
- Test DP sources 10Gb/s, 13.5Gb/s, and 20Gb/s lane rates at the new 128b/132b line coding
- View incoming video and metadata—including DSC compressed--from a source device
- Capture and decode incoming video, protocol, and control packets including Display Stream Compression (DSC)
- Run functional tests on displays and monitors at UHBR lane rates with large format and test pattern library
- Configure link training parameters to test display's handling of link training
- Generate Display Stream Compression (DSC), select patterns and configure slices and video parameters

- View and edit EDID and DPCD registers
- Monitor Aux Channel transactions while emulating a DP 1.4 or DP 2.0 source or sink
- Passively monitor the Main Link and Aux Channel between a source & display at UHBR lane rates
- Panel Replay testing for sources and sinks
- LTTPR device emulation in Transparent mode for testing LTTPR-capable source devices at 8b/10b line code for lane rates up to HBR3 (support for LTTPR in non-transparent mode for 128b/132b at UHBR rates is coming soon)
- View Power Delivery (PD) negotiations for USB-C DP Alt Mode
- DP 2.0 Link Layer compliance tests on source devices up to 13.5Gb/s per lane
- 1.4 Link Layer compliance tests on sources and sinks up to 8.1Gb/s per lane
- Run DP 1.4 Forward Error Correction (FEC) and Display Stream Compression (DSC) compliance tests for sources and sinks
- Run HDCP 2.3 compliance tests on DisplayPort sources, sinks and branch devices
- Run audio tests using programmable LPCM sine wave audio tones
- Run tests on embedded DisplayPort (eDP) 1.4b sources and panels using fast link training, ALPM & backlight control

1.2 What makes the M42d 80Gbps Video Analyzer/Generator unique?

The Teledyne LeCroy quantumdata M42d Video Analyzer/Generator provides an unprecedented combination of functional and compliance testing for video, audio and protocol of DisplayPort 2.0 and DisplayPort 1.4. The M42d supports legacy DisplayPort lane rates of 1.62, 2.7, 5.4, 8.1 Gb/s and the new DP 2.0 higher speed lane rates and new line coding— 128b/132b—of 10.0, 13.5, and 20.0Gb/s data rates up to 4 lanes.

The protocol analyzer provides a snapshot status view and deep analysis using captures of incoming DisplayPort 2.0 (and DP 1.4) streams from source devices including DSC/FEC compressed streams.

The M42d's video generator can be used for testing displays, USB-C adapters, extenders, etc. The video generator offers a large library of standard video timings and test patterns necessary for testing next generation high resolution displays.

The M42d supports a full suite of DP 1.4 link layer, forward error correction (FEC) and Display Stream Compression (DSC) compliance tests for both sources and sinks. Support for Compliance Tests for DP 2.0 are being added on a rolling basis. See the **compliance** tab on the M42d product page (https://www.quantumdata.com/m42d.html) for currently supported compliance tests.

The Passive Probe feature, based on Teledyne LeCroy's cutting-edge T.A.P.4[™] technology, enables full monitoring of the DisplayPort Main Link and the Aux Channel between two DisplayPort devices up to 20 Gb/s.

1.3 Scope of this User Guide

This user guide documents the operation of the M42d 80 Gbps Video Analyzer/Generator. It is intended to be used with the M42d Quick Start Guide.

The user guide describes the features and functions of the M42d 80 Gbps Video Analyzer/Generator as operated either through the standalone PC application (i.e. the ATP GUI Manager) or with the ATP GUI Manager running on the M42d itself and displayed on an external monitor connected to the HDMI port on the back of the M42d. The screen shots used are usually from the most current release of the ATP GUI Manager running on a host PC.

High-level tasks described in this chapter

- Getting started procedures
- Provisioning the IP address of the M42d
- Installing the M42d ATP GUI Manager on a PC
- Establishing an IP session between an M42d and the host PC running the ATP GUI Manager
- Connecting the DisplayPort source or sink devices under test to the M42d

What is not covered in this user guide

The M42d supports a full suite of DP 1.4 and 2.0 link layer, Forward Error Correction (FEC) and Display Stream Compression (DSC) compliance tests for both sources and sinks. Support for compliance tests for DP 2.0 are being added on a rolling bases; however, please refer to the M42d product page for updates on these functionalities. **Note:** These compliance tests are not covered in this user guide.

1.4 **Revisions to this user guide**

This is the first version of this user guide. Any additions or changes in future versions will be noted in this section.

Note: please be sure to check the quantumdata website and M42d product page for updates to this User Guide https://www.quantumdata.com/m42d.html.

1.5 What kinds of data does the M42d 80 Gbps Video Analyzer/Generator allow you to view?

By providing visibility into the DisplayPort protocol, and the underlying protocol, video and secondary data packets blocs, as well as DPCD data during link training, the M42d Video Analyzer/Generator enables you to detect changes and identify anomalies in either the DP 1.4 or 2.0 signal. The following is a list of the data types you can view (currently):

- Main Link
 - K Character
 - Control data
 - Video data

- Audio data •
- Secondary Data Packets
- Aux Channel Read/Write transactions, including:
 - Native DisplayPort aux transactions for capabilities discovery •
 - Link Training transactions •
 - Multi-Stream Transport Sideband Messages
 - Other DPCD •
 - EDID •
 - HDCP authentication transactions .
- Error data .
- Markers

1.6 What is in the M42d shipping box?

When a Teledyne LeCroy quantumdata M42d 80G Video Analyzer/Generator is shipped, it will contain the following additional items:

- . AC power line cord
- CE mark declaration
- DisplayPort to DisplayPort cable
- USB-C cable (unmarked)
- USB-C cable (marked) .
- CATC Micro-D cable assembly .
- Ethernet cable .
- Mouse
- **Quick Start Guide**

Positioning/Orientation

The M42d can be positioned either flat or upright, pictured here:





Upright

1.7 Getting the M42d up and running

Use the following procedures to get your M42d up and running.

- 1. Remove the M42d from the shipping box and lay it flat or upright on your desktop or benchtop.
- 2. Connect the M42d power cable (provided) to a suitable outlet (110-240V 50/60Hz). The power socket is on the back of the M42d as shown below.



3. Connect an external HDMI monitor to the HDMI connector on the back of the M42d; labeled "External Monitor" at the location indicated below.



The setup is depicted below.



- 4. Connect a mouse to one of the USB ports on the front or back of the M42d as shown below.
- 5. Optionally connect a keyboard to one of the other USB ports on the front or the back of the M42d. You can also use the virtual keyboards that present themselves in the ATP Manager.



Power up the M42d via the power button on the front of the M42d.



Notes: Regarding Power Button color:

- Solid Red = Powered down/standby
- Solid Green = Booted without network connectivity
- Solid Blue = Booted with network connectivity
- Solid Yellow = The front button is being actively pressed in
- Flashing Yellow = Instrument is powering up
- Flashing Green = Instrument is nearly done powering up (FPGA is ready, firmware still loading)
- Flashing Red = Error

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



Adjusting M42d Internal Fan Speed

Once the hardware is set up with an external display connected directly, you may optionally adjust the internal fan on the M42d unit from its default Full Speed setting to the Standard Speed.

Full Speed is enabled by default in order 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, which is quieter than the Full Speed setting.

Note: This procedure needs to be done on the M42d instrument itself using a display connected to the M42d 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.

Connecting a DisplayPort Source Device Under Test

To connect your source DUT to the M42d:

Connect the source device under test to the M42d DisplayPort In/Rx port as shown below. Note that you can connect either through the full-size standard DP port or the USB-C DP Alt Mode port depending on the lane rate (USB-C port shown in the example below).



The full test setup up is shown below with the ATP Manager running on the M42d with the ATP Manager GUI on the external display. The sample screen show shows an DisplayPort analysis screen.



Page 15

Connecting a DisplayPort Sink Device Under Test

To connect your sink DUT to the M42d:

Connect the sink device under test to the M42d DisplayPort Out/Tx port as shown below. Note that you can connect either through the full size standard DP port or the USB-C DP Alt Mode port depending on the lane rate (example shows connection to USB-C port).



The full test setup up is shown below. This example uses the ATP Manager installed on a host PC.



Connecting a DisplayPort Source and Sink Device for Passive Monitoring

Passive Monitoring or Passive Probing is a licensed feature of the M42d as well. Full instructions for the connections and Passive Monitoring itself are provided in **Chapter 7 Passive Monitoring**

1.8 Connectors and Controls

The table below describes the M42d connectors and controls.

M42d Configurations	Information / Function
Protocol Analyzer in M42d	 Front panel: A – USB-C Out/Tx port for all HBR and UHBR data rates up to 20 Gbps. B – USB-C In/Rx port for all HBR and UHBR data rates up to 20 Gbps. C – DP Out/Tx port for RBR, HBR, HBR3, and UHBR10 (10G data rates) D – DP In/Rx port for RBR, HBR, HBR3, and UHBR10 (10G data rates) E – USB ports (2) used for connecting a mouse and keyboard. F – Knob for turning up or down the volume for the internal speaker. G – Power button; press and release. H – eDP block for Backlight Control (See Note Balaw)
	 Back panel: I – Power plug (110-220VAC 50/60Hz) J - HDMI – Admin port for connecting external HDMI UHD display for M42d ATP Manager. K - DisplayPort – Not recommended for use currently. L - USB/USB-C (2 ea.) – For mouse & keyboard. M - RJ45 (2) - E1 Network for connecting host PC running ATP Mgr. E2 Aux – Future. N - DVI – Possible future use. O - RS-232 (2) – Possible future use. P - Audio (2) – Possible future use. Q – CrossSync™ for TRIG IN/OUT – Future. R - RCA SPDIF In/Out

Note: The eDP header block provides PWM signal used for controlling the backlight of some eDP displays. The pinout and functions are shown on the next page.

eDP Pin Configurations



eDP is covered in Chapter 10 Embedded DisplayPort.

Important Notes Using External Monitor for ATP Manager

Note 1: Selection of external monitor

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

- Dell UltraSharp 27 inch Monitor Model U2718Q.
- Dell UltraSharp 27 inch 4K Monitor Model U2720Q.
- ASUS 28" 4K UHD Monitor Model VP28U.
- ViewSonic 27" 4K UHD Monitor Model VX2776-4K-MHD.
- Other 4K HDCP 2.3 displays may work as well. (for most up-to-date list, refer to the latest revision of the User Guide on the M42d product page https://www.quantumdata.com/m42d.html.

Note 2: Changing the ATP Manager GUI Display Resolution

You can change the resolution that the ATP Manager GUI is display at on the connected monitor using the Mint Linux utilities. Follow these steps:

Step 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.

Step 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.

Step 3: Select the **Settings** primary menu on the left and then on the right select **Display Configuration** secondary menu. The Display Configuration menu appears.

Step 4: Set the resolution to 1080p using the **Resolution** pull-down menu. The resolution should change and persist through a reboot.

2.1 Operating the ATP Manager from an external display

The M42d is operated through the Advanced Test Platform (ATP) Manager. The ATP Manager is a GUI application that can run either on a **Windows host PC** or on an **external display** connected to the HDMI port on the back of the M42d.

When operating from an external display, a mouse (provided) is required and a keyboard is optional but recommended. In this case of the external display, the ATP Manager is running on the M42d itself, but the ATP Manager GUI is displayed on the external monitor. This operational scenario is shown below.



ATP Manager Running on External Display (Source Test Example)

You can operate the M42d from the ATP Manager application installed on a host PC. The connection can either be direct, or over a LAN. It is suggested that you consult with your local IT or network administrator for address assignment policies if using your local area network.

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 M42d over an Ethernet IP connection. These procedures are provided below.

Please note: You will have to have completed the procedures in the section above (1.8 Getting the M42d Up and Running) in order to complete the following steps.

Installing and Connecting the M42d ATP Manager GUI Application

This procedure describes how to setup the ATP Manager application on your host PC and connect to the M42d.

1. Download the ATP Manager GUI application from the quantumdata downloads page: http://www.quantumdata.com/downloads.html.



Double click on ATP Manager 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 also from an icon on your host PC Desktop.

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

3. Connect your PC to the M42d using an Ethernet cable. The connection is made to the Rj45 jack on the back of the M42d labeled E1 to Network as shown below.



The Ethernet IP connection from the host PC to the M42d can be accomplished through your corporate network or you can connect directly. Both scenarios are depicted below.



PC Running ATP Manager with Ethernet Direct Connection



PC Running ATP Manager w/ Ethernet Connection thru Corporate LAN

4. Set the IP address of the M42d from the Other page under the Control window of the ATP Manager GUI. Select the Instrument Network Settings icon. A dialog box appears enabling you to set DHCP or specify an IP address. Sample screen shots of these windows are shown below.



Instrument Network Settings $\qquad imes \qquad$					
Instrument "AL_M41d"					
DHCP Off					
IP Address:	10.30.196.30				
Netmask: 255.255.255.0					
Gateway: 10.30.196.254					
CHANGE CANCEL					

Note: Be sure to use an IP address that is compatible with your corporate LAN or your PC if you are connecting directly.

5. The instrument will automatically power cycle upon applying changes to the Network Settings.



Note: If using DHCP for IP address assignment, check for the resulting IP address at the bottom left of the embedded GUI after rebooting, as shown below.



6. Add your M42d to the ATP Manager application using the green + Add icon or the + Add item on the Instrument pull-down menu within the Navigator, identified below.



The **Add Instrument** dialog appears enabling you to enter the name and IP information for the M42d that you are trying to connect to (below).

Add Instrument				
Name:	MyM4d			
IP Address:	10.30.196.30			
		ADD CANCEL		

7. Enter the name (any suitable name) and IP address (*obtained in step 4*) of the M42d 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 a dialog boxes describing the progress. One example is shown below:



The M42d with the IP address you entered appears on the list in the **ATP Navigator** panel (below). The ATP Manager application will automatically connect to the M42d once you add the M42d to the application.

8. (If not already connected) Connect to the M42d using the **Connect** button or the **Connect** item on the right click menu as shown in the screen below.



A dialog box appears indicating that a connection is in progress.

Saving the Instrument Information Report

Once the connection is made the information about the connected M42d is available via the Information button as shown below.

T ATP Manager					
🕾 Navigator				- 0	
Captures	Connect		Name	IP Address	
	Disconnec	t	AL_M41d	10.30.196.30	
Compliance	Add				
ACA	Edit				
EDID/DPCD	Delete				
2010/01 00	Informatio	n			
Formats	Configure	Þ			
Images	Install	Þ			
	Licenses	Þ			
Instruments	Misc	Þ			
Other					
Help 🕨					
Import					
Exit					

The information is then displayed in a separate window. The information on the Instrument Information window tells you the firmware and hardware release and version information as well as what options you have. This report will be needed if you contact Teledyne LeCroy technical support for any operational questions or issues. The procedure for saving the information report is described on the next page.

```
About..
                                                                                                            \times
                                                                                                             ~
      Instrument: AL_M41d
      IP Address: 10.30.196.30
       Net Mask: 255.255.255.0
      Gateway IP: 10.30.196.254
      Free Space: 394.37 GB of 441.58 GB (89.3%)
      M-Series Test Platform Version: 5.71.9 Alpha
      M4PMU Version: 0x01
      DP 1.4 USB C Protocol Analyzer [294800334486,pca:12,pcb:5,sn:9299090078,] at 1 [DDR 4096MB]:
       Gateware: [Version: 4.26.94 Build Number: 1 (12/19/2019 15:15:19 CST) PCB: 2/C rev=1, DP Product C
        Firmware: [Version: 5.71.9 Build Number: 113027 (qd 05/13/2020 17:29:23 CDT) M41d]
      System Information:
        System SN : [ A3010810B0E83CB8::20010062 ]
       Date : [ Thu May 21 19:00:19 CDT 2020 ]
                    : [ N/A::N/A ]
        SN
        Main Board : [ "Super Server" ]
        CPUx4
                    : [ 6.158.11 "Intel(R) Core(TM) i3-8100 CPU @ 3.60GHz" ]
       DDR
                   : [ 7 GB + 512 MB ]
                   : [ NVME SSD 465 GB (500107862016 bytes) ]
        HD
                    : [ Linux M4XX 5.3.9 #1 SMP Fri Nov 8 14:43:50 CST 2019 x86 64 x86 64 x86 64 GNU/Linux
        os
1
        GUI manager : [ Version 5.71.9_30487_202005131621 ]
                    : [ lo
                             inet 127.0.0.1/8 scope host lo ]
        1
        PCIE3
                    : [ ]
        HDMI SRC CT : [ 4.13.3 ]
        HDMI 2.0 SRC CT: [ 1.0.4 ]
        HDCP SRC CT : [ 4.8.0 ]
      HDMI 2.1 SRC CT: [ 1.0.0 ]
HDCP Key File MD5 Checksums:
```

M42d Video Analyzer/Generator - User Guide	
--	--

You can save this instrument information report as a .txt file. This is necessary when contacting Teledyne **PSG Support**, as a current version of the report is needed for general support purposes.

Save the Instrument Information Report by selecting the **SAVE TO FILE** button at the bottom left of the report window, as shown below.

Abo	out	\times
	HDCP Key File MD5 Checksums: HDCP 1.x RX Key: 6bfaa9d92d1865a1d1a90e1709f1dec6 HDCP 1.x TX Key: 81efd4be37c2fd04523829c492ead82b HDCP 2.x RX Key: 85d55306babfd754e7a71d73c9ae4cd0 HDCP 2.x TX Key: f092c7036330e29ddd5c7db7154b362c	^
	Licensed Features	
	Licensed: 21 [Part of 95-00259 DP Auxiliary Channel Analyzer, M42]	
	Licensed: 21 [Part of 95-00261 M42d DP 1.4 DP Auxiliary Channel Analyzer, M42]	
	Licensed: 32 [Part of 95-00226 DisplayPort Capture/Analysis, M42]	
	Licensed: 33 [Part of 00-00259 M42d DP 2.0 HDCP 2.3 Function, M42]	
	Licensed: 33 [Part of 00-00261 M42d DP 1.4 HDCP 2.3 Function, M42]	
	Licensed: 42 [95-00214 DP HDCP 2.3 Compliance Test - Source, M42]	
	Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Sink, M42]	
	Licensed: 47 [Part of 95-00216 DisplayPort CT Package 2 LLCT 1.2 Core - Sink, M42]	
	Licensed: 48 [Part of 95-00213 DisplayPort CT Package 3 LLCT HBR3 Source Tests, M42]	
	Licensed: 48 [Part of 95-00252 DisplayFort HERS Link Layer Source Compliance Tests, M42]	
	Licensed: 50 [Part of 00-0025] M42d DF 2.0 Video Generator Function, M42]	
	Licensed, 51 [Part of 00-00259 M2d DF 1.4 Video Generator Function, M2]	
	Licensed: 51 [Part of 00-00261 M42d DP 1.4 Basic Video Analyzer Software, M42]	
	Licensed: 55 [Part of 95-00226 DP 1.4 Display Stream Compression (DSC) Bx Analysis, M42]	
	Licensed: 56 [Part of 95-00225 DP 1.4 FEC/DSC Tx. M42]	
	Licensed: 61 [Part of 95-00216 DisplayPort CT Package 4 LLCT 1.4 - Sink Tests, M42]	
		、 *
		-
	SAVE TO FILE	OSE

Enter the desired file name and folder directory, and the information report will be saved as a .txt file.

Ver. A1

2.3 ATP Manager Home Screen and Navigator

The previous sections briefly showed the ATP Manager GUI, but this section will cover the basics of the Interface in more detail, specifically the Home Screen and **Navigator**.

Home

When first opening the ATP Manager, you will see the Home screen. This interface has 4 tabs:

- Control
- Compliance
- Editors
- Other

Each of these tabs has its own apps within them. Aside from Compliance, these will all be covered in detail throughout this User Guide. An example of the home screen on a remote PC ATP Manager GUI is shown below.

🛪 ATP Manage	r					– 🗆 🗙
🕿 Navigator		-	😒 Apps			- 0
Captures	Refresh	Name		quantumo	lata	
Compliance	New Folder	> > HDMI Capture > > DP Capture	Control	Compliance	Editors	Other
Compilation	Browse	> 🗁 DI Match				
ACA	Delete					
EDID/DPCD	Information				9	
Formats	Rename		Generator	Receiver	ACA F	Remote
	Transfer					
Images	Organize					
Instruments	Open		60	(R)		
Other	Export					
			Capture Contr	OI HEAC		
Help ▶						
Import						
Exit		< >				

Notice the **Navigator** panel is side by side with the home screen (labeled **Apps**). Either can be minimized or restored using the buttons at the top right of the respective panel. The example below has the Navigator minimized.

7	ATP Manager			_		×		
8	🕏 Apps							
	quantumdata							
4	Control	Compliance	Editors		Other			
						^		
	4							
	Generator	Receiver	ACA Ren Contro	note ol				

The screenshot below is of the embedded GUI on the M42d instrument itself. Note the main difference being that the Navigator and Home are separated in this GUI.

In order to access the Navigator, click the **Navigator** icon at the bottom left of the screen. Additionally, you can use the **BACK** button to navigate back to previous utilities, or click the power button in the bottom right to shut down or reboot the device.

Control		Compliance	Editors	Other		
	(
	Generator	Protocol Analyzer RX	Analyzer	Capture Control		
BACK Navigator	STATIC: 10.30.19	06.38 ATP Version: 6.26.24-Alp	oha 64 bit	Switch to VPS GUI		

Navigator

The Navigator is a feature-rich utility in the ATP Manager that allows for data portability and customization with the M42d 80G Video Analyzer/Generator.

The Navigator has a sidebar, as seen in the table below, with several options. This subsection will cover a few of these options now, while others are detailed in later chapters.

Navigator Sidebar						
Sidebar	Button	Description				
🕿 Navigator	Captures	Access the directory containing Captures on the device or remote PC.				
Captures	Compliance	Access the directory containing Compliance Test selections and results				
Compliance	ACA	Access the directory containing Aux Channel Analysis data and Filters				
ACA EDID/DPCD	EDID/DPCD	Access the directory containing saved EDID configurations and DPCD registers				
Formats	Formats	Access the directory containing saved Formats and Format Lists				
Images	Images	Access the directory containing Image Patterns and Image Lists				
Instruments Other	Instruments	List of connected devices. Covered in Section 2.2 Installing and Connecting the M42d				
	Other	Access Saved Reports				
Help 🔹	Help	Access the help/about menu				
Import	Import	Import a file onto a remote PC ATP Manager (remote manager only)				
Exit	Exit	Quit the ATP Manager Application				

The Navigator allows you to **Import** and **Export** files onto the M42d instrument itself or the remote PC running the ATP Manager GUI. These features enable you to disseminate or receive data and files to/from colleagues, subject matter experts, or Teledyne LeCroy technical support.

The **Transfer** tool within certain tabs is only available on the Remote ATP Manager GUI. The transfer tool allows you to transfer data and files between the remote PC and the M42d instrument. This can be useful for backing up files to both devices or for remote access of tests or analyses run using the embedded GUI ATP Manager on the M42d device.

Examples of file import and export as well as transfer are covered in 6.6 Importing, Exporting, and Transferring Capture Files as well as 7.5 Importing, Exporting, and Transferring ACA Data

2.4 Accessing Device Settings and Information

Note: Any selections in the Other panel not explained here will be covered later on in this User Guide.

Applying Licenses

Many of the features of the M42d require a specific license to operate. This subsection will demonstrate applying a license.

A list of all available licenses is located in Appendix A: Licenses.

Note: To obtain a license for the M42d, contact Teledyne Support, accessible at http://quantumdata.com/support.html

To apply a license:

1. Upload the license file (.lic) using the Navigator by clicking **Instruments**, then selecting **Licenses** and clicking **Apply ATP License**. Alternatively, you can access this by selecting the **Other** tab on the GUI home screen and selecting **Apply ATP License**. Both are shown below.

Note: As the license file will likely be saved to your PC, it is recommended to use the remote host ATP Manager for this function. All screenshots are based on this GUI, though they are both similar.

称 ATP Manager - 8 🕾 Navigator Connect Name **IP Address** Captures M42d Test 10.30.196.195 Disconnect Compliance Add ACA Edit Delete EDID/DPCD Info tion Form Con re ⊳ Imag Insta ₽ Instruments Licenses **JID File** ⊳ Genera Misc ⊳ Apply License Other Apply ATP License Apply Demo License Help Import Exit

Using the Navigator:

Using the GUI:



2. A file explorer will appear, as shown below. Navigate to the correct directory of the previously downloaded license, select the .lic file, and click **Open**.

称 Open								\times
$\leftarrow \rightarrow \cdot \uparrow$	> This PC	> Desktop	~ (ע	O Searc	h Desktop		
Organize • N	ew folder					•		?
- Ouick accord	^ N	ame				Date modi	fied	
Desktop	*	M42d-CB-total.lic				5/27/2021	11:06 PI	N
🖊 Downloads	*							
Documents	*							
Not the second s	*							
import0611	~ <)
	File name:			× *.	ic			\sim
					Open		Cancel	

3. A confirmation will appear, and you must reboot the device for the changes to take effect.

Verifying Current Licenses

Upon reboot, you may wish to confirm that the correct license was applied. Use the following procedure to check the licenses that are currently applied to your M42d instrument.

- 1. Using either the embedded M42d GUI or Remote Host PC ATP Manager, open the Navigator.
- 2. Select the **Instruments** tab.
- 3. Choose the instrument that you are looking up and select Information on the left-hand side bar.

The Remote ATP Manager will automatically connect to the specified device, if not already connected.



The **About** window will appear, which has various information about the device, and has the **Licensed Features** listed toward the bottom of the report, as demonstrated below.

Instructions for saving the Instrument Information Report can be found in Section 2.2. This saved Information Report is necessary when contacting Teledyne LeCroy PSG Support, as a current version of the report is needed for creating licenses.

```
About...
                                                                                             \times
                                                                                             ~
    M-Series Test Platform Version: 6.30.2
    M4PMU Version: 0x07
    DP 2.0 Protocol Analyzer [29480038034c,pca:8,pcb:3,sn:20170017,] at 1 [DDR 4096MB]:
      Gateware: [Version: 4.27.132 Build Number: 1 (06/08/2021 17:17:21 CST) PCB: 2/C rev=1,
      Firmware: [Version: 6.30.2 Build Number: 113029 (qd 06/14/2021 16:14:25 CDT) M42d]
      PD [Version Tx:11, Rx:11]
    System Information:
       System SN : [ A301081ED0E83CC6::N/A ]
                 : [ Tue Jul 6 08:58:45 CDT 2021 ]
      Date
      SN
                 : [ N/A::N/A ]
      Main Board : [ "Super Server" ]
      CPUx6 : [ 6.158.10 "Intel(R) Core(TM) i5-9400 CPU @ 2.90GHz" ]
      DDR
                  : [ 7 GB + 512 MB ]
                  : [ NVME SSD 465 GB (500107862016 bytes) ]
      HD
      os
                 : [ Linux M4XX-95a7 5.4.31 #3 SMP Tue May 5 12:08:24 CDT 2020 x86 64 x86 6
      GUI manager : [ Version 6.30.2 34492 202106141601 ]
                 : [ lo inet 127.0.0.1/8 scope host lo ]
      1
                            inet 10.30.196.195/24 brd 10.30.196.255 scope global noprefix:
      2
                 : [ eno2
      PCIE3
                  :[]
      HDMI SRC CT : [ 4.13.3 ]
      HDMI 2.0 SRC CT: [ 1.0.4 ]
      HDC
              CT : [ 4.8.0 ]
      HDM
               SRC CT: [ 1.0.0 ]
    HDCP
              ile MD5 Checksums:
      HDC
               RX Key: 6bfaa9d92d1865a1d1a90e1709f1dec6
1
               TX Key: 81efd4be37c2fd04523829c492ead82b
      HDC
      H
                X Key: 85d55306babfd754e7a71d73c9ae4cd0
      HDC
              TX Key: f092c7036330e29ddd5c7db7154b362c
    License Features
      Licensed: 21 [Part of 95-00259 DP Auxiliary Channel Analyzer, M42]
      Licensed: 21 [Part of 95-00261 M42d DP 1.4 DP Auxiliary Channel Analyzer, M42]
      Licensed: 32 [Part of 95-00226 DisplayPort Capture/Analysis, M42]
      Licensed: 33 [Part of 00-00259 M42d DP 2.0 HDCP 2.3 Function, M42]
      Licensed: 33 [Part of 00-00261 M42d DP 1.4 HDCP 2.3 Function, M42]
      Licensed: 42 [95-00214 DP HDCP 2.3 Compliance Test - Source, M42]
      Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Sink, M42]
      Licensed: 47 [Part of 95-00216 DisplayPort CT Package 2 LLCT 1.2 Core - Sink, M42]
      Licensed: 48 [Part of 95-00213 DisplayPort CT Package 3 LLCT HBR3 Source Tests, M42]
      Licensed: 48 [Part of 95-00232 DisplayPort HBR3 Link Layer Source Compliance Tests, M4
      Licensed: 50 [Part of 00-00259 M42d DP 2.0 Video Generator Function, M42]
      Licensed: 50 [Part of 00-00261 M42d DP 1.4 Video Generator Function, M42]
      Licensed: 51 [Part of 00-00259 M42d DP 2.0 Basic Video Analyzer Software, M42]
      Licensed: 51 [Part of 00-00261 M42d DP 1.4 Basic Video Analyzer Software, M42]
      Licensed: 55 [Part of 95-00226 DP 1.4 Display Stream Compression (DSC) Rx Analysis, M4
      Licensed: 56 [Part of 95-00225 DP 1.4 FEC/DSC Tx, M42]
      Licensed: 61 [Part of 95-00216 DisplayPort CT Package 4 LLCT 1.4 - Sink Tests, M42]
      Licensed: 61 [Part of 95-00233 DisplayPort HBR3 Link Layer Sink Compliance Tests, M42]
      Licensed: 68 [95-00259 M42d DP 2.0 USB-C Alt Mode Enable, M421
    <
                                                                                           >
     SAVE TO FILE
                                                                                      CLOSE
```

Setting the Instrument date and time

This procedure describes how to set a M42d's data and time. The procedure assumes that you have connected to an M42d through the external ATP Manager.

To set the date and time of the M42d:

From the Other page (Page 4) of the Apps Window select Set Instrument Date/Time.

77	ATP Manager			- 0	×
8 6.	1 Apps	quant	umdata		
	Control	Compliance	Ed	1 Other	
	ACA Data Viewer	HDMI Capture Viewer	DP Capture Viewer	Command Console	
	8	8	2		
	Instrument Network Settings	Set Instrument Date/Time	Instrument Information	Install Software Update	-
					V
	Install CT Script Update	Apply ATP License	Apply Demo License	Generate License UID	

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

Set the month and date and time by selecting from the Calendar and time dials.

Select Date/Time ×								
Ηοι	ır	Minute			Second			
7 :		2	0]:[5	4	P	M
				Date				
	•		May, 2020				•	
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
	26	27	28	29	30	1	2	
	3	4	5	6	7	8	9	
	10	11	12	13	14	15	16	
	17	18	19	20	21	22	23	
	24	25	26	27	28	29	30	
	31	1	2	3	4	5	6	
, ,								·
OK CANCEL								

2.5 Upgrading ATP Manager

This section provides information about upgrading your M42d and M42d 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 quantumdata downloads page http://www.quantumdata.com/downloads.html.



Two software packages are available for upgrading the M42d:

The firmware and gateware package for the M42d 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 ATP Manager that will be installed.

Windows-based ATP Manager. This is the ATP Manager GUI that can be used to control the M42d instrument from a Windows PC. This download is discussed previously in Section 2.2 – Operating the ATP Manager on a host PC

Notes:

You must upgrade the Windows-based ATP manger every time you upgrade the firmware/software on the unit. **Upgrade the ATP Manager first,** and then upgrade the M42d application firmware as indicated in the release notes.

Please be sure to refer to the Release Notes for the specific release for detailed upgrade instructions.
2.6 VNC Remote Connection

Sections 2.1 and 2.2 discussed controlling the M42d device either directly using an external monitor, or remotely using the ATP Manager application on a remote host PC. However, the M42d 80G Video Analayzer/Generator does come with another built-in option for controlling the device remotely.

The instruments come with **TightVNC Server** installed and enable the user to access the embedded GUI of the instrument remotely as an alternative to using the ATP Remote Manager. The main advantage of this is to utilize features that are modified or inaccessible while using a remote host ATP Manager.

Installing TightVNC Viewer and Connecting to the Device

TightVNC Viewer for windows is available for free download at https://tightvnc.com/download.php. Navigate to this page on the remote PC that you would like to control the M42d device from, and install the compatible software package.

Note: TightVNC comes pre-installed on the M42d device and the server runs automatically on startup, so nothing further needs to be done on the instrument other than powering the device on.

Once TightVNC is installed on the remote computer, open the **TightVNC Viewer** application from the installation directory folder.



Enter the device's IP address in the **Remote Host** field, and click **Connect**. Instructions for locating the device's IP address are in **2.2 Operating the ATP Manager on a Host PC**.

	an or sea cel		
Remote Host:	31.41.592.65		Connect
Enter a name o append it after	r an IP address. To spec two colons (for example	cify a port number, e, mypc::5902).	Options
Reverse Conner	tions		
Listening mode	allows people to attach	your viewer to	
their desktops.	Viewer will wait for incor	ming connections.	Listening mode
TightVNC Viewer	Tishward is seen alout		
TightVNC Viewe	TightVNC is cross-platf	orm remote control	software.
TightVNC Viewe	TightVNC is cross-platf Its source code is avai	orm remote control lable to everyone, o	software. either freely

The default password for the instrument is *elocution*, though this can be modified on the **TightVNC Server** application on the M42d device itself.

With the VNC Viewer, you can operate the instrument's embedded GUI to access certain features unavailable on a remote host PC ATP Manager GUI.

Generator

3 Generator

3.1 Overview

This section provides information for using the M42d video generator function. To access this, select the Generator application icon from the home screen.

The Generator screen has a status area on the top of its panel, pictured below.



The status area provides the following information:

Generato	r Status Area (Top)	
Number	Item	Description
1	Mode	Multi-stream (Multi-Stream Transport) or Single-stream (SST) Transport
2	DSC	Indicates whether Display Stream Compression is currently on or off
3	FMT	The currently active format (selected resolution)
4	IMG	The currently active image (selected test pattern)
5	Resolution, scan, and color	Resolution, scan type, and colorimetry type of active format.
6	P-Rate	The pixel clock rate of the selected timing.
7	F-Rate	The frame or vertical refresh rate of the selected timing.
8	H-Rate	The horizontal refresh rate of the selected timing.
9	Video Identification Code (VIC)	The VIC code is shown in parentheses, followed by the resolution, frame rate, and aspect ratio of the active format.

3.2 Selecting DisplayPort Video Format

Use the following procedures to select a video resolution (format). To access the formats menu, select the Format tab at the top of the Generator application in the M42d GUI Manager.

III Generator					-		×
Mode: MST V DSC:Off FMT:240p4 IMG:Outli	lxS3 ine3		P-Rate:54.00MH	z F-Rate:59.83Hz H-Rate:15.73kHz	Output	Discor	nnect
(13) 2880x240p @ 60 Hz 6:9		2880x240 Prog	gressive RGB-8bpc			Refre	esh
Format 🗸	Pattern	Audio	Tools	Topology		DD/1107	
CTA VESA Folder Lists	EDID					DP/USE Gener	ator
Resolution Vtotal	Frame Rate	Aspect 240p4xS3					
240p2x 240p4x 262 262	24/1.001 24	Ratio VIC 13					

You can select formats (timings) from either the M42d 80G Video Analyzer/Generator's format library, from the CTA or VESA parameter filters, or from a reduced subset of formats. You can select a format in one of four ways, which are all covered in this section.

- Select using CTA or VESA smart filters
- Select from the entire library list of formats
- 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

Once you've selected the desired format, you can adjust the settings of this format, which is covered at the end of this section.

Selecting format using the CTA or VESA Smart Filtering button

From the Generator, click the Format tab.

Select either the **CTA** or **VESA** subtab underneath the Format tab. The smart filtering screen enables you to select CTA or VESA formats through filtering of various video parameters such as Resolution, Vtotal, Frame Rate, and Aspect Ratio.

💷 Gene	rator											_	
Mode: I	MST 🚽 D	SC:0	ff F I	MT:240p MG:Outl	4x_3 ine3			P-R	ate:54.00MF	Iz F-Rate:59 H-Rate:19	9.83Hz 5.73kHz €C	Output	
(12) 28	80x240p	@ 60	Hz (4:3		2880x240 Progressive RGB-8bpc							
	Format			Patte	rn	A	Audio				Topology		
СТА	VESA	Fol	lder	Lists	EDID								
	0		Vto	otal	Frame	Rate	Arpect		480p59	480p59LH	480p60		
2 2)	< D4>	C	262	263	24/1.001	Ava	ilabla						
2 2)	(o4)	C	312	313		For	nate		480p60LH VIC 2	480p59SH VIC 3	480p60SH VIC 3		
480p			314		30/1.001	1011		1	100 - 110		100.000		
480p2	480i2x	:			48/1.001	48	4.27		480p119 VIC 48	480p119L VIC 48	480p120 VIC 48		
480p4	480i4x	:				50	256:135		480p120L	480p119S	480p120S		
576p					60/1.001	60	Box]	VIC 48	VIC 48 VIC 49			
576p2	c 576i2x	:				100	FILL		480p239 VIC 56	480p239L VIC 56	480p240 VIC 56		
576p4)	576i4x				120/1.00	1 120	4:3		490p2401	490-2208	490-2408		
720p						200	16:9		VIC 56	480p2395 VIC 57	VIC 57		
1080p	1080i	1	1125	1250	240/1.00	1 240	1.85:1						
2160p	4320p			1			2.39:1						
				Le	eft to Right	🗢 🕴 ettin	gs Edit (Clear	Selection				

In the previous screenshot, **Left to Right** selection is enabled (circled at bottom of screen). This will show available formats (on the right) that meet the filtering criteria as you narrow down the specified parameters in the following order:

- 1. Resolution
- 2. Vtotal
- 3. Frame Rate
- 4. Aspect Ratio
- 5. Box

Instead of Left to Right, you can also select **Arbitrary**, which enables you to specify filtering criteria in any order. Refer to the example below.

In this example, we are using the VESA smart filter and selecting a Frame Rate of 30 Hz and a 16:9 Aspect Ratio. A list of formats on the righthand side of the screen shows the formats that match these first two criteria selected. You may select one of these formats now or continue filtering by Resolution and Type.

💷 Gene	rator										_
Mode: N (4) 128	MST - 80x720p	DSC:Off @ 60_H:	f FMT: IMG:(z 16:9	720p60 Outlin	e3	1	1 280x720	P-Rate:74.25M	Iz F-Rate:60 H-Rate:45 RGB-8bpc	.00Hz .00kHz [●] Out;	out
Format Pattern						Au	Audio Tools			Topology	
CTA	VESA	Folde	er Li	sts	EDID						
Туре		Resol	ution		Frai	me Rate	Aspect	CVT3830H	CVT5130H	CVT7630H	
CVT	640	720	768	800		24	Ratio	CVR3830H	CVR5130H	CVR7630H	
CVR	848	900	960			30	4:3	CVR10230H	C2R3830H	C2R5130H	
C2R	1064	1152	1224	1280		43	5:3	C2R7630H	C2R10230H		
DMT	1360	1366	1400	1440		48	5:4				
DMR	1536	1600	1680	1704		50	11:5				
	1728	1792	1800	1856		60	16:9				
	1864	1920	2048	2128		72	16:10				
	2304	2456	2560	2728		75	64:27				
	3072	3840	5120	7680		85					
	10240					100					
						120					
						144					
				Arbitra	у	Setting	gs Edit	Clear Selection			

Note: To unselect any of the selected filtering criteria, click Clear Selection at the bottom of the window

Selecting format from Library List

Use the following procedures to select a video resolution (format) using the Library List method.

From the Format tab of the Generator app, click the **Folder** subtab. The directory whose formats are being displayed is listed in the lower panel. Typically, **SELECT FOLDER Path: /Standard** this would be the Standard directory where the M42d's format list is stored. The default path is the Standard path.

A list of DP, HDMI, or DVI formats will appear as shown in the example below.

🔳 G	enerator							
Мос	le: MST 👻 DSC	C:Off FMT:108 TMG:Out	0p24 line3	P-R	ate:74.25MHz F-R	Rate:24.00Hz	Outp	out
(32)	1920x1080p (24 Hz 16:9		1920x1080	Progressive RGB	-8bpc		
	Format	Patter	'n	Audio	Tools	Topolo	ogy	
CT	A VESA	Folder Lists	EDID					
	1035i29	1035i30	1080i23W	1080i24W	1080i25	1080i25W		^
	1080i25_	1080i29	1080i30	1080i50	1080i59	1080i60		
	1080p100	1080p100B	1080p100SB	1080p119	1080p120	1080p120B		
	1080p120SB	1080p23	1080p23W	1080p24	0p24B	1080p24SB		
	1080p24W	1080p25	1080p25B	1080p25SE	3 1080p25W	1080p29		
	1080p29W	1080p30	1080p30B	1080p30SE	8 1080p30W	1080p47		
	1080p47SH	1080p47W	1080p48	1080p48SH	1080p48W	1080p50		~
SELE	CT FOLDER Pa	th: /Standard	L				62	*
			Edit Setting	gs Find Trar	nsfer			

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 icon in the bottom right rightharpoondown for the panel, and the window will scroll to the currently selected format.

Select a format by clicking on it. Note that you can browse for a format using the scroll bar on the right. You can also search for a format using a test strings on the Find Format dialog box.

Click on the **Find** button on the lower portion of the Format panel.

	1080p47SH 1080p47W		1080	1080p48 1080p48SH			1080p48W	1080p50		~	
SELE	CT FOLDER	Path	h: /Standard							62	*
				Edit	Setting	s Find					

M42d Video Analyzer/Generator - User Guide	Ver. A1
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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.

In this screenshot example, the text "CVT" has returned 180 possible matches.

Find		\times
Search Text:	Matches: 180	
CVT	CVT0650	^
Case Sensitive	CVT0650D	
 Starts with 	CVT0650H CVT0660	
 Contains 	CVT0660D	
	CVT0660H	
	CVT0675	\checkmark
	OK CANCEL	

Selecting format using custom Lists

You can create a custom list of formats using the Format Editor (**covered in section 4.5, under the Tools tab**). This allows you to quickly select from an abbreviated list of your preferred formats. To access your list(s), Click the **Lists** subtab underneath the Format tab. The screen below is what you will see; notice that before selecting your list, you'll get a blank screen and the bottom taskbar will read "<No Lists Selected>"

Format			Pattern		Aud	dio		Tools	Topology	
CTA	VESA	Folder	Lists	EDID						
SELECT	<no lis<="" td=""><td>sts Sele</td><td>ected></td><td></td><td></td><td></td><td></td><td></td><td></td><td>*</td></no>	sts Sele	ected>							*
				Edit	Settings	Find	Transfer			

You can open up and activate any custom Format Lists you have previously defined using the **SELECT** icon (arrow above). A dialog box will appear enabling you to select a custom format list or lists.

■ Format Lists ×
Instrument Files
 ✓ [™] User ■ List2Demo ■ mylist
CHECK ALL UN-CHECK ALL OK CANCEL

You can select any or all of the custom Format Lists. The example above shows two custom lists, but you can make as many as you'd like. Note that selecting multiple Lists will display all of them in the Format selection window. The screenshot below shows a single list selected. The name of the list or lists will appear in the bottom taskbar.

Format		F	Pattern		Audio			Tools	Topology
С	TA VESA	Folder	List	s E	DID				
	1080p30	1080p2	25W	108	0p29	1080p2	29W	1080p48SH	
SEL	ECT Lists:	List2Dem	no						*
				Edit	Settings	Find 1	Fransfei		

Generating format from EDID

The final subtab under Format is the **EDID** smart activation panel. Click on this button to configure the list of formats in accordance with the EDID for the connected display. The screenshot below shows the EDID panel and the **READ EDID AND GENERATE FORMATS** button, which will present a listing of the preferred formats for the connected DUT.

	Format	Patterr	า	Audio	Tools	Topol	ogy
СТ	A VESA	Folder Lists	s EDID				
	APP0667	APP0875	APP1175	CVT0860	CVT1960D	CVT1960H	^
	DMR1660H	DMT0660	DMT0672	DMT0675	DMT0856	DMT0860	
	DMT0872	DMT0875	DMT1043	DMT1060	DMT1070	DMT1075	
	DMT1260G	DMT1275G	DMT1660	DetQDI1	DetQDI2	DetQDI3	
	DetQDI4	DetQDI5	DetQDI6	DetQDI7	IBM0770H	SMT0660D	
							~
	Hot-Plug Formats Mode READ EDID AND GENERATE FORMATS						
			Edit Setting	gs Find Trai	nsfer		

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.

Specify the format settings by clicking on the Settings button on the lower center of the panel.

	1080p47SH	1080p47V	V 1	080p48	1080p	48SH	1080p48W	1	080p50	~
SEI	ECT FOLDER	Path: /Stan	dard							*
				Setting	js Find	Transfer				

The Settings dialog box appears as shown below. Select the Color Space, Range, and Bits per Component from the **Format Settings** dialog box in accordance with your requirements.

Format Settings						
Color Space						
RGB	BT2020 RGB					
YCbCr	BT2020 cYCC					
BT2020 YCC						
4:4:4	4:2:2 4:2:0					
F	Range					
Full	Shoot Limited					
Bits per Component 6 8 10 12 16						
APPLY						

Format Settings					
Parameter	Description	Options			
Color Space	Colorimetry and video pixel	• RGB – Uses 4:4:4 sampling.			
	encoding settings.	• YCbCr – Uses either 4:4:4, 4:2:2 sampling.			
		• BT2020RGB			
		• BT2020 cYCC			
		• BT2020 YCC			

Format Settings					
Parameter	Description	Options			
Quantization 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 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 specification section on Video Quantization Ranges for more details. 			
Bits per Component	Color depth per component.	 6 – Six (6) bit per component (24 bit per pixel) color depth. 			
		 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. 			
		 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. 			

3.3 Pattern

Use these procedures to select a test pattern and configure its settings. Click on the **Pattern** tab at the top of the Generator app to access the list of test patterns. You can select a pattern either from the Library List (Folder subtab) or a custom list that you create.

Selecting a test Pattern from the Library List Folder

Upon clicking the Pattern tab, a list of patterns will appear. The directory of this Library List is located at the bottom of the window, as shown below. By default, the path is set to Standard, which will display the entire test pattern library.



Select a pattern from the list by clicking 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 (located at the bottom of the window, as seen above), you are presented with a dialog window where you can search for a pattern by name using initial and mid-string partial searches.

The following example shows a search for patterns starting with "col" and returns two results: ColorBar and ColorBox.

Find	×
Search Text:	Matches: 2
col	ColorBar
□ Case Sensitive	ColorBox
Starts with	
 Contains 	
	OK CANCEL

Using Custom List to select a Test Pattern

The subtab **Lists** at the top of the window allows you to pick from a pre-defined list of patterns that you can compile using the Pattern Editor (covered in section 4.5, under Tools).

Once again, this list will initially be empty, as shown in the following screenshot. Click the **SELECT** icon at the bottom of the panel to choose a list or set of lists. This is depicted below with two custom lists as options in the Select dialog box.

Format		Pattern	Audio	Tools	Topology
Folder Lists	1.				
					1
		Image Lists		×	
			Instrument Files		
		∽ 🖻 User			
		DemoList2			
		QuickList			
2.			ALL UN-CHECK ALL	OK CANCEL	
		<u>r</u>			·
SELECT <no :<="" lists="" td=""><td>Selecte</td><td>ed></td><td></td><td></td><td>*</td></no>	Selecte	ed>			*
		S	ettings Find Transf	er	

You can select any or all of the custom pattern lists you have defined. The **Check All** and **Un-Check All** 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 following example. A limited set of patterns area displayed. The **Path** icon at bottom status panel will display that new list's name (DemoList2).



Configuring Test Patterns Settings

Use the following procedures to select a test pattern.

To specify test pattern settings:

1. From the Pattern tab, click the **Settings** button on the lower center of the panel.

WHT_EM+	WHT_I	EM	Y	CbCrTest	ZonePlt		~
SELECT FOLDER Path:	/Standard					1	*
		Settings	Find Tra	ansfer			

The **Settings** dialog box appears as shown in the following screenshot:



2. Enable and disable Gamma and Pseudo-random 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 vision, to maximize the use of the bits or bandwidth relative to how humans perceive light and color.	• On • Off
Pseudo-Random 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

3. Select the rendition where applicable using the Rendition button. The associated dialog box is shown further below.

Some test patterns—such as GraysAll—have multiple versions. 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 2 is currently being rendered on the sink DUT.

Pattern Settings ×						
Gating	Rendition	Level	Params			
	€ 2	(MAX = 255)				

4. 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.

Pattern Settings $ imes$						
Gating	Params					

5. Set the pixel depth (PELD) if necessary through the Level button and associated dialog box in the previous screenshot.

PELD establishes the number of data bits that represent each active pixel in video memory (frame buffer). Parameter. The default setting and setting of 8 allows 256 colors on an image (test pattern) to be rendered. This is suitable for the majority of 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 M42d video generator default
- 8 8 bits-per-pixel (256 colors)
- 32 24 bits-per-pixel (16,777,216 colors).
- 6. Set the pattern parameters, if necessary, through the **Params** button and associated dialog box shown below. The following table describes each parameter.

Pattern Settings \times							
Gating	Rendition	Level	Params				
OFFX 0	OFFY 0 P	PENW 0	PENH 0				
DELX 4	DELY 4	SPAX 32	SPAY 32				
	DWEL 1	NCYC 1]				

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

3.4 Testing audio on an audio rendering device

The M42d supports audio testing for sink audio rendering devices. You can output LPCM audio over up to 8 channels at user selectable sampling rates and bits per sample. The audio signal is a sine wave. You can also specify the amplitude and the frequency of the sine wave. You can also specify the amplitude and frequency of each channel separately. Use the following procedures to test a DP audio rendering device.

Note: When generating DisplayPort Multistream, the audio signal that you specify will be transmitted on all virtual channels.

To test an audio rendering device:

From the Generator app of the M42d ATP Manager interface, select the **Audio** tab. If not already selected, click the PCM Sine Wave icon on the left side of the window. Both are shown below, as well as the full audio tab interface.

💷 Generator			-
Mode: MST 👻 I	DSC:Off FMT:IBM0770H IMG:GraysAll	P-Rate:28.	32MHz F-Rate:70.09Hz H-Rate:31.47kHz • Output
No VIC Code		720x400 Progressive RGB-8bpc	
Format	Patter	Audio Tools	Topology
PCM Sine Wave	Channels	Sample Rate	Bits/Sample
	2.0 🔻	48 kHz 👻	24 👻
		Channel Selection 🤌	
		1 2	
		Channel: 1 Mute: On Off	
		Level (dB) Frequency (Hz)	
		-3dB -48 +3dB -1000 1000 +	1000 👻
		APPLY STATUS	

The table below summarizes the M42d 80G 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.	 2.0 2.1 5.1 6.1 7.1 						

LPCM Programmable	Sine Wave options	
Parameter	Description	Options
Sampling Rate	This is the sampling rate of the audio sine wave test tone.	 32kHz 44.1kHz 48kHz 88.2kHz 96kHz 176.4kHz 192kHz
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 unmwutes the audio for a particular channel.	• On • Off
Frequency (Hz)	The frequency of the audio sine wave test tone.	Programmable throughout a range of .008 kHz to 20kHz (per channel) in increments of: • 1Hz • 10Hz • 10Hz • 1kHz

Next to **Channel Selection** is a clickable icon is which allows you to link channels together so that you can adjust settings for all of them at once. Click this icon and the **Edit Channel Links** dialog box appears, as shown in the following screenshot (Note: if you have 2.0 Channels selected, clicking this icon will simply link these two channels, and no dialog box will appear).

Edit Channel Links		\times
Linked Channels	LINK UNLINK	
	1 2 3 4 5 6	
	All None	
	OK CANCEL	

In this dialog box, you can select any number of channels you wish to link. Easily select **All** or **None** of the channels using the respective button.

Once you have the channels selected that you wish to link, click the **LINK** button at the top of the dialog box. The following example has channels 1-3 selected and ready to link.



After clicking LINK, the numbered boxes that you selected for linking will turn green. Click **OK** to be taken back to the main Audio testing interface.



Notice that in the example below, Channels 1-3 are now only one clickable icon, and 4, 5, and 6 remain separate.



In this next example, all of the channels are linked:



To change or unlink the channels, click the *i* con again to return to the Edit Channel Links dialog box. You must select the group of linked channels in the left column, as shown below. In this case there is only one grouping of linked channels. Click **UNLINK** at the top of the dialog box and then ok. The Channel Selection area will return to its previous form.



Once you have entered your desired settings for audio testing, click **APPLY** at the bottom of the window.

Click **STATUS** to see testing settings before or after applying changes.

3.5 Tools

The **Tools** tab has several utilities, located on the left sidebar. To access these, click on the **Tools** tab in the Generator app on the M42d ATP Manager. This section will review these tools in detail.

💷 Generator					_		×
Mode: MST 👻	DSC:Of:	f FMT:IBM0770H IMG:GraysAll		P-Rate:28.32MHz H	F-Rate:70.09Hz H-Rate:31.47kHz © Output	Disco	nnect
No VIC Code			720x400 Progressiv	re RGB-8bpc		Refr	resh
Forma	ıt	Pattern	Audio	Tools	Topology	DP/US	BC 2.0
Link Train						Gene	rator
ALPM							
Backlight							
USB-C							
DPCD Viewer							
HDCP Test							
EDID Decode	• • • • • • • • • • • • • • • • • • •						
EDID Comp							
Image Shift							
Image Ctrl							
DSC							
Editors							
Scripts							
						CLO	SE

Link Train

The M42d 80G Video Analyzer/Generator enables you to control the link training with a DisplayPort sink device. There are three modes:

- Adaptive Training
- Non-Adaptive Training.
- Fast Training

Adaptive and Non-Adaptive are covered in this section, and Fast Training will be covered in Chapter 10 Embedded DisplayPort (eDP)

Adaptive Training enables you to train based on Lane Count and Link Rates capabilities that you define in the application. When you set the Lane Count and Link Rate in the Adaptive training mode you are emulating a DP source with those capabilities. The link will be established with the appropriate voltage swing level and pre-emphasis necessary to establish a proper link.

In the Non-Adaptive mode, you are forcing the Lane Count and Link Rate as well as the voltage swing level and pre-emphasis and bypassing the typical link training function.

Note: You can monitor the link training transactions with the Auxiliary Channel Analyzer (ACA) if desired.

Accessing the Link Training Control application

Use the following procedure to test link training with your DP display device. This procedure assumes that you have already selected a DP VESA format and a test pattern to meet your test application requirements (Instructions for this found in sections 4.1 and 4.2.

1. Access the **Link Train** control application through the **Tools** tab in the Generator interface as shown below.



2. Select the link training mode tab (Adaptive or Non-Adapative) in accordance with your requirements.

The first example on the following page will cover **Adaptive Training**. For **Non-Adaptive Training**, skip to step 5

3. Select the **Train at Lane Count** and **Train at Link Rate** parameters using the labeled icons provided (4 lanes and 8.1Gbps link rate shown in the example below).

The link training will occur after each selection is made; note the Current Status panel at the top of the screen.



Note that in the top left of the screen, the **Mode** drop-down selection is still enabled, as shown below, allowing you to select either Single-Stream (SST) or Multi-Stream Transport (Multi-Stream Transport) mode for testing.



Training at any rate 10.0 Gbps or above forces Mult-Stream Transport mode (Multi-Stream Transport). This will be demonstrated on the following pages.

4. Click on the **Train Based on Capabilities** activation button to initiate link training that automatically trains at the highest capabilities of the DUT.

The results and status of the link training will be shown on the Link Train application screen as shown below. The DUT in this example trained at 4 Lanes and 13.5 Gbps.

Note: You can monitor the link training transactions with the **Auxiliary Channel Analyzer (ACA)** if desired.

Mode: MST 👻	DSC:Off	FMT:IBM0770H IMG:GraysAll					P-Rate	:28.32MHz	F-Rate:70.09Hz H-Rate:31.47kHz SOutput
No VIC Code				720x400 1	Progres	sive B	RGB-8bpc		
Form	at	Pattern		Au	dio		Тос	ols	Topology
Link Train	S	oread Spectrum 🕖 💿	Ŧ		Synchr	onous	Clock 🔍		FEC 🚾
ALPM				Cui	rent	Sta	tus		
Backlight				Main	Stream:	USB-C	TX enabled		
USB-C				Li	ink Rate:	13.50G	bps		
DPCD Viewer					Lane 1:	CR don	e, EQ done, S e EO done S	Lock done [1	fe0]
HDCP Test					Lane 3:	CR don	e, EQ done, S e, EQ done, S	Lock done [1	fe0]
EDID Decode				Inter-lane Ali	Lane 4: anment:	CR don Yes	e, EQ done, S	SLock done [1	fe0]
EDID Comp		Adaptive Training		N	∽ Jon-Adai	otive Tr	aining		Fast Training
Image Shift				Tre	in ot la		unt		
Image Ctrl				110					
DSC					1 2	- 4	J		
Editors				Train	at Link	Rate (Gbps)		
Scripts				1.62	2.70	5.40	8.10		
				10.0	13.5	20.0			
					Retries	. 			
					BASED OI		BILITIES		

Note that the **Mode** drop-down menu is disabled (grayed out) because the Link Rate is above 10.0 Gbps. Multi-Stream Transport is selected as it is the only option given these settings.

I Generator		
Mode: MST 👻 No VIC Code		FMT:IBM0770H IMG:GraysAll
Form	at	Pattern
Link Train	Sp	read Spectrum 🔵 📼

This guide will expand on Multi-Stream Transport in section **4.6 Topology**.

- 5. Optionally, select the **Non-Adapative** link training mode using the tab provided.
- 6. Specify the Lane Count, Link Rate, Voltage Swing Level and Pre-emphasis level parameters. (Note that the link training does *not* automatically occur with each selection, unlike with Adaptive Training)
- 7. Click on the **Force Train** activation button to initiate the link establishment using the parameters you have specified.

Note: It is common that many combinations of link parameters will not establish a successful link, because the link training process is not occurring.

The example below shows Non-Adaptive Link Training where the M42d force training at a Link Rate of 8.10 Gbps with a Lane Count of 2, Voltage Swing Level of 1, and Pre-emphasis Level of 2.



Note: You can monitor the link training transactions with the **Auxiliary Channel Analyzer (ACA)** if desired.

The second example below shows Non-Adaptive Link Training where the M42d forces training at a Link Rate of 13.5 Gbps at 4 lanes. UHD requires Multi-Stream Transport and requires an **FFE Preset Value** rather than Voltage Swing level and Pre-emphasis level. This difference is shown below as well as the resulting status of the force train.

Mode: MST 🗕	DSC:Off	FMT:IBM0770H IMG:GraysAll							P-Rat	e:28.3	2MHz F-F H-F	Rate:70.0 Rate:31.4	9Hz 7kHz 🎙	Output
No VIC Code			7	20x4	00 Pr	ogres	sive	RGB-	8bpc					
Form	at	Pattern			Audi	0			То	ols		Τοι	pology	
Link Train	S	pread Spectrum 🔵 📼				Synch	ronou	s Cloc	ck 🔍			FEC		
ALPM					Curi	cent	Sta	atus	5					
Backlight					Main S Lane	tream: Count:	USB-0 4 Lan	C TX ei ies	nabled					
USB-C					Lin	k Rate:	13.50	Gbps						
DPCD Viewer					L	.ane 1: .ane 2:	CR do	one, EQ one, EQ) done,) done.	SLock d SLock d	one [ffe0] one [ffe0]			
HDCP Test					L	ane 3:	CR do	one, EQ	done,	SLock d	one [ffe0]			
EDID Decode			In	ter-lar	L ne Aligr	ane 4: ment:	CR do Yes	one, EQ	done,	SLock d	one [ffe0]			
EDID Comp		Adaptive Training			No	n-Ada	ptive -	Trainin	ng			Fast Tra	ining	
Image Shift		Lane Count								Link R	ate (Gbp	s)		
Image Ctrl		1 2 4							1.62	2.70	5.40	8.10		
DSC									10.0	13.5	20.0			
Editors														
Scripts		N	_		FFE	E Pres	et Va	lue						
			0	1	2	3	4	5	6	7				
			8	9	10	11	12	13	14	15				
					F	Retries	: 🔍							
						FORCE	TRAIN	1						

DPCD Viewer

Use the following procedures to view a display's DPCD registers.

Note: When the generator is configured for MultiStream, you can read the DPCD of any configured downstream sink. This is covered here, with more details on Multi-Stream Transport mode in **section 4.5 Topology and Multi-Stream Transport.** You can also produce an HTML report of the DPCD registers, which is detailed at the end of this subsection.

To view the DPCD of a connected display:

1. From the main window of the M42d 80G Generator application, select the **Tools** tab and navigate to the **DPCD Viewer** interface using the button on the left-hand sidebar.

💷 Generator						_
Mode: SST 👻	DSC:Off FMT:IBM IMG:Gra	10770H VSA11		P-Rate:	28.32MHz F-	Rate:70.09Hz Rate:31.47kHz SOutput
No VIC Code		101111	720x400 Progres	sive RGB-81	bpc	a do to 1 1 1 / Kill
Forma	t Pa	ttern	Audio		Tools	Topology
Link Train	Receiver Capability	Ranges		READ ALL	D PAGE	REPORT
ALPM	Link Config.		1	Receiver C.		
Backlight	Link/Sink Status	Base 00000-0000F	Register dat	ta has not l	read.	
USB-C	Panel Replay	Adv/AV				
DPCD Viewer	2	00020-0002E				
HDCP Test	Test Automation	GUID	1			
EDID Decode	Source Specific	00030-0003F				
EDID Comp	Sink Specific	GUID 2				
Image Shift	Branch Specific	00040-0004F				
Image Ctrl	Sink Control	RX_GTC				
DSC	eDP Backlight		-			
Editors	ESI	00080-0008F				
Scripts	Ext Rcv. Capability	FEC				
	Protocol Converter	00090-00091				
	LTTPR					

- 2. **Multi-Stream Transport** mode requires you to select a downstream device. *If you are in* **SST** *mode, skip this page and move to step 3.*
 - a. If you are in Multi-Stream Transport Mode (indicated at the top left of the screen as shown below) and a port has not already been selected, you must select a port to read by clicking the dropdown that will read **<NO PORT>**.

The following screenshot shows the interface with a DUT using Multi-Stream Transport:

Mode: MST -	DSC:Off FMT:IBN IMG:Gra	10770H 1ysAll		P-Rate:28.	32MHz F-Rate H-Rate	■:70.09Hz ■:31.47kHz ● Output
No VIC Code			720x400 Progressive	e RGB-8bpc		
Forma	t P	attern	Audio	Tool	s	Topology
Link Train	Receiver Capability	🗆 Rang	<no port=""> 🔹</no>	READ ALL	READ PAGE	REPORT
ALPM	Link Config.		Re	ceiver Capabil	ity	
Backlight	Link/Sink Status	Base 00000-0000F	Register data h	as not beer	n read.	
USB-C	Panel Replay	Adv/AV				
DPCD Viewer	DSC	00020-0002E				
HDCP Test	Test Automation	GUID				

b. The Select a Device/Port dialog box will pop up. You can select any downstream sink or branch device. In the following example, Sink-4 has been selected. Click OK once you have selected the appropriate downstream device.



3. Select a Register page to read, and click **READ PAGE** to retrieve the DPCD report for that page. The register pages are listed on the left-hand side of the window in a new sidebar, as shown below.

An example is shown below, with the first page of the Receiver Capability DPCD register displayed in the main panel.

Mode: SST 👻	DSC:Off	FMT: IBM IMG: Gra	10770H NysAll			P	-Rate:28.3	2MHz F H	-Rate:70.09Hz -Rate:31.47kHz	Output
No VIC Code				72	0x400 Progres	sive RGB-8	Bbpc			
Form	at		Patern		Audio		Tools	- 1	Topolog	y
Link Train	Receiver C	apability	< l			READ ALL	READ PAGE	E REP	ORT	
ALPM	Link Co	nfig.		1		Receiver Ca	apability			
Backlight	Link/Sink	Status	Base 00000-0000F	00000: Bit	DPCD_REV			Value	Description	Â
USB-C	Panel R	eplay	Adv/AV							
DPCD Viewer	DSC	>	00020-0002E	7-4	MAJOR_REV MINOR_REV			1 4		
HDCP Test	Test Auto	mation	GUID	00001:	MAX LINK RATE					
EDID Decode	Source S	pecific	00030-0003F	Bit	Name			Value	Description	
EDID Comp	Sink Spe	ecific	GUID 2	7-0) MAX_LINK_RA	ATE		1Eh	8.1 Gbps/lane	
Image Shift	Branch S	pecific	00040-0004F	00002:	MAX LANE COUN	т				
Image Ctrl	Sink Co	ntrol	RX_GTC	Bit	Name			Value	Description	
DSC	eDP Bac	klight		4-0	MAX_LANE_CO	UNT		4 N(0)	4 lanes	
Editors	ESI		00080-0008F	6	TPS3_SUPPOF	TED		Y(1)		
Scripts	Ext Rcv. Ca	apability	FEC	· · ·	ENHANCED_FF	CAME_CAP		1(1)		
	Protocol Co	onverter	00090-00091	00003: Bit	MAX_DOWNSPREA Name	D		Value	Description	
	LTTP	R			MAX DOWNSPF	EAD			 Up to 0.5%	
				1 2 3	STREAM_REGE	N_STATUS_C	CAP	N(0) 0 0	Reserved	~

Alternatively, you can click **READ ALL** without selecting a register, and the DPCD report will be generated for all registers.

4. Click on a different register to view its DPCD. The example below displays the DSC register on the main panel.

Format		Pattern		Audio		Tools			Topology	
Link Train	Receiver Ca	pability	Ranges			READ	ALL	READ PAGE	REF	PORT
ALPM	Link Cor	nfig.					DSC			
Backlight	Link/Sink	Status	Capabilities 1 00060-0006F	00060:	DSC SUPPORT		$\left \right $		Value	Description
USB-C	Panel Re	play	Car bilities 2							
DPCD Viewer	DSC			0	DSC Support DSC Pass-th	rough			Y(1) N(0)	
HDCP Test	Test Autor	nation	Enab.e/Config	2	Dynamic PPS	Updat	e Cm	np->Cmp	N(0) N(0)	
EDID Decode	Source Sp	ecific	00160-00161	4	Dynamic IID	opaac		iomp vomp	0	Reserved
EDID Comp	Sink Spe	cific	DSC	6					0	Reserved Reserved
Image Shift	Branch Sp	ecific	02260-02273	7					0	Reserved
Imaga Ctrl	Sink Cor	atrol		00061:	DSC ALGORITHM	REVIS	ION			

5. View additional blocks/pages of each register by navigating to them using the sidebar to the left of the main panel. The example below displays the **Enable/Config** page of the DSC register set.



6. To view and save the DPCD of a connected display as an .html file, select **REPORT** at the top of the window:

Mode: SST 👻	DSC:Off FMT:IBM IMG:Gra	0770H ysAll		P-Rate:28.32MHz F-Rate:70.09Hz H-Rate:31.47kHz					
No VIC Code			72	0x400 Progressive	e RGB-8bpc				
Format		Pattern		Audio	Tools		Topology		
Link Train	Receiver Capability	Ranges		- • RE	AD ALL READ PA	GE REPO	RT		
ALPM	Link Config.			Li	ink/Sink Status				
Backlight	Link/Sink Status	Base 00200-0020F	00200: 5	SINK_COUNT				^	
USB-C	Panel Replay	Eman Counts	B1t	Name		Vaiu.			
DPCD Viewer	DSC	00210-00217	6	SINK_COUNT CP_READY		1 Y(1)	3 7 + 5 : 0		
HDCP Test	Test Automation	FEC	00201• T	FVICE SERVICE IRC	VECTOR				
EDID Decode	Source Specific	00280-00282	Bit	Name	_violoit	Value De	scription		
EDID Comp	Sink Specific	VC Payload	0	REMOTE_CONTROL_C	COMMAND_PENDING	N(0)			
Image Shift	Branch Specific	002C0-002FF	1 2	AUTOMATED_TEST_F CP_IRQ	REQUEST	N(0) N(0)			

The HTML report will be generated, allowing you to save to your desktop.

Note: The HTML DPCD Register Report will only include registers of the sink device that were retrieved using steps 1 - 5. To ensure a full report of all registers, click the **READ ALL** button in the main DPCD viewer interface, as described in step 4.

IL Viewer			
		DPCD Register Report	
ine 8, 2021	4:31 PM DPC DF	<u>www.quantumdata.com</u> D Register Report CD Revision 1.4	
	Re	eiver Capability	
00000: D	PCD_REV		
Bit	Name	Value Description	
7-4 3-0	MAJOR_REV MINOR_REV	1 4	
00001: M	AX_LINK_RATE		
Bit	Name	Value Description	
7-0	MAX_LINK_RATE	lEh 8.1 Gbps/lane	
00002: M	AX_LANE_COUNT		
Bit	Name	Value Description	
4-0 5 6 7	MAX_LANE_COUNT POST_LT_ADJ_REQ_SUP TPS3_SUPPORTED ENHANCED_FRAME_CAP	4 4 lanes N(0) Y(1) Y(1)	
00003: M	AX_DOWNSPREAD		
BACK F	Name	Value Description CLOSE	1

To test HDCP on a connected display using the Tools HDCP utility:

1. Access the HDCP Test through the Tools tab in the Generator app as shown below.

🔳 Generator					_
Mode: SST 👻	DSC:Off	FMT:IBM0770H IMG:GraysAll		P-Rate:28.32MHz F	-Rate:70.09Hz -Rate:31.47kHz SOutput
No VIC Code			720x400 Progressiv	e RGB-8bpc	
Forma	ıt	Pattern	Audio	Tools	Topology
Link Train	Options				
ALPM			HDCP Mo	de 🖌 🔶	
Backlight			None 1.3	2.3	
USB-C			Status	s S	
DPCD Viewer			REFRESH		
HDCP Test	\leq _				
EDID Decode					
EDID Comp					
Image Shift					
Image Ctrl					

2. Enable HDCP by selecting either **1.3** or **2.3**. The Status section will update automatically. View the results and status of the test through the HDCP Test screen as shown below.

Mode: SST 👻	DSC:Off	FMT:IBM0770H IMG:GraysAll		P-Rate:28.32MHz	F-Rate:70.09Hz H-Rate:31.47kHz © Output
No VIC Code		-	720x400 Progres:	sive RGB-8bpc	
Forma	t	Pattern	Audio	Tools	Topology
Link Train	Options				
ALPM			HDCP	Mode	
Backlight			None 1	.3 2.3	
USB-C			Key T	vne	
DPCD Viewer			Production	Facsimile	
HDCP Test			Stat	- 11 C	
EDID Decode			DEED		
EDID Comp			HDCP2ENABLED	:YES	
Image Shift			RXHDCP2ENABLED	:YES	
Image Ctrl			RXCAPS	:0 0 0	
DSC			AKE_INIT RX CERT	:SND_VALID :RCVD INVALID	
Editors			STORED KM	NOT RCVD	
Scripts			HPRIME PAIRING	NOT_RCVD	

Viewing the EDID of a connected display

Note: You can read the EDID of any specific downstream node. Procedures for this are within this subsection, with more details on Multi-Stream Transport mode covered in **section 4.6 Topology and Multi-Stream Transport**.

To view the EDID of a connected display:

- 1. From the Generator app of the M42d GUI Interface, select the **Tools** tab.
- 2. Activate the **EDID Decode** button on the left-hand sidebar (indicated below).

Mode: SST 👻	DSC:Off	FMT:IF IMG:G	M0770H aysAll				P-Rate:28.32MH	z F-Rate:70.09Hz H-Rate:31.47kHz • Output
No VIC Code					720x400	Progressiv	e RGB-8bpc	
Forma	t	Pattern			A	udio	Tools	Topology
Link Train	– 👻 Re	ad Save	Load	Edit				
ALPM								
Backlight								
USB-C								
DPCD Viewer								
HDCP Test								
EDID Decode		,						
EDID Comp								
Image Shift								
Image Ctrl								
DSC								
Editors								
Scripts								
	Block «	0/0	> Pag	je « I	0/0 >			

💷 Generator

3. **Multi-Stream Transport** mode requires you to select a downstream device. *If you are in* **SST** *mode, skip this page and move to* **step 4**.

If you are in Multi-Stream Transport Mode (indicated at the top left of the screen as shown below) and a port has not already been selected, you must select a port to read by clicking the dropdown that will read **<NO PORT>**.

The following screenshot shows the interface with a DUT using Multi-Stream Transport:



The **Select a Device/Port** dialog box will pop up. You can select any downstream sink. In the following example, **Sink-4** has been selected. Click **OK** once you have selected the appropriate downstream device.



4. Click the **Read** button at the top left of the window.

Mode: SST 👻	DSC:0)ff F1 II	MT: MG:						P-Rate:	F-Rate: • 0 H-Rate:
Form	nat		Pattern		Audio		Tools		Topology	
Link Train	F	Read	Save	Load	Edit					
ALPM		\wedge								
Backlight	4		\							
USB-C										
DPCD Viewer										
HDCP Test	-									
EDID Decode										
EDID Comp										
Image Shift										



Mode: SST 👻	DSC:Off F I	MT : MG :				P-Rate: F-Rate: ● Output H-Rate:							
Form	nat		Pattern	Audio	Tools	Topology							
Link Train	– 🔻 Read	Save Lo	oad Edit										
ALPM	Block #00												
Backlight	Block Type	: Base El verified											
USB-C	OVersion 1	Version 1 header verified											
DPCD Viewer	Man Pro	ufacture duct Code	r: QDI e: 980 (03D4h)										
HDCP Test	м	Serial #	#: 17 (00000011) r: 2020	h)									
EDID Decode	EDID Versi	on 1, Rev	vision 4										
EDID Comp	Number of	additiona	al Diocks: 2										
Image Shift													
Image Ctrl													
DSC													
Editors													
Scripts													
	Block < 1	1/3 👂	Page < 1/10										

5. Navigate through the blocks and pages of the EDID using the arrow buttons on the lower panel (indicated below).

DPCD Viewer	Product Code: 980 (03D4h)						
HDCP Test	Serial #: 17 (00000011h) Model Year: 2020						
EDID Decode	EDID Version 1, Revision 4						
EDID Comp							
Image Shift							
A V	Block < 1/3 > Page < 1/10 >						

Examples of the **EDID Decode** second and third blocks are shown below.

Forma	t Pattern	Audio	Tools	Topology								
Link Train	– 🔻 Read Save Load E	dit										
ALPM	Block #01											
Backlight	Descriptor Block: Detail Pixel clock: 262.750 MF	led Timing (DTD) Iz										
USB-C	Refresh Rate: 29.981 Hz	(approx.)										
DPCD Viewer	Horz Active: 3840											
HDCP Test	Vert Active: 2160 Horz Blank: 160	Vert Active: 2160 Horz Blank: 160										
EDID Decode	Vert Blank: 31 HSvnc Delav: 48	Vert Blank: 31 HSync Delay: 48 HSync Width: 32										
EDID Comp	HSync Width: 32											
Image Shift	VSync Width: 5											
Image Ctrl	Image size: 527 mm x 2 Border: 0 pixels x	296 mm x O lines										
DSC	Stereo mode: Normal dis	splay, no stereo										
Editors	Sync. Digital Se	parace, vsinc-, nsinc+										
Scripts												
	Block ≪ 2/3 ≥ Page ≪	6/10 👂										

Forma	ıt	í	Pattern		A	Audio	Tools		Topology				
Link Train	Re	ad Save	Load	Edit									
ALPM	Block #()2								^			
Backlight	Data Blo Rev	a Block: Tag 24h, bytes 45: Type IX Timing - Formula Based Revision: 0 Flags: 00h Cload Bytes: 42											
USB-C	Pavload												
DPCD Viewer	Type IX	IX Descriptor Count: 7											
HDCP Test	Timing Timi	ng # 1 Siming Algo: CVT Standard v1.2+ Reduced Blanking											
EDID Decode	3D	Support	: Monos	scopic	or Stere	30							
EDID Comp	Vert	: Active	: 2160	lines	>								
Image Shift	Refre *(100	≥sh Rate)0/1001)	: 60 H: : No	Z									
Image Ctrl	Timing #	‡ 2	CVTT (nd 11 24	Poducod Pl	nking						
DSC	3D	Support	: Monos	scopic	or Stere	BO BIG	anking						
Editors	Hor: Vert	: Active t Active	a: 5120 a: 2160	pixel: lines	5								
Scripts	Refre *(100	sh Rate 00/1001)	: 60 H: : No	z									
	Block <	3/3 >>	Page <	₹ 2/2	>					~			
DSC (Display Stream Compression)

The M42d 80G Video Analyzer/Generator supports a DSC/FEC video generator function. You can output DSC/FEC streams with a user selectable slice configuration, various compression settings, bit depths, colorimetry, etc. You can import your own configuration parameters from a Picture Parameter Set (PPS) of values. You can select from a set of provided DSC images or import your own DPX images.

Display Stream Compression display testing is supported through the standard DP Tx port or the USB-C DP alt mode port.

To test a DSC/FEC-capable display device:

From the **Tools** tab of the Generator app, select the **DSC** button in the left-hand sidebar. The DSC tools panel appears as shown below.

🔳 Generator							-
Mode: SST 👻	DSC:01	ff FMT: IMG:			P-Rate:	F-Rate: H-Rate:	 Output
Form	nat	Pattern	Audio	Tools		Topology	
Link Train	Setting	APPLY STOP			Import DPX	Delete	Refresh
ALPM	le lle e		Availab	le Images			0.000
Backlight	in Use: -						Count: 19
USB-C		2kClrSq.dpx	2kClrSq422.dpx	4K_Master.d	4K_Master	.dsc	
DPCD Viewer		4kClrSq.dpx	4kClrSq422.dpx	5kClrSq.dpx	5kClrSq422	.dpx	
HDCP Test		8kClrSq.dpx	8kClrSq422.dpx	BlueFrame1080p.dpx	BlueFrame1080	p422.dpx	
EDID Decode		CBar1080p.dpx	Master1080p.dpx	RedFrame1080p.dpx	RedFrame1080	p422.dpx	
Image Shift		Sunset1080n dox	Support1080p422 day	test zone day			
Image Office		Sunser 1000p.upx	Sunset 1000p422.upx	test_zone.upx			
Editore							
Corinto							
Scripts			211.000	. To umo to a			
			Allowed	1 Formats			

A list of **Available Images** will appear in the top panel. There are many by default on the M42d itself, otherwise you can add your own using the **Import DPX** button at the top right. This will be covered in the next subsection.

Select a file from **Available Images** by clicking on it. Options will appear in the **Allowed Formats** panel below, as shown in the following example. The first format is selected by default. Click **APPLY** once you have the desired image and format.

Form	at		Pattern		Audio		Tools			Topolog	∃У	
Link Train	Settings	APPLY	APPLY					Impo	rt DPX	Delete	Refr	esh
ALPM					Available Images							
Backlight	In Use:					_					Coun	t: 19
USB-C		2kClrSq.	dpx	26	ClrSq422.dpx		4K_Master.dpx		4K_Master.dsc			
DPCD Viewer		4kClrSq.	dpx	4k	ClrSq422.dpx		5kClrSq.dpx	5kClrSq422.dpx			:	
HDCP Test		8kClrSq.	dpx	8k	ClrSq422.dpx	Blu	ueFrame1080p.dpx	BlueFrame1080p422.dpx			.dpx	
EDID Decode		-					1					
EDID Comp	C	Bar1080	o.dpx	Ma	ister1080p.dpx		80p.dpx	Re	edFrame	1080p422	.dpx	
Image Shift	Su	unset1080)p.dpx	Suns	set1080p422.dpx		test_zone.dpx					
Image Ctrl												
DSC												
Editors					Allowe	d Fo	rmats					
Scripts	1	080p30	1080p60	1080	p120							
				M	agic=SDPX Col ix Geometry=192	orimet 0x1080	ry=RGB BPC=8					

Once a file is selected, the lower information panel shows the parameters of the selected video frame file and the **In Use** area at the top left shows the selected file name.

The Settings dialog box is accessed using the Settings button at the top left of the window.

(63) 1920x10	80p @ 120	Hz 16:	9	1920x1080	Progressive RGB	-8bpc			
Form	at		Pattern	Audio	Tools			Topolog	зу
Link Train	Settings	APPLY	STOP			Impo	rt DPX	Delete	Refresh
ALPM				Available	Images				
Backlight	In Use: 5kC	IrSq.dpx							Count: 19

The Settings dialog box is shown below. You can set the video parameters, compression, slice configuration, etc. here, or import a custom set of PPS parameters from a text file. The Selections for the dialog box are described on the table that follows.



DSC Video Generator S	DSC Video Generator Settings Dialog Box									
Item	Parameters	Comments								
Color Mode	Selections are: - RGB - 4:4:4 - 4:2:2 Simple - 4:2:2 Native - 4:2:0									
Bits Per Component	The color depth per component. Options are: - 8 - 10 - 12	These selections would be 24, 30 or 36 respectively for color depth per pixel.								
Bits/Pixel	This is the compression, i.e. the number of bits per pixels desired in the compressed output. Select throughout a range of 8 to 15.	The compression ratio can be calculated as Bits per Component x 3 / Bits per Pixel. Example: 8 bit color depth: 8 x 3 = 24 / 8 = 3:1 compression ratio.								
Slice Width (pixels)	The Width in number of pixels across a slice.	All slices have to be the same size and they are all rectangular.								
Slice Height (lines)	The Height in number of lines in a slice.									
Block Prediction	This selection indicates if the video generator will use Block Prediction.	Block prediction is an optional prediction method for the sink. You must be sure that the display you are testing supports Block Prediction.								
Line Buffer Bit Depth	This is a Picture Parameter Set (PPS) parameter. It is used to generate the bitstream. You can set this value or import this value as part of a Configuration File using the Custom tab.	You can import a text file to use.								

The **Settings** dialog box parameters are described below:

Here is a sample of a .txt Configuration File that you can import:

```
SRC_LIST /qd/dsc_images/cache/src_list.txt
  FUNCTION 1
  OUT DIR /qd/dsc images
  DSC VERSION MINOR 32628
  SLICE WIDTH 3840
  SLICE HEIGHT 1080
  INCLUDE
             /qd/dsc images/cfg/rc 8bpc 8bpp.cfg
  DPX FILE OUTPUT 0
  BLOCK PRED ENABLE 1
  LINE BUFFER BPC 16
  // DPX read options (the following work well for most modes for GM/IM, some
  anomalies are autodetected)
                         // Pad to 32-bit boundaries
  DPXR PAD ENDS
                     1
  DPXR DATUM ORDER 1
  DPXR FORCE BE
                     0
  SWAP R AND B 1
  // DPX write options (the following work well for most modes for GM/IM)
  DPXW PAD ENDS
                  1
                        // Required to output RGB to XNView 1.99 (but not
  YUV!)
  DPXW DATUM_ORDER
                   1
                         // Method to use for 10 & 12-bit data
  DPXW FORCE PACKING 1
  SWAP R AND B OUT 1
PPM FILE OUTPUT 0
                    // Output PPM files
```

Importing a DPX

Import your own DPX by clicking the **Import DPX** button in the top right of the **DSC** window, shown below. You may also **Delete** a file from the Available Images panel or **Refresh** this listing to show current available files.

Forma	at		Pattern		Audio	Audio		Tools			Topolo	gy	
Link Train	Settings	APPLY	PPLY STOP						Impo	rt DPX	Delete	Refr	esh
ALPM					Availab	ole I	mage	s			\wedge	- /	\
Backlight	In Use:									4		Cor	19
USB-C		2kClrSq.d	рх	2	ClrSq422.dpx		4K_Ma	ster.dpx		4K_Ma	dso	:	
DPCD Viewer		4kClrSq.d	рх	4	ClrSq422.dpx		5kClr	Sq.dpx		5kClrS	422.dp	x	
HDCP Test		8kClrSq.d	рх	8	ClrSq422.dpx	Blu	eFrame	e1080p.dpx	BI	ueFrame1	080p42	2.dpx	
EDID Decode		-							-		-		
EDID Comp	С	Bar1080p.	.dpx	Ma	ster1080p.dpx	Re	dFrame	e1080p.dpx	R	edFrame1	080p42	2.dpx	
Image Shift	Su	inset1080p	p.dpx	Suns	et1080p422.dpx		test_z	one.dpx					
Image Ctrl													
DSC													
Editors					Allowe	d For	rmat	S					
Scripts	10)80p30	1080p60	1080	p120								
				M	agic=SDPX Col ix Geometry=192	orimet 0x1080	ry=RGE	BPC=8					

From the **DPX Image Import** dialog box, select the DPX File for Import by clicking the **Browse** button. Add or Remove any supported formats, and click the **IMPORT** button to add to the list of Available Images.



Note: You may need to click the **Refresh** button in the top right for the newly imported DPX Image to display in the list of Available Images.

Other Tools

The tools tab has several other utilities:

- ALPM (Advanced Link Power Management) A utility for embedded DisplayPort (eDP). This will be discussed in Chapter 10 eDP.
- Backlight Also for eDP, discussed in Chapter 10 eDP.
- USB-C Change Supported Pin Assignments. Power Role Swap is not currently supported on the M42d.

Format	Pattern	Audio	Tools	Topology
Link Train		Supported Pin As	signments	
ALPM		DC		
Backlight			-	
USB-C		Power Role	Swap	
DPCD Viewer		Enabled D	isabled	
HDCP Test		Power Role Swap is curre	ntly not supported.	

- EDID Comp Compare the EDIDS of two sink devices, a sink device vs an imported EDID, or two imported EDIDs vs one another.
 - Select the EDID Comp utility from the Tools tab.

From here you can select which EDIDs to compare. If you are comparing imported EDIDs, click the **Select** button to import. The following example is comparing a sink device vs an imported EDID.

S	elect the EDI	Ds to Compare	
Two Si	Sink vs ED	DID #2 EDID #1 vs EDID #1	DID #2
Ed	lid #1 Select	Read from Sink	
Ed	lid #2 Select		
	Сом	PARE	

The next example shows two sink devices and the result after clicking the **COMPARE** button.

	Select the EDIDs to Compare																
		Two	Sin	k Re	ads	Si	nk vs	B EDI	D #2	2 E	EDID	#1 v	/s El	DID #	‡ 2		
	Edid #1 Select Read from Sink																
Edid #2 Select Read from Sink																	
							С	OMP	ARE								
						The	EDIC)s ar	e ide	ntica	d.						
#1 : R€	ad f	Erom	Sir	ık			4 B	lock	1/3	Þ			#2:	Rea	d fi	rom	Sink
	0	1	2	3	4	5	6	7	8	9	А	в	С	D	Е	F	
00	00	FF	FF	FF	FF	FF	FF	00	44	89	D4	03	11	00	00	00	
1() FF	1E	01	04	E5	80	48	78	18	DA	FF	A3	58	4A	A2	29	
20	17	49	4B	FF	FF	80	31	40	45	40	61	40	81	80	A9	40	
30	82	00	BA	88	21	00	00	15	40	50 D0	00	20	FO	70	35	80	
	30	20	35	00	5F	59	21	00	00	1A	00	00	00	FC	00	51	
60	0 44	20	4D	34	32	64	0A	20	20	20	20	20	00	00	00	FD	
70	A0	17	E2	0F	F5	FO	04	12	03	FF	F8	38	FO	78	02	В4	
	DECODE AND DIFF																

Editors – Create a custom format or custom lists of patterns and formats. Screenshot example below.

Mode: MST 👻	DSC:Off FMT:2160p IMG:TVBa	p24 P rH	-Rate:297.00MHz F-Rat H-Rat	e:24.00Hz e:54.00kHz • Output
(93) 3840x216	50p @ 24 Hz 16:9	3840x	2160 Progressive RGB	-8bpc
Format	Pattern	Audio	Tools	Topology
Link Train				
ALPM				
Backlight		Ø	Ø	
USB-C		Format Editor	Format List Edito	r
DPCD Viewer				
HDCP Test				
EDID Decode				
EDID Comp		A		
Image Shift				
Image Ctrl	Pa	ttern List Editor		
DSC				
Editors				
Scripts				

 Scripts – Allows user to implement custom functionality based on low level instrument commands by loading a batch shell script into the directory folder.

Note: A batch shell script must be loaded into the folder path using an external file explorer.



The M42d 80G Video Analyzer/Generator emulates an Multi-Stream Transport source for testing an Multi-Stream Transport branch device or Multi-Stream Transport-capable monitor. Up to four (4) streams are supported depending on bandwidth (resolutions) with a depth of one. You can configure the Multi-Stream Transport topology using a graphical interface. The optional Auxiliary Channel Analyzer (ACA) utility depicts the Multi-Stream Transport negotiations with the connected Multi-Stream Transport Rx device.

When Multi-Stream Transport is configured, the same video pattern and audio signal is transmitted to all downstream nodes. There is a number indicator that appears on the upper left screen of the downstream Multi-Stream Transport sink that identifies which stream is being delivered.

Note: Multi-Stream Transport testing is supported through both the standard DP port and the USB-C DP alt mode port.

Accessing the Multi-Stream Transport Topology window

Use the following procedure to test Multi-Stream Transport on a connected Multi-Stream Transport-Capable sink device.

1. At the Generator dialog box, select Multi-Stream Transport from the Interface drop down menu. Refer to the screen example below.

🔳 Generator					_
Mode: SST →	DSC:Off	FMT:1080p120 IMG:Samsung6	P-Rat 720x400 Progress:	e:28.32MHz F-Rat H-Rat ive RGB-8bpc	e:70.09Hz e:31.47kHz [€] Output
Mode: MST		Pattern	Audio	Tools	Topology
Read EDID R	ead DPCD	VC# 1 /	2 3 4 DEE	DESH	

Click **OK** when the confirmation dialog box appears.

Note If the **Mode** dropdown is unselectable (grayed out, as shown below), then the Sink device has been trained at a UHD link rate, which requires Multi-Stream Transport. If this is the case, and you would like the option to select **Mode: SST**, refer to the subsection of this chapter titled **Returning to SST Mode**.

I Generator				
Mode: MST -	FMT: IBM0770H IMG: Samsung6	P-	Rate:28.32MHz F-Ra H-Ra	ate:70.09Hz ate:31.47kHz 🔍 0
No VIC Code		720x400 Progressi	ve RGB-8bpc	
Format	Pattern	Audio	Tools	Topology
Read EDID Read DP	CD VC# 1 2	3 4 REFRESH		

July 18, 2021

2. From the Generator window, access the **Topology** tab to control the Multi-Stream Transport application as shown below. Notice the **Mode** has been switched to Multi-Stream Transport after the previous step.



The table below summarizes the graphical controls of the Multi-Stream Transport Topology window.

Multi-Stream Transport Topology Window						
Button	Description					
Read EDID	Enables you to read the EDID of the selected downstream Multi- Stream Transport Rx node.					
Read DPCD	Enables you to read the DPCD of the selected downstream Multi- Stream Transport Rx node.					
Virtual Channels VC #1…VC #4	Select the virtual channel to analyze					
Refresh	Refreshes the view.					

Use the following procedure to configure the number of downstream Multi-Stream Transport nodes.

To access the Multi-Stream Transport dialog box:

1. Using the embedded ATP Manager GUI on the M42d, navigate to the **DisplayPort/USBC 2.0 Protocol Analyzer RX** interface, or the **Receiver** interface on a remote PC ATP Manager.

	quantum <mark>d</mark> ata											
Contr	ol	Compliance	Editors		0ther							
	Generator	DisplayPort/USBC 2.0 Protocol Analyzer RX	Aux. Channel Analyzer	Captu	Leg ure Control							
Naviga	tor STATIC	: 10.30.196.38 ATP Versio	n: 6.26.24-Alpha 64	bit	Switch to VPS GUI	0						

Note: This application is covered in detail in Chapter 4 Source Verification with Basic Analyzer

- 2. Click the **Tools** button on the right sidebar.
- 3. The **Tools** dialog box will appear. Select the **Multi-Stream Transport** tab within this dialog box, as shown below.



The previous screenshot shows the dialog box with a device that has link trained at 10.0, 13.5, or 20.0 Gb/s. These rates are UHBR which require Multi-Stream Transport, and SST is not an option under **Mode**.

The next example of the dialog box below shows a device link trained at 8.1 Gb/s or lower.

The dialog box has three fields:

- Mode: Select between SST and Multi-Stream Transport
- Virtual Channel to Show: Select which virtual channel to display within the Protocol Analyzer/Receiver.
- Configured Stream Count: Change the number of streams between transmitted by the Generator.

Tools	\times
Link Status	Mode
LTTPR	Mode MST SST
MST	
Hot-plug	Virtual Channel to Show
HDCP	1 2 3 4
ALPM	
eDP	
USB-C	Configured Stream Count
Error Info	1 2 3 4
Backlight	Stream Count changes take effect after a manual reboot
SPDIF / Trigger	
	CLOSE

To add/remove a downstream node:

This dialog box enables the user to add or remove a downstream node. Select the desired number of nodes in the **Configured Stream Count** field. The following example has selected two streams.

Note: After selecting a stream count, you must reboot the M42d for the changes to apply. You will also need to retrain to the desired link rate after the reboot, if applicable.



After rebooting, navigate to the **Topology** tab to verify the number of downstream nodes. Continuing from the previous example, the topology now displays a branch device and two sinks, as shown below.



Reading the EDID or DPCD of a downstream Multi-Stream Transport node

EDID Decode and DPCD Viewer are covered in section **4.5 Tools**, but there is another way to access these utilities while in Multi-Stream Transport mode from the Topology tab.

The **Read EDID** and **Read DPCD** buttons are located at the top left of the window in the Topology tab (shown below). Clicking either of these will take you to the respective utility in the Tools tab. The example below has Sink-4 selected.



Returning to Single-Stream Transport (SST) Mode

If your device previously trained at a link rate of 8.1 Gbps or lower, returning to SST mode is as simple as clicking the **Mode** drop down in the top left and selecting **Mode: SST** as depicted below.

🛄 Generator											—
Mode: MST 👻	DSC:Off	FMT:IBM IMG:Sam	1077 Isun	0H g6			P-I	Rate:28.32MHz	F-Ra H-Ra	te:70.09Hz te:31.47kHz	Output
No Mode: SST	$\boldsymbol{<}$				720	x40	0 Progressi	ve RGB-8bpc			
Mode: MST		Patte	rn				Audio	Tools		Topolo	gy
Read EDID R	ead DPCD	VC#	1	2	3	4	REFRESH				

If the **Mode: Multi-Stream Transport** drop down is not clickable, your sink device is likely trained at a UHD link rate (10.0 Gbps or higher), which requires Multi-Stream Transport mode. You must use the **Link Train** utility in the **Tools** tab to train at a link rate of 8.1 Gbps or lower.

An example of this is depicted below. More on link training can be found in the Link Train subsection of this chapter.

Mode: SST 👻	DSC:Off FMT:IBM0770H IMG:Samsung6			P-Rat	te:28.32MHz	F-Rate:70.09Hz H-Rate:31.47kHz SOutput
No VIC Code		720x400	Progres	sive H	RGB-8bpc	
Format	Pattern	Au	dio		Tools	Topology
Link Train	Spectrum 🖉		Synch	ronous	Clock 🔍	FEC 🛛
ALPM		Cui	rrent	Sta	tus	
Backlight		Main Lan	Stream: e Count:	USB-C1 4 Lanes	TX enabled	
USB-C		Li	ink Rate:	8.10Gb	ps	
DPCD Viewer			Lane 1: Lane 2:	CR don	e, EQ done, SLo e. EO done. SLo	ck done [v0, p0] ck done [v0, p0]
HDCP Test			Lane 3:	CR don	e, EQ done, SLo	ck done [v0, p0]
EDID Decode		Inter-lane Ali	Lane 4: anment:	CR don Yes	e, EQ done, SLo	ck done [v0, p0]
EDID Comp	Adaptive Training	N	Jon-Ada	otive Tra	aining	Fast Training
Image Shift		Tes	ain at l	ano Co	unt	
Image Ctrl			1 2			
DSC					•	
Editors		Train	at Link	Rate (Gbps)	
Scripts		1.62	2.70	5.40	8.10	
		10.0	13.5	20.0		
			Retries			
		TRAIN	BASED O	N CAPA	BILITIES	

Note: Do not click on **TRAIN BASED ON CAPABILITIES** as this will likely train at a link rate higher than desired for SST.

SST mode will be selected by default after this link training, as shown below.



Basic Analyzer Description

- Emulates an DP 1.4 or DP 2.0 sink device including EDID, DPCD, Multi-Stream Transport, Link Training emulation.
- Provides real time view of the incoming source video and metadata including status of mainstream attributes, secondary data packets, link training, Multi-Stream Transport, HDCP.
- Provides support for viewing the Aux Channel transactions using the quantum data Auxiliary Channel Analyzer (ACA) application when testing a DP source.

Note: Chapter 5 will cover the Protocol Analyzer/Capture Control function of the M42d.

4.1 Accessing Basic Analyzer Features

From the Home screen of the M42d ATP Manager, select the **DisplayPort/USBC 2.0 Protocol Analyzer Rx** app, as shown below.

			quantum	data			
Control		Complia	nce	Edito	ors	0ther	
Ger	nerator	DisplayPort Protocol A RX	/USBC 2.0 Inalyzer	Aux. Channel Analyzer	Captu	re Control	
Nevigotor	STATIC.	10 20 106 20	ATD Version	6 26 24 Alpha	ca bit	Switch to VDS CUI	Ø
Navigator	STATIC:	10.30.190.38	AIP version:	0.20.24-Alpha	04 DIT	Switch to VPS GUI	e

The Analyzer panel appears showing the incoming video image. The M42d's Rx analyzer port provides periodic video frame captures enabling you to view frames of video. This feature provides a basic confidence test to verify that the incoming video is essentially correct.

There is a dashboard on the top of the panel indicating the essential video characteristics, and there is a set of controls on the right-hand side, as shown below.



Note: The Analyzer panel is *not* transmitted to a **Remote PC ATP Manager**. When selecting the **Receiver** on a desktop ATP Manager, only the **Tools** dialog box (discussed later in this chapter) will appear, as shown below. The Analyzer panel is accessible remotely using a VNC. This is discussed in **2.5 VNC Remote Connection**.



For this reason, most instructions and screenshots in the next two chapters are from the embedded ATP Manager GUI on the M42d device itself.

Basic Analyzer Dashboard

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

Basic Analyzer – Dashboard Items
Example dashboard of DisplayPort 2.0 Protocol Analyzer Rx
Port: DisplayPort/USBC 2.0 Protocol Analyzer RXDP: LicensedUSB-C: LicensedMonitor: HDCP 1.41LTTPR Emulation: OffPassive Monitor: Off (Auto)MEASUREDDPBandwidth: 10.00Active: 720 x 400V-Total: 449VRate: 70.1 fpsMETADATARes: 720 x 400Total: 900 x 449Sync: 108-, 2+Start: 162, 37RGB sRGB, VESA 8 bpcProgressiveMETADATASync-Clk: YStereo-3D: NMute: NVfreq: 28.32 MHzAfreq: 48000 HzMETADATAPixel Clock: 28.322 MHzDwnSp: offHDCP-Enc: offExample using USB-C DP-alt mode with DSC enabled and active
Port: DisplayPort/USBC 2.0 Protocol Analyzer RXDP: LicensedUSB-C: LicensedMonitor: UnencryptedLTTPR Emulation: OffPassive Monitor: Off (Auto)MEASUREDUSB-CBandwidth: 8.10Active: OsC x Enabled1125METADATARes: 1000Total: 2200 x 1125Sync: 44+, 5+Start: 192, 41na, CEA 8 bpcMETADATASync-Clk: YStereo-3D: NMute: NMvid: 74250Nvid: 810000Maud: 512Naud: 16875METADATAPixel Clock: 74.250MHzDwnSp: offHDCP-Enc: offHDCP-Enc: off
The following items are on the Real Time dashboard:
Top Row Items – Module and Port:
 Port: DisplayPort/USBC 2.0 Protocol Analyzer RX - The Port area shows the current Rx port that is being displayed on the Basic Analyzer.
Second Row Items:
• Monitor: HDCP 1.4 - Indicates the HDCP encryption status of the received video.
Note: If unencrypted, this will be the indicator: Monitor: Unencrypted
LTTPR Emulation LTTPR Emulation: Off - Indicates whether LTTPR emulation is active
 Passive Monitor Passive Monitor: Off (Auto) – Indicates whether passive monitoring is enabled.
Third Row Items:
 Measured MEASURED DP or MEASURED USB-C - Indicates whether USB-C or DP (DisplayPort) is currently connected.
 Lanes Lanes: 4 - The number of lanes used during link training.
 Bandwidth Bandwidth: 13.50 - The link rate (per lane).
Active (video resolution) Active: 3840 x 2160 - This is the measured video resolution.
Note: If DSC is active this will be indicated Active: DSC x Enabled
 V-Total <u>V-Total: 2250</u> - This is the measured total vertical video lines per frame.
VRate VRate: 60.0 fps - This is the measured vertical frame rate
Fourth Row Items:
Res Res: 3840 x 2160 - The active video resolution in horizontal pixels and vertical lines
determined from the main stream attributes.
 Total 4400 x 2250 - The total video in horizontal pixels and vertical lines determined from the main stream attributes

Basic Analyzer – Dashboard Items
• Sync: 88+, 10+ - Horizontal sync pulse width (in pixels) and polarity, followed by vertical sync
pulse width (in lines) and polarity. (e.g. Hsync 88 pixels, positive; Vsync 10 lines, positive)
Start Start: 384, 82 - The starting pixel and line in the active video determined from the main
stream attributes.
Colorimetry and bit depth RGB sRGB, CEA 8 bpc - The colorimetry and bit depth determined
from the main stream attributes.
 Scan Progressive - The scan type used, progressive (e.g. Prog) or interlaced (Inter) determined
from the main stream attributes.
Fifth Row Items:
Sync-Clk Sync-Clk: Y - Indicates if the Link Clock and Main Video Stream clock are asynchronous
or synchronous. A value of N means async; a value of Y means synchronous. This value is determined
by the main stream attributes.
 Stereo-3D Stereo-3D: N - The status of 3D audio determined from the main stream attributes.
 Mute: N - The AudioMute flag status determined from the main stream attributes.
 Vfreq Vfreq: 594.00 MHz - Video pixel frequency determined from the main stream attributes.
Afreq Afreq: 48000 Hz - Audio sampling frequency determined from the main stream attributes.
Sixth Row Items:
Pixel Clock Pixel Clock: 594.000 MHz - How often pixels occur (frame rate x pixels per frame)
DwnSp DwnSp: off - DownSpread indicates whether Spread Spectrum Clocking (SSC) is enabled

HDCP-Enc HDCP-Enc: off – Indicates if HDCP encryption is currently active

Main Control Panel

This subsection describes the main control panel for the Basic Analyzer. Refer to the table below for a description of these controls. This chapter expands on many of the tools presented in this table in later sections.

Basic Analyzer – Control Panel	Control Button Descriptions
Main Control Panel	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
Home	associated with them. The purpose of each button and their basic control functions are described below:
Back	 Home – The Home button Home is a navigation button that when pressed takes you back to the home screen Apps Panel.
Stop	 Back – The Back button Back is a navigation button that when pressed takes you back to the previously viewed screen.
Color	 Start/Stop – The Start / Stop button Stop / Start is used to enable and disable the showing of the incoming video image.
PPS	 Color – The Color button Color and associated dialog box enables you to identify the color of any particular pixel.
VSC ACA	 Scale – The Scale button Scale and associated dialog box enables you to set the size, quality and aspect ratio of the incoming video image.
Set EDID	 PPS – The PPS button PPS brings up the Picture Parameter Set panel. Used with DSC Analysis.
Set DPCD	VSC – The VSC button VSC displays Video Stream Configuration data
Tools	ACA – The ACA button ACA is used to bring up the ACA utility.
Dassiva	Set EDID – The Set EDID button Set EDID is used to set the EDID
Monitor	 Set DPCD – The Set DPCD button Set DPCD is used to set the DPCD
	 Tools – The Tools button in this chapter.
	 Passive Monitor – The Passive Monitor button toggle Passive Monitor mode.
	Note: More details on Passive Monitoring are found in Chapter 7 Passive Monitoring.

4.2 Controlling the Basic Analyzer

This subsection provides procedures on how to control the Basic Analyzer features.

Viewing the Color values

The M42d enables you to determine the color values of any individual pixel.

1. Access the Color dialog box by clicking the icon on the right-hand side control panel, as shown below.



The Video Color dialog box will open.



3. Read the pixel values on the dialog box provided. The pixel values (X for the horizontal – Y for the vertical) are provided in both hex and decimal.

Ver. A1

Setting the video image size and aspect ratio

The M42d enables you to set the size and aspect ratio of the displayed video image.

Access the **Image Scale** dialog box by clicking the **Scale** icon on the right-hand side control panel, as shown below.

Port: DisplayPort/USBC 2.0 Protocol Analyzer RX DP: Licen	sed USB	-C: Lice	nsed			Home	
Monitor: HDCP 1.4 LTTPR Emulation: Off Passive Monitor: Off (Auto)							
METADATA Res: 720 x 400 Total: 900 x 449 Svnc: 108 2	+ Start	: 162. 3	7 RGB SR	GB. VESA 8 bi	oc Progressive	6. 02.07	
METADATA Sync-Clk: Y Stereo-3D: N Mute: N Vfreq: 28.3	2 MHz A	freq: 48	000 Hz	,,		Stop	
METADATA Pixel Clock: 28.322 MHz DwnSp: off HDCP-Enc:	off						
						Color	
	Image Sc	ale				Scale	
	Mo	de				200	
	1:1	Scaled					
	Qual	ity				VSC	
	Low	High				ACA	
	Aspect	Ratio					
	Fit	H:V				Set EDID	
	4:3	5:3				Set DPCD	
	5:4	11:5				Tools	
	16:9	16:10				Daggiya	
	32:9	64:27				 A Monitor 	
	256:135						

Set the size to either 1:1 or Scaled.

- The 1:1 setting means that the image appears in its true size. In this mode, if the image is too large for the viewing panel, it can be moved by clicking and dragging to view all areas of the image.
- The Scaled setting means that the image appears scaled to fit within the viewing area of the M42d's ATP GUI display, or within the Aspect Ratio defined.

The example below shows Image Scale set to Scaled with an Aspect Ratio set Fit the viewing panel.



This final example below is in Scaled mode with an Aspect Ratio of 4:3.

Note: In order to set the Quality and the Aspect Ratio you must set the Mode to Scaled.

Port: DisplayPort/USBC 2.0 Protocol Analyzer RX DP: Licensed USB-C: Licensed	Home
tonitor: HDCP 1.4 LTTPR Emulation: Off Passive Monitor: Off (Auto)	Back
TEASUKED USB-C Lanes: 4 Bandwighth: 13.50 Active: 720 x 400 V-Total: 449 VKate: 70.1 Tps TETADATA Res: 770 x 400 Total: 900 x 449 Svpc: 108. 24 Start: 162 37 RGR SEGR VESA & hor Progressive	6.02.07
ETADATA Sync-Clk: Y Stereo-3D: N Mute: N Vfreq: 28.32 MHz Afreq: 48000 Hz	Stop
IETADATA Pixel Clock: 28.322 MHz DwnSp: off HDCP-Enc: off	
	Color
	Scale
Image Scale	PPS
	¥30
	ACA
Aspect Ratio	Set EDID
Fit H:V	Set DPCD
4:3 5:3	Tools
5.4 11:5	
16:9 16:10	Passive
32.9 64.27	Monitor
256135	
200.100	

Note: Scaling uses simple decimation, so some fine image details may be inaccurate or lost.

Monitoring transactions using the ACA Utility

You can monitor the Aux channel transactions from the ACA Utility, as well. The Aux Channel Analyzer is covered in detail in **Chapter 6**. The tool is discussed briefly here, but you can refer to Chapter 6 for a more in-depth look at the ACA utility.

Access the ACA Utility by clicking the ACA button on the right-hand sidebar, as shown below.



Click **Start** to begin monitoring the Aux Channel transactions. The ACA Utility will begin monitoring for Aux transactions and display them, as shown below.

: DisplayPort/USBC 2.0 Protocol A	nalyzer RX	DP: Lic	ensed U	SB-C: Licensed			Home
tor: HDCP 1.4 LTTPR Emulation: O	off Passiv	e Monitor	•: Off (A	uto)	WPator 48 0 fpc		Back
DATA Res: 3840 x 2160 Total: 5	500 x 2250	Sync: 8	40 X 2100 8+, 10+	Start: 384, 82	RGB sRGB, CEA 8 bp	c Progressive	6.02.07
DATA Sync-Clk: Y Stereo-3D: N	Mute: N \	/freq: 59	4.00 MHz	Afreq: 48000 Hz	z		Stop
DATA Pixel Clock: 594.000 MHz I	DwnSp: off	HDCP-En	c: off				
		te: 112					Color
		13. 112			~~~		Scale
	Start Paus	e Clear	Events	Details Options 🗢			
	103 DNAT	13	< ACK	41 00 77 77 05 03	3 00 00 🕤		PPS
	104 DPPRE	11	Precha	rge/Sync Count: 3	32		VSC
	105 DNAT	11	> R+2A	A STNK COUNT L=8			ACA
			P ILLU				
	106 DPPRE	: 13	Precha	rge/Sync Count: 3	32		Set EDID
	107 DNAT	13	> R:20	0 SINK_COUNT L=8	\odot		Set DPCD
					- T		Tools
							Passive

Click the **Options** flyout menu to toggle certain viewing settings. In the example below, the Time-Stamps and Port Names for each event are displayed.

\varTheta AC	A Events: 1	391						٦	\times
Stop	Pause	Clear	Events	Details	Options 🗢				
1379	DPSB	DPUS	SBC-T11	+00:1	Time-Stam	ps	< DN_REP 1:0 -PSE:0 6		۲
1380	DPSB	DPUS	SBC-R13	+00:1			< DN_REP 1:0 -PSE:0 6		
1381	DPMST	DPUS	SBC-T11	+00:1	Port Name	es	< RPL: ACK - Allocate Payload		
1382	DPMST	DPUS	BC-R13	+00:1	Scroll Loc	:k	< RPL: ACK - Allocate Payload		
1383	DPPRE	DPUS	6BC-T11	+00:1	5.52.4502	, [Precharge/Sync Count: 32		
1384	DNAT	DPUS	5BC-T11	+00:1	15:32.4902	77	> W:201 DEVICE_SERVICE_IRQ_VECTOR L=1	10	
1385	DPPRE	DPUS	6BC-R13	Port N	Name 2	77	Precharge/Sync Count: 32		
1386	DNAT	DPUS	SBC-R13	+00:1	.5:32.4902	77	> W:201 DEVICE_SERVICE_IRQ_VECTOR L=1	10	
1387	DPPRE	DPUS	BC-T1	+00:1	5:32.4903	59	Precharge/Sync Count: 32		
1388	D	Time-s	stamp	+00:1	15:32.4903	59	< ACK		(8)
1389	DPPRE	DPUS	SBC-R1	+00:1	5:32.4903	59	Precharge/Sync Count: 32		
							· ···		

In the ACA Utility, you can click the **Events** button for a dialog box that enables you to select which events you would like the Analyzer to display. Easily select All or No events, or check the specific events you would like to monitor. In the example below, all DP Native, EDID, and Multi-Stream Transport Transaction events are selected.



Click the **Events** button for a dialog box displaying the details of the selected event. Easily navigate to the previous or next event inside this box using the arrows at the top, as shown in the two dialog boxes below.

⊖ ACA Events: 1593 .							
Stop	Pause	í í	Details Options 🗢				
1578	DNAT	11	> R:201 DEVICE_SERVICE_IRQ_VECTO				
1579	DPPRE	13	Precharge/Sync Count: 32				
1580	DNAT	13	<pre>> R:201 DEVICE_SERVICE_IRQ_VECTO</pre>				
1581	DPPRE	11	Precharge/Sync Count: 32				
1582	DNAT	11	< ACK 04				
1583	DPPRE	13	Precharge/Sync Count: 32				
1584	DNAT	13	< ACK 04				
1585	DPPRE	11	Precharge/Sync Count: 32				
1586	DHDCP	11	> R:69493 RxStatus L=1				
1587	DPPRE	13	Precharge/Sync Count: 32				
1588	DHDCP	13	> R:69493 RxStatus L=1				
1589	DPPRE	11	Precharge/Sync Count: 32				
ACA E	Event Details		₽ ×				
ACA E	Event Details ⇒		₽ ×				
	Event Details ⇒ Start T: T: Direct: Comma	ime: +0 ype: Na ion: Re and: AC					
ACA E	Event Details ⇒ Start T: Direct: Command to Read	ime: +0 ype: Na ion: Re and: AC Reques	<pre>> >> >>> >>>>>>>>>>>>>>>>>>>>>>>>>>></pre>				
ACA E Reply 00201 B 	Event Details Start T: Direct: Comma to Read DEVICE it Name REMO AUTOI CP_II AUTOI CP_III AUTOI CP	ime: +0 ype: Na ion: Re and: AC Reques _SERVIC _SERVIC _ TE_CONT MATED_T RQ _ IRQ _ REP_MS EQ_MSG _ SPECIF	<pre> P0:16:32.173765 P1ive Pply K St. CE_IRQ_VECTOR Value Descriptio TROL_COMMAND_PENDING N(0) TEST_REQUEST N(0) Y(1) N(0) SG_RDY N(0) RDY N(0) TC_IRQ N(0) O Reserved O O O O O O O O O O O O O O O O O O O</pre>				

Setting the EDID for the Rx port

The M42d enables you to set Rx ports EDID for emulation. The ATP GUI provides an EDID Editor enabling you to create your own custom EDIDs. You can also capture EDIDs from the M42d's Tx ports and save them for testing on the Rx port.

1. Access the Set EDID dialog box by clicking the **Set EDID** button on the right-hand sidebar, as shown below.

Port: DisplayPort/USBC 2.0 Protocol Analyzer RX	DP: Licensed USB-C: Licensed		Home	
Monitor: HDCP 1.4 LTTPR Emulation: Off Passive Monitor: Off (Auto)				
METADATA Rest 720 x 400 Total: 900 x 449 Sync	108-2+ Start: 162 37 RGB sRGB	VESA 8 hpc Progressive	a.02.07	
METADATA Sync-Clk: Y Stereo-3D: N Mute: N V	freq: 28.32 MHz Afreq: 48000 Hz		Stop	
METADATA Pixel Clock: 28.322 MHz DwnSp: off H	IDCP-Enc: off		0-1	
			Scale	
	Set RX EDID X		PPS	
	Local Files		VSC	
	🖻 User		ACA	
	🗉 🖻 Standard			
			Set EDID	
			Set DPCD	
			Tools	
	Permanently set the EDID:		Dessive	
	Issue Hot Plug:		A Monitor	
	issue not hug.			
	OK CANCEL			



3. You may also wish to generate a hot plug while setting EDID or set the EDID permanently. You can do these by toggling either setting in the Set RX EDID dialog box, as shown below.



The M42d's Rx port will emulate the EDID you selected.

Refer to the section of Chapter 3 titled **Viewing EDIDs of a Connected Display** for instructions on how to capture EDIDs from HDTVs.

Setting the DPCD for the Rx port

The M42d enables you to set the DPCD. The ATP GUI provides an DPCD Editor enabling you to create your own custom DPCDs, as well.

1. Access the Set DPCD dialog box by clicking the **Set DPCD** button on the right-hand sidebar, as shown below.



2. Select the desired DPCD and then click OK.



Refer to the section of Chapter 3 titled **DPCD Viewer** for instructions on how to view a display's DPCD registers.

4.3 Tools Dialog Box

The **Tools** dialog box offers additional features, options, and statuses within it. This section will cover these in varying detail. Access the Tools dialog box by clicking the **Tools** button on the right-hand side control menu, as shown below.



Overview of Tools dialog box selections:

- Link Status- Provides information on the Rx Main Link lanes and link rate
- LTTPR- Access tools for LTTPR Emulation (license required). This feature is covered in Chapter 8 LTTPR Testing
- Multi-Stream Transport- Provides for Multi-Stream Transport configuration. This feature is covered in detail in 4.6 Topology and Multi-Stream Transport.
- Hot-plug- Generate a hot-plug pulse of duration between .1 4000 milliseconds. Example shown below

Tools	×
Link Status	
LTTPR	Duration 100.00 ms (0.1 - 4000)
MST	GENERATE HOT-PLUG
Hot-plug	
HDCP	nome and over 12 may a press
ALPM	
eDP	

HDCP- Enable/Disable HDCP or select version. You may also edit the Key Type or Bcaps from this screen.

9 Protocol Analyzer RX DP: Licensed USB-C: Licensed						
Emulati	Emulation: Off Passive Monitor: Off (Auto)					
Total - 000 - 440 Super 100 - 24 Storte 162 - 37 DCB SDCB VECK & her Drespective						
tereo-3	Tools			× Stop		
8.322 MH	Link Status		None 1.3 2.3	Color		
	LTTPR			Scale		
	MST		Кеу Туре			
	Hot-plug	Prod	ction Facsimile Facsimile #2	PPS		
	носр		Status	VSC		
		Fachlad Disabled	REFRESH	ACA		
		Enabled	HDCP2ENABLED :YES	Set EDID		
		Depth	TXCAPS :NA			
	USB-C		AKE_INIT :NOT_RCVD	Set DPCD		
	Error Info	0	STORED KM :NOT RCVD	Tools		
	Backlight	Device Count	NO_STORED_KM :NOT_RCVD	Passive		
	SPDIF / Trigger		HPRIME :NOT_RCVD PATRING :NOT_RCVD	I Monitor		
		0	LC_INIT :NOT_RCVD			
			LPRIME :NOT_RCVD			
			AUTHENTICATED :NO			
			REPAUTH_RCVIDLST:MSG_NOT_SND			
			CLOSE			

In the exampled shown below, HDCP 2.3 is enabled.

- ALPM- Advanced Link Power Management: Provides information on ALPM States
- eDP- Enable or Disable embedded DisplayPort. This feature is covered in Chapter 10 eDP.
- USB-C- Select from supported USB-C Pin Assignments
- Error Info- Displays status of Forward Error Correction (FEC). FEC is enabled in the example shown below.

Tools	×	(
HDCP	Status	
ALPM	EEC: Enabled	
eDP	UnCorrected Errors: 0,0,0,0	
USB-C	Corrected Errors: 0,0,0,0 Bit Errors: 0.0.0.0	
Error Info	Parity Block Errors: 0,0,0,0	
Backlight	Parity Bit Errors: 0,0,0,0	
SDDIE / Triggor		
∧ ∨		
	CLOSE	

- Backlight- Displays backlight intensity percentage.
- **SPDIF / Trigger** Allows you to Toggle SPDIF and/or Trigger output.

Tools	\times
Link Status	Enable SPDIE Output:
LTTPR	
MST	Enable Trigger Output:
Hot-plug	
HDCP	
ALPM	
eDP	
USB-C	
Error Info	
Backlight	
SPDIF / Trigger	
	CLOSE

This section covers Display Stream Compression features within the Analyzer.

DSC Real-time (Snapshot) Analysis

The DSC Analysis feature allows you to view the incoming DSC decompressed frame. The DSC video is presented as a series of snapshots (not "real time"). You will be able to see the DSC metadata in the Picture Parameter Set (PPS).

To access the Picture Parameter Set panel in the Analyzer interface, select the **PPS** button from the righthand side controls. The PPS panel is shown below.



DSC Test CRC Verification

You can also verify the Test CRC of the incoming DSC decompressed frame to support test automation on Display Stream Compressed (DSC) frames.

The DisplayPort specification requires registers in a DSC-capable sink device for exposing calculated CRCs on the decompressed ("reconstructed") pixel values. This enables a DSC source developer to acquire an objective verification that their compression engine is working properly.

Prior to this, a developer would have to view the compressed image frames received by the M42d and subjectively assess the compression through a visual inspection.

The source DUT transmits a DSC compressed frame to the DSC sink. The Test CRC registers in the sink (in this case the M42d analyzer emulating a sink) now expose the calculated values to be read by the source, thus enabling the verification. Developers of a DSC-capable source can read these registers over the Aux Channel.

Accessing and reading the DPCD register is covered in the **Chapter 3 section titled DPCD viewer**. To access the CRC Test readouts, select the Test Automation register and click Set 3, as shown in the example below.

DSC: On FMT:1080p30 P-Rate:74.25MHz F-Rate:30.00Hz Output Mode: MST • IMG:Sunset1080p_444_bpp8p0000_bpc8_s960x1080_pe1_lbd H-Rate:33.75kHz • Output (34) 1920x1080p @ 30 Hz 16:9 1920x1080 Progressive RGB-8bpc								
Format Pa		ttern	Audio	Tools		Тор	ology	
Link Train	Receiver	Capability	🗆 Ranges	SINK-2 PORT-0		READ PAGE	REPO	रा
АМ	M Link Confid			T	est Automation			
Ba ght	Link/S Pane	Status	Set 1 0021 0219	00240: TEST_CRC_R CRC: 0000h (0)	_CR			
DPCD Viewer		,pidy	S 2 0022 J234	00242: TEST_CRC_G CRC: 0000h (0)	_Y			
HDCP Test	Test Aut	tomation	Set 3	00244: TEST CRC B	СВ			
EDID Decode	Source	Specific	00240-00246	CRC: $000\overline{0}h(\overline{0})$	—			
EDID Comp	Sink S	pecific	Set 4	00246: TEST_SINK_	MISC			
Image Shift	Branch	Specific	00248-0024E	Bit Name		7	Value 1	Description
Image Ctrl	Sink C	Control	Set 5	3-0 TEST_CRC	_COUNT		0	Reserved
DSC	eDP Ba	acklight	00250-00256	5 TEST_CRC	_SUPPORTED	1	N (0) V	1
Editors	E	SI	Set 6 00260-00262	о 7			0 1	Reserved Reserved
Scripts	Ext Rcv.	Capability	Set 7					
	Protocol	Converter	00270-00274					

5 Protocol Analyzer with Capture Control

Protocol Analyzer Description:

- Requires the Basic Analyzer license to be installed as well.
- Provides capture and store of the main link protocol, video and metadata including main stream attributes and secondary data from an incoming DP source device.

Operational workflow for capturing data with your M42d DP Protocol Analyzer

This subsection describes how to use the M42d analyzer function to capture and analyze DisplayPort source devices. Testing an DP source device involves the following high-level steps:

- 1. Configure the M42d analyzer with the proper EDID.
- 2. Connecting the DP source device. (see Chapter 3 Connecting DUT)
- 3. View the incoming video in real time to check the status of the device under test.
- 4. Specify a trigger method.
- 5. Initiate the capturing of the data.
- 6. Examine the test data through the ATP GUI Manager at the high-level view on the **Event Plot** panel or the Video Analysis panel.
- 7. Drill down to examine the data at the lower level through the details of the Data Decode panel view.
- 8. (Optional) You may wish to capture and view the raw hex data.
5.1 Getting started with the Protocol Analyzer

Configuring the M42d DP Protocol Analyzer with an EDID

Use the procedures below to provision the M42d Rx port with an EDID to emulate a sink device.

- 4. Open the DisplayPort/USBC 2.0 Protocol Analyzer from the home screen.
- 5. Access the Set EDID dialog box by clicking the **Set EDID** button on the right-hand sidebar, as shown below.

Port: DisplayPort/USBC 2.0 Protocol Analyzer RX	DP: Licensed USB-C: Licensed		Home
Monitor: HDCP 1.4 LTTPR Emulation: Off Passive MEASURED USB-C Lanes: 4 Bandwidth: 13 50 Ac	e Monitor: Off (Auto)	70 1 fps	Back
METADATA Res: 720 x 400 Total: 900 x 449 Syn	c: 108-, 2+ Start: 162, 37 RGB sRGB	, VESA 8 bpc Progressive	6.02.07
METADATA Sync-Clk: Y Stereo-3D: N Mute: N V	/freq: 28.32 MHz Afreq: 48000 Hz		Stop
METADATA PIXet CLOCK: 20.322 Mm2 DWHSp; 011			Color
			Scale
	Set RX EDID ×		PPS
	Local Files		VSC
	🗁 User		ACA
	🗉 🖆 Standard		
			Set EDID
		La construction de la constructi	Set DPCD
	Permanently set the EDID:		10015
			Passive
	Issue Hot Plug:		Monitor
	OK CANCEL		

6. Select the EDID that you wish to emulate on the module's Rx port and then click **OK**.



7. You may also wish to generate a hot plug while setting EDID or set the EDID permanently. You can do these by toggling either setting in the Set RX EDID dialog box, as shown below.



The M42d's Rx port will emulate the EDID you selected.

Verifying source video

Before you capture data, you should verify that you are receiving DisplayPort video from the source.

Verify the incoming video of the DisplayPort source to ensure that the source is outputting the proper video. In the screen example below the video shown is a test pattern. Typically, the video you will see will be from a PC or some other source. Verify the information in the top status bar.



The following is an example of a Real Time view with USB-C source



5.2 **Capture Control Panel**

Access the **Capture Control** app from the Home Screen of the ATP Manager interface.

You initiate a new capture through the Capture Control panel. The Capture Control panel enables you to setup the capture parameters. The figure below shows the Capture Control panel and its control and selection items.

Capture Control		_		×
Capture Port Select Quantu	m Data, Inc. DP2.0 protocol analyzer: Po	ort 12 (10.30.196.38)		
Data	Raw (10bit)	Raw (UHB	R)	
Buffer Size:			61	4.40 MB
4.000% <				>
Trigger Position (TP)	within the Buffer:			0.00 MB
0.000% <				>
Trigger Mode: Any Ra	ate ONOn-UHBR Only			
Start of vertical blanking	(SST) or SR/LLCPM symbol (MS	T) -		
Trigger Count: 1				
Extract Video Fran	mes: 🖉			
Decompress DSC Fran	mes: 💷			
Capture AUX (ACA) Transact	ions:			
	START CAPTURE			
			CLOS	SE

The following table describes the functions of the Capture Control panel, specifically the Data tab:

Capture Control Panel - Function	Item - Description
Buffer Size	 Enables you to set the size of the captured data in percent. This is a slidebar that provides an indication (on the left) of the percent of the total possible size to be captured. A lower value will require less time for the captured data to accumulate.
Trigger Position within Buffer	 Enables you to set the position of the trigger event within the captured data. This slidebar determines how much of the data that has accumulated in the capture buffer has occurred before the trigger

Capture Control Panel - Function	Item - Description
	 event. The slidebar has an indication (on the left) of the location of the trigger event within the captured data. The value is expressed as a percent. A value of 0% indicates that the trigger event occurs at the beginning of the resulting captured data and 100% indicates that the trigger event occurs at the end of the resulting captured data. A value of 50% indicates that the trigger event is in the middle of the captured data. Note: The Buffer Position Slidebar is not applicable when you select Vsync as the trigger condition.
Trigger Mode	 Enables you to specify the type of data that you want to capture. <i>Note:</i> This is covered in greater detail after this table.
Trigger Count	 Option to specify which occurrence of the selected trigger event will initiate capture eg. a Trigger Count of 5 will start capture at the 5th occurrence of the trigger event
Extract Video Frames	Enables you to view the video frames that were captured.
Decompress DSC Frames	 Makes video frames viewable if DSC mode is enabled Extract Video Frames toggle must be enabled for this option to be active
Capture AUX (ACA) Transactions	Enables you to capture the Aux Channel transactions
Start Capture (Capture Tab)	Initiates a capture using the criteria defined in the Trigger Mode and Trigger Symbol .

The **Trigger Mode** drop down selection allows you to pick the specific event occurrence that will initiate the capture. You may use the radio buttons to select a trigger at **Any Rate** or **Non-UHBR Only**

With the **Any Rate** radio button selected, a set of options is selectable from the drop-down menu beneath it, as shown below and described in the following table:

Any Rate Trigger Mode Drop Down Menu	Trigger Options
Trigger Mode: * Any Rate ONON-UHBR Only Start of vertical blanking (SST) or SR/LLCPM symbol (MST) Start of vertical blanking (SST) or SR/LLCPM symbol (MST) SDP Type Received SDP Type Not Received VB-ID Received VB-ID Not Received AUX Read or Write (Only Writes in Passive Mode) Start of TPS2 as indicated by DPCD 0x00102 Exit from TPS2 as indicated by DPCD 0x00102 Start of HDCP 2.2 (N/A in Passive Mode) Exit from HDCP 2.2 (N/A in Passive Mode)	 Start of vertical blanking (SST) or SR/LLCPM symbol (Multi-Stream Transport) SDP Type Received SDP Type Not Received VB-ID Received VB-ID Not Received AUX Read or Write (Only Writes in Passive Mode) Start of TPS2 as indicated by DPCD 0x00102 Exit from TPS2 as indicated by DPCD 0x00102 Start of HDCP 2.2 (N/A in Passive Mode) Exit from HDCP 2.2 (N/A in Passive Mode)

When selecting **Non-UHBR Only** Trigger, another set of options is selectable from the drop-down menu beneath it. A few of these triggers require you to select the lane for the trigger to occur on, as shown and described in the table below.

Non-UHBR Only Trigger Mode Drop Down	Trigger Options					
Trigger Mode: O Any Rate Non-UHBR Only	If Specified Symbol is selected then select one of:					
Specified Symbol 👻	BS=Blanking Start					
Trigger Count: 1	BE=Blanking End					
Trigger On Lanes: 1 2 3 4	BF=Blanking Fill					
Trigger Symbol: #1: BS ~ DC	C0-C7=VC Payload Fill Control code sequence					
AVF BE BF	CP=Content Protection					
BS C0 C1	FE=Fill End, FS=Fill Start					
C2 C3 C4	• R0-2					
C5 C6 C7	SE=Secondary Data End					
CP CPF EOC	SR=Scrambler Reset					
FE FS LLCPM						
PM R2 SE	SS=Secondary Data Start					
SF SR SS	Other					
VCPF Other						

Specified Symbol	Data Byte Value
Data Byte Value	8B10B Symbol Error
8B10B Symbol Error	8B10B Disparity Error
8B10B Disparity Error	 Start of TPS3 as indicated by DPCD 0x00102
Start of TPS3 as indicated by DPCD 0x00102	
Exit from TPS3 as indicated by DPCD 0x00102	Exit from TPS3 as indicated by DPCD 0x00102
Start of TPS4 as indicated by DPCD 0x00102	Start of TPS4 as indicated by DPCD 0x00102
Exit from TPS4 as indicated by DPCD 0x00102	• Exit from TPS4 as indicated by DPCD 0x00102
Start of HDCP 1.3 (N/A in Passive Mode)	Start of HDCP 1.3 (N/A in Passive Mode)
Exit from HDCP 1.3 (N/A in Passive Mode)	• Exit from HDCP 1.3 (N/A in Passive Mode)
FEC Decode Enable Sequence	
FEC Decode Disable Sequence	FEC Decode Enable Sequence
ML_PHY_STANDBY sequence detected on the main link	FEC Decode Disable Sequence
ML_PHY_SLEEP sequence detected on the main link	 ML_PHY_STANDBY detected on main link
AUX_PHY_WAKE sequence detected on the AUX channel	 ML_PHY_SLEEP detected on main link
	AUX_PHY_WAKE detected on AUX channel

The next subsection will describe the procedures for capturing and viewing data using **Capture Control**.

Capturing Displayport source data

The procedures for running a capture of the DisplayPort source are described in this subsection. You can operate the Protocol Analyzer either through the M42d ATP GUI or via a PC through the external ATP GUI Manager. Most of the examples in this section are taken from the embedded ATP GUI Manager but the look and feel are quite similar between the two.

Capturing DisplayPort source data

1. Access the **Capture Control** application from the ATP Manager home screen.

Capture Co	ntrol			_		×
Capture Port	Select Quant	um Data, Inc. DP	2.0 protocol analyzer: Por	t 12 (10.30.196.38)		
Da	ata	R	aw (10bit)	Raw (UHE	BR)	
Buffer Siz	e:				61	4.40 MB
4.000% <						>
Trigger Po	sition (TP)	within the	Buffer:			0.00 MB
0.000% <	:					>
Trigger Mo	de: 🔹 Any R	ate O Non-	UHBR Only			
Start of ve	ertical blankin	g (SST) or SR	/LLCPM symbol (MST) -		
Trigger Co	unt: 1					
Ex	tract Video Fra	mes: 🛛 🖝				
Decom	npress DSC Fra	mes: 📑				
Capture AUX	(ACA) Transac	ions: 🛛 🜌				
			START CAPTURE			
					CLOS	SE

The Capture Control window opens as shown below.

- 2. Select the port using the **Select** activation button at the top of the window.
- 3. Specify the **Buffer Size** and **Trigger Position**, **Mode**, and **Count** in accordance with the information provided earlier in this chapter.
- 4. Toggle on or off the options to Extract Video Frames, Decompress DSC (if applicable), and Capture AUX (ACA) Transactions.
- 5. Initiate the capture by clicking on the **Start Capture** activation button **START CAPTURE**

You will be prompted with a **New Capture** dialog box (below) given you an opportunity to assign a name to the capture file.

New Capture	\times					
Capture Name						
Enter a name for the capture:						
DP_Capture_1						

6. Enter a name in the space provided in the New Capture dialog box.

Click **OK** to begin the capture process. A progress bar will appear, as shown below.

If the capture trigger event does not occur, you may click the **MANUAL TRIGGER** or **STOP AND SAVE DATA** buttons. They are described below. You can also **CANCEL** the capture at any time.

- Manual Trigger If the trigger event does not occur as expected, or if you are viewing the video display in real time and you notice an occurrence that you would like to capture the data of, manually initiate a capture with the previously set specifications at this point.
- Stop and Save Data If the capture is not triggered as expected, you can essentially cancel the capture and keep the raw data for later analysis.



Once the capture trigger event has occurred, the data will be decoded and saved for viewing. An example of the progress bar while this occurs is below.

DP Capture	
Decoding the data	
85% processed.	
MANUAL TRIGGER	STOP AND SAVE DATA CANCEL



When the capture is complete, the data is presented in the **DP Capture Viewer**. An example of the captured

The **Capture Viewer** and its features/functionality is covered in much detail in the next two sections of this chapter. **5.4 Capture Viewer Panels** covers the Event Plot, Data Decode/Details, and Link Symbol panels, while **5.5 Searching and Filtering** for Specific Data Elements covers searching for events or symbols, and filtering using the functions within the Capture Viewer.

data is shown in the screen shot example below.

Opening an Existing Capture

Before covering the DP Capture Viewer in detail in the following sections, this subsection will go over opening a previously saved capture within the Capture Viewer.

After running a capture, the DP Capture Viewer opens to display the resulting data, as shown below.



The Capture Viewer can also be opened from the Home screen of the ATP Manager. Click the **Other** tab, and select the **DP Capture Viewer** icon, as shown below.



DP Capture	Viewer								_	-		×
Events/Data	Frames					\geq	Open	Open	VC	VC Vie	ewer	ACA
Open Segm	ent Rows	s Events	Find	Time: HH:MM:SS.ms.us.n	ns(.ps	;) 🗸						
○ ④ & ⊨	0 Q N	larker 1: 🗆 🔇	• >	Marker 2: 🗌 < 🔹 🗲		Find	Goto	MTP	s 💽	II)		
						Offect	10) 11	12	13		•
						Oliset		,	LZ	1.5		0
Data												
CSB												
Errors												
Markorr												
Markers												
0		Link	Clock #	0								
# Link Cloc	k # Times	Stamp	•		^							
			0									
			<		, ×							
					^							
			• <		>							•
											CLOS	ε

Once in the Capture Viewer, click the **Open** button at the top right of the window, as shown below.

A dialog box will open up, prompting you to select a capture file, as shown below. Select the capture you wish to open and click **OK**.

► Open Capture ×
Local Files
🗸 🖻 User
DP_Capture_13
DP_Capture_1
OK CANCEL

5.3 Capture Viewer Panels

Capture Viewer Overview

The **Capture Viewer** 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.

There are three (3) panels in the Capture Viewer:

- Event Plot Panel Visual presentation of the audio, video, metadata, protocol and control elements.
- Data Decode (Transactions panel and Details panel) Tabular chronology of audio, video, metadata, protocol and control elements with precise timestamps assigned. Enable searching and filtering.
- Link Symbol Panel Table of link symbol values in hex for all lanes.

The panels are synchronized with one another. When a datum is selected, it automatically selects the corresponding information in the other two panels. Refer to the screen capture and information below.



Before looking at the Capture Viewer panels, the following subsection will cover the toolbar at the top of the Capture Viewer interface.

Capture Viewer Toolbar

The toolbar at the top of the Capture Viewer interface enables you to view, find, or filter for specific data types, as well as customize the format that the time is displayed in. You can also open or simply view the different virtual channels captured.

Additionally, certain utilities on the toolbar are accessible if the option was enabled when executing the capture in the previous steps, specifically the **Frames** tab and **ACA Data Viewer**.

A screenshot of the toolbar is below. Note that the **Open VC** and **VC Viewer** toolbar buttons at the top right are utilized during UHD/Multi-Stream Transport transport captures. This is covered **later in this section**.

DP Capture Viewer									- (×
Events/Data Frames 06_16_2021_08_42_08							Open	Open VC	VC Vie	wer	ACA
Open Segmen	t Rov	ws	Events	Find	Time:	HH:MM:SS.ms.us.ns(.ps) -					

If the **Extract Video Frames** and/or **Capture AUX (ACA) Transactions** options were toggled off when starting the capture, those buttons will be greyed out, as shown below.

🕨 DP Capture V	/iewer			1						_		\times
Events/Data	Fra	mes	\langle	021_14	_35_03			Open	Open VC	VC		ACA
Open Segme	ent	Rov	/S	Events	Find	Time: HH	H:MM:SS.ms.us.ns(.ps) 👻				r	

Open Segment

The Open Segment button Open Segment is enabled when performing a large capture. The capture is broken up into segments within the Capture Viewer, and you can click **Open Segment** to view the segment in its entirety.

Rows

The Rows button **Rows** brings up the **Row Selection/Ordering** dialog box, as shown below. The following example has **Data**, **Errors**, **Markers**, and **CSB** (Channel Status Block) rows selected and ordered.

Make a row visible in the Event Plot Panel by clicking on it in the **Available Rows** (left-hand) column. Reorder using the arrows in the **Row Order** (right-hand) column. Remove a row by clicking it again in the Available Rows column or selecting it in the Row Order column and clicking the red **X** at the top of the column, as shown below.

Row Selection / Ordering	×
Available Rows	Row Order
Data Symbols and packets identified in the data stream.	Data
Errors Identify the location of protocol errors.	Symbols and packets identified in the data stream.
Markers Markers inserted to identify important	CSB Channel Status Block
logical locations in the data stream.	Errors Identify the location of protocol errors.
Tunneled USB Packe	Markers
AUX R/W	Markers inserted to identify important
Basic AUX Read/Write Transactions	logical locations in the data stream.
Basic AUX Read/Write Transactions HDCP 2.3 AUX HDCP 2.3 Messages	logical locations in the data stream.

The Capture Viewer window with these settings will display as follows, with the selected rows in the Event Plot Panel.



The Events Events and Find Find buttons will be covered in Section 6.5 Searching and Filtering for Specific Data Elements.

Time:

The Time drop down selection **Time:** enables you to specify the format of the **TimeStamp** in the Data Decode panel. The screenshot below shows the **Time** dropdown menu. In this example, the format selected is HH:MM:SS.ms.us.ns(.ps) which shows demicals down to the picoseconds.



This next example shows the TimeStamp shown in Nano-Seconds.



Frames

If you selected to **Extract Video Frames** when running the capture, the button to access the **Frames** tab will be enabled, as shown below.

DP Capture Viewer											
Events/Data	Fra	mes	K	21_08	_42_08						
Open Segme	ent	Ro	ws	Events	Find	Time:	HH:MM:SS.ms.us.ns(.				

Click this to access the **Frames** tab, which is shown below. Depending on the **Buffer Size** specified, there will be more or less frames to view. The example below is a 1.000% buffer size, which extracted two video frames in this case.

Events/Data Fra	mes	06_16_2021_08_42_08	Open	Open VC	VC Viewer	ACA
Export Image Dat	а					
Frame 1	Fra	ame 2				

This next example is a 4.000% buffer size, which extracted 10 video frames.



From this tab you can open the **Video Image Viewer** by double clicking any frame. This pop out panel is shown below.



Once in the Video Image Viewer, you can scale the image and toggle on or off the colorimetry panel (CIE Plot). The previous image was scaled to 1:1, and the following example is scaled to fit. The colorimetry panel is also enabled on the left-hand side of the panel.

You can also navigate to the **Previous** or **Next** image frame, or move to an adjacent pixel using the arrows at the bottom of the panel.



Event Plot Panel

The **Event Plot** is shown below. The **Event Plot** provides a graphical view of the captured data symbols. The vertical axis is the data types. In this example the Data, CSB, Errors, and Markers rows are enabled. The scale along the bottom shows the Link Clock number.



The timestamp of the cursor is shown near the top of the panel. As you move the pointer tool throughout the **Event Plot** panel the timestamp of the pointer's location is provided on the top of the panel as indicated below:

Events,	/Data	Fra	mes	es 06_09_2021_17_14_43 [Segment 1						
Open :	Segme	nt	Ro	ws	Events	Find	Time: HH			
<u>ଚ</u> ଏ	Ð	Q	Mark	ker 1: 🗆 🔨	Marker 2:					
1155739	9 (0:0:0	.014	.268.3	393.82	27) 🧹					
		_								
				- <u>(</u> -) -)						
Data	FIL	L	∕ID		VBID					
CSB										

Scrolling in the Event Plot Panel

A scroll bar is provided to enable you to quickly browse through the data. The scroll bar is under the set of function icons 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 $\mathbf{K} \ll \mathbf{C}$ backward and forward activation **buttons located to the right of the scroll bar**.

You can also click and drag the panel in either direction if **Pan Mode** is enabled. Click the hand icon 💌 at the top left of the Event Plot Panel to enable click and drag in Pan Mode.



Zooming in the Event Plot Panel

You can zoom in and zoom out and pan across the data using the slide bars 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 Icons	Function
Zoom Icons ∩	 Previous — This icon reverts the Event Plot Panel to the previous view. This will effectively "undo" a zoom or scroll. Range Zoom — This function zooms in on a selected range within the Event Plot. Details below. Zoom In/Out icons • — 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.

Surrounding and Zooming

The **Event Plot** provides a Range Zoom tool \bigcirc . 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 following screen shows an example of the Range Zoom Mode. The rectangle indicates the resultant section that is surrounded.





The resulting screen is as follows:

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" at particular points of interest using the Markers activation button \bowtie . The **Event Plot** will show you the time difference between the two cursors. Note the example below.



You can fine tune the position of the markers with the left and right arrows associated with each marker: Marker 1: Image: A start of the markers with the left and right arrows associated with each marker: Marker 1: Image: A start of the start of the



You can see the timestamp associated with each marker which are color coded (blue and red) just above the area where the data is shown. The dark text to the right labeled **Dif** shows the difference between the two markers in pixels and time.



Note: You can also set an individual marker using the right click menu shown below.



Link Clock timeline.

The Link clock symbol times are shown at the bottom of the Event Plot panel as indicated below.

Events/Data Fran	mes 06	_16_2021_13	_03_54					Ope	en (Open	VC	VC Vi
Open Segment	Rows	Events	Find	Tim	e: HH:MM:SS.ms.us	.ns(.ps) 🔻						
ମ എ ଫ ⊨ ⊕	Q Mar	ker 1: 🗆 🔇	• >	Mark	ker 2: 🗌 < 🌢 🖒		Fin	d Go	to	MTP	s 🗍	CIF)
74821403 (0:0:0.092.	372.102.4	69)								1128	36398	B
					K « <	K « <	Offs	et	LO	L1	L2	L3
Data								-9	00	00	00	00
								-8	FE	FE	FE	FE
CSB								-7	00	00	00	00
Errors								-6	00	00	00	00
Markors		-		Ļ				-5	00	00	00	00
Markers								-4	BS	BS	BS	BS
/4//5/96	/4/	/8/4/3	/4/99 Link Cl	9150 lock #	/481082/	/4822505		-3	BF	BF	BF	BF
# Link Clock	# Tim	eStamp		•	VB-ID		^	-2	BF	BF	BF	BF
366040 112863	94 0:0	0:0.013.93	3.819.75	53	VBID: 41 41 41 41			-1	BS	BS	BS	BS
366041 112863	95 0:0	0:0.013.93	3.820.98	38 🕘	Mvid: al al al al al Maud: 00 00 00 00			+0	41	41	41	41
366042 112863	96 0:0	0:0.013.93	3.822.22	22	NoVideoStream:	No		+1	AI	AI	AI	AI
366043 112863	97 0:0	0:0.013.93	3.823.45	57	AudioMute:	No		12	41	41	41	41
366044 112863	98 0:0	0:0.013.93	3.824.69	91	Interlace:	No		+4	71	71	71	71
366045 112863	98 0:0	0:0.013.93	3.824.69	91	FieldID:	0		+5	00	00	00	00
366046 112864	L9 0:0	0:0.013.93	3.850.61	17	HDCP Sync Detect:	No		+6	41	41	41	41
366047 1128642	20 0:0	0:0.013.93	3.851.85	52	<	162	Ť	+7	Al	Al	Al	Al
366048 112864	21 0:0	0:0.013.93	3.853.08	36				+8	00	00	00	00
366049 112864	30 0:0	0:0.013.93	3.864.19	98				+9	41	41	41	41
366050 112864	38 0:0	0:0.013.93	3.874.07	74				+10	Al	Al	Al	Al
366051 112864	39 0:0	0:0.013.93	3.875.30	09	<	>		+11	00	00	00	00

Data Decode Panels

The **Data Decode Panel** is shown below. The **Data Decode panel** provides a tabular or transactional view of the captured data symbols. When you highlight a transaction the information in the transaction appear in the Details panel to the right. The information in the Details panel is decoded in human readable text.

The example below shows an Audio Stream data type highlighted.

Audio Stream Link Clock # # TimeStamp Type Packet ID: 0 3091346 95995923 0:0:0.118.513.485.185 Video Data Coding: 0 (2-8 Ch LPCM, IEC 61937 <= 3091347 95995926 0:0:0.118.513.488.889 BS Layout: 2 Channel Layout 3091348 95995927 0:0:0.118.513.490.123 Sample 0 BF ch01=98ff0089 ch02=a8ff0089 3091349 95995928 0:0:0.118.513.491.358 BF Sample 1 3091350 95995929 0:0:0.118.513.492.593 BS ch01=90fefc37 ch02=a0fefc37 3091351 95995930 0:0:0.118.513.493.827 BS Data Sample 2 ch01=98fefc56 ch02=a8fefc56 3091352 95995950 0:0:0.118.513.518.519 SS Sample 3 3091353 95995951 0:0:0.118.513.519.753 Audio Stream ch01=90ff00e8 ch02=a0ff00e8 3091354 95995958 0:0:0.118.513.528.395 Channel Status Block (Ch 1) 3091355 95995959 0:0:0.118.513.529.630 Channel Status Block (Ch 2) < 3091356 95995963 0:0:0.118.513.534.568 SE Lane 3: 01 67 37 fc fe a0 48 e8 00 ff 69 3091357 96000658 0:0:0.118.519.330.864 BE Lane 2: 00 00 37 fc fe 90 2d e8 00 ff 90 Lane 1: 02 ce 89 00 ff a8 74 56 fc fe a8 3091358 96000659 0:0:0.118.519.332.099 Video Data 3091359 96000661 Lane 0: 00 00 89 00 ff 98 11 56 fc fe 98 0:0:0.118.519.334.568 Fill 3091360 96000691 0:0:0.118.519.371.605 Fill \odot < >

The next example below shows the details panel of an MSA data type highlighted.

```
MSA
         0x006ea1 0x006ea1 0x006ea1 0x006ea1
Mvid:
         0x0c5c10
Nvid:
Htotal: 900 pixels
Vtotal: 449 lines
Hwidth: 720 pixels
Vheight: 400 lines
Hstart: 162
         (-) 108 pixels
Hsync:
Vstart: 37 lines
Vsync:
         (+) 2 lines
MISC:
    Stream Clock:
                       Synchronous
    Interlaced v-even: Vtotal Odd
    3D Signaling:
                       No in-band signaling
  * Refer to the VSC SDP for the Pixel Encoding/Colorimetry Format.
<
                                                                        5
Lane 3: 00 6e al 0c 5c 10 21
                             40
                                00
                                                                           ~
Lane 2: 00 6e al 02 d0 01 90 00
Lane 1: 00 6e al 00 a2 00 25 00 02
Lane 0: 00 6e al 03 84 01 cl 80
                                6c
<
                                                                        5
```

Link Symbol Panel

The **Link Symbol Panel** is shown below. The **Link Symbol Panel** provides an event list of all the raw link symbols in the capture for each lane. The data for each lane is presented in a separate column.

When you double click on a link symbol, the offset is reset to zero at that link symbol and the other two panels are then synchronized to that that point in the capture. The Link Symbol that is synchronized to is presented at the top of the panel as indicated below. The same occurs when a data type is selected in either of the other two panels.

Find	Go	to	MTP	s 💽	OF)		
			1015	7626	1		
Offset		LO	L1	L2	L3		۲
-	-9	00	00	00	00		
-	-8	00	00	00	00		
-	-7	00	00	00	00		
-	-6	00	00	00	00		
-	-5	00	00	00	00		
-	-4	00	00	00	00		
-	-3	00	00	00	00		
-	-2	SS	SS	SS	SS		
-	·1	SS	SS	SS	SS		
_>+	-0	00	00	00	00		
+	-1	6E	6E	6E	6E		
+	-2	Al	Al	Al	Al		
+	-3	03	00	02	0C		
+	-4	84	A 2	DO	5C		
+	-5	01	00	01	10		
+	-6	Cl	25	90	21		
+	-7	80	00	00	40		
+	-8	6C	02	00	00		
+	-9	SE	SE	SE	SE		•

The **Find** button enables you to search for any type of control element. The Find dialog box is shown below with the Blanking Start (BS) control element selected. You can then search through the Link Symbol panel for all occurrences of that symbol or any other using the **PREVIOUS** and **NEXT** buttons within the Symbol Search box.

Syı	mbol Sea	rch	\times
#1:	On	BS ⊽	
#2:	Off	Data 👻	00
#3:	Off	Data 👻	00
#4:	Off	Data 👻	00
#5:	Off	Data 👻	00
#6:	Off	Data 👻	00
#7:	Off	Data 👻	00
#8:	Off	ta 👻	00
	PREVIOU	JS NEX	Т
		CLOSE	

You can select up to 8 symbols to search for.

The **Goto** button enables you to snap to a specific Symbol number. When **Absolute** is selected, you will enter the exact Link Symbol number to find.

Goto Symbol #										
Absolute	Relative to Zero									
Symbol #: 1523049										
GOTO	CLOSE									

When **Relative to Zero** is selected, the function finds the Link Symbol relative to the Link Symbol with **Offset** of +0. Negative and Positive numbers are both accepted in this mode.

Note: If the Symbol # entered (either Absolute or Relative to Zero) is out of bounds, the **GOTO** button will be grayed out and unclickable.

UHD/Multi-Stream Transport Captures

When performing a capture in Multi-Stream Transport mode, the **Capture Viewer** will display the main link capture data within the Event Plot Panel, as shown below.

Note: For information on Multi-Stream Transport modes, see 3.6 Topology and Multi-Stream Transport.

▶ 0	P Capture Vie	ewer										_		×
Eve	nts/Data	Frames 06	_17_2021_08	_41_47						Open	Open VC	VC	Viewer	ACA
Ор	en Segmer	nt Rows	Events	Find	Time: HH:MM	I:SS.ms.us.	ns(.ps)	▽						
Ð	.∜ & ⊬	⊕ Q Mar	rker 1: 🗆 🔇	• >	Marker 2: 🗆 🔇	• >	Find	Goto	MTPs	; O	Names	X		
2986	43 (0:0:0.00	0.730.014.667	7)							:	1			
				К «	к к к к к к к к к к к к к к к к к к к		Offset		LO	L1	L	2	L3	۲
Data							4	+0	SF	SF	' S	F	SF	8
Dutu								L1	SF	SF	' S	F	SF	
CSB						< N	1ain L	_ink	SF	SF	' S	F	SF	
							1	-3	SF	SF	' S	F	SF	
Error	S						4	+4	SF	SF	' S	F	SF	
Mark	orc							+5	SF	SF	' S	E,	SF	
Pitting								+6	SF	SF	' S	F	SF	
	1	145635	Link Cloc	0 k #	436904 58	\$2539		+7	SF	SF	S	F	SF	
#	Link Clock #	TimeStamp	(0		^	4	+8	SF	SE	· s	F.	SF	
1	1	0:0:0.000	.000.002.	8				F9	SE	SE	, S	Ľ	SE	
2	1	0:0:0.000	.000.002.				±1	10	25	DI CT	, c	с г	1G 77	
3	1	0:0:0.000	.000.002.				1	12	1C 72	1C #2	, c	יי די	1C 72	
4	182	0:0:0.000	.000.444.				+1	13	SF F	ाट स्र	, s	<u>-</u> म	1C 72	
5	193	0:0:0.000	.000.471.				+1	14	SF	SF	, s	۲ F	SF	
6	65722	0:0:0.000	.160.652.			~	+1	15	SF	SE	' S	~ म	SE	
7	131262	0:0:0.000	.320.860.	<		>	+]	16	SF	SE	, s	F	SF	
8	196802	0:0:0.000	.481.070.			^	+]	17	SF	SF	, s	F	SF	
9	262342	0:0:0.000	.641.278.				+]	18	SF	SF	, s	F	SF	
10	327882	0:0:0.000	.801.488.	• <		>	+1	19	SF	SF	, s	F	SF	
													CLOS	Ε

To access the desired virtual channel and its captured data, use the **Open VC** button enabled in the top right of the window, as shown below.

P Capture V	'iewer									—		\times
nts/Data	Fra	mes	06_	17_2021_08	_41_47				Open VC	VC	Viewer	ACA
en Segme	nt	Rov	vs	Events	Find	Time:	HH:MM:SS	S.m	s.us.ns(.ps) -		

The **Open a Virtual Channel** dialog box will appear. Select the desired virtual channel you wish to view, and click **OK**, as demonstrated below.



Upon selecting a virtual channel, the **DP VC Viewer** will present the specified virtual channel and the data will be available for viewing, as described previously in this section.

You can easily return to the Main Link capture viewer by clicking the **Main Link** button, or open a different virtual channel by clicking the **Open VC** button as well, both in the top right of the window (pictured below)

DP VC Viewer × Events/Data Frames 06_17_2021_08_41_47 [VC-3] Open VC Main Link Rows Events Find Time: HH:MM:SS.ms.us.ns(.ps) -Q Marker 1: □ **〈 ● 〉** Marker 2: □ **〈 ● 〉** Find Goto 46419 (0:0:0.000.286.537.037) 60752 Offset LO L1 L2 L3 < " > К 00000000 00000000 00000000 00000000 Data 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 -9 00000000 00000000 CSB -8 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 Errors -6 00000000 00000000 00000000 00000000 -5 00000000 00000000 00000000 00000000 -4 00000000 00000000 00000000 00000000 Markers 00000000 00000000 00000000 00000000 -2 00000000 00000000 00000000 00000000 35606 45778 50865 30520 Link Clock # 00000000 00000000 00000000 00000000 • Channel Status Block (Ch 1) # Link Cloc... TimeStamp ^ Type +0 00000000 Bits Accumlated: 192 7428 296694 0:0:0.001.831.444.444 Video Data +1 00000000 00000000 00000000 00000000 Use: Consumer 7429 296754 0:0:0.001.831.814.815 EOC Linear PCM: Yes 00000000 00000000 00000000 00000000 7430 296755 0:0:0.001.831.820.988 BS Copyright: No +3 00000000 00000000 00000000 00000000 Additional Info: 2 Audio chan: 7431 296756 0:0:0.001.831.827.160 BS Data +4 00000000 00000000 00000000 00000000 Mode: Digital Audi 7432 296760 0:0:0.001.831.851.852 SS Category: 0x00 General Pre-Recorded: No +5 00000000 00000000 00000000 00000000 7433 296761 0:0:0.001.831.858.025 Audio Stre +6 00000000 00000000 00000000 00000000 Source #: Ignored 7434 296768 0:0:0.001.831.901.235 Channel St 00000000 00000000 00000000 00000000 Channel #: Ignored 7435 296769 0:0:0.001.831.907.407 Channel St Sampling Freq: 48 kHz +8 00000000 00000000 00000000 00000000 7436 296764 0:0:0.001.831.876.543 SE Clock Accuracy: Level II +9 00000000 00000000 00000000 00000000 Max Word Length: 20 bits 7437 296864 0:0:0.001.832.493.827 BE 00000000 00000000 00000000 00000000 < > 7438 296865 0:0:0.001.832.500.000 Video Data 00000000 00000000 00000000 1 2 3 4 5 6 7 7439 296925 0:0:0.001.832.870.370 EOC ^ +12 00000000 00000000 00000000 00000000 Video Data 7440 296926 0:0:0.001.832.876.543 00000000 00000000 00000000 00000000 296986 0:0:0.001.833.246.914 EOC 7441 +14 00000000 00000000 00000000 00000000 016 0 0 0 0 Video Data 7442 296987 0:0:0.001.833.253.086 00000000 00000000 00000000 00000000 024| 1 0 0 0 0 0 7443 297047 0:0:0.001.833.623.457 EOC +16 00000000 00000000 00000000 00000000 032 7444 297048 0:0:0.001.833.629.630 Video Data 0401 0 0 0 0 0 +17 00000000 00000000 00000000 00000000 ~ 7445 297108 0:0:0.001.834.000.000 EOC +18 00000000 00000000 00000000 00000000 CLOSE

The example shown below has virtual channel 3 selected.

5.4 Searching and Filtering for Specific Data Elements

You can locate data items by browsing either through the **Event Plot** view of the **Event Data** table. The two windows (**Event Plot** and **Event Table**) are in sync as you browse, search or select an item.

Event Search

You can locate specific data types using the **Event Search** feature in either the **Event Plot** or the **Event Table**. The following screen shot is a typical example of captured data. The **Event Search** dialog box is accessible from the **Find** activation button **Find** on the top of the **DP Capture Viewer** window as shown below.



M42d Video Analyzer/Generator - User Guide	Ver. A1
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The **Event Search** dialog box is shown below. You can search for specific data types using the tabs and the check boxes within each tab. This example has MSA Secondary Packet data type selected for search.

Event Searc	:h			×
Deselect A	ll Ca	tegories		
Category			Selec	t All Select None
		Туре	Count	Description
General		VBID	5146	VB-ID, Mvid7:0, Maud7:0
		MSA	12	MSA Secondary Packet
		Fill	2933065	Active fill (FS/FE)
Secondary		Video	1230487	Active Data
		CSB	78	Channel Status Block
		LLCP	0	LLCP Data
KChar		USB4	0	Tunneled USB4 Packets
		TS	0	Timestamp (internal)
Error				
Marker				
ACA				
Search: PR		US NEX	т	
Result:				
				CLOSE

The dialog box enables you to select all or none of the data element types per category using the **Select All** or **Select None** buttons on the top of the dialog box, as shown below.

There are several tabs on the sidebar. Each tab enables you to select from a category of data types. You can click **Deselect All Categories** to uncheck all data types in every tab.

Event Sea	rch			×
Deselect	All Ca	ategories		+
Category			Selec	t All Select None
		Туре	Count	Description
General	O	VBID	5146	VB-ID, Mvid7:0, Maud7:0
		MSA	12	MSA Secondary Packet
		Fill	2933065	Active fill (FS/FE)
Secondary	YO	Video	1230487	Active Data

Select as many or few data types as you need to find.

Once you have selected your desired data types, click the **NEXT** button to move to the first result. The results of a search are shown at the bottom of the dialog box, under **Results**, as shown below. This example searches for the VSC data type. Note that the **Count** is an indication of the number of that data element that appears in the captured data.

Event Searc	h)	\times
Deselect A	ll Ca	tegories				
Category			Seit	Select None		
General		Туре	Count	Description		^
General		Aud-TS	12	Audio TimeStamp		
		Aud-S	1962	Audio Stream		
Secondary		Ext	0	Extension		
		Aud-CM	0	Audio Copy Management		
KChar		ISRC	0	ISRC		
		VSC	12	VSC		
Frror		PPS	12	Picture Parameter Set		
LIIOI		EXVESA	0	VSC Ext. VESA		
		EXCTA	0	VSC Ext. CTA		
Marker		A-SYNC	0	Adaptive Sync		
		RSVD	0	CTA Reserved		
ACA		VSIF	0	CTA Vendor Specific		
		AVI	0	CTA AVI		~
Search: PRE	VIO	JS NEXT				
Result: Four	nd V	SC @ 1155784	2, #368	638		
				CLOSE	Γ	

This next screenshot is the same search, after pressing the **NEXT** button one more time and proceeding to the next occurrence of the VSC data type.

Event Searc	:h				\times					
Deselect All Categories										
Category		Select All Select None								
General		Туре	Count	Description	^					
Secondary		Aud-S	1962	Audio Stream						
Secondary		Ext	0	Extension						
KChar		Aud-CM	0	Audio Copy Management						
Error		ISRC	0	ISRC						
		VSC	12	VSC						
Marker		PPS	12	Picture Parameter Set						
ACA		EXVESA	0	VSC Ext. VESA	~					
Search: PR		JS NEXT								
Deputt: Form	ad U	CC 0 2211502	0 #727	25.6						
Result. Four	ia v	20 6 2011200	o, #131.	200						
				CLOS	SE					

In the following example, the **Trigger** condition **Marker** is searched for. Note that the status of the search is shown on the bottom of the dialog box. The search function centered the trigger condition marker on the **Event Plot** which you can partially see behind the dialog box. Since the panels are synchronous, the trigger marker is also selected in the **Data Decode** and **Link Symbol** panels.



Note: If the **Count** column shows a count of greater than zero, but clicking **NEXT** yields the message **No Events Found** (example below), you may be ahead of that occurrence, and need to click the **PREVIOUS** button instead.



The following example shows a search of audio packets.



Filtering Specific Data Elements

You can filter the captured data to show only specific data types using the **Event Selection** feature. The **Event Selection** dialog box is accessible from the **Events** activation button **Events** on the top of the **DP Capture Viewer** window as shown below, with the **DP Event Selection** window on the right.

DP Capture Vi	ewer							
Events (Dete		0001 17 11 10 1		DP Event Se	election		>	<
Events/Data	Frames 06_09	_2021_17_14_43 [segment i (Select All Ca	ategories	Deselect All C	ategories In Range 💷	A
Open Segmer	nt Rows I	Events Find	Time: HH:MN	Category		Select A	II Select None	
•) ⁴ & ↔	Q Q Marker	/ < • >	Marker 2:		T	vpe Count	Description	
0040934 (0.0.0.0	00.190.003.931					BID 5146	VB-ID, Mvid7:0, Maud7:0	
			к (General	□ M	SA 12	MSA Secondary Packet	•
Data	FILL	VBID			🗌 Fi	2933065	Active fill (FS/FE)	
Dutu	1465	Vole			🗆 Vi	deo 1230487	Active Data	
					□ C	SB 78	Channel Status Block	
CSB				Secondary		JCP 0	LLCP Data	
				occondury		SB4 0	Tunneled USB4 Packets	
Errors					U 1	.5 0	Timestamp (internal)	
Markers 6640927	6640939	66409: Link Cle	52 664(KChar				
# Link Clo	ock # TimeStamp	En ere	Type					
192756 66409	42 0:0:0.008	3.198.693.827	Video Data	Emer				
192757 66409	44 0:0:0.008	3.198.696.296	BS	Error				
192758 66409	45 0:0:0.008	8.198.697.531	BF					
192759 66409	46 0:0:0.008	3.198.698.765	BF					
192760 66409	0:0:0.008	3.198.700.000	BS					
192761 66409	48 0:0:0.008	3.198.701.235	BS Data	Marker				
192762 66409		3.198.717.284	SS Dudi a Shuara					
192764 66405		3 198 733 333	Audio Stream					
192765 66461	89 0:0:0.008	3.205.171.605	BE					
192766 66461	90 0:0:0.008	3.205.172.840	Video Data	A.C.A				
192767 66461	.92 0:0:0.008	3.205.175.309	Fill	ACA				
192768 66462	22 0:0:0.008	3.205.212.346	Fill					
192769 66462	254 0:0:0.008	8.205.251.852	Video Data				OK CANCEL	•
							CLOSE	
							ULUSE	

The following screen shows an example of filtering for an MSA Secondary Packet. Check the box next to the data type you wish to filter, and click **OK**. The results of the filter apply to both the **Event Plot** and the **Event Data** panels.

DP Event S	DP Event Selection									
Select All C	atego	ories	Des	elect All Ca	ategories	In Range 🏾 🗩				
Category				Select	All Selec	ct None				
General		Тур	e	Count	Description	n				
Secondary		VBI MS/	D A	5146 12	VB-ID, MSA Sec	Mvid7:0, Maud7:0				
KChar		Fil	.1	2933065	Active	fill (FS/FE)				
Error		CSI	в	78	Channel	Status Block				
Marker		LLC USB	P	0	LLCP Da Tunnele	ta d USB4 Packets				
ACA		TS		0	Timesta	mp (internal)				
						OK CANCEL				

The results of the filter for MSA data elements on the Event Plot and Event Table panels are shown below.

Eve	ents/Data Fr	ames 06_	09_2021_17	_14_43 [S	egment	1 of	3]					Ope	en	Open '	VC	VC Vie
Op	en Segment	Rows	Events	Find	Time:	H	H:MM:SS.	ms.us	.ns(.p) - (8						
n	. 4 30 €	Q Mark	ker 1: 🗆 🔇	• >	Marker	r 2:	□ < ●	>			Fi	ind Go	to	MTP	s 🖂	aff)
6769	99047 (0:0:0.08	3.579.070.3	70)											2317	16832	2
		N					к « <	>	»	К	Of	fset	LO	L1	L2	L3
				Í								-13	00	00	00	00
Data												-12	00	00	00	00
												-11	00	00	00	00
CSB												-10	00	00	00	00
												-9	00	00	00	00
Erro	rs											-8	00	00	00	00
												-7	00	00	00	00
Mark	ers											-6	00	00	00	00
	-27461852	-2039	5927	222001	0.9		49916223		7	4242248		-5	00	00	00	00
	-27401052	-2055	1021	Link Clo	ck #		40010225			7272270		-4	00	00	00	00
#	Link Clock #	TimeStamp			Type	۰	MSA				^	-3	00	00	00	00
1	36	0:0:0.00	0.000.044	.444	MSA	0	Mvid:	0x0	06ea1	. 0x006e;		-2	00	00	00	00
2	11557392	0:0:0.01	4.268.385	.185	MSA		itotal:	900	pixe) els		+0	00	00	00	00
3	23114588	0:0:0.02	8.536.528	.395	MSA	K		449	line	s		+1	00	00	00	00
4	34671944	0:0:0.04	2.804.869	.136	MSA		Vheight:	400	line	213		+2	00	00	00	00
5	46229140	0:0:0.05	57.073.012	2.346	MSA		Hstart:	162				+3	00	00	00	00
6	57786496	0:0:0.07	1.341.353	.086	MSA		Hsync:	(-)	108	pixels		+4	00	00	00	00
7	69343688	0:0:0.08	85.609.491	358	MSA		Vstart: Vsvnc:	37. (+)	2 li	nes	~	+5	00	00	00	00
8	80901048	0:0:0.09	9.877.837	.037	MSA		<			>		+6	00	00	00	00
9	92458240	0:0:0.11	4.145.975	.309	MSA	Ì	Lane 3:	00 6	e al	0c 5c 10	~	+7	00	00	00	00
10	104015600	0:0:0.12	28.414.320	.988	MSA		Lane 2:	00 6	e al	02 d0 0:		+8	00	00	00	00
11	115572792	0:0:0.14	2.682.459	.259	MSA		Lane 1: Lane 0:	00 6	e al e al	00 a2 00 03 84 0	~	+9	00	00	00	00
12	127130152	0:0:0.15	6.950.804	.938	MSA	•	<			>		+10	00	00	00	00

Similarly to the **Find** dialog box, you can **Select** or **Deselect All Categories** with the buttons at the top of the dialog box. The categories are listed in the left-hand column. You can also **Select All** or **Select None** within an individual category. The example below has opted to Select All within the **KChar** category.

DP Event Selection			×				
Select All Categories	Deselect A	II Catego	ories In Range 💿				
Category	Sel	Select All Select None					
General	Type	Count	Description				
	SR	20	Scrambler Reset				
Secondary	SS	2034	Secondary-data Start				
Wolker 🖸	CPF	0	CP Symbol (FEC)				
KChar	BS	10272	Blanking Start				
Error 🛛	EOC	0	End of Chunk				
	R2	0	Reserved 2				
Marker	BE	4558	Blanking End				
	SE	2022	Secondary-data End				
ACA 🖸	CP	0	CP Symbol 🗸				
			OK CANCEL				

The following screen shows the results of the filter.


This section describes the Import, Export, and Transfer features of the M42d.

The **Import** and **Export** options on the right-click menu and the **Navigator** sidebar allow you to exchange capture files between your PC or a USB Drive and the ATP GUI Manager application.

You may Export a capture file to disseminate to colleagues or other subject matter experts. You import a file when you want to examine a capture file taken by a colleague or transferred from USB storage. The **Export** and **Import** function zips or unzips a capture file to enable you to post it on an FTP server or disseminate through email of the file is not too large.

The **Transfer** feature enables you to simply transfer a capture file executed on the M42d embedded GUI onto your PC's ATP Manager for viewing/analysis, or vice versa. The Transfer feature is only accessible from the Remote ATP Manager on a PC since you need a remote PC to execute the transfer.

You may Transfer a capture file to back up your captures to your PC from your instrument and vice versa. You also need to transfer a capture in this manner in order to view it remotely if you originally ran the capture on the M42d embedded ATP Manager.

All of these features are accessible through the **Navigator** interface on the instrument or the remote manager.

Exporting a Capture File

To export a capture file, navigate to its folder in the ATP Manager Navigator interface by clicking **Captures** and expanding the folder(s) that it is contained in. An example below shows capture files stored in the **User** folder on a PC running the remote ATP Manager.



Click on a capture file, and export by selecting the **Export** button on the left sidebar, or right-clicking and selecting **Export**, both shown below.

AIP Manage	er						
🌤 Navigator							
Captures	Refresh	Name	Date / Time				
Compliance	New Folder	> > HDMI Capture					
compliance	Browse	 ✓ Dr cupture ✓ D User 					
ACA	Delete	> DP_Capture_1	2021/06/15 15-10-44				
EDID/DPCD	Information	> > 06 17 2021 0 41 47	Import				
	Rename	> 06 16 2021 0 42 08	Export				
Formats	Transfer	> > 06_16_2021_08_40_49	Open)				
Images	Organize	> > 06_15_2021_16_23_07	Information				
Instrumente	Onen	> > 06_15_2021_15_20_35	Delete				
instruments	Open	21_14_47_57	Rename				
Other	Export	21_14_37_05	Browse				
		06_15_2021_14_35_03	2021/06/15 14:39:23				
Heln i		> > 06_09_2021_17_14_43	2021/06/09 17:31:23				
Import							
Exit							

When you select **Export**, a File Explorer window will show up enabling you to save the capture as a zip file in a directory and name of your choosing. Refer to the screen example below.

Note: If you are on the M42d instrument itself, the file explorer window will be Linux-based.

🛪 Export							×
\leftrightarrow \rightarrow \checkmark \frown	> This P	PC > Desktop	~	Ü	,	h Desktop	
Organize • Nev	v folder						7
✓	^	Name	^			Date modified	
Desktop	*		No item	is match	your search.		
🖊 Downloads	*						
Documents	*						
E Pictures	*						
📜 import0611							
📜 import0615							
📜 M42d	~	<					>
File <u>n</u> ame:	DP_Cap	ture_1					~
Save as type:	*.zip						\sim
∧ Hide Folders					<u>S</u> ave	Cancel	

Choose a desired directory and filename, and click **Save**. This capture file will then be accessible in a file explorer as a compressed zip file, as shown below.



Importing a Capture File

Similarly, to import a file, in the Navigator either right click on the desired target folder, or select the folder and click the **Import** button at the bottom left of the window. The example below demonstrates importing a capture file into the **User** folder.

🕋 ATP Manage	er			
🕾 Navigator				- D
Captures	Refresh	Name		Date / Time
Compliance	New Folder	> ⇒ HDMI Ca > ⇒ DP Capto	ipture ure	
	Browse	∽ 🖾 User	Import	
	Delete	> ► DP_ > ► 06_	New Folder	21/06/17 08:41:59
EDID/DPCD	Information	> ► 06_	Information	21/06/16 13:05:31
Formats	Rename	> ► 06_ > ► 06	Browse	21/06/16 08:42:43
Images	Organize	> > 06_ > > 06_	15_2021_16_23_07	2021/06/15 17:22:18
Instruments	Open	> > 06_	15_2021_15_19_59	2021/06/15 15:20:23
	Export	> ► 06_` > ► 06_`	15_2021_14_47_57 15_2021_14_37_05	2021/06/15 14:48:41 2021/06/15 14:37:19
Help ▶		> ► 06_1	15_2021_14_35_03 09 2021 17 14 43	2021/06/15 14:39:23 2021/06/09 17:31:23
Import		> 🗁 DI Match)	,,,,,,,,,
Exit				

A File Explorer window will appear enabling you to navigate to the directory where you have stored your zipped capture file. Select the file and click **Open** as shown below.

✤ Select the file(s) to import	×
\leftarrow → \checkmark ↑ ■ > This PC > Desktop > \checkmark ひ	. ✓ Search Desktop
Organize • New folder	· · · ?
 A Quick access Desktop Downloads Documents Pictures import0611 import0615 	Date modified 6/17/2021 10:06 AM
File name:	All Open Cancel

You will then be given an opportunity to rename the file with the **Import DP Capture** dialog box as shown below. Click **OK** once you have the desired name for the import.

Import to	\times					
Destination Name						
Import: DP Capture						
to: (select a destination name						
DP_Capture_1						
► 00DP_Capture_3	^					
	~					

You will see a confirmation dialog box and you the new capture will appear in the list of captures in the **Navigator** panel as shown below.

C 980 Manager	and the count	D · D
File Edid Instrument Help		
🕾 Navigator		💮 Apps
🕨 Captures 🔯 Compliance 🗊 ACA 📝	EDID/DPCD 📕 Formats	
Name	Date / Time	
a 🗁 HDMI Capture		
Diser		
a 🗁 DI Match		
🗁 User		
a 🗁 DP Capture		
🔺 🗁 User		
D TimCapture	2015/05/11 11:34:42	
DpCapture4	2015/05/13 16:38:41	
DpCapture3	2015/05/11 11:34:44	
DpCapture2	2015/05/11 11:34:43	
DpCapture10	2015/08/17 11:25:34	
⊿ ▷ DpCapture1	2015/05/11 11:34:42	
dpdecode_index.bin: 20876142	Ł	
dpdecode_details.txt: 34631865	1	
dplanedata.bin: 150833148 byte	:S	
Import DP Capture		×
Import completed successfully to: DpC		
		ок

Transferring a Capture File Between Instrument and Remote PC.

To Transfer a file, use the Navigator interface to select the folder on the remote PC that you wish to transfer to/from. Click the **Transfer** button on the left sidebar. An example below shows a Transfer with the **User** folder selected.

🕋 ATP Manage	er		
🕿 Navigator			- D
Captures	Refresh	Name	Date / Time
Compliance	New Folder	> 🗁 HDMI Capture 👻 🗁 DP Capture	
	Browse	Y 🖾 User	
ACA	Delete	> DP_Capture_1	2021/06/15 15:19:44
	Information	> • 06_17_2021_08_41_47	2021/06/17 08:41:59
EDID/DPCD	intornation	> • 06_16_2021_13_03_54	2021/06/16 13:05:31
Formats	Rename	06_16_2021_08_42_08	2021/06/16 08:42:43
	Transfer <	021_08_40_49	2021/06/16 08:41:40
Images	Organiza	021_16_23_07	2021/06/15 17:22:18
	Organize	▶ 06_15_2021_15_20_35	2021/06/16 13:03:41
Instruments	Open	> > 06_15_2021_15_19_59	2021/06/15 15:20:23
	Export	> > 06_15_2021_14_47_57	2021/06/15 14:48:41
	схрон	> > 06_15_2021_14_37_05	2021/06/15 14:37:19
Holp		> > 06_15_2021_14_35_03	2021/06/15 14:39:23
пер •		> > 06_09_2021_17_14_43	2021/06/09 17:31:23
Import		> 🗁 DI Match	
Exit			

The Data Transfer: DP Capture dialog box will appear, as shown below.



M42d Video Analyzer/Generator - User Guide	Ver. A1
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To transfer a capture file from the PC to the Instrument, select the file in the left-hand column labeled **Local Files.** Next, click on a target folder in the righthand column labeled **Instrument Files.** At this point you may either **Copy** the file to the instrument or **Move** it—which removes the file from the local storage on the PC.

The example below shows copying the file DP_Capture_2 from the PC onto the Instrument's **User** folder.



The result is the DP_Capture_2 file now appearing in the **Instrument Files** column as well, as shown below.

Note: If the **Move>>** transfer option is utilized, the file will not appear in both directories, only the target folder on the instrument, as mentioned earlier.



To transfer a file from the Instrument to the Local Host, select a file from the **Instrument Files** column, and a target folder from the **Local Files** column, and click **Copy** or **Move** to transfer. The following example shows the file 00DP_Capture_3 being moved from the Instrument to the PC.



The result is shown below. Notice the file is no longer contained within the **User** folder of the **Instrument Files**.



Note: If a file in the target folder already has the same name as the file you are attempting to transfer, the **Copy** and **Move** buttons will not be enabled. You will need to rename the capture first using the **Rename** button at the bottom of the dialog box.

6 Auxiliary Channel Analyzer (ACA)

The Auxiliary Channel Analyzer **(ACA)** utilities enable you to view the DDC and aux channel traffic for DisplayPort streams in real time or from stored real time log files. For DisplayPort, you can view the HDCP authentication transactions, EDID exchanges, Link Training transactions, side band messages, Multi-Stream Transport negotiations, etc. in real time with the ACA either through the embedded ATP GUI Manager or the external ATP GUI Manager application running on a host PC.

You can view the transactions between the M42d 80G Video Analyzer/Generator, generator ports and a connected DP display device and you can monitor the transactions between the M42d's analyzer port and a connected DP source device.

There are three (3) Auxiliary Channel Analyzer utilities:

- Auxiliary Channel Analyzer ("ACA") Used for real time viewing auxiliary channel DisplayPort Aux Chan data through the ATP GUI Manager. You can also open existing ACA trace files stored on the M42d Instrument.
- ACA Remote Control Used for viewing auxiliary channel DisplayPort data through the ATP GUI 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 a M42d test instrument to view these transactions.

6.1 Accessing the Auxiliary Channel Analyzer (ACA)

Use the following procedures to monitor the DisplayPort Aux Chan transactions with a DisplayPort device in real time. The procedures assume that the DP device under test is powered up and connected to one of the M41d 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 connected external HDMI display and the **ACA Remote Control** on the ATP GUI Manager running on the host PC is similar, though both are covered in this section.

Accessing the Auxiliary Channel Analyzer on the embedded M42d GUI

For the ACA utility, Select the Aux. Channel Analyzer app.



START	PAUSE	Clear	Events	Options	Scroll-lock	File 🗢		Þ	Close	Navigator	Home	Back
🕨 🕨 Aux. C	hannel Analyzer	[-] Events: 0										
							•					

The Aux Channel Analyzer panel appears as shown below:

The following table describes the ACA Control menu, located at the top of the window in the above screenshot. This is just a brief overview, as detailed instructions on certain features here will be described in following sections.

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:					
START STOP	Starts and Stops the collection of DDC data				
PAUSE	Halts the updates of the data to the ACA panel to view traces and allows you to resume.				
Clear	Clears the ACA Trace Panel.				
Events	Opens up the ACA Event Selection window. This feature is described in detail later in this section.				

Options	Opens up the Options dialog box. Described in detail later in this section.
Scroll-lock	Pauses the Trace Panel on the selected event. With Scroll Lock off, the Trace Panel will continue to move in order to display the most recent event.
File ↓ Open Save	 File – Opens flyout menu with Open and Save options Open – Open a previously saved ACA file Save – Save current trace locally
Home	Navigates you back to the Home menu screen of the M42d ATP GUI Manager.
Back	Navigates back to the previous screen in the Real Time mode.
Navigator	Takes you to the Navigator interface
Close	Closes out the ACA application.

Accessing the Auxiliary Channel Analyzer Remote Control on a PC

This subsection describes the **ACA Remote Control** utility used for viewing the real time DisplayPort Aux Channel transactions through the ATP GUI Manager.

ACA Remote Control – Panel Description

The **ACA Remote Control** panel application is available only on the ATP GUI Manager. It enables you to collect and view the ACA transactions in real time from a remotely connected PC with the ATP GUI Manager application. A screenshot of the Remote Control window is below. Notice there are a few slight differences from the embedded GUI, which are detailed in the table below.

🔢 ACA Remote	Control						_		×
CONNECT	START	RESUME	Events	Options	Scroll-lock	Clear	Save	*	۵
Service And American	cted>								
			•						
			0						
			0	\$					
									1.0

There are a few differences between the ACA window on the embedded M42d GUI and the ACA Remote Control on a PC. These changes are outlined below. Connect to your test instrument. Will either connect automatically (if you have just one instrument in ATP Manager), or offer you to select a device to CONNECT connect to. Save – drops down Save flyout menu Save -Save to Instrument – allows you to save the current ACA Trace to the M42d itself Save to Instrument Save to PC – allows you to save the current ACA Trace to the host • Save to PC PC

P	Drop-down menu allowing you to change text size of the window
---	---

6.2 Monitoring Auxiliary Channels with Aux Channel Analyzer Utilities

This section describes the procedures for monitoring the auxiliary channel data through the ATP GUI Manager using the Aux Channel Analyzer real time utilities—both the Aux Channel Analyzer utility available through the M42d ATP GUI Manager or the ACA Remote Control utility available through the external ATP GUI Manager running on a PC. You can monitor the DisplayPort transactions in real time when module is emulating a DisplayPort source device. If you have the M42d Rx Analyzer port you can emulate a DisplayPort sink device to test a DisplayPort source device.

Use the following procedures to monitor the DisplayPort Aux Chan transactions with a DisplayPort device in real time. The procedures assume that the DP device under test is powered up and connected to one of the M41d 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 connected external HDMI display and the **ACA Remote Control** on the ATP GUI Manager running on the host PC is similar. The screen examples used in this subsection are from the **ACA Remote Control** utility on the ATP GUI Manager exceptions related to the operation of the ACA on the ATP GUI Manager running on the connected external HDMI display are noted.

To monitor the DisplayPort transactions:

- 1. Access the **Aux Channel Analyzer** / **ACA Remote Control** (depending on the display method for the ATP Manager GUI).
- 2. If you are using the **ACA Remote Control** on a host PC, first connect to the desired instrument, as shown below.





The ACA Event Selection dialog box will appear, as shown below.

ACA Event Selection	×
All Events No Events Unselect All Eve	nts on Port
DP-T10: DP/USBC 2.0 Generator TX	DisplayPort/USBC 2.0 Generator TX
DP-R12: DP/USBC 2.0 PA RX RX	<pre> All Events Hot-Plug Preamble Count </pre>
DPUSBC-R13: DP 2.0 USB-C RX IN	 PHY Wake Native HDCP Link-Train Other Native I2C EDID DDC/CI
	 Other I2C Side-Band Message MST Transaction HDCP 2.3 Message

4. Select the ports and events you wish to monitor. Refer to the table below for options.

All Events	Select all events on all ports
No Events	Deselect all events on all ports
Unselect All Events on Port	Deselect all events only on the selected port
DP-T10: DP/USBC 2.0 Generator TX	Select events on the M42d's Generator simulated Tx port
DP-R12: DP/USBC 2.0 PA RX RX	Select events on the M42d's Protocol Analyzer simulated Rx port
DPUSBC-T11: DP 2.0 USB-C TX OUT	Select events on the connected DP or USB-C Tx port

DPUSBC-R13: DP 2.0 USB-C RX IN

Select events on the connected DP or USB-C Rx port

5. Specify which DP events you wish to monitor. You can select **All Events** of any set of individual events. In the following example, the user has selected All Events (on all ports), which is the default selection.

Important Note: You can filter and search through the ACA traces after the data collection has completed, as well. Procedures for searching and sorting are provided in a separate subsection further below.



In the next example, the user has selected to monitor only DP events on the DP/USB-C Tx Out port.

ACA Event Selection $ imes$				
All Events No Events Unselect All Eve	ents on Port			
DP-T10: DF SBC 2.0 Generator TX	DisplayPort 2.0 USB-C TX OUT			
DP-RIZ: DI SBC 2.0 PA KX KX	✓ ☑ DP			
DPUSBC-T11: DP 2.0 USB-C TX OUT	🗆 Hot-Plug			
DPUSEC-R13. DP 2 0 USE-C RX IN	🗆 Preamble Count			
	🗆 PHY Wake			
	> Native			
	>□ I2C			
	Side-Band Message			
	MST Transaction			
	🗆 HDCP 2.3 Message			
	↓□ USB-C PD			
	□ SOP			
	□ SOP'			
	□ SOP"			
	CLOSE			

- 6. Touch select the **Start** button on the ACA Control Menu at the top to initiate the viewing of the DP Aux Chan transactions.
- 7. Take the necessary action—such as a hot plug—to initiate EDID, HDCP or Link Training transactions. You will see the Aux Chan transactions in the ACA panel as shown below.

An example showing monitored data is shown below. You can stop or pause the collection at any time using the buttons on the ACA Control Menu.



D	ISCONNECT	S	TOP PAUSE Ever	ts Options Scroll-lock Cl	aar Save -	Þ
•	Total Events:	120				
11	DNAT	13	+01:35:30.789379	> R:200 SINK_COUNT L=8	Start Time: +01:35:31.837596	^
12	DPPRE	11	+01:35:30.789453	Precharge/Sync Count: 32	Type: Native	
13	DNAT	11	+01:35:30.789453	< ACK 41 00 77 77 05 03	Direction: Reply	
14	SCONNECT STOP PAUSE Events Options Scroll-lock Clear Save * fold Events: 120 DNAT 13 +01:35:30.789379 > R:200 SINK_COUNT L=8 Type: Native DPFRE 11 +01:35:30.789453 Precharge/Sync Count: 32 Direction: Reply DNAT 11 +01:35:30.789453 Precharge/Sync Count: 32 Direction: Reply DNAT 14 +01:35:31.837521 Precharge/Sync Count: 32 Reply to Read Request. DPFRE 11 +01:35:31.837521 Precharge/Sync Count: 32 NAT DNAT 14 +01:35:31.837521 Precharge/Sync Count: 32 Stnk COUNT L=8 DNAT 14 +01:35:31.837521 Precharge/Sync Count: 32 Stnk COUNT L=8 DNAT 14 +01:35:31.837595 Precharge/Sync Count: 32 Stnk COUNT L=8 DNAT 14 +01:35:31.837596 Precharge/Sync Count: 32 Stnk COUNT L=8 DPFRE 14 +01:35:34.907211 Precharge/Sync Count: 32 NAT N(0) DNAT 14 +01:35:34.907211 Precharge/Sync Count: 32 N(0) N(0) DNAT 14 +01:35:34.907285 Precharge/Sync Count					
15	DNAT	13	+01:35:30.789453	< ACK 41 00 77 77 05 03	Reply to Read Request.	
16	DPPRE	11	+01:35:31.837521	Precharge/Sync Count: 32	00200 · SINK COINT	
17	DNAT	11	+01:35:31.837521	> R:200 SINK_COUNT L=8	Bit Name Value Description	
18	DPPRE	13	+01:35:31.837522	Precharge/Sync Count: 32		
19	DNAT	13	+01:35:31.837522	> R:200 SINK_COUNT L=8	SINK_COUNT 1 Bits 7 + 5:	0
20	DPPRE	13	+01:35:31.837595	Precharge/Sync Count: 32	6 CP_READY Y(1)	
21	DNAT	13	+01:35:31.837595	< ACK 41 00 77 77 05 03	00201. DEVICE CERVICE TRO VECTOR	
22	DPPRE	11	+01:35:31.837596	Precharge/Sync Count: 32	Bit Name Value Description	
23	DNAT	11	+01:35:31.837596	< ACK 41 00 77 77 05 03		
24	DPPRE	11	+01:35:34.907211	Precharge/Sync Count: 32	0 REMOTE_CONTROL_COMMAND_PENDING N(0)	
25	DNAT	11	+01:35:34.907211	> R:200 SINK_COUNT L=8	1 AUTOMATED_TEST_REQUEST N(0)	
26	DPPRE	13	+01:35:34.907211	Precharge/Sync Count: 32	$2 CP_{IRQ} N(0)$	
27	DNAT	13	+01:35:34.907211	> R:200 SINK_COUNT L=8	3 MCCS_IRQ N(0)	
28	DPPRE	11	+01:35:34.907285	Precharge/Sync Count: 32	5 UP REO MSG RDY N(0)	
29	DNAT	11	+01:35:34.907285	< ACK 41 00 77 77 05 03	6 SINK SPECIFIC IRQ N(0)	
30	DPPRE	13	+01:35:34.907285	Precharge/Sync Count: 32	7 0 Reserved	
31	DNAT	13	+01:35:34.907285	< ACK 41 00 77 77 05 03		
32	DPPRE	11	+01:35:35.918054	Precharge/Sync Count: 32	00202: LANEO_1_STATUS:	
33	DNAT	11	+01:35:35.918054	> R:200 SINK_COUNT L=8	Bit Name Value Description	
34	DPPRE	13	+01:35:35.918055	Precharge/Sync Count: 32	0 LANEO CR DONE Y(1)	
35	DNAT	13	+01:35:35.918055	> R:200 SINK_COUNT L=8	1 LANE0_CHANNEL_EQ_DONE Y(1)	
36	DPPRE	11	+01:35:35.918128	Precharge/Sync Count: 32	2 LANEO SYMBOL LOCKED Y(1)	~
					Z3: < ACK 41 00 // // 05 03 00 00	

The next subsection will break down the ACA Window in more detail. It is very similar to the ACA Data viewer utility, which will also be covered.

8. Once you have finished running the trace, 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**.

Save As	\times			
Instrument Files				
🗸 🔯 User				
Aux_Channel_Analysis				
New Rename Delete				
Path: /User				
Name: ACA_Sample1				
OK CANCEL				

Please note:

- In order to use the ACA Data Viewer utility (Section 6.4) on your PC to view the traces or the ACA viewer on the ATP GUI Manager running on the external display with the powerful searching and filtering features, you must save the file, as shown in the previous step.
- If you are working on the Aux Channel Analyzer viewer but prefer to use ACA Data Viewer on the external ATP GUI Manager, you will have to transfer the saved file to your PC using the ATP GUI

Ver. A1

Manager running on the external display. This is covered in **6.5 Importing, Exporting, and Transferring ACA Data**.

• You can also passively monitor ACA transactions while testing both a source and sink device. Instructions for this procedure are in **Chapter 7 Passive Monitoring**.

6.3 ACA Window and Panel Description

The ACA Window will display the trace details from the data collection executed in the previous section. An example of a populated ACA window is below. Note the top toolbar remains unchanged from when first opening the Aux Channel Analyzer.

	DISCONNEC	r s	TART PAUSE Eve	ents Options Scroll-lock Clear	Save +	P
	Total Event	s: 136				
11	L DNAT	13	+01:35:30.789379	> R:200 SINK_COUNT L=8	Start Time: +01:35:31.837596	^
1:	2 DPPRE	11	+01:35:30.789453	Precharge/Sync Count: 32	Type: Native	
13	B DNAT	11	+01:35:30.789453	< ACK 41 00 77 77 05 03 00 00	Direction: Reply	
14	DPPRE	13	+01:35:30.789453	Precharge/Sync Count: 32	Command: ACK	
1!	5 DNAT	13	+01:35:30.789453	< ACK 41 00 77 77 05 03 00 00	Reply to Read Request.	
1	5 DPPRE	11	+01:35:31.837521	Precharge/Sync Count: 32	00200 STNK COINT	
1	7 DNAT	11	+01:35:31.837521	> R:200 SINK_COUNT L=8	Bit Name Value Description	
18	B DPPRE	13	+01:35:31.837522	Precharge/Sync Count: 32		
1	DNAT	13	+01:35:31.837522	> R:200 SINK_COUNT L=8	SINK_COUNT 1 Bits 7 + 5:0	
20	DPPRE	13	+01:35:31.837595	Precharge/Sync Count: 32	6 CP_READY Y(1)	
2	L DNAT	13	+01:35:31.837595	< ACK 41 00 77 77 05 03 00 00	00201, DEVICE SERVICE TRO VECTOR	
22	2 DPPRE	11	+01:35:31.837596	Precharge/Sync Count: 32	Bit Name Value Description	
2	B DNAT	11	+01:35:31.837596	ACK 41 00 77 77 05 03 00 00		
24	DPPRE	11	+01:35:34.907211	Precharge/Sync Count: 32	0 REMOTE_CONTROL_COMMAND_PENDING N(0)	
2	5 DNAT	11	+01:35:34.907211	> R:200 SINK_COUNT L=8	1 AUTOMATED_TEST_REQUEST N(0)	
2	5 DPPRE	13	+01:35:34.907211	Precharge/Sync Count: 32	2 CP_IRQ N(0)	
2	7 DNAT	13	+01:35:34.907211	> R:200 SINK_COUNT L=8	4 DOWN REP MSG RDY N(0)	
21	B DPPRE	11	+01:35:34.907285	Precharge/Sync Count: 32	5 UP REO MSG RDY N(0)	
2	DNAT	11	+01:35:34.907285	< ACK 41 00 77 77 05 03 00 00	6 SINK_SPECIFIC_IRQ N(0)	
30	DPPRE	13	+01:35:34.907285	Precharge/Sync Count: 32	7 0 Reserved	
3	L DNAT	13	+01:35:34.907285	< ACK 41 00 77 77 05 03 00 00		
32	2 DPPRE	11	+01:35:35.918054	Precharge/Sync Count: 32	00202: LANEO 1 STATUS:	
3	B DNAT	11	+01:35:35.918054	> R:200 SINK_COUNT L=8		
34	DPPRE	13	+01:35:35.918055	Precharge/Sync Count: 32	0 LANEO CR DONE Y(1)	
3	5 DNAT	13	+01:35:35.918055	> R:200 SINK_COUNT L=8	1 LANEO_CHANNEL_EQ_DONE Y(1)	
3	5 DPPRE	11	+01:35:35.918128	Precharge/Sync Count: 32	2 LANE0_SYMBOL_LOCKED Y(1)	
3.	DNAT	11	+01:35:35.918128	< ACK 41 00 77 77 05 03 00 00	3 0 Reserved	
31	B DPPRE	13	+01:35:35.918128	Precharge/Sync Count: 32	4 LANEI_CK_DONE Y(1)	~
					S 23: < ACK 41 00 // // 05 03 00 00	

You can access the **Options** dialog box using the top Control menu. Options menu items are described in the following table:

Options Dialog Box		Box	Scroll Lock – Locks the left-hand trace panel to the sele	ected
	Options	×	the most recent event.	with
	Table	DP	 Show Port Name – Enables you to display or not display Port name (the Port number is always shown). 	y the
	Show Port Name		 Show Time-stamp – Enables you to show or not show t time stamps for each transaction. 	:he
Show Time-deltas SET ZERO TIME RESET ZERO TIME		Time-deltas	 Show Time-deltas – Enables you to show the time stam relative to the previous transaction. Only available when Time-Stamps are shown (see above). 	ıps
			 Set Zero Time – Enables you to set a log record to zero Subsequent log records are relative to this new zero time record. 	e
			 Reset to Zero Time – Resets the initial record in the act log in the ACA Trace window to zero. 	ive

The **ACA Trace Panel** displays each event in a row with some information. This information is expanded in the ACA Event Details panel which will be covered next. An example of the ACA Trace Panel is below. The numbered arrows correspond to the descriptions immediately following the screenshot.

To	Total Events: 112						
81	DNAT	DPUSBC-T11	+00:00:20.369114	> R:200 SINK_COUNT L=8			
1	DPPRE	DPUSBC-R13	+00:00:20.369115	Precharge/Sync Count: 32			
	DNAT	DPUSBC-R13	+00:00:20.369115	> R:200 SINK_COUNT L=8			
	DE	DPUSBC-T11	+00:00:20.369188	Precharge/Sync Count: 32			
85	2 r	DPUSBC-T11	+00:00:20.369188	< ACK 41 00 77 77 05 03 00 00			
86	DL E	DPUSBC-R13	+00:00:20.369188	Precharge/Sync Count: 32			
87	DNAT	DPU -R13	+00:00:20.369188	< ACK 41 00 77 77 05 03 00 00			
88	DPPRE	DPU -T11	+00:00:20.480915	Precharge/Sync Count: 32			
89	DNAT	DPUST11	+00:00:20.480915	> R:200 SINK_COUNT L=8			
90	DPPRE	DPUSBC-R13	+00:00:20.480915	Precharge/Sync Count: 32			
91	DNAT	DPUSBC-R13	+00:00 .480915	> R:200 SINK_COUNT L=8			
92	DPPRE	DPUSBC-T11	+00:00 480989	Precharge/Sync Count: 32			
93	DNAT	DPUSBC-T11	+00:00:	< ACK 41 00 77 77 05 03 00 00			
94	DPPRE	DPUSBC-R13	+00:00:20.480989	Precharge/Sync Count: 32			
95	DNAT	DPUSBC-R13	+00:00:20.480989	< A(1 00 77 77 05 03 00 00			
96	DPPRE	DPUSBC-T11	+00:00:24.481999	Prec 5 ge/Sync Count: 32			
97	DNAT	DPUSBC-T11	+00:00:24.481999	> R. J SINK_COUNT L=8			
98	DPPRE	DPUSBC-R13	+00:00:24.481999	Precharge/Sync Count: 32			
99	DNAT	DPUSBC-R13	+00:00:24.481999	> R:200 SINK_COUNT L=8			
100	DPPRE	DPUSBC-T11	+00:00:24.482073	Precharge/Sync Count: 32			
101	DNAT	DPUSBC-T11	+00:00:24.482073	< ACK 41 00 77 77 05 03 00 00			
102	DPPRE	DPUSBC-R13	+00:00:24.482073	Precharge/Sync Count: 32			
103	DNAT	DPUSBC-R13	+00:00:24.482073	< ACK 41 00 77 77 05 03 00 00			
104	DPPRE	DPUSBC-T11	+00:00:24.576825	Precharge/Sync Count: 32			
105	DNAT	DPUSBC-T11	+00:00:24.576825	> R:200 SINK_COUNT L=8			
106	DPPRE	DPUSBC-R13	+00:00:24.576825	Precharge/Sync Count: 32			
				-			

- 1. Item number This is a unique sequence number of the transaction.
- 2. **Type** The type of Aux Chan transaction; either EDID, HDCP DPLT (Link Training), DNAT (DP native Aux transactions), etc.
- 3. Port Name and Number Port Name is an optional viewing field. Port Number will always be displayed.
- 4. **Time stamp** (optional viewing field) Shows the timestamp of each transaction. Can either be absolute time based (shown) on the M41d system clock or relative time (Time-deltas) referenced from the initial transaction in the trace.
- 5. **Transaction Description** A brief description of the transaction.

The **ACA Event Details Panel** will display the details of the selected transaction within the trace panel, as shown below. This screenshot is of details for a Link Training transaction.

St	art Time: +00:00:24.576899 Type: Native			^
D	irection: Reply			
2.	Command: ACK			
Reply to	Read Request.			
00200. 8	THE COURT			
00200: 5. Bit	Name	Value	Description	
BIC	Name	varue	Description	
	SINK_COUNT	1	Bits 7 + 5:0	
6	CP_READY	Y(1)		
00201. D				
00201: D	LVICE_SERVICE_IRQ_VECTOR	Value	Decovintion	
BIC	Name	varue	Description	
0	REMOTE CONTROL COMMAND PENDING	N(0)		
1	AUTOMATED TEST REQUEST	N(0)		
2	CP IRQ ~	N(0)		
3	MCCS IRQ	N(0)		
4	DOWN REP MSG RDY	N(0)		
5	UP REQ MSG RDY	N(0)		
6	SINK SPECIFIC IRQ	N(0)		
7		0	Reserved	
00202 · T	ANEO 1 STATUS			
Bit	Name	Value	Description	
0	LANEO CR DONE	Y(1)		
1	LANEO CHANNEL EQ DONE	Y(1)		
2	LANEO SYMBOL LOCKED	Y(1)		
3		0	Reserved	
4	LANE1_CR_DONE	Y(1)		~
< >	111: < ACK 41 00 77 77 05 03	00 00		

The following list describes the information that is provided in the ACA **Event Details** dialog box.

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

- **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 There are various types of data that can be monitored on the DisplayPort interfaces: EDID, HDCP and DP specific data types related to Link Training, side band messaging, Multi-Stream Transport transactions, native transactions, etc.
- **Direction** The direction of the transaction either a request or a reply.
- **Command** The type of Command being issued
- Address The register address of the transaction
- 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, as shown below.

The left and right arrows allow you to navigate to the immediately previous or following transaction.

The Status Field to the right shows the sequence number and the description of the selected transaction.



6.4 ACA Data Viewer

This subsection describes the **ACA Data Viewer** utility used for viewing DisplayPort Aux Channel transactions that have been stored on the PC hosting the ATP GUI Manager. You can use the **ACA** utility on the ATP GUI Manager to view ACA trace files stored on the M41d 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 similar to the embedded version.

Please note that in order to use the **ACA Data Viewer** utility on your remote PC to view the traces or the ACA viewer on the M42d ATP GUI Manager 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 GUI Manager, you will have to transfer the saved file to your PC using the external ATP GUI Manager. Instructions for transferring are detailed in the next section.

ACA Data Viewer - Panel Description

Access the ACA Data Viewer by selecting the **Other** tab on the home screen and clicking the ACA Data Viewer icon, as shown below.



You'll notice the window looks similar to the ACA Utility, though there are a few distinct and very useful additions. A screenshot of the populated **ACA Data Viewer** is below. Notice the **Trace Panel** and **Event Details Panel** are the same as described in **7.3 ACA Window and Panel Description**.

	-
Open Close Export Options Filter Find	Þ
⊖ [-] Events: 0	
0	

The main difference is in the Control Menu at the top of the window. The following are features not found in the ACA Utility:

- Open Open a file saved locally, whether on the instrument or host PC
- Filter Filter results shown in the Trace Panel
- Find Find a specific data type in the Trace Panel
- **Export** Export results as text or html file

E ACA Data Viewer				
Open 🔶 se	Export	Options	Filter	Find
\varTheta [-] Events: 0				

To load an ACA Data set, click the **Open** button in the control menu. The **Open ACA Data** dialog box will appear, as shown below.

Select the data set you would like to open, and then click **OK**.

Open ACA Data	\times
ACA Data	
Select an ACA Data set.	
sample	

The resulting populated ACA Data Viewer is shown in the example below. Notice the Trace Panel and Event Detail Panel are identical to the view while monitoring in the ACA Utility itself.

Op	ben	Close	Export	Options	Filter	Find						Þ
D [:	sample] Events: 24											
0	0 DPPRE 13 Precharge/Sync Count: 32							s St	tart Time: +03:06:23.538912			^
1	DNA	AT 13	> R:2	00 SINK_CO	OUNT L=8		8)	Type: Native			
2	DPPF	RE 13	Prech	arge/Sync	Count: 3	2		I	Direction: Reply			
3	DNA	AT 13	< ACK	41 00 77	77 05 03	00 00		Deplet to	Command: ACK			
4	DPPF	RE 11	Prech	arge/Sync	Count: 3	2		керту со	s Read Request.			
5	DNA	AT 11	> R:2	00 SINK_CO	OUNT L=8			00200: 5	SINK COUNT			
6	DPPF	RE 11	Prech	arge/Sync	Count: 3	2		Bit	Name	Value	Description	
7	DNA	AT 11	< ACK	41 00 77	77 05 03	00 00						-
8	DPPF	RE 13	Prech	arge/Sync	Count: 3	2			SINK_COUNT	1	Bits 7 + 5:0	
9	DNA	AT 13	> R:2	00 SINK_CO	OUNT L=8			6	CP_READY	Y(1)		
10	DPPF	RE 13	Prech	arge/Sync	Count: 3	2		00201 · T	EVICE SERVICE TRO VECTOR			
11	DNA	AT 13	< ACK	41 00 77	77 05 03	00 00		Bit	Name	Value	Description	
12	DPPF	RE 11	Prech	arge/Sync	Count: 3	2						-
13	DNA	AT 11	> R:2	00 SINK_CO	OUNT L=8			0	REMOTE_CONTROL_COMMAND_PENDING	N(0)		
14	DPPF	RE 11	Prech	arge/Sync	Count: 3	2		1	AUTOMATED_TEST_REQUEST	N(0)		
15	DNA	AT 11	< ACK	41 00 77	77 05 03	00 00		2	CP_IRQ MCCS_TPO	N(0)		
16	DPPF	RE 13	Prech	arge/Sync	Count: 3	2		4	DOWN REP MSG RDY	N(0)		
17	DNA	AT 13	> R:2	00 SINK_CO	OUNT L=8			5	UP REQ MSG RDY	N(0)		
18	DPPF	RE 13	Prech	arge/Sync	Count: 3	2		6	SINK_SPECIFIC_IRQ	N(0)		
19	DNA	AT 13	< ACK	41 00 77	77 05 03	00 00		7		0	Reserved	
20	DPPF	RE 11	Prech	arge/Sync	Count: 3	2		00202. 1	ANEO 1 CHAMIC.			
21	DNA	AT 11	> R:2	00 SINK_CO	OUNT L=8			00202: 1 Bit	Name	Value	Description	~
22	DPPF	RE 11	Prech	arge/Sync	Count: 3	2	C	< ۲	3: < ACK 41 00 77 77 05 03 00	00		

Exporting ACA Data as Text or HTML File

The **Export** feature allows you to export the current ACA Data Set as either a text or HTML file and save it locally to the hard disk.

The following table features a screenshot of the **Export as...** dialog box. In this example, **All** events have been selected.

Export Dialog Box								
Export as ×	Field	Description						
Events All Range	Events	Enables you to select all recorded events, or a specified range						
Max Range: 1 - 24 Start: 1	Start	Field available only when Range radio button is active to specify the first record of the range of records to include in the export operation						
End: 1 Show Time Delta 🖉	End	Field available only when Range radio button is active to specify the last record of the range of records to include in the export operation.						
Show Details	Show Time Delta	Toggle enabling you to export the data with the time showing as relative to the previous event						
Show Raw Data	Show Details	Toggle enabling you to export the data and include the human-readable information in the Event Details Panel						
Text HTML	Show Raw Data	Toggle enabling you to export the data and include the raw data						
OK CANCEL	File Format	Enables you to select between Text or HTML file export						

Once you have selected the desired options, choose a folder to save the file in, and click **Save**.

This data will then be accessible in any program that is capable of reading .txt or .htm files.

Using the ACA Filter Feature

The ACA Filter dialog box is accessible using the Filter button. The ACA Filter function enables you to filter an ACA trace file to view a subset of the log records in a particular data set.

The ACA Filter feature is only available within the **ACA Data Viewer**. If you wish to use the Filter feature on ACA traces that you have captured using the **ACA Remote Control** (remote PC) or **Aux Channel Analyzer** (embedded GUI), you have to save the ACA data and reload it through the **ACA Data Viewer** utility.

See 7.2 Monitoring Auxiliary Channels with ACA Utility for instructions on saving an ACA Data set.

Filtering Data

You access the ACA Filter function using the **Filter** button on the control menu at the top of the **ACA Data Viewer** window.



The ACA Filter dialog box appears, as shown below.

ACA Filter $ imes$											
Open Save Clear Add Remove											
• All Events											
Source		Туре	Label	Detail							
Other	DP-I	Native	DP-I2C								
HDMI	DP-I	EDID	DP-HDCP								
eARC		T									
MHL		LI									
DP	🗆 DP-I	HPD	DP-PREAM	BLE							
USBC-PD	DP-	SB	DP-MST								
USB4-DP		HDCP-MSG									
			OK	CANCEL							

There are four tabs within the dialog box, as well as a control toolbar at the top. Each tab will be covered in detail within this subsection, along with examples.

Note that criteria may be selected and combined amongst all four filtering options if so desired.

The following table gives an overview of the Control Menu at the top of the dialog box:

ACA Filter – Control Menu									
ACA Filter Open Save	e Clear Add Remove	\times							
Button	Function	Description							
Open Save	Opens a stored user-created Filter configuration. Saves the current user-	You can store commonly used filter configurations using the Save function and recall them for quick access using the Open button.							
	created Filter configuration.								
Clear	Clear the existing Filter criteria.	You can build up complex filter configurations by combining multiple filter criteria. When you add							
Add	Sets the currently defined Filter criteria defined in either the Source, Type, Label or Details sub-panels and adds another row for a new filter criterion.	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 GUI Manager							
Remove	Removes a highlighted filter criterion of an existing filter configuration.	When you are assembling filter configurations you car 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.							

Filter by Source

The following screenshot demonstrates the **Source** tab within the **ACA Filter** dialog box. A description is following the image.

ACA Filter				\times
Open Save	Clear	Add	Remove	
• All Event	s			
Source		e	Label	Detail
DP-T10				
DP-R12				
DPPM-R14	Ļ			
DPUSBC-T	11			
DPUSBC-R	13			
			ОК	CANCEL

The **Source** tab features checkboxes to select the port on a particular module 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, the Filter function will locate all records matching the criteria. If only the Source (port) is specified, all records from or to that source will be highlighted.

Filter by Type

The following screenshot demonstrates the **Type** tab within the **ACA Filter** dialog box. The **Type** tab consists of check boxes enabling you to specify which data types you wish to filter for. When you select multiple data types they behave as a logical OR function.



Filtering by Label

The following screenshot demonstrates the **Label** tab within the **ACA Filter** dialog box. A description is following the image.

ACA Filter					×							
Open Save	Clear A	dd Remove										
• All Events	• All Events											
Source		Тур	Label		Detail							
Text contains:												
Regular Expres	ssion Svn	tax 🕞										
	SSION SYN											
				ОК	CANCEL							

The **Label** tab is used for specifying criteria for text that appears in the Label field of the event log. When you enter a criterion in the Label field, it will automatically be added to the set of criteria in the panel above it.

- Text Contains A toggle to activate the Label criteria.
- NOT A checkbox 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). NOTE: This text field is case sensitive.
- 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 checkbox is checked, you can enter in any regular expression into the text field for a string match.

The following example filters for an event with "Precharge" in its label (result on the left):

E ACA Data Viewer						ACA F	ilter					\times	
Op	oen Cl	ose	Export	Options	Filter	Find	Open	Save	Clear	Add Remo	ve		
21	sample] E	vents:	12 (24)				• When	re Labe	el CON	TAINS "Prec	harge"		
0	DPPRE	13	Prech	arge/Sync (Count:	32	S	ource		Type	Label		Detail
1	DPPRE	13	Prech	arge/Sync (Count:	32		ource		Type	Laber		Detail
2	DPPRE	11	Prech	arge/Sync (Count:	32	Text c	ontains	: •				
3	DPPRE	11	Prech	arge/Sync (Count:	32							
4	DPPRE	13	Prech	arge/Sync (Count:	32		Т					
5	DPPRE	13	Prech	arge/Sync (Count:	32							
6	DPPRE	11	Prech	arge/Sync (Count:	32				Prech	arge		
7	DPPRE	11	Prech	arge/Sync (Count:	32	Regula	ar Evore	secion 9	Syntax m			
8	DPPRE	13	Prech	arge/Sync (Count:	32	Regula		531011 0	Syntax Se			
9	DPPRE	13	Prech	arge/Sync (Count:	32							
10	DPPRE	11	Prech	arge/Sync (Count:	32							
11	DPPRE	11	Prech	arge/Sync (Count:	32						ок 🚺	CANCEL

Filtering by Detail

The following screenshot demonstrates the **Detail** tab within the **ACA Filter** dialog box. A description is following the image.

ACA Filter $ imes$										
Open Save Cl	ear Add Remove									
Source	Туре	Lŧ	Detail							
Text contains:	ON NO.									
Regular Expressi	on Syntax 🏾 🗃									
		ſ	OK CANCEL							

The **Detail** tab is used for specifying criteria for text that appears in the Details field of the event log. When you enter a criterion in the Detail field, it will automatically be added to the set of criteria in the panel above it.

The fields and functionality in this panel are the same as the Label tab (see above).

The following example filters for events that do **NOT** contain the word "LANE" (the field is case-sensitive). The results are on the left-hand side within the ACA Data Viewer Trace Panel.

Note that the Event counter above the Trace Panel shows how many events are within the filter, followed by the total number of events in the unfiltered trace in parentheses.

:8	ACA Data V	iewer		ACA Filter			\times
O	pen Clo	se E	Export Options Filter Find	Open Save Clea	r Add Remove		
21	sample] Ev	ents: 1	8 (24)	• Where Details	!CONTAINS "LAN	Ε"	
0	DPPRE	13	Prechar je/Sync Count: 32				
1	DNAT	13	> R:200 SINK_COUNT L=8		-		D () (
2	DPPRE	13	Precharge/Sync Count: 32	Source	Туре	Label	Detail
3	DPPRE	11	Precharge/Sync Count: 32	Text contains:			
4	DNAT	11	> R:200 SINK_COUNT L=8				
5	DPPRE	11	Precharge/Sync Count: 32	NOT			
6	DPPRE	13	Precharge/Sync Count: 32				
7	DNAT	13	> R:200 SINK_COUNT L=8		LA	NE	
8	DPPRE	13	Precharge/Sync Count: 32				
9	DPPRE	11	Precharge/Sync Count: 32	Regular Expression	Syntax		
10	DNAT	11	> R:200 SINK_COUNT L=8				
11	DPPRE	11	Precharge/Sync Count: 32				
12	DPPRE	13	Precharge/Sync Count: 32				
13	DNAT	13	> R:200 SINK_COUNT L=8				
14	DPPRE	13	Precharge/Sync Count: 32				
15	DPPRE	11	Precharge/Sync Count: 32				
16	DNAT	11	> R:200 SINK_COUNT L=8			(
17	DPPRE	11	Precharge/Sync Count: 32				OK CANCEL

Using the ACA Find Feature

The ACA Find dialog box is accessible using the Find button. The ACA Find function enables you to quickly locate different types of events.

The ACA Filter feature is only available within the ACA Data Viewer. If you wish to use the Filter feature on ACA traces that you have captured using the ACA Remote Control (remote PC) or Aux Channel Analyzer (embedded GUI), you have to save the ACA data and reload it through the ACA Data Viewer utility.

See 7.2 Monitoring Auxiliary Channels with ACA Utility for instructions on saving an ACA Data set.

A screenshot of the ACA Find dialog box is below. Note that the Find dialog box is similar in appearance to the Filter dialog box.

Finding Specific Data

You access the ACA Find function using the Find button on the control menu at the top of the ACA Data Viewer window.

ACA Data Viewer									
Open Close Export Options Find									
🙋 [samp	Sample] Events: 24								

The ACA Find dialog box appears, as shown below.

ACA Find $ imes$												
Open Save												
• All Events												
Source	Туре	Label	Detail									
Other	Other DDC											
HDMI												
eARC												
MHL		U IZC-SDA-FE										
DP	I2C-SDA-RE	I2C-SCL-FE										
USBC-PD	I2C-SCL-RE	HDMI-HPD										
USB4-DP												
	PREVIOUS NEXT											
			CLOSE									

There are four tabs within the Find dialog box, as well as a control toolbar at the top. Each tab will be covered in detail within this subsection, along with examples.

Note that criteria may be selected and combined amongst all four finding options if so desired.

The following table gives an overview of the Control Menu at the top of the dialog box:

ACA Filter – Control Menu							
ACA Find	ACA Find ×						
Open Save Clear Add Remove							
Button	Function	Description					
Open	Opens a stored user-created Find configuration.	Description You can store commonly used find configurations using the Save function and recall them for quick access using the Open button. You can build up complex find configurations by combining multiple find criteria. When you add multiple configurations, they behave as a logical OR function underscharge the construction in Trues the complex find criteria in Trues the complex in the complex in True and t					
Save	Saves the current user- created Find configuration.	access using the Open button.					
Clear	Clear the existing Find criteria.	You can build up complex find configurations by combining multiple find criteria. When you add multiple					
Add	Sets the currently defined Find criteria defined in either the Source, Type, Label or Details sub-panels and adds another row for a new find criterion.	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 GUI Manager					
Remove	Removes a highlighted find criterion of an existing find configuration.	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.					

The bottom of the dialog box features a **PREVIOUS** and **NEXT** button. These will take you to the next or previous match of the find criteria within the Trace Panel. Use these to navigate the events that were found matching the desired criteria.



Find by Source

The following screenshot demonstrates the **Source** tab within the **ACA Find** dialog box. A description is following the image.



The **Source** tab features checkboxes to select the port on a particular module that you want to find. 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.

Find by Type

The following screenshot demonstrates the **Type** tab within the **ACA Find** dialog box. The **Type** tab consists of check boxes enabling you to specify which data types you wish to find. When you select multiple data Types they behave as a logical OR function.

ACA Find							\times		
Open Sav	/e Clea	ar Add R	emo	/e					
Source Type Detail									
Other		P-Native		DP-I2C					
HDMI					5				
eARC									
MHL									
DP		DP-HPD		DP-PREA	MBLE				
USBC-PD		DP-SB		DP-MST					
USB4-DP		P-HDCP-M	SG	□ WAKE					
	PREVIOUS								
						CLOSE			

The following example demonstrates a search for all events of type DP-Native. The result of clicking **NEXT** once DP-Native has been checked appears on the left-hand side within the ACA Trace Panel.

E ACA Data Viewer					ACA Find		×	
Oper	Close	Exp	oort Options Filter Find		Open Save	e Clear Add Rem	iove	
🖻 [Au	x_Channel_	Analys	sis] Events: 1230		• Where Type=(DP-Native)			
7	DNAT	13	< ACK 41 00 77 77 05 03 00 00	۰				
8	DPPRE	11	Precharge/Sync Count: 32		Source	Туре	Label Detail	
9	DNAT	11	> R:200 SINK_COUNT L=8					
10	DPPRE	13	Precharge/Sync Count: 32					
11	DNAT	13	> R:200 SINK_COUNT L=8					
12	DPPRE	11	Precharge/Sync Count: 32		Other	DP-Native	DP-I2C	
13	DN T	11	< ACK 41 00 77 77 05 03 00 00					
14	D	13	Precharge/Sync Count: 32		HDIMI	DP-EDID	DP-HDCP	
15	D :	13	< ACK 41 00 77 77 05 03 00 00		eARC			
16	PD	13	** Invalid		MU	DP-LT	DP-DDC/CI	
17	ERR	13	Sync Error: PREAMBLE 0x205FD4F3					
18	PDCTL	11	** Invalid		DP	DP-HPD	DP-PREAMBLE	
19	ERR	11	Sync Error: PREAMBLE 0x205FD714		USBC-PD			
20	PDCTL	11	** Invalid		USBC-PD	DP-SB	DP-MST	
21	ERR	11	Sync Error: PREAMBLE 0x206021AD		USB4-DP			
22	PDCTL	11	** Invalid			U DP-HDCP-MSG		
23	ERR	11	Sync Error: PREAMBLE 0x20602398					
24	PDCTL	11	** Invalid					
25	DNAT	11	> R:200 SINK_COUNT L=2			Found Even	t #16	
26	DPPRE	11	Precharge/Sync Count: 32					
27	DPHP	11	HPD Rising Edge			PREVIOUS		
28	DPHP	11	HPD Falling Edge				CLOSE	

Clicking **NEXT** again would take the Trace Panel to the next DNAT data type on line 25.

Finding by Label

The following screenshot demonstrates the **Label** tab within the **ACA Find** dialog box. A description is following the image.

ACA Find	\times						
Open Save Clear Add Remove							
Source Label Detail							
Text contains:							
Degular Expression Suntax							
PREVIOUS NEXT							
CLOSE							

The **Label** tab is used for specifying criteria for text that appears in the Label field of the event log. When you enter a criterion in the Label field, it will automatically be added to the set of criteria in the panel above it.

- Text Contains A toggle to activate the Label criteria.
- NOT A checkbox which when checked will find 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). NOTE: This text field is case sensitive.
- 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 finding the text. You can find detailed examples on the web including Wikipedia. If Regular Expression checkbox is checked, you can enter in any regular expression into the text field for a string match.

The following example retains the previous criterion (type DP-Native), but searches for a label with text containing "ACK." Note the top right panel which lists all criteria for the search.

E ACA	E ACA Data Viewer				ACA Find >				\times			
Open	Close	Exp	oort Options	Filter	Find		Open	Save	Clear	Add Ren	nove	
🖻 [Aux	_Channel_/	Analys	is] Events: 1230				• Wher	re Typ	e=(DP-	Native) A	ND Label CONT	AINS "ACK"
22	PDCTL	11	** Invalid			10						
23	ERR	11	Sync Error: PI	REAMBLE	0x20602398	0	Sc	ource		Type	Label	Detail
24	PDCTL	11	** Invalid			<u> </u>						
25	DNAT	11	> R:200 SINK_0	COUNT L	=2		Text c	ontains	s: 🗨			
26	DPPRE	11	Precharge/Synd	c Count	: 32			-				
27	DPHP	11	HPD Rising Edg	ge								
28	DPHP	11	HPD Falling Ed	dge						A	K _	
29	DNAT	11	< ACK									
30	DPPRE	11	Precharge/Synd	c Count	: 32		Regula	ar Expre	ession S	Syntax 🔵 🖻	Ð	
31	DNAT	11	> W:201 DEVICE_SERVICE_IRQ_VE									
32	DPPRE	11	Precharge/Synd									
33	DNAT	11	< ACK 00 00 31 80									
34	DPPRE	11	Pre harge/Sync Count: 32									
35	DNAT	11	>10 DOWN	REP (16) L=4							
36	DPPRE	11	Pr arge/Synd	c Count	: 32							
37	DPHP	14	HP ising Edg	ge								
38	DPHP	14	HPD Falling Ed	dge								
39	DPHP	14	HPD Rising Edg	ge								
40	DPHP	14	HPD Falling Ed	dge						Found Ev	vent #34	
41	ERR	13	ERR (1:8200000	0) Tryi	ng to rec					PREVIOUS	NEXT	
40	DDDDD	11	Drechange / Com	Count	. 20					11211000		

Finding by Detail

The following screenshot demonstrates the **Detail** tab within the **ACA Find** dialog box. A description is following the image.

ACA Find	d					×		
Open S	Save	Clear	Add	Remove				
Sour	rce		Туре			Detail		
Text cor	ntains	: 07						
Regular	Regular Expression Syntax 🖉 💷							
			PREVIC	OUS NEX	СТ	_		
						CLOSE		

The **Detail** tab is used for specifying criteria for text that appears in the Details field of the event log. When you enter a criterion in the Detail field, it will automatically be added to the set of criteria in the panel above it.

The fields and functionality in this panel are the same as the Label tab (see above).

The following example retains the previous two criteria (DP-Native data type and "ACK" in the label), but searches for events that contain the text "DPCD" (the field is case-sensitive).

The **ACA Find** dialog box is below and the result of the search in the **ACA Data Viewer** window follows. Note the top right panel which lists all the criteria for the search.

ACA Find			×						
Open Save Clear Add	d Remove								
• Where Type=(DP-Nati	ve) AND Label CONTA	INS "ACK" AND Detail:	3 CONTAINS "DPCD"						
Source	Туре	Label	Detail						
Text contains: 🔍									
		4							
DPCD									
Regular Expression Syntax									
Regular Expression Syntax									
PREVIOUS NEXT									
			CLOSE						
M42d Video Analyzer/Generator - User Guide

E 11 Pi large/Sync Count: 32

DPPRE 11 Precnarge/Sync Count: 32

DPPRE 11 Precharge/Sync Count: 32

DNAT 11 < ACK 08 08 90 00 0E 00

13 Pi large/Sync Count: 32

 DNAT
 11
 > R:80 DWN_STRM_PORTX_CAP L=4

 ERR
 11
 ERR (3:30000128) Trying to rec...

 ERR
 11
 ERR (3:205A4510) Trying to rec...

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D E

II ACA Data Viewer _ Open Close Export Options Filter Find [Aux_Channel_Analysis] Events: 1230 DPPRE 11 Precharge/Sync Count: 32 DNAT 11 > R:E TRAINING_AUX_RD_INTERVA... DPPRE 11 Precharge/Sync Count: 32 Start Time: +01:22:51.905287 Type: Native Direction: Reply Command: ACK DNAT 11 < ACK 81 Reply to Read Request. DPPRE 11 Precharge/Sync Count: 32 DNAT 11 > R:0 DPCD_REV L=1 02200: DP1.3 DPCD DPPRE 11 Precharge DNAT 11 < ACK 14 Precharge/Sync Count: 32 Value Description Bit Name DPPRE 11 Precharge/Sync Count: 32 3-0 Minor Revision 4 DNAT 11 > R:2200 DP1.3_DPCD_REV L=16 7-4 Major Revision 1 DPPRE 11 Precharge/Sync Count: 32 02201: MAX LINK RATE DNAT 11 < ACK 14 1E C4 81 01 01 03 04... Bit Name Value Description D RE 11 harge/Sync Count: 32 Pr 11 7 10 DPRX_FEATURE_ENUMERA... 7-0 MAX LINK RATE 1Eh 8.1 Gbps/lane

02202: MAX LANE COUNT

4-0 MAX_LANE_COUNT

5 POST_LT_ADJ_REQ_SUP 6 TPS3_SUPPORTED

7 ENHANCED_FRAME_CAP

Bit Name

<

<

٠

Value Description

4 4 lanes

- ----

N(0)

Y(1)

Y(1)

> 53: < ACK 14 1E C4 81 01 01 03 04 00 20 04 08 00 00

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>

6.5 Importing, Exporting, and Transferring ACA Data

This subsection will describe the following processes in detail:

- Export of an ACA Data file to a file folder or USB storage
- Import of an ACA Data file from a local file folder or USB storage
- Transfer of an ACA Data set from an M42d instrument to a remote host PC or vice versa.

All of these features are accessible through the **Navigator** interface either on the instrument itself or through the remote ATP Manager.

Exporting an ACA Data File

To export an ACA data file, navigate to its folder in the ATP Manager Navigator interface by clicking **ACA** and expanding the folder(s) that it is contained in. An example below shows ACA data files stored in the **User** folder on a PC running the remote ATP Manager

🛪 ATP Manager					
🕏 Navigator 📃 🗆					
Captures	Refresh	Name	Date / Time		
Compliance	Browse	✓ ➢ ACA Data ✓ ➢ User			
	Delete	> 🛛 sample	2021/06/22 15:32:50		
ACA	hation	> Aux_Channel_Analysis	2021/06/22 15:57:20		
EDID/DPCD	Rename	V GACA Filter			
Formats	Transfer				
	Organize				
Images	Open				
Instruments	Export				
Other	Import 780 ACA Trace				

Click on an ACA data file, and export by selecting the **Export** button on the left sidebar, or right-clicking and selecting **Export.** Both shown below.

TP Manager					
🕿 Navigator					
Captures	Refresh	Name		Date / Time	
Compliance	Browse	✓ See ACA Data			
compliance	Delete	> sample		2021/06/22 15:3	2:50
ACA	Information	> Aux_Channel_Ar	nalysis	2021/06/22 15:5	7:20
EDID/DPCD	Rename	✓ ➢ ACA Filter ☑ User	port		
Formate	Transfer		Exp	port	
Formats	Organize		Op	ben	
Images	Open		Inf	ormation	
Instruments	Export		De	lete	
Other	Import 780 ACA Trace		owse		

When you select **Export**, a File Explorer window will show up enabling you to save the capture as a zip file in a directory and name of your choosing. Refer to the screen example below.

Note: If you are on the M42d instrument itself, the file explorer window will be Linux-based.



Choose a desired directory and filename, and click **Save**. This capture file will then be accessible in a file explorer as a compressed zip file, as shown below.

🛄 🛃 🖡 🗧 Deskto	p			_		×
File Home Sh	are View	w				~ ?
\leftarrow \rightarrow \checkmark \uparrow \blacksquare >	This PC 🔉	Desktop	*	U	,∕⊃ Se	earch D
📌 Quick access	▲ Nar	me Aux_Channel_Analysis1	Type Compressed (zipped) Folder	Size	15 KB
🖊 Downloads 🖈						
🖆 Documents 🖈						
Network Pictures 🖈						
import0611 1 item	~ <					

Importing a Capture File

Similarly, to import a file, in the Navigator either right click on the desired target folder, or select the folder and click the **Import** button at the bottom left of the window. The example below demonstrates importing an ACA Data file into the **User** folder.



A File Explorer window will appear enabling you to navigate to the directory where you have stored your zipped capture file. This can be a local file on the PC/Instrument itself or a USB storage drive. Select the file and click Open as shown below.

🔭 Select the file(s) t	to import	×
$\leftrightarrow \rightarrow \cdot \uparrow$	> This PC > Desktop V 🖸 🔎 Sear	ch Desktop
Organize • No	ew folder	• • •
 Quick access Desktop Downloads Documents Pictures 	Name Aux_Channel_Analysis1	Date modified 6/22/2021 4:52 PM
	File name: All	> Cancel

A dialog box will appear, instructing you to choose a destination name. The contents of the zipped folder will be unzipped to a new folder with this name. This is the same as naming an ACA Trace file when saving in the ACA Remote Control (PC) or Aux Channel Analyzer Utility (M42d)

Choose the default, or type in a destination name for the ACA Data, then click OK.

Import to	\times
Destination Name	
Import: ACA Data	
to: (select a destination name	
ACA_Import_Example	
Aux_Channel_Analysissample	
OK CANCEL	

The ACA Data file folder will now appear in the folder that you imported into.

You can view ACA traces using the ACA viewer off-line on your PC with the **ACA Data Viewer** utility. In order to view the ACA files on your PC with the ATP GUI 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 Teledyne customer support. You can view the ACA traces without a M41d test instrument once you have transferred the files to your PC.

Note: Transferring files must be done on a host PC that is connected remotely to an M42d instrument.

Transferring ACA Data Files

To Transfer a file, use the Navigator interface to select the folder on the remote PC that you wish to transfer to/from. Click the **Transfer** button on the left sidebar. An example below shows a Transfer with the **User** folder selected.



$\ \ $ Data Transfer: ACA Data $\ \ imes$			
Local Files		Instrument Files	
🗸 🖻 User		🗸 🖻 User	
Aux_Channel_Analysis	Conv	ACA_Trace	
🗐 sample	Сору »	SampleACAdata1	
	Move 🎾		
	< Сору		
	« Move		
Rename Delete		Rename Delete	
		CLOSE	

The Data Transfer: ACA Data dialog box will appear, as shown below.

To transfer a capture file from the PC to the Instrument, select the file in the left-hand column labeled **Local Files.** Next, click on a target folder in the righthand column labeled **Instrument Files.** At this point you may either **Copy** the file to the instrument or **Move** it—which removes the file from the local storage on the PC.

The example below shows **copying** the file Aux_Channel_Analysis from the PC onto the Instrument's **User** folder.

Data Transfer: ACA Data		×
Local Files		Instrument Files
🕶 🗁 User		🗸 🗁 User 🧹 📃
Aux_Channel_Analysis		ACA_Trace
🗉 sample	Сору >	SampleACAdata1
	Move ≫ ≪ Copy ≪ Move	■ sample
Rename Delete		Rename Delete
		CLOSE

The result is the Aux_Channel_Analysis file now appearing in the **Instrument Files** column as well, as shown below.

Note: If the **Move>>** transfer option is utilized, the file will not appear in both directories, only the target folder on the instrument, as mentioned earlier, and shown in the next example.

Data Transfer: ACA Data		×
Local Files		Instrument Files
∽ 🖻 User		🗸 🗁 User
Aux_Channel_Analysis		ACA_Trace
💷 sample	Сору 🔈	SampleACAdata1
	Move N	💷 sample
		Aux_Channel_Analysis
	& Copy	
	< Move	
Rename Delete		Rename Delete
		CLOSE

To transfer a file from the Instrument to the Local Host, select a file from the **Instrument Files** column, and a target folder from the **Local Files** column, and click **Copy** or **Move** to transfer. The following example shows the file SampleACAdata1 being **moved** from the Instrument to the PC's user folder.



The result is shown below. Notice the file is no longer contained within the **User** folder of the **Instrument Files**.



Note: If a file in the target folder already has the same name as the file you are attempting to transfer, the **Copy** and **Move** buttons will not be enabled.

7 Passive Monitoring

Passive Monitoring, or Passive Probing, is a licensed feature of the M42d. The M42d allows the user to place the instrument between a DP1.4/2.0 source and a DP1.4/2.0 Sink and monitor the video information passing through the unit using the Protocol Analyzer as well as performing regular and ACA captures. Note that HDCP video content cannot be displayed or captured.

Passive Monitoring enables the user to perform the following functionality:

- Use the Basic Analyzer dashboard to view all the video data passing through in real time
- Use the ACA to perform capture of Aux Channel data
- Perform regular data capture of the data passing through using the Capture Control Protocol Analyzer.

7.1 Connecting a DisplayPort Source and Sink Device Under Test

This procedure describes how to connect a source and a sink device to the M42d for Passive Monitoring. Connections can be made to the M42d via native high quality 8K DP cables (one meter or less) or the USB-C cables provided.

The following procedure will provide for a stable connection. Use the diagram below as a guideline. Note that this diagram shows connections only to the USB-C ports. Alternatively, you can use the DisplayPort connectors up to 10G lane rates. But you must use the same type ports (DP or USB-C) on each side.



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.

To connect your source and sink DUT to the M42d:

- 1. Open the "Real Time" Receiver (Basic Analyzer) window of the embedded ATP (running on the externally connected display connected to the HDMI admin port in back).
- 2. Click on the Passive Monitoring button and ensure it is **Off**. **Note**: You *cannot* do this step from the External ATP Manager running on a PC.



- 3. Connect your source to the M42d Rx port of your choice (either USB-C or DisplayPort) with the appropriate cable to your source device.
- 4. Configure your source device to output a DisplayPort video stream.
- In the case of USB-C cable connections, make sure that the cable connections are correct. The port status LED should be Green and you should see the video on the external display connected to the M42d HDMI admin port. Flip the USB-C cable at the M42d if the status LED is Red.
- 6. Connect a cable to the M42d Tx port with the appropriate cable (DisplayPort or USB-C that you used to connect from your source device) to the display device.
- 7. Configure the M42d to generate a DIsplayPort signal.
- In the case of USB-C cable connections, verify that the cable connections are correct. The port status LED should be Green and you should see the generated video on your Sink display device. Flip the USB-C cable at the M42d if the status LED is Red.
- 9. Once you have verified that the status LED's on the ports are **Green** (Note this LED does not indicate the orientation during Passive Probing)

Enable Passive Probing

You can now enable Passive Probing by turning On Passive Monitoring through the Basic Analyzer window as shown below.



Important Note: In the passive-probing mode, you may need to generate a hot plug by physically disconnecting/connecting <u>only</u> the cable between Source and the M42d Rx port.

The cable between M42d Tx port and Sink must remain connected.

7.2 Passively Viewing Video Data in Real Time

The Basic Analyzer provides real time view of the monitored source video and metadata including status of mainstream attributes, secondary data attributes, link training, Multi-Stream Transport, and HDCP.

Passive Monitoring using the Rx Analyzer real-time viewer is similar to the procedures outlined in **Chapter 4 Source Verification with Basic (Real-time) Analyzer**. Refer to that chapter if necessary for more in-depth coverage of this process.

Accessing Basic Analyzer Features

From the Home screen of the M42d ATP Manager, select the **DisplayPort/USBC 2.0 Protocol Analyzer Rx** app, as shown below.

quantum <mark>data</mark>							
Control		Complian	ce	Edito	ors	0ther	
	<u>.</u>	F			(
Gen	erator	DisplayPort/I Protocol Ar RX	JSBC 2.0 aalyzer	Aux. Channel Analyzer	Captu	ire Control	
Navigator	STATIC:	10.30.196.38	ATP Version:	6.26.24-Alpha	64 bit	Switch to VPS GUI	0

The Analyzer panel appears showing the passed-through video image. The M42d's Basic Analyzer provides periodic video frame captures of the source video, enabling you to view frames of video. This feature provides a basic confidence test to verify that the passed-through video is essentially correct.



Basic Analyzer Dashboard

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

Basic Analyzer – Dashboard Items
Example dashboard of DisplayPort 2.0 Protocol Analyzer Rx in Passive Monitoring mode.
Port: DisplayPort/USBC 2.0 Protocol Analyzer RX DP: Licensed USB-C: Licensed Monitor: HDCP 1.4 LTTPR Emulation: Off Passive Monitor: On (Auto) MEASURED DP Lanes: 4 Bandwidth: 10.00 Active: 720 x 400 V-Total: 449 VRate: 70.1 fps METADATA Res: 720 x 400 Total: 900 x 449 Sync: 108-, 2+ Start: 162, 37 RGB sRGB, VESA 8 bpc Progressive METADATA Sync-Clk: Y Stereo-3D: N Mute: N Vfreq: 28.32 MHz Afreq: 48000 Hz METADATA Pixel Clock: 28.322 MHz DwnSp: off HDCP-Enc: off
Example using USB-C DP-alt mode in Passive Monitoring mode with DSC enabled and active.
Port: DisplayPort/USBC 2.0 Protocol Analyzer RX DP: Licensed USB-C: Licensed Monitor: Unencrypted LTTPR Emulation: Off Passive Monitor: On (Auto) MEASURED USB-C Lanes: 4 Bandwidth: 10.00 Active: OSC x Enabled V-Tota : 1125 VRate: 30.0 fps METADATA RAY 1920 x 1080 Total: 2200 x 1125 Sync: 44+, 5+ Start: 192, 41 na, CEA 8 bpc Progressive METADATA CLk: Y Stereo-3D: N Mute: N Mvid: 74250 Nvid: 810000 Maud: 512 Naud: 16875 METADATA Publ Clock: 74.250 MHz DwnSp: off HDCP-Enc: off
Note: The Source and Sink devices must both be connected to the same type of port (USB-C or DP) for Passive Monitoring to work.
The following items are on the Real Time dashboard:
 Fort Port: DisplayPort/USBC 2.0 Protocol Analyzer RX - The Port area shows the current Rx port that is being displayed on the Basic Analyzer. Currently the only analyzer port is the Video Generator port.
 Second Row Items: Monitor Monitor: HDCP 1.4 - Indicates the HDCP encryption of the monitor. Note: If unencrypted, this will be the indicator: Monitor: Unencrypted LTTPR Emulation LTTPR Emulation: Off - Indicates whether LTTPR emulation is active Passive Monitor Passive Monitor: On (Auto) - Indicates that passive monitoring is enabled.
 Third Row Items: Measured MEASURED DP or MEASURED USB-C - Indicates whether USB-C or DP (DisplayPort) is currently connected. Lanes Lanes: 4 - The number of lanes used during link training. Bandwidth Bandwidth: 13.50 - The link rate (per lane).
 Active (video resolution) Active: 3840 x 2160 - This is the measured video resolution. Note: If DSC is active this will be indicated Active: 010 x 0100 Active. V-Total V-Total: 2250 - This is the measured total vertical video lines per frame. VRate VRate: 60.0 fps - This is the measured vertical frame rate
 Fourth Row Items: Res Res: 3840 × 2160 - The active video resolution in horizontal pixels and vertical lines determined from the main stream attributes. Total Total: 4400 × 2250 - The total video in horizontal pixels and vertical lines determined from the main stream attributes.

Basic Analyzer – Dashboard Items	
• Sync Sync: 88+, 10+ - Horizontal sync pulse width (in pixels) and polarity, followed by vertical sync	
pulse width (in lines) and polarity. (e.g. Hsync 88 pixels, positive; Vsync 10 lines, positive)	
Start Start: 384, 82 - The starting pixel and line in the active video determined from the main stress	am
attributes.	
Colorimetry and bit depth RGB sRGB, CEA 8 bpc - The colorimetry and bit depth determined from	n
the main stream attributes.	
Scan Progressive - The scan type used, progressive (e.g. Prog) or interlaced (Inter) determined from	n
the main stream attributes.	
Fifth Row Items:	
Sync-Clk Sync-Clk: Y - Indicates if the Link Clock and Main Video Stream clock are asynchronous of	or
synchronous. A value of N means async; a value of Y means synchronous. This value is determined by t	the
main stream attributes.	
Stereo-3D Stereo-3D: N - The status of 3D audio determined from the main stream attributes.	
 Mute Mute: N - The AudioMute flag status determined from the main stream attributes. 	
 Vfreq Vfreq: 594.00 MHz - Video frequency determined from the main stream attributes. 	
 Afreq Afreq: 48000 Hz - Audio frequency determined from the main stream attributes. 	
Sixth Row Items:	
Pixel Clock Pixel Clock: 594.000 MHz - How often pixels occur (frame rate x pixels per frame)	
DwnSp: off - DownSpread indicates whether Spread Spectrum Clocking (SSC) is enabled	
HDCP-Enc HDCP-Enc: off – Indicates if HDCP encryption is currently active	

For a more in-depth look at the Rx Analyzer, see section **Chapter 4 Source Verification with Basic (Real-time) Analyzer**. Real-time analysis with the Basic Analyzer is functionally similar to these procedures while in Passive mode.

7.3 Passively Monitoring ACA Transactions

The Auxiliary Channel Analyzer **(ACA)** utilities enable you to view the DDC and aux channel traffic for passively monitored DisplayPort streams in real time. For DisplayPort, you can view the HDCP authentication transactions, EDID exchanges, Link Training transactions, side band messages, Multi-Stream Transport negotiations, etc. in real time with the ACA utility.

In **Passive Monitor** mode, you can view the transactions between the connected DP source device and a connected DP display device.

Passively Monitoring the Auxiliary Channel Transactions

To passively monitor the Aux Channel transactions:

1. Access the Aux Channel Analyzer, as demonstrated below.



2. Specify which DP events you wish to passively monitor using the **EVENTS** button in the control menu, as shown below.



The ACA Event Selection dialog box will appear, as shown below.

ACA Event Selection	×
All Events No Events Unselect All Eve	ents on Port
DP-T10: DP/USBC 2.0 Generator TX	DisplayPort/USBC 2.0 Generator TX
DP-R12: DP/USBC 2.0 PA RX RX	→ Hot-Plua
DPUSBC-T11: DP 2.0 USB-C TX OUT	🗆 Preamble Count
DPUSBC-R13: DP 2.0 USB-C RX IN	 PHY Wake Native HDCP Link-Train Other Native I2C EDID DDC/CI Other I2C Side-Band Message MST Transaction HDCP 2.3 Message
	CLOSE

3. Select the ports and events you wish to monitor. Refer to the table below for options.

Note: In Passive Monitoring, you will only want to monitor transactions on the DP 2.0/USB-C Tx Out and Rx In (bottom two ports listed), *not* the Generator or PA Rx (top two ports listed).

All Events	Select all events on all ports
No Events	Deselect all events on all ports
Unselect All Events on Port	Deselect all events only on the selected port
DP-T10: DP/USBC 2.0 Generator TX	Select events on the M42d's Generator simulated Tx port (not used in Passive Monitoring)
DP-R12: DP/USBC 2.0 PA RX RX	Select events on the M42d's Protocol Analyzer simulated Rx port (not used in Passive Monitoring)
DPUSBC-T11: DP 2.0 USB-C TX OUT	Select events on the connected DP or USB-C Tx port
DPUSBC-R13: DP 2.0 USB-C RX IN	Select events on the connected DP or USB-C Rx port

4. Specify which DP events you wish to passively monitor. You can select **All Events** of any set of individual events. In the following example, the user has selected All Events (on all ports), which is the default selection.

Important Note: You can filter and search through the ACA traces after the data collection has completed, as well. Procedures for searching and sorting are provided in **6.4 ACA Data Viewer**.

In this example, the user has selected to passively monitor only DP events on the DP/USB-C Tx Out port.



- 5. Select the **Start** button on the ACA Control Menu at the top to initiate passive monitoring of the passedthrough Aux Chan transactions.
- 6. Take the necessary action—such as a hot plug—to initiate EDID, HDCP or Link Training transactions between the connected source and sink devices. You will see the passed-through Aux Chan transactions in the ACA panel as shown below.

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 Control Menu.

DIS	CONNECT	S		Options Scroll-lock C	lea	r Save -			Þ
🕨 To	otal Events:	120							
11	DNAT	13	+01:35:30.789379	> R:200 SINK_COUNT L=8	٢	Start Time: +01:35:31.837596			^
12	DPPRE	11	+01:35:30.789453	Precharge/Sync Count: 32		Type: Native			
13	DNAT	11	+01:35:30.789453	< ACK 41 00 77 77 05 03		Direction: Reply			
14	DPPRE	13	+01:35:30.789453	Precharge/Sync Count: 32		Command: ACK			_
15	DNAT	13	+01:35:30.789453	< ACK 41 00 77 77 05 03	8	Reply to Read Request.			-
16	DPPRE	11	+01:35:31.837521	Precharge/Sync Count: 32		00200 · STNK COUNT			
17	DNAT	11	+01:35:31.837521	> R:200 SINK_COUNT L=8		Bit Name	Value	Description	
18	DPPRE	13	+01:35:31.837522	Precharge/Sync Count: 32					
19	DNAT	13	+01:35:31.837522	> R:200 SINK_COUNT L=8		SINK_COUNT	1	Bits 7 + 5:0	
20	DPPRE	13	+01:35:31.837595	Precharge/Sync Count: 32		6 CP_READY	Y(1)		
21	DNAT	13	+01:35:31.837595	< ACK 41 00 77 77 05 03		00201. DEVICE CERVICE TRO VECTOR			
22	DPPRE	11	+01:35:31.837596	Precharge/Sync Count: 32		Bit Name	Value	Description	
23	DNAT	11	+01:35:31.837596	< ACK 41 00 77 77 05 03					_
24	DPPRE	11	+01:35:34.907211	Precharge/Sync Count: 32		0 REMOTE_CONTROL_COMMAND_PENDING	N(0)		
25	DNAT	11	+01:35:34.907211	> R:200 SINK_COUNT L=8		1 AUTOMATED_TEST_REQUEST	N(0)		
26	DPPRE	13	+01:35:34.907211	Precharge/Sync Count: 32		2 CP_IRQ	N(0)		
27	DNAT	13	+01:35:34.907211	> R:200 SINK_COUNT L=8		3 MCCS_IRQ	N(0)		
28	DPPRE	11	+01:35:34.907285	Precharge/Sync Count: 32		5 UP REO MSG RDY	N(0)		
29	DNAT	11	+01:35:34.907285	< ACK 41 00 77 77 05 03		6 SINK SPECIFIC IRQ	N(0)		
30	DPPRE	13	+01:35:34.907285	Precharge/Sync Count: 32		7 – – – –	0	Reserved	
31	DNAT	13	+01:35:34.907285	< ACK 41 00 77 77 05 03					
32	DPPRE	11	+01:35:35.918054	Precharge/Sync Count: 32		00202: LANE0_1_STATUS:			
33	DNAT	11	+01:35:35.918054	> R:200 SINK_COUNT L=8		Bit Name	Value	Description	
34	DPPRE	13	+01:35:35.918055	Precharge/Sync Count: 32		0 LANEO CR DONE	Y(1)		
35	DNAT	13	+01:35:35.918055	> R:200 SINK_COUNT L=8		1 LANEO CHANNEL EQ DONE	Y(1)		
36	DPPRE	11	+01:35:35.918128	Precharge/Sync Count: 32		2 LANEO SYMBOL LOCKED	Y(1)		~
					•	✓ ≥ 23: < ACK 41 00 77 77 05 03 0	0 00		

Section 6.3 breaks down the ACA Window in more detail. It is very similar to the ACA Data viewer utility, which is also be covered.

7. Once you have finished running the trace, click on **Save to Instrument**. A dialog box appears (below). Enter a name and then click on **OK**.

Save As	Ş
Instrument Files	
∽ 🖾 User	
Aux Channel Analysis	
New Rename Delete	
Path: /User	
Name: Passively Monitored ACA	
OK CANCEL	

Please note:

- In order to use the ACA Data Viewer utility (Section 6.4) on your PC to view the traces or the ACA viewer on the ATP GUI Manager running on the external display with the powerful searching and filtering features, you must save the file, as shown in the previous step.
- If you are working on the Aux Channel Analyzer viewer but prefer to use ACA Data Viewer on the external ATP GUI Manager, you will have to transfer the saved file to your PC using the ATP GUI Manager running on the external display. This is covered in 6.5 Importing, Exporting, and Transferring ACA Data.

ACA Window and Panel Description

The ACA Window will display the trace details from the data collection executed in the previous section. An example of a populated ACA window is below. Note the top toolbar remains unchanged from when first opening the Aux Channel Analyzer.

	DISCONNECT	s	TART PAUSE Eve	nts Options Scroll-lock Clear	Sa	ve 🔻	P
	Total Events:	136					
1	1 DNAT	13	+01:35:30.789379	> R:200 SINK COUNT L=8	•	Start Time: +01:35:31.837596	^
1	2 DPPRE	11	+01:35:30.789453	Precharge/Sync Count: 32		Type: Native	
1	3 DNAT	11	+01:35:30.789453	< ACK 41 00 77 77 05 03 00 00		Direction: Reply	
1	4 DPPRE	13	+01:35:30.789453	Precharge/Sync Count: 32		Command: ACK	
1	5 DNAT	13	+01:35:30.789453	< ACK 41 00 77 77 05 03 00 00	۲	Reply to Read Request.	4
1	6 DPPRE	11	+01:35:31.837521	Precharge/Sync Count: 32		00200 · STNK COINT	
1	7 DNAT	11	+01:35:31.837521	> R:200 SINK_COUNT L=8		Bit Name Value Description	
1	8 DPPRE	13	+01:35:31.837522	Precharge/Sync Count: 32			
1	9 DNAT	13	+01:35:31.837522	> R:200 SINK_COUNT L=8		SINK_COUNT 1 Bits 7 + 5:0	
2	0 DPPRE	13	+01:35:31.837595	Precharge/Sync Count: 32	_	6 CP_READY Y(1)	
2	1 DNAT	13	+01:35:31.837595	< ACK 41 00 77 77 05 03 00 00	_	00201 · DEVICE SERVICE TRO VECTOR	
2	2 DPPRE	11	+01:35:31.837596	Precharge/Sync Count: 32	- 1	Bit Name Value Description	
2	3 DNAT	11	+01:35:31.837596	<pre>< ACK 41 00 77 77 05 03 00 00</pre>	- 1		
2	4 DPPRE	11	+01:35:34.907211	Precharge/Sync Count: 32	- 1	0 REMOTE_CONTROL_COMMAND_PENDING N(0)	
2	5 DNAT	11	+01:35:34.907211	> R:200 SINK_COUNT L=8	- 1	1 AUTOMATED_TEST_REQUEST N(0)	
2	6 DPPRE	13	+01:35:34.907211	Precharge/Sync Count: 32	- 1	2 CP_IRQ N(0) 3 MCCS TRO N(0)	
2	7 DNAT	13	+01:35:34.907211	> R:200 SINK_COUNT L=8	- 1	4 DOWN REP MSG RDY N(0)	
2	8 DPPRE	11	+01:35:34.907285	Precharge/Sync Count: 32	- 1	5 UP REQ MSG RDY N(0)	
2	9 DNAT	11	+01:35:34.907285	< ACK 41 00 77 77 05 03 00 00	- 1	6 SINK_SPECIFIC_IRQ N(0)	
3	0 DPPRE	13	+01:35:34.907285	Precharge/Sync Count: 32	- 1	7 0 Reserved	
3	1 DNAT	13	+01:35:34.907285	< ACK 41 00 77 77 05 03 00 00	- 1		
3	2 DPPRE	11	+01:35:35.918054	Precharge/Sync Count: 32	- 1	Bit Name Value Description	
3	3 DNAT	11	+01:35:35.918054	> R:200 SINK_COUNT L=8	- 1		
3	4 DPPRE	13	+01:35:35.918055	Precharge/Sync Count: 32	- 1	0 LANE0_CR_DONE Y(1)	
3	5 DNAT	13	+01:35:35.918055	> R:200 SINK_COUNT L=8	- 1	1 LANE0_CHANNEL_EQ_DONE Y(1)	
3	6 DPPRE	11	+01:35:35.918128	Precharge/Sync Count: 32		2 LANEO_SYMBOL_LOCKED Y(1)	
3	7 DNAT	11	+01:35:35.918128	< ACK 41 00 77 77 05 03 00 00	- 1	4 LANEL CR DONE Y(1)	
3	8 DPPRE	13	+01:35:35.918128	Precharge/Sync Count: 32	G	23. < ACK 41 00 77 77 05 03 00 00	¥
						23. ACK 41 00 // // 05 05 00 00	

You can access the **Options** dialog box using the top Control menu. Options menu items are described in the following table:



The **ACA Trace Panel** displays each event in a row with some information. This information is expanded in the ACA Event Details panel which will be covered next. An example of the ACA Trace Panel is below. The numbered arrows correspond to the descriptions immediately following the screenshot.

• T	otal Events:	112		
81	DNAT	DPUSBC-T11	+00:00:20.369114	> R:200 SINK_COUNT L=8
	DPPRE	DPUSBC-R13	+00:00:20.369115	Precharge/Sync Count: 32
1	DNAT	DPUSBC-R13	+00:00:20.369115	> R:200 SINK_COUNT L=8
-	D	DPUSBC-T11	+00:00:20.369188	Precharge/Sync Count: 32
	2	DPUSBC-T11	+00:00:20.369188	< ACK 41 00 77 77 05 03 00 00
86	p L	DPTCPC-R13	+00:00:20.369188	Precharge/Sync Count: 32
87		DP 2 -R13	+00:00:20.369188	< ACK 41 00 77 77 05 03 00 00
88	DPPRE	DP -T11	+00:00:20.480915	Precharge/Sync Count: 32
89	DNAT	DPL C-T11	+00:00:20.480915	> R:200 SINK_COUNT L=8
90	DPPRE	DPUSBC-R13	+00:00 480915	Precharge/Sync Count: 32
91	DNAT	DPUSBC-R13	+00:00 4 480915	> R:200 SINK_COUNT L=8
92	DPPRE	DPUSBC-T11	+00:00 180989	Precharge/Sync Count: 32
93	DNAT	DPUSBC-T11	+00:00 480989	< AC
94	DPPRE	DPUSBC-R13	+00:00:20.480989	Prec 5 e/Sync Count: 32
95	DNAT	DPUSBC-R13	+00:00:20.480989	< 🗚 00 77 77 05 03 00 00
96	DPPRE	DPUSBC-T11	+00:00:24.481999	Prech ge/Sync Count: 32
97	DNAT	DPUSBC-T11	+00:00:24.481999	> R:200 SINK_COUNT L=8
98	DPPRE	DPUSBC-R13	+00:00:24.481999	Precharge/Sync Count: 32
99	DNAT	DPUSBC-R13	+00:00:24.481999	> R:200 SINK_COUNT L=8
100	DPPRE	DPUSBC-T11	+00:00:24.482073	Precharge/Sync Count: 32
101	DNAT	DPUSBC-T11	+00:00:24.482073	< ACK 41 00 77 77 05 03 00 00
102	DPPRE	DPUSBC-R13	+00:00:24.482073	Precharge/Sync Count: 32
103	DNAT	DPUSBC-R13	+00:00:24.482073	< ACK 41 00 77 77 05 03 00 00
104	DPPRE	DPUSBC-T11	+00:00:24.576825	Precharge/Sync Count: 32
105	DNAT	DPUSBC-T11	+00:00:24.576825	> R:200 SINK_COUNT L=8
106	DPPRE	DPUSBC-R13	+00:00:24.576825	Precharge/Sync Count: 32

- 1. Item number This is a unique sequence number of the transaction.
- 2. **Type** The type of Aux Chan transaction; either EDID, HDCP DPLT (Link Training), DNAT (DP native Aux transactions), etc.
- 3. Port Name and Number Port Name is an optional viewing field. Port Number will always be displayed.
- 4. **Time stamp** (optional viewing field) Shows the timestamp of each transaction. Can either be absolute time based (shown) on the M41d system clock or relative time (Time-deltas) referenced from the initial transaction in the trace.
- 5. Transaction Description A brief description of the transaction.

The **ACA Event Details Panel** will display the details of the selected transaction within the trace panel, as shown below. This screenshot is of details for a Link Training transaction.



The following list describes the information that is provided in the ACA Event Details dialog box.

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

• **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 There are various types of data that can be monitored on the DisplayPort interfaces: EDID, HDCP and DP specific data types related to Link Training, side band messaging, Multi-Stream Transport transactions, native transactions, etc.
- **Direction** The direction of the transaction either a request or a reply.
- **Command** The type of Command being issued
- Address The register address of the transaction
- 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, as shown below.

The left and right arrows allow you to navigate to the immediately previous or following transaction.

The Status Field to the right shows the sequence number and the description of the selected transaction.



7.4 Passively Analyzing Video Data using Capture Control

The Capture Control utility allows the user to capture and store passed-through data of the main link protocol, video, and metadata—including main stream attributes and secondary data—from a passively monitored DP connection.

Use the following procedure to capture passively monitored video data using the Capture Control utility.

Verifying Source Video

Before you capture passively monitored video data, you should verify that you are properly receiving the passed-through DisplayPort video from the source.

Verify the incoming video of the DisplayPort source to ensure that the source is outputting the proper video. In the screen example below the video shown is a test pattern. Typically, the video you will see will be from a PC or some other source device. Verify the information in the top status bar, and that **Passive Monitor** is on, as shown below.



Capture Control Panel

Access the **Capture Control** app from the Home Screen of the ATP Manager interface.

You initiate a new capture of passively monitored data through the Capture Control panel. The Capture Control panel enables you to setup the capture parameters. The figure below shows the Capture Control panel and its control and selection items.

Capture Control		_		×
Capture Port Select Quantum D	ata, Inc. DP2.0 protocol analyzer: Po	ort 12 (10.30.196.38)		
Data	Raw (10bit)	Raw (UHB	R)	
Buffer Size:			61	4.40 MB
4.000% <				>
Trigger Position (TP) wi	thin the Buffer:			0.00 MB
0.000% <				>
Trigger Mode: Any Rate	 Non-UHBR Only 			
Start of vertical blanking (S	ST) or SR/LLCPM symbol (MS	T) -		
Trigger Count: 1				
Extract Video Frame	s: 🔵 off			
Decompress DSC Frame	s: 💷			
Capture AUX (ACA) Transaction	s: 🕜			
	START CAPTURE			
			CLO	SE

The following table describes the functions of the Capture Control panel, specifically the Data tab:

Capture Control Panel - Function	Item - Description
Buffer Size	 Enables you to set the size of the captured data in percent. This is a slidebar that provides an indication (on the left) of the percent of the total possible size to be captured. A lower value will require less time for the captured data to accumulate.
Trigger Position within Buffer	 Enables you to set the position of the trigger event within the captured data. This slidebar determines how much of the data that has accumulated in the capture buffer has occurred before the trigger

Capture Control Panel - Function	Item - Description
	 event. The slidebar has an indication (on the left) of the location of the trigger event within the captured data. The value is expressed as a percent. A value of 0% indicates that the trigger event occurs at the beginning of the resulting captured data and 100% indicates that the trigger event occurs at the end of the resulting captured data. A value of 50% indicates that the trigger event is in the middle of the captured data. Note: The Buffer Position Slidebar is not applicable when you select Vsync as the trigger condition.
Trigger Mode	 Enables you to specify the type of data that you want to capture. Note: This is covered in greater detail later in this section
Trigger Count	 Option to specify which occurrence of the selected trigger event will initiate capture eg. a Trigger Count of 5 will start capture at the 5th occurrence of the trigger event
Extract Video Frames	Enables you to view the video frames that were captured.
Decompress DSC Frames	 Makes video frames viewable if DSC mode is enabled Extract Video Frames toggle must be enabled for this option to be active
Capture AUX (ACA) Transactions	Enables you to capture the Aux Channel transactions
Start Capture (Capture Tab)	Initiates a capture using the criteria defined in the Trigger Mode and Trigger Symbol .

The **Trigger Mode** drop down selection allows you to pick the specific event occurrence that will initiate the capture. You may use the radio buttons to select a trigger at **Any Rate** or **Non-UHBR Only**

With the **Any Rate** radio button selected, a set of options is selectable from the drop-down menu beneath it, as shown below and described in the following table:

Any Rate Trigger Mode Drop Down Menu	Trigger Options
Trigger Mode: * Any Rate ONON-UHBR Only Start of vertical blanking (SST) or SR/LLCPM symbol (MST) Start of vertical blanking (SST) or SR/LLCPM symbol (MST) SDP Type Received SDP Type Not Received VB-ID Received VB-ID Not Received AUX Read or Write (Only Writes in Passive Mode) Start of TPS2 as indicated by DPCD 0x00102 Exit from TPS2 as indicated by DPCD 0x00102 Start of HDCP 2.2 (N/A in Passive Mode) Exit from HDCP 2.2 (N/A in Passive Mode)	 Start of vertical blanking (SST) or SR/LLCPM symbol (Multi-Stream Transport) SDP Type Received SDP Type Not Received VB-ID Received VB-ID Not Received AUX Read or Write (Only Writes in Passive Mode) Start of TPS2 as indicated by DPCD 0x00102 Exit from TPS2 as indicated by DPCD 0x00102 Start of HDCP 2.2 (N/A in Passive Mode) Exit from HDCP 2.2 (N/A in Passive Mode)

When selecting **Non-UHBR Only** Trigger, another set of options is selectable from the drop-down menu beneath it. A few of these triggers require you to select the lane for the trigger to occur on, as shown and described in the table below.

Non-UHBR Only Trigger Mode Drop Down	Trigger Options	
Trigger Mode: O Any Rate Non-UHBR Only	If Specified Symbol is selected then select one of:	
Specified Symbol 👻	BS=Blanking Start	
Trigger Count: 1	BE=Blanking End	
Trigger On Lanes: 1 2 3 4	BF=Blanking Fill	
Trigger Symbol: #1: BS - BE	C0-C7=VC Payload Fill Control code sequence	
AVF BE BF	CP=Content Protection	
BS C0 C1	FE=Fill End, FS=Fill Start	
C2 C3 C4	• R0-2	
C5 C6 C7	SE=Secondary Data End	
CP CPF EOC	SR=Scrambler Reset	
FE FS LLCPM	20. Ocean dans Data Otart	
PM R2 SE	SS=Secondary Data Start	
SF SR SS	Other	
VCPF Other		

Specified Symbol	Data Byte Value
Data Byte Value	8B10B Symbol Error
8B10B Symbol Error	8B10B Disparity Error
8B10B Disparity Error	 Start of TPS3 as indicated by DPCD 0x00102
Start of TPS3 as indicated by DPCD 0x00102	
Exit from TPS3 as indicated by DPCD 0x00102	Exit from TPS3 as indicated by DPCD 0x00102
Start of TPS4 as indicated by DPCD 0x00102	Start of TPS4 as indicated by DPCD 0x00102
Exit from TPS4 as indicated by DPCD 0x00102	Exit from TPS4 as indicated by DPCD 0x00102
Start of HDCP 1.3 (N/A in Passive Mode)	Start of HDCP 1.3 (N/A in Passive Mode)
Exit from HDCP 1.3 (N/A in Passive Mode)	Exit from HDCP 1.3 (N/A in Passive Mode)
FEC Decode Enable Sequence	FFO Danada Frankla Osmunana
FEC Decode Disable Sequence	FEC Decode Enable Sequence
ML_PHY_STANDBY sequence detected on the main link	FEC Decode Disable Sequence
ML_PHY_SLEEP sequence detected on the main link	 ML_PHY_STANDBY detected on main link
AUX_PHY_WAKE sequence detected on the AUX channel	ML_PHY_SLEEP detected on main link
	AUX_PHY_WAKE detected on AUX channel

The next subsection will describe the procedures for passively capturing and viewing data using **Capture Control**.

Capturing Passed-through Displayport Video Data

1. Access the **Capture Control** application from the ATP Manager home screen.

The Capture Control window opens as shown below.

Capture Control		- [×
Capture Port Select Quan	tum Data, Inc. DP2.0 protocol analyzer: Por	t 12 (10.30.196.38)	
Data	Raw (10bit)	Raw (UHBR)	
Buffer Size:			614.40 MB
4.000% <			>
Trigger Position (TP)	within the Buffer:		0.00 MB
0.000% <			>
Trigger Mode: Any F	Rate ONON-UHBR Only		
Start of vertical blankin	g (SST) or SR/LLCPM symbol (MST	·) -	
Trigger Count: 1			
Extract Video Fra	ames: 🕜		
Decompress DSC Fra	ames: 📴		
Capture AUX (ACA) Transac	tions: 🖉		
	START CAPTURE		
		С	LOSE

- 2. Select the port using the **Select** activation button as shown below.
- 3. Specify the **Buffer Size** and **Trigger Position**, **Mode**, and **Count** in accordance with the information provided earlier in this chapter.
- 4. Toggle on or off the options to Extract Video Frames, Decompress DSC (if applicable), and Capture AUX (ACA) Transactions.
- 5. Initiate the capture by clicking on the **Start Capture** activation button **START CAPTURE**

You will be prompted with a **New Capture** dialog box (below) given you an opportunity to assign a name to the capture file.

New Capture	\times					
Capture Name						
Enter a name for the capture:						
DP_Capture_1						

6. Enter a name in the space provided in the New Capture dialog box.

Click **OK** to begin the capture process. A progress bar will appear, as shown below.

If the capture trigger event does not occur, you may click the **MANUAL TRIGGER** or **STOP AND SAVE DATA** buttons. They are described below. You can also **CANCEL** the capture at any time.

- Manual Trigger If the trigger event does not occur as expected, or if you are viewing the video display in real time and you notice an occurrence that you would like to capture the data of, manually initiate a capture with the previously set specifications at this point.
- Stop and Save Data If the capture is not triggered as expected, you can essentially cancel the capture and keep the raw data for later analysis.

DP Capture
Capturing.
Waiting for the capture trigger event to occur
MANUAL TRIGGER STOP AND SAVE DATA CANCEL

Once the capture trigger event has occurred, the data will be decoded and saved for viewing. An example of the progress bar while this occurs is below.

DP Capture						
Decoding the data						
85% processed.						
MANUAL TRIGGER	STOP AND SAVE DATA	CANCEL				

M42d Video Analyzer/Generator - User Guide

DP Capture Viewer					_		×
Events/Data Frames 06_09_2021_17_14_43 [Segment 1 of 3]		Open	Oper	n VC	VC V	iewer	ACA
Open Segment Rows Events Find Time: HH:MM:SS.ms.us.ns(.ps) -							
⑦ ④ ④ Q Q Marker 1: □ <	Find	Goto	MTI		(OF)		
12878656 (0:0:0.015.899.575.309)	Tind	0010	125	81498	1		
	Offset		0 11	12	13		
	-	12 0	0 00	00	00		
Data	-	11 0	0 00	00	00		
	-	10 0	0 00	00	00		8
CSB		-9 0	0 00	00	00		
		-8 0	0 00	00	00		
Errors		-7 0	0 00	00	00		
		-6 0	0 00	00	00		
Markers		-5 0	0 00	00	00		
4935141 8246265 11557390 14868515 18179640		-4 0	0 00	00	00		
Link Clock #	_	-3 0	0 00	00	00		
# Link Clock # TimeStamp BS	•	-2 0	0 00	00	00		
368932 12766377 0:0.015.760.959.259		-1 0	0 00	00	00		
368933 12766378 0:0:0.015.760.960.494		+1 0	0 00	00	00	1	
368934 12792226 0:0:0.015.792.871.605		+2 0	0 00	00	00		
368935 12/92227 0:0:0.015.792.872.840		+3 0	0 00	00	00		
368936 12/92228 0:0:0.015.792.874.074		+4 0	0 00	00	00		
368938 12792230 0.0.0 015 792 876 543		+5 0	0 00	00	00		
368939 12817854 0:0:0.015.824.511.111		+6 0	0 00	00	00		
368940 12817855 0:0:0.015.824.512.346	,	+7 0	0 00	00	00		
368941 12817856 0:0:0.015.824.513.580		+8 0	0 00	00	00		
368942 12817857 0:0:0.015.824.514.815		+9 0	0 00	00	00		
368943 12817858 0:0:0.015.824.516.049	+	10 0	0 00	00	00		
368944 12823797 0:0:0.015.831.848.148	+	11 0	0 00	00	00		
368945 12823798 0:0:0.015.831.849.383	+	12 0	0 00	00	00		
							•
						CLOS	E

When the capture is complete, the data is presented in the DP Capture Viewer. An example of the captured data is shown in the screen shot example below.

The Capture Viewer and its features/functionality are covered in much detail in sections 6.4 Capture Viewer Panels (covers the Event Plot, Data Decode/Details, and Link Symbol panels) and 6.5 Searching and Filtering for Specific Data Elements (searching for events or symbols, and filtering using the functions within the Capture Viewer).

8 LTTPR Testing

All LTTPR testing features are licensed. More information about licenses can be found in **Appendix A**. **Licenses**.

8.1 Overview

The M42d supports the testing of LTTPR-capable source devices and also provides link layer transaction data for LTTPR devices and a DPRx sink.

Two revisions of LTTPR are supported, revisions 14h and 20h. Revision 14h is for non-transparent mode or transparent mode for LTTPR in an 8b/10b network. Revision 20h is used when testing LTTPRs in non-transparent mode in UHBR networks.

While testing a source device in the non-transparent mode, each LTTPR is trained in the link. This ensures better signal quality to the end-to-end link. When testing an LTTPR-capable source device, the M42d can emulate a network of up to 8 LTTPR devices and a DPRx (sink).

The M42d can also generate video to LTTPR device(s) as a DPTx (source).

8.2 LTTPR Emulation for Testing Source Devices

The tool you will use for LTTPR emulation is located within the **Protocol Analyzer Rx** interface, accessible from the Home screen of the M42d's embedded ATP Manager GUI.

To access the LTTPR utility, click the **Tools** icon in the control menu on the right-hand side of the Receiver. This will display the **Tools** dialog box. Click the **LTTPR** tab on the left sidebar to access the utility, as demonstrated below.



The LTTPR emulation tool appears as shown above. Using this tool, you can emulate up to eight LTTPR devices. This tool offers options for configuring the emulated LTTPR, and more configurations are available within the DPCD Editor, which is covered in the next section.

To emulate LTTPR for testing a source device, first select the version of LTTPR according to your testing specification, as shown below.



Notice that with version 14h selected, the adjustable UHBR options within the LTTPR tool for do not apply to non-UHBR emulation. These are enabled with version 20h in UHBR mode, as shown below.

Tools	×
Link Status	Emulated LTTPD Version
LTTPR	Revision 14h Revision 20h
MST	
Hot-plug	Emulated UHBR EO INTERLANE ALIGN DONE Delay (1 - 4095 ms)
HDCP	[Note: Delay timer starts when DPCD 204h, bit 0 is set by emulated LTTPR closest to Tx]
ALPM	
eDP	
USB-C	Emulated UHBR CDS_INTERLANE_ALIGN_DONE Delay (1 - 4095 ms)
Error Info	[Note: Delay timer starts when Tx sets DPCD 102h = 0x3]
Backlight	🔶 5 🗭
SPDIF / Trigger	Emulated UHBR EQ DONE per LTTPR
	[Note: Value 0 means DPCD F0008h will be set based on configured LTTPR.
	Value (1-FF) to override DPCD F0008h return value.]
	0
	Emulated ITTPD Count
	Off
	1 2 3 4 5 6 7 8
	CLOSE

If emulating LTTPR version 20h (non-transparent LTTPR), modify the values of the adjustable fields in accordance with your testing specifications.

For example, in the screenshot below, the source device will read that the emulated LTTPR8 is not set due to the user-configured override value of 7F in the bottom-most field.

Tools	\times							
Link Status	Emulated LTTPP Version							
LTTPR	Pevision 14h Pevision 20h							
MST	Revision Fin Revision 201							
Hot-plug	Emulated UHBR EO INTERLANE ALIGN DONE Delay (1 - 4095 ms)							
HDCP	[Note: Delay timer starts when DPCD 204h, bit 0 is set by emulated LTTPR closest to Tx]							
ALPM	◆ 20 ◆							
eDP								
USB-C	Emulated UHBR CDS_INTERLANE_ALIGN_DONE Delay (1 - 4095 ms)							
Error Info	[Note: Delay timer starts when Tx sets DPCD 102h = 0x3]							
Backlight	🗢 5 🇭							
SPDIF / Trigger	Emulated UHBR EQ DONE per LTTPR							
	[Note: Value 0 means DPCD F0008h will be set based on configured LTTPR.							
	Emulated LTTPR Count							
	Off							
	1 2 3 4 5 6 7 8							
	CLOSE							

Note: Any adjustments to these settings must be done with the **Emulated TPPR Count** set to **Off**. Once an LTTPR count has been set, the M42d begins emulating LTTPR and the settings cannot be changed without again turning emulation off.

Once you have adjusted these fields per your testing requirements, select the number of LTTPR devices you wish to emulate. The following example has selected an LTTPR count of 4.

Tools	\times
Link Status	Emulated LTTDD Version
LTTPR	Revision 14h Revision 20h
MST	
Hot-plug	Emulated LIHER FO INTERLANE ALIGN DONE Delay (1 - 4095 ms)
HDCP	[Note: Delay timer starts when DPCD 204h, bit 0 is set by emulated LTTPR closest to Tx]
ALPM	4 1 4
eDP	
USB-C	Emulated UHBR CDS_INTERLANE_ALIGN_DONE Delay (1 - 4095 ms)
Error Info	[Note: Delay timer starts when Tx sets DPCD 102h = 0x3]
Backlight	
SPDIF / Trigger	Emulated UHBR EQ DONE per LTTPR
	[Note: Value 0 means DPCD F0008h will be set based on configured LTTPR.
	Emulated LTTPR Count
	Off
	1 2 3 4 7 8
	CLOSE

As mentioned previously, notice that the adjustable fields are now disabled, as emulation has begun.

In order to re-enable adjustment of these fields and re-activate LTTPR:

1. Turn off emulation by clicking the **Off** button.



- 2. Make adjustments to desired fields in LTTPR Tool
- 3. Re-enable LTTPR emulation by selecting desired LTTPR Count.



8.3 Modifying LTTPR Capability Registers

Once the M42d has begun LTTPR emulation, you can modify the DPCD of the emulated Rx LTTPR device to further meet your testing specifications. To do this, access the **DPCD Editor** utility within the **Editors** tab of the Home screen, as shown below.

quantum data						
Control	Compliance	Editors	Other			
EDID Editor	CDS Editor	Format Editor	Format List Editor			

This takes you to the **DPCD Editor**. From there, navigate to the **LTTPR** tab on the left-hand sidebar, as demonstrated below.

DPCD Edito	E			Close	Naviga	tor Ho	me Back
Base	F0000h LTTPR_FIELD_DATA_STRUCTURE_REV	New Open Save			Read RX	Write RX	Read TX
DSC	F0001h 8b/10b_MAX_LINK_RATE_PHY_REPEATER		<pre><no file="" name=""> DisplayPort/USBC 2.0 Protocol Analyzer RX</no></pre>	(RX)			
PR	F0002h PHY_REPEATER_CNT		LTTPR_FIELD_DATA_STRUCTURE	REV			
Sink	FOODSN PHY_REPEATER_MODE		F0000h	2012			
Branch	F0005b PHY REPEATER EXTENDED WAKE TIMEOUT	Bit Field Name	Field Value				
eDP	F0006h MAIN LINK CHANNEL CODING PHY REPEATER	7-4 Major Revision	0				
Ext	F00071 PHY_REPEATER_1288/1328_RATES	3-0 Minor Revision	0				
LTTPR							
LTTPR1							
LTTPR2							
LTTPR3							
LTTPR4							
LTTPR5							
LTTPR6							
LTTPR7							
LTTPR8							
		Bytes:					
		00					
			Read Page W	rite Page			
The window displays tabs for each LTTPR Capability Register that can be changed. To display the registers for the current Rx being emulated by the M42d, click **Read Rx** in the top right corner of the window. A loading bar will appear while the Rx DPCD is read, as shown below.

Note: The LTTPR emulation demonstrated in the previous section *must be enabled* for the registers to correctly to populate field values other than zero. LTTPR off will display zero for all field values.

		Close Navigator Home Back									
F0000h LTTPR_FIELD_DATA_STRUCTURE_REV	New Open Save	Read RX Write RX Read TX									
F0001h 8b/10b_MAX_LINK_RATE_PHY_REPEATER F0002h PHY_REPEATER_CNT F0003h PHY_REPEATER_MODE	<pre></pre>										
F0004h MAX_LANE_COUNT_PHY_REPEATER	Bit Field Name Field Value										
F0005h PHY_REPEATER_EXTENDED_WAKE_TIMEOUT F0006h MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4 Major Revision 0										
F0007h PHY_REPEATER_128B/132B_RATES	3-0 Minor Revision 0										
	DPCD Editor Reading DPCD Registers 90701, L=1: EDP_GENERAL_CAPABILITY_1 (1.4) CANCEL	0									

The DPCD Editor will now display the LTTPR Capability Registers with their current field values. The example below is emulating LTTPR 2.0 (20h). Major Revision value is 2, Minor Revision value is 0.

DPCD Edito	r								Close	Naviga	itor Hor	ne Back
Base	Feecoh	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open	Save					Read RX	Write RX	Read TX
DSC	F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER				DisplayP	<no file<="" td=""><td>Name></td><td>(PX)</td><td></td><td></td><td></td></no>	Name>	(PX)			
PR	F0002h	PHY_REPEATER_CNT				LTTPR	FIELD DATA	STRUCTURE	REV			
Sink	F0003h	PHY_REPEATER_MODE				0.00000000	F0000	h				
Branch	F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field I	lame	Field Val	lue					
aDD	Feessh	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT	7.4	Major	Revision	2						
EUP	Feeesth	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	1-4	najoi	Revision	2						
EXI	recorn	mi_herealen_1200/1320_hales	3-0	Minor	Revision	Θ						
LITPR												
LTTPR1												
LTTPR2												
LTTPR3												
LTTPR4												
LTTPR5												
LTTPR6												
LTTPR7												
LTTPR8												
			Bytes:									
			88									
k			-					Read Page W	rite Page			

These capability registers are configurable to be able to emulate different LTTPR configurations. A full list of the registers is listed in **Appendix B. Configurable LTTPR Capability Registers**.

To modify the configuration, select the LTTPR register you wish to change, as shown below. This example has selected the F0006h MAIN_LINK_CHANNEL_CODING_PHY_REPEATER register. The currently emulated configuration supports 128b/132b coding.

DPCD Edito	r									Close	Naviga	ator	Home	Back
Base	Feeeh	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Ope	n Save	9					Read RX	Write	RX	Read TX
DSC	F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER				Dist	lavPort	<no< td=""><td>o File Name> 0 Protocol Analyzer RX</td><td>(RX)</td><td></td><td></td><td></td><td></td></no<>	o File Name> 0 Protocol Analyzer RX	(RX)				
PR	F0002h	PHY_REPEATER_CNT				LT	TPR_F	IELD	DATA_STRUCTURE	REV				
Sink	F0003h	PHY_REPEATER_MODE					1000		F0000h	55				
Branch	F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field	d Name		Field	Value						
eDP	F0005h	MAIN LINK CHANNEL CODING PHY REPEATER	0	1285	o/132b	SUPPORTED	1 =	Yes 🗢						
Ext	F0007h	PHY_REPEATER_1288/1328_RATES	7-1	RESE	RVED		Θ							
LTTPR														
LTTPR1														
LTTPR2														
LTTPR3														
LTTPR4														
LTTPR5														
LTTPR6														
LTTPR7														
LTTPR8														
			Bytes:											
			00											
									Read Page W	rite Page				

Edit the fields that you wish to re-configure according to your testing specifications. Furthering the previous example, the user has disabled support for 128b/132b coding using the drop-down menu, as demonstrated below.

F0003h PHY_REPEATER_MODE F0004h MAX_LANE_COUNT_PHY_REPEATER F0005h PHY_REPEATER_EXTENDED_WAKE_TIMEOUT F0006h MAIN_LINK_CHANNEL_CODING_PHY_REPEATER F0007h PHY_REPEATER_128B/132B_RATES	Bit Field Name Field Value 0 128b/132b SUPPORTED 1 = Yes 7-1 RESERVED 0 = No 1 = Yes
F0003hPHY_REPEATER_MODEF0004hMAX_LANE_COUNT_PHY_REPEATERF0005hPHY_REPEATER_EXTENDED_WAKE_TIMEOUTF0006hMAIN_LINK_CHANNEL_CODING_PHY_REPEATERF0007hPHY_REPEATER_128B/132B_RATES	Bit Field Name Field Value 0 128b/132b SUPPORTED 0 = No マ 7-1 RESERVED 0

Additionally, continuing with the example, the user would select F0007h

PHY_REPEATER_128B/132B_RATES and disable support for all UHBR rates, as shown in the following sample screenshots.

F0000h	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open Save	
F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER			
F0002h	PHY_REPEATER_CNT	11		
F0003h	PHY_REPEATER_MODE			
F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field Name	Field Value
F0005h	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT	0	10 Gbps/lane Support	1 = Yes =
F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	Ū	to obportance support	
F0007h	PHY_REPEATER_128B/132B_RATES	1	20 Gbps/lane Support	0 0 = NO
		2	13.5 Gbps/lane Support	1 = Yes
		7-3	RESERVED	Θ
		100.0000		
FAAAAb		Nou	Open Save	
F0001h	8b/10b MAX LINK RATE PHY REPEATER	New	open oave	
F0002h	PHY REPEATER ONT			
F0003h	PHY REPEATER MODE			
F0004h	MAX LANE COUNT PHY REPEATER	Dit	Field Name	Field Value
F0005h	PHY REPEATER EXTENDED WAKE TIMEOUT	DIL	rielu name	
F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	0	10 Gbps/lane Support	0 = No マ
and the second second	and a subscription of the			
F0007h	PHY_REPEATER_128B/132B_RATES	1	20 Gbps/lane Support	0 = No ⇒
F0007h	PHY_REPEATER_128B/132B_RATES	1 2	20 Gbps/lane Support 13.5 Gbps/lane Support	0 = No マ 1 = Yes マ
F0007h	PHY_REPEATER_1288/1328_RATES	1 2 7.2	20 Gbps/lane Support 13.5 Gbps/lane Support	0 = No = 1 = Yes = 0 = No N
F0007h	PHY_REPEATER_1288/1328_RATES	1 2 7-3	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED	0 = No = 1 = Yes
F0007h	PHY_REPEATER_1288/1328_RATES	1 2 7-3	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED	0 = No マ 1 = Yes → 0 = No 1 = Yes
F0007h	PHY_REPEATER_1288/1328_RATES	1 2 7-3	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED	0 = No red 1 = Yes red 0 = No red 1 = Yes
F0007h	PHY_REPEATER_128B/132B_RATES	1 2 7-3	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED	0 = No = 1 = Yes = 0 = No 1 = Yes Field Value
F0007h F0004h F0005h	PHY_REPEATER_1288/1328_RATES MAX_LANE_COUNT_PHY_REPEATER PHY_REPEATER_EXTENDED_WAKE_TIMEOUT	1 2 7-3 Bit	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED Field Name	$0 = No \Rightarrow$ $1 = Yes \Rightarrow$ $0 = No \bigcirc$ 1 = Yes Field Value
F0007h F0004h F0005h F0006h	PHY_REPEATER_128B/132B_RATES MAX_LANE_COUNT_PHY_REPEATER PHY_REPEATER_EXTENDED_WAKE_TIMEOUT MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	1 2 7-3 Bit 0	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED Field Name 10 Gbps/lane Support	$0 = No \bigtriangledown$ $1 = Yes \bigtriangledown$ $0 = No \bigcirc$ $Field Value$ $0 = No \bigtriangledown$
F0007h F0004h F0005h F0006h F0007h	PHY_REPEATER_128B/132B_RATES MAX_LANE_COUNT_PHY_REPEATER PHY_REPEATER_EXTENDED_WAKE_TIMEOUT MAIN_LINK_CHANNEL_CODING_PHY_REPEATER PHY_REPEATER_128B/132B_RATES	1 2 7-3 <u>Bit</u> 0 1	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED Field Name 10 Gbps/lane Support 20 Gbps/lane Support	$0 = No \bigtriangledown$ $1 = Yes \bigtriangledown$ $0 = No \bigtriangledown$ $Field Value$ $0 = No \bigtriangledown$ $0 = No \bigtriangledown$
F0007h F0004h F0005h F0006h F0007h	PHY_REPEATER_128B/132B_RATES MAX_LANE_COUNT_PHY_REPEATER PHY_REPEATER_EXTENDED_WAKE_TIMEOUT MAIN_LINK_CHANNEL_CODING_PHY_REPEATER PHY_REPEATER_128B/132B_RATES	1 2 7-3 Bit 0 1 2	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED Field Name 10 Gbps/lane Support 20 Gbps/lane Support 13.5 Gbps/lane Support	$0 = No \Rightarrow$ $1 = Yes \Rightarrow$ $0 = No \Rightarrow$ $1 = Yes$ Field Value $0 = No \Rightarrow$ $0 = No \Rightarrow$ $0 = No \Rightarrow$
F0007h F0004h F0005h F0006h F0007h	PHY_REPEATER_128B/132B_RATES MAX_LANE_COUNT_PHY_REPEATER PHY_REPEATER_EXTENDED_WAKE_TIMEOUT MAIN_LINK_CHANNEL_CODING_PHY_REPEATER PHY_REPEATER_128B/132B_RATES	1 2 7-3 Bit 0 1 2 7-3	20 Gbps/lane Support 13.5 Gbps/lane Support RESERVED Field Name 10 Gbps/lane Support 20 Gbps/lane Support 13.5 Gbps/lane Support	0 = No = I = Yes $0 = No $ $1 = Yes$ $Field Value$ $0 = No = Io $ $0 = No = Io $ $0 = No = Io$

Once you have configured the LTTPR Capability Registers to your testing specifications, click on **Write Rx** in the top corner, and the M42d's receiver will update its emulated LTTPR with the modified DPCD.

			Close	Naviga	tor Horr	ne Back
A_STRUCTURE_REV	New Open Save			Read RX	Write RX	Read TX
RATE_PHY_REPEATER		<no file="" name=""> DisplayPort/USBC 2.0 Protocol Analyzer RX</no>	(RX)			
r.		LTTPR FIELD DATA STRUCTURE	REV		7 Г	
JE		F0000h	2			
PHY_REPEATER	1	DPCD Editor		0		
FENDED_WAKE_TIMEOUT	Writing DPCD Registers					
EL_CODING_PHY_REPEATER						
3B/132B_RATES	02200, L=1: DP1.3_DPCD_REV			-		
				-		
		CANCEL				

A dialog box (example pictured below) may appear with warning messages regarding the M42d's simulated Rx. This can be ignored when testing a source device and writing a configured DPCD to the M42d as an Rx.

- WARNING:	RX is not a branch	device
- WARNING:	RX does not support	downstream ports
- WARNING:	RX is not a branch	device
- WARNING:	RX does not support	downstream ports

The emulated LTTPR will now reflect the newly configured LTTPR capabilities.



In the previous screenshot, the user has navigated back to the M42d Receiver and the dashboard is still reading as 4 LTTPR being emulated.

In this specific example, the M42d Rx still supports LTTPR version 2.0, emulating 4 LTTPR. However, based on the DPCD editing, the emulated LTTPR only supports up to 8.10 Gbps link rate and will not support any UHBR rates or 128b/132b coding. The source is forced into transparent 8b/10b LTTPR link training at a rate of up to 8.10 Gbps.

Note: Configured LTTPR capabilities using the DPCD Editor have to be reapplied anytime the LTTPR is reset/modified and reenabled from the Rx Analyzer Tools menu. Instructions for saving and quickly reapplying user modified register configurations are in the following subsection.

Saving and Opening/Reapplying Saved LTTPR Configurations

As stated in the previous section, the DPCD and LTTPR Capability Registers reset to the specifications given in the LTTPR tab of the Tools Menu within the Rx Analyzer. Any manually reconfigured capability registers will be overwritten with DPCD of the newly enabled Rx and emulated LTTPR.

The M42d offers the ability to save and open a modified DPCD (including LTTPR Capability Registers) to quickly reapply these configurations when LTTPR is reset or reenabled from the Rx Analyzer Tools menu.

For example, a user can configure the DPCD according to their test specifications and save the DPCD, then recall the DPCD any time they start or restart a test session.

The procedure for this process is as follows:

Saving DPCD

1. Once you have the configurations you would like to save within the DPCD Editor, click **Save** at the top of the window.

			1			Close	Navig	ator
TRUCTURE_REV	New	Open Save					Read RX	W
TE_PHY_REPEATER			DisplayPort/USB	<no file="" na<br="">C 2.0 Protoco</no>	me> ol Analyz	er RX (RX)		
			LTTPR_FIEL	D_DATA_S	STRUCT	URE_REV		
_REPEATER IDED_WAKE_TIMEOUT	Bit	Field Name	i i	Field Va	lue	2		
CODING_PHY_REPEATER	0	128b/132b	SUPPORTED	0 = No) 🗢			
	7-1	RESERVED		0				

2. A **Save** dialog box will appear. Select the desired path, type in a name for the new DPCD, and click **OK**, as shown below.

		Local File	S	
0	lser 🧹			
DP	DP14.1	DPCD.de	fault	
DP	DP14	USRC DP	CD. defau	1+
-	01 1410	0500.01	condenda	LL
	011410	0000.01	ep rueruu	
	0.111	0000.01	ep rue ruu	
	0.111	55500.01	eprocrau	
	New	Rename	Delete	
Path:	New /User	Rename	Delete	
Path:	New /User	Rename	Delete	

The DPCD is now saved in the **User** folder.

With the configured DPCD now saved, you can open apply this DPCD at any time from the DPCD Editor. In the following example, the user will enable LTTPR with slightly modified settings using the LTTPR Tool within the Analyzer Rx, as demonstrated in the first section of this chapter.

Note: Keep in mind through the next several steps that when loading a custom DPCD, LTTPR *must already be emulating*. If you begin LTTPR emulation after loading the custom DPCD, the DPCD registers will be reset to the default configurations for the given emulation.

Reset LTTPR Emulation

3. Navigate to the LTTPR Tool within the Analyzer Rx.



LTTPR Emulation should still be active, as shown below.

4. Turn off LTTPR emulation.



5. Make the desired adjustments to the emulated LTTPR within this Tools dialog box, and resume LTTPR emulation. In the following example, the LTTPR version has been switched to 1.4 and there are now 8 emulated LTTPR.



Upon reactivating LTTPR emulation, the DPCD will revert to the settings applied in this step using the Analyzer Rx LTTPR Tool.

6. To verify this, navigate to the DPCD Editor and click Read Rx.

DPCD Edito	r						Close	Navig	ator Hon	ne Back
Base	F0000h	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open Save				Read RX	Write RX	Read TX
DSC PR Sink	F0001h F0002h F0003h	8b/10b_MAX_LINK_RATE_PHY_REPEATER PHY_REPEATER_CNT PHY_REPEATER_MODE			DisplayP LTTPR	<pre><no file="" name=""> ort/USBC 2.0 Protocol Analyzer RX _FIELD_DATA_STRUCTURE_ F0000h</no></pre>	(RX) REV			
Branch	F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field Name	Field Val	ue				
eDP	F0005h F0006h	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4	Major Revision	2					
Ext	F0007h	PHY_REPEATER_1288/1328_RATES	3-0	Minor Revision	0					
LTTPR										

After reading the Rx DPCD, the first LTTPR Capability register will display as version 1.4, as shown below.

Feech	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open	Save		
F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER					<no file="" name=""></no>
F0002h	PHY_REPEATER_CNT	-			LTTPR	FTELD DATA STRUCTURE REV
F0003h	PHY_REPEATER_MODE					F0000h
F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field N	lame	Field Value	e
F0005h	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT					1 2
F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4	Major	Revision	1	
F0007h	PHY_REPEATER_1288/1328_RATES	3-0	Minor	Revision	4	

Open/Reapply Previously Saved DPCD

7. To restore the previously set and saved LTTPR capabilities, open the saved DPCD file by clicking the **Open** button at the top of the DPCD Editor window.

OPCD Edito	r						Clo	se	Nε
Base	Feenah	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open Save				Rea	ad
DSC	F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER		\wedge	Dice	lauPort /	<no file="" name=""></no>		
PR	F0002h	PHY_REPEATER_CNT			LT	PR FI	ELD DATA STRUCTURE RE	1	
Sink	F0003h	PHY_REPEATER_MODE				-	F0000h		
SHIK	F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field Name	Field	Value			
Branch	F0005h	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT			1.0.0.000	1			
eDP	F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4	Major Revisio	n 1				
Ext	F0007h	PHY_REPEATER_128B/132B_RATES	3-0	Minor Revisio	n 4				

8. An **Open** dialog box will appear. Select the desired DPCD file and click **OK**



Once the DPCD has loaded, the file name will appear at the top of the window, as shown below. Notice as well that the first LTTPR Capability Register displays the previously configured Field Values for the LTTPR version number being emulated by the Rx.

DPCD Edito	r								Close	
Base	F0000h	LTTPR_FIELD_DATA_STRUCTURE_REV	New	Open	Save				1	R
DSC	F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER				Display	/User/L	TTPR OPCO demo	(RX)	
PR	F0002h	PHY_REPEATER_CNT				LTTPR	FIELD C	DATA STRUCTURE	REV	f
Sink	F0003h	PHY_REPEATER_MODE				ेसर		F0000h	17 A	
SIIIN	F0004h	MAX_LANE_COUNT_PHY_REPEATER	Bit	Field N	lame	Field Value	()			
Branch	F0005h	PHY_REPEATER_EXTENDED_WAKE_TIMEOUT	-			discourse and the	4			
eDP	F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4	Major	Revision	2	<			
Ext	F0007h	PHY_REPEATER_1288/1328_RATES	3-0	Minor	Revision	θ		-		
LTTPR										

The example within this subsection was a rudimentary change to the DPCD's LTTPR Register, but demonstrated the capability to save and open custom DPCDs when dealing with LTTPR. This gives the user the ability to pick up where they left off with previous configurations when beginning a new testing session.

A full list of the configurable LTTPR Capability Registers within the DPCD Editor can be found in **Appendix B. Configurable LTTPR Capability Registers**.

8.4 **Testing LTTPR Devices with M42d as DPTX**

The M42d also has the capability to test and read the ability of one or multiple LTTPR devices to link train with a Tx source.

The negotiated transactions can be viewed within the ACA Utility. Detailed instructions for executing an Aux Channel trace are provided in **Chapter 6 Auxiliary Channel Analyzer**. This section will cover using the ACA utility with one or multiple LTTPR devices.

Note: This is a separately licensed capability. More information on licenses can be found in **Appendix A**. **Licenses**.

Monitoring Link Training Negotiations with LTTPR(s)

This subsection outlines the procedures for monitoring the link training transactions between the M42d instrument acting as a source and up to eight LTTPRs between source and sink.

With the LTTPR devices properly connected, open the ACA Utility or ACA Remote Control. The screenshot examples in this section are of the ACA Remote Control operating on a remote host PC, though the operation is similar to that of the ACA Utility on the embedded GUI ATP Manager of the M42d.

1. Connect to the correct M42d instrument if using the ACA Remote Control, and click **START** to begin monitoring the aux channel transactions.

E ACA Remote Co	ntrol						—	\times
DISCONNECT	START	Events	Options	Scroll-lock	Clear	Save 👻		Þ
Total Events: 0								
					\$			

2. Navigate to the **Tools** tab within the **Generator** application. From there, select **Link Train** from the lefthand sidebar.

Mode: MST 👻 I	DSC:Off FMT:2160p30 IMG:TVBarH	P-	Rate:297.00MHz F-R H-R	ate:30.00Hz ate:67.50kHz € Output
(95) 3840x2160p	p @ 30 Hz 16:9	3840x2160	Progressive RGB-8	opc
Format	Pattern	Audio	Tools	pology
Link Train	ead Spectrum 🖉 🛥	Synchron	ous Clock 🔍	FEC 📼
ALPM		Current S	Status	
Backlight		Main Stream: US	B-C TX enabled	
		Lane Count: 4L	Lanes	
		Link Rate. 13 Lane 1: CR	R done, EQ done, SLock d	one [ffe0]

3. Within the **Link Train** tool, select a **Lane Count** and a **Link Rate** according to your desired testing specifications, as shown below. Link training will automatically occur at the selection of a Link Rate.

Mode: MST 👻	DSC:Off	FMT:2160p30 IMG:TVBarH			P-F	Rate:29	7.00MH	z F-Rate:3 H-Rate:6	30.00Hz 57.50kHz	Output
(95) 3840x21	60р @ 30 Н:	z 16:9		3840x216	0 Prog	gressive	e RGB-	8bpc		
Forma	it	Pattern	Au	oibu		Тос	ols		Topolog	y
Link Train	Spre	ad Spectrum 🖉 🗃		Synchro	onous C	Clock 💁	\bigcirc		FEC 💽	
ALPM			Cu	rrent	Stat	cus				
Backlight			Mair	n Stream: ne Count:	USB-C T 4 Lanes	X enable	d			
USB-C			l	ink Rate:	13.50Gb	ops				
DPCD Viewer				Lane 1:	CR done	e, EQ done	, SLock	done [ffe0]		
HDCP Test				Lane 3:	CR done	e, EQ done	, SLock , SLock	done [ffe0]		
EDID Decode			Inter-lane A	Lane 4:	CR done	e, EQ done	, SLock	done [ffe0]		
EDID Comp	h۵	antive Training		Non-Adan	tive Tra	ainina		Fa	ast Training	
Image Shift	Au	aptive framing	Te			anning .			Jot Huming	
Image Ctrl			II	ain at La						
DSC				1 2						
Editors			Trair	n at Link	Rate (C	Gbps)				
Scripts			1.62	2.70	5.40	8.10	1			
			10.0	13.5	20.0					
				Retries:						
			TDAIN	RASED ON						
			TRAIN	BASED ON	САРАВ	DIETTIES				

4. Once link training is complete, return to the ACA Utility or ACA Remote Control and click STOP to end the ACA trace.

:: A	III ACA Remote Control											
DIS	CONNECT	•	STOP	ents	Options	Scroll-lock	Clea					
🕨 T	otal Events	s: 72	•									
52	DPPRE	13	+01:09:48.366944	Prec	harge/Sync	2 💿	Star					
53	DNAT	13	+01:09:48.366944	< AC	K 41 00 77	7						

Note: To use the more robust features of the ACA Data Viewer, including finding and filtering for specific event types, see Chapter 6 Auxiliary Channel Analyzer (ACA) for detailed instructions on saving trace files and accessing the ACA Data Viewer.

- 5. Within the Trace Panel, scroll to the appropriate event to view the LTTPR capabilities read during Link Training. A few of the capabilities demonstrated in the following example are displayed within the Event Details panel as follows:
 - LTTPR version 2.0 (value for Major Revision 2, Minor Revision 0)
 - Max Link Rate value is 1Eh (8.1 Gbps per lane)
 - LTTPR Count value is 10h (4 LTTPRs)
 - LTTPR Mode value is AAh (Non-transparent LTTPR)

II AC	A Remote C	ontrol				- 🗆	×
DISC	ONNECT	ST	ART PAUSE Even	ts Options Scroll-lock Clear Save -			Q
Tot	al Events:	1727					
407	DNAT	11	+01:11:25.828208	< ACK Start Time: +01:11:25.828337			^
408	DPPRE	11	+01:11:25.828264	Precharge/Sync Count: 32 Type: Native			
409	DNAT	11	+01:11:25.828264	> R:F0000 LTTPR_FIELD_DATA_S Direction: Reply			
410	DPPRE	13	+01:11:25.828264	Precharge/Sync Count: 32			_
411	DNAT	13	+01:11:25.828264	> R:F0000 LTTPR_FIELD_DATA_S			_
412	DPPRE	13	+01:11:25.828337	Precharge/Sync Count: 32 F0000: LTTPR FIELD DATA STRUCTURE REV			
413	DNAT	13	+01:11:25.828337	< ACK 20 1E 10 AA 04 10 01 05 Bit Name	Value	Description	
414	DPPRE	11	+01:11:25.828338	Pre harge/Sync Count: 32			4
415	DNAT	11	+01:11:25.828338	20 1E 10 AA 04 10 01 05 3-0 Minor Revision Number	0		
416	DPPRE	11	+01:11:25.828526	Pr arge/Sync Count: 32 7-4 Major Revision Number	2		
417	DNAT	11	+01:11:25.828526	> D003 PHY_REPEATER_MODE F0001: 8b/10b MAX LINK BATE PHY REPEATE	R		
418	DPPRE	13	+01:11:25.828526	Prarge/Sync Count: 32 Bit Name	Value	Description	
419	DNAT	13	+01:11:25.828526	> W:F0003 PHY_REPEATER_MODE			ł
420	DPPRE	13	+01:11:25.828607	Precharge/Sync Count: 32 7-0 MAX_LINK_RATE	1Eh	8.1 Gbps/lane	
421	DNAT	13	+01:11:25.828607	< ACK			
422	DPPRE	11	+01:11:25.828608	Precharge/Sync Count: 32 F0002: PHI_REPEATER_CNT Bit_Name	Value	Description	
423	DNAT	11	+01:11:25.828608	< ACK			
424	DPPRE	11	+01:11:25.828702	Precharge/Sync Count: 32 7-0 LTTPR Count	10h	4	
425	DPLT	11	+01:11:25.828702	> W:108 MAIN_LINK_CHANNEL_CO			
426	DPPRE	13	+01:11:25.828702	Precharge/Sync Count: 32 F0003: PHY REPEATER MODE	Value	Decemintion	
427	DPLT	13	+01:11:25.828702	> W:108 MAIN_LINK_CHANNEL_CO Bit Name	varue	Description	
428	DPPRE	11	+01:11:25.828/84	Precharge/Sync Count: 32 7-0 Mode	AAh	Non-transparen	t
429	DPLT	11	+01:11:25.828784	< ACK			
430	DPPRE	13	+01:11:25.828784	Frecharge/Sync Count: 32 F0004: MAX LANE COUNT PHY REPEATER			
431	DPLT	13	+01:11:25.828784	< ACK Bit Name	Value	Description	
432	DPPRE	11	+01:11:25.020039	N:100 JINK DW CEULT 1 04 4-0 MAX LANE COUNT	04h	Four lanes	
433	DEDEE	12	+01.11.25 828829	Preshaves/Sung Count: 32	0	Reserved	
434	DRIT	13	+01.11:25.828839	= 6	0	Reserved	~
433	DEPL	13	+01.11:23.020039	✓ 1.100 DIMA_DH_SEI L-1 04 ☑ 《 》 413: < ACK 20 1E 10 AA 04 10	01 05		

Reading DPCD Registers with LTTPR(s) Present

As discussed in **Chapter 3 Generator**, you can view the DPCD of a connected sink. The **DPCD Viewer** has the capability of reading connected LTTPR devices as well.

Navigate to the DPCD Viewer tool within the Generator application and Tools tab.

Select the LTTPR Registers from the left sidebar and click **READ PAGE** or **READ ALL**. From here you will be able to see the capabilities and configurations similar to what was monitored within the ACA Utility in the previous subsection.

A brief example below shows the results of reading the DPCD with the DPCD Viewer.

Mode: MST 👻	DSC:Off FMT:210 IMG:TVH	50p30 BarH			P-Rate:29	7.00MHz F H	-Rate:30.00Hz -Rate:67.50kHz	Output
(95) 3840x21	60p @ 30 Hz 16:9			3840x216 Progre	essive RGB-8	Bbpc		
Form	nat	Pattern		Audio	Tools		Topology	
Link Train	Receiver Capability	🗆 Ranges		SINK-3 PORT-0 - RI	EAD ALL REA	D PAGE	RT	
ALPM	Link Config.		1	LT	TPR			
Backlight	Link/Sink Status	Capability/ID F0000-F0007	F0000: L Bit	TTPR_FIELD_DATA_S Name	TRUCTURE_RE	V Value	Description	^
USB-C	Panel Replay	RPT-1 Config/Status	3_0	Minor Powigion N	lumbor			
DPCD Viewer		F0010-F005F	7-4	Major Revision N	lumber	2		
HDCP Test	Test Automation	RPT-2 Config/Status	F0001: 8	b/10b MAX LINK RA	TE PHY REPE	ATER		
EDID Decode	Source Specific	F0060-F00AF	Bit	Name		Value	Description	
EDID Comp	Sink Specific	RPT-3 Config/Status	7-0	MAX_LINK_RATE		1Eh	8.1 Gbps/lane	
Image Shift	Branch Specific	F00B0-F00FF	F0002: P	HY REPEATER CNT				
Image Ctrl	Sink Control	RPT-4 Config/Status	Bit	Name		Value	Description	
DSC	eDP Backlight		7-0	LTTPR Count		01h	8	
Editors	ESI	F0150-F019F	F0003: P Bit	HY_REPEATER_MODE Name		Value	Description	
Scripts	Ext Rcv. Capability	RPT-6 Config/Status		 Mode		 77b	Non the prove	+
	Protocol Converter	F01A0-F01EF	7-0	Mode		ААП	Non-transparen	L
	LTTPR	fig/Status F01F0-F023F	F0004: M Bit	AX_LANE_COUNT_PHY Name	REPEATER	Value	Description	
		RPT-8 Config/Status	4-0	MAX_LANE_COUNT		04h	Four lanes	
		F0240-F028F	6			0	Reserved	
		RPT-1 Cap/Status	7			0	Reserved	
		F0290-F0297	F0005: P	HY_REPEATER_EXTEN	IDED_WAKE_TI	MEOUT	Description	
		RPT-2 Cap/Status	BIT	t Name		varue	Description	
		A V	6-0	EXT_WAKE_TIMEOUT	REQUEST	16		~

9 Panel Replay Testing

9.1 Overview

The M42d's supports basic testing of Panel Replay-capable source devices. This feature provides the following:

- Basic emulation through the DPCD
- The ability to capture the Panel Replay VSC packets in Capture Control to show the selective updates to frames
- Viewing of the Panel Replay VSCs in the Basic Analyzer window
- Viewing of the Auxiliary transactions for querying the Panel Replay capabilities in the DPCD

Note: Panel Replay testing is a licensed feature. Information on specific licenses can be found in **Appendix A. Licenses**

9.2 Emulation through the DPCD

The following DPCD registers are implemented in support of Panel Replay.

- PANEL REPLAY CAPABILITY SUPPORT registers (DPCD address 00B0h-0B4h
- PANEL REPLAY ENABLE, AND CONFIGURATION registers (DPCD address 001B0h)
- PANEL REPLAY STATUS registers (DPCD address 002004h 0020024h)

You can configure the DPCD registers to emulate support for Panel Replay, as shown in the following screenshot example.

DPCD Editor			– 🗆 ×
Base00080h0DSC00081h000082hSPR00084hSink00180h02021hSeDP02022h02022hSExt02024hLTTPR1LTTPR2LTTPR3	Capability Support Capability UU X Granularity UU Y Granularity Camable/Config Chror Status UU/PR Status Indicator Sink Status Debug 1	New Open Save Connect Read R	Write RX Read TX
LTTPR4 LTTPR5 LTTPR6		Bytes: 03 Read Page Write Page	0

9.3 Viewing Panel Replay VSCs in Basic Analyzer window

The M42d offers the ability to view the Panel Replay VSCs within the real time Basic Analyzer.

Use the following procedures to view the Video Stream Configuration data while testing a Panel Replaycapable source DUT.

Open the Basic Analyzer from the Home Screen. More information on the Basic Analyzer can be found in **Chapter 4 Source Verification with Basic Analyzer**.

Access the VSC information window by clicking the **VSC** button in the right-hand control menu within the Analyzer. The VSC window will appear within the Analyzer, as demonstrated below.



The VSC window contains information about Panel Replay. Note the **PR State** and selective updates fields in the VSC packet example below.

✓ VSC: 0 (32) 9082640									
Pause		cmþ	Clear	Show Ref	Set Ref	Filter 🗢			
VS D	P								
Pi t Tj Da 8 3D Het Revisi PR sta CRC Vao SU Reg Rectan SU Reg Rectan Pixel Dynami Compon Conten 01 01 17 18	ID: yn N ytes hod on: te: lid: rdin ion gle Enco c Ra ent t Ty 03 19	umber : code: Jpper Vidth First Heigh Jing nge: Dit d De: C 04 0 20 2	0 7 6 0x10 Fra VSC Act Valid: -left (Pixe Scan th (Pixe Scan th (Pixe) Scan th (Pixe) Scan th	ame/Field SDP supp tive VSC part corner X el Count) Line Y-co cel Count) Dorimetry Range Type: Rese cs 07 08 09 23 24 25	Sequent porting ayload d t update -coordinat coordinat): y: YCbCr erved 10 11 1 26 27 2	ial, type=0 3D stereo + PR [6] bes not contain a valid CRC of the SU region/full active fram the RFB ate (Pixel Count): 4105 4625 2: 5139 5653 4:4:4 ITU-R BT.2020 Y'C'BC'R. 2 13 14 15 16 8 29 30 31 00			
1									

You may also utilize the **Filter** drop-down menu to view the Panel Replay VSC packets in real time, as demonstrated below.

O vsc:	0 (32	2) 908	2640																				P	\times
Pause	~	cmþ	Clea	r Sh	ow Ref	Set	Ref	ilter	~	\leq														
VSC SD	P							٨																
Packet	ID:		0					~	un .															
Type:			7					Panel	Repla	av														
Revisi	on N	umbe	r: 6					GITCT		-7														
Data B	ytes	: codo	0x1	0	Field	For																		
SU Meti	on	code	· ·		P SUDI	Sequ	ing 3D	ster	ype=	+ P	[6] R													
PR sta	te:		A	ctive	i Sup		ing 50	510			K [0]													
CRC Va	lid:				VSC pa	ayloa	ad doe	s no	t co	nta	in a v	ali	d CR	C of	the	SU	re	gior	n/ful	l a	ctive	fram		
SU coo	rdin	ates	Vali	d:	Do no	tupo	late t	he Ri	FB									-						
SU Reg	ion	Uppe	r-lef	t Cor	ner X	- 0001	rdinat	e (P:	ixel	Co	unt):	4	105											
Rectan	gle	Widt	h (Pi	xel C	ount)							4	625											
SU Reg	ion	Firs	t Sca	n Lin	e Y-c	oordi	inate:					5	139											
Rectan	gle	Heig	nt (P	ixel	Count):	then 4				BT 202	0 1	053											
Pixet		aing	and	COLOR	imetry	y: YC	DCF 4	:4:4	110)-к	BI.202	0 1	.с.в	с.к.										
Compone	c Rd	nge:	denth	Type	· Pos	arver																		
Conten	t Tv	De:	Graph	ics	. nesi	er vet																		
01 01	03	04 (5 06	07 6	18 09	10	11 12	13	14	15	16													
17 18	19	20 2	21 22	23 2	24 25	26	27 28	29	30	31	00													
																								10

9.4 Capturing Panel Replay VSC Packets

The M42d offers the ability to capture VSC packets in the Protocol Analyzer. A **Panel Replay Active** trigger mode is available within the Capture Control utility, as shown below.

Capture Control		_		×
Capture Port Select Quantum Data, Inc.	DP2.0 protocol analyzer: Port 12 (10.30.196.222)			
Data	Raw (10bit)	Raw (UHBR)		
Buffer Size:		614.(40 MB	
4.000% <				>
Trigger Position (TP) within the	e Buffer:		0.0	00 MB
0.000% <				>
Trigger Mode: Any Rate Panel Replay Active Trigger Count: Extract Video Frames: Decompress DSC Frames:	on-UHBR Only			
Capture AUX (ACA) Transactions:	START CAPTURE		CLOSE	

After executing the capture, the Virtual Channels within the Capture Viewer show the VSC packets and the selected update regions. Note the selective updates fields in the Event Details panel of the selected VSC packet.



9.5 Viewing Panel Replay Auxiliary transactions

ACA decoding has been implemented for all Panel Replay DPCD registers. When a source DUT makes a connection to the M42d, you can monitor the Aux Channel to verify that the source reads the Panel Replay DPCD registers as shown below.

Note: For procedures for using the M42d's ACA utility, including running an analysis and finding/filtering for specific events, see **Chapter 6 Auxiliary Channel Analyzer**.

The following example shows an Aux Channel Analysis in which the source DUT confirms that Panel Replay capability is supported by the M42d's emulated Rx.

:= /	ACA Data V	iewer			-	×
Op	oen Cl	ose	Export Options Filter Find			Þ
2	PanelRep	lay_DP	CD6] Events: 12 (24)			
0	DNAT	13	> R:200 SINK_COUNT L=8	Start Time: +02:07:00.208930		
1	DNAT	13	< ACK 41 00 77 77 05 03 00 00	O Type: Native		
2	DNAT	11	> R:B0 PANEL REPLAY CAPABILITY	Command: ACK		
3	DNAT	11	< ACK 00	Reply to Read Request.		
4	DNAT	11	> R:200 SINK_COUNT L=8			
5	DNAT	11	< ACK 41 00 00 00 00 03 00 00	000B0: PANEL REPLAY CAPABILITY SUPPORTED		
6	DNAT	13	> R:200 SINK_COUNT L=8	Bit Name Value De ription		
7	DNAT	13	< ACK 41 00 77 77 05 03 00 00	A Bread Barlan Sumanh (1/1)		
8	DNAT	11	> R:200 SINK_COUNT L=8	1 Selective Undate Support Y(1)		
9	DNAT	11	< ACK 41 00 00 00 00 03 00 00	2 0 Reserved		
10	DNAT	13	> R:200 SINK_COUNT L=8	3 0 Reserved		
11	DNAT	13	< ACK 41 00 77 77 05 03 00 00	4 0 Reserved		
				5 0 Reserved		
				7 0 Reserved		
				[0000][00 03][]		
				O < ≥ 3: < ACK 03		

10 eDP

The M42d 80G Video Analyzer/Generator supports several eDP features such as fast link training, alternate scrambler seed, Advanced Link Power Management (ALPM) and backlight control through control pins. A pin header is available to provide access to the backlight Tx control test feature. The M42d offers the hardware necessary to support a variety of optional eDP features.

Note: The eDP features are optional and require purchase of a license to activate.

eDP Pin Configurations



- BL_Enable (Possible Future Rx input)
- BL_Enable (Tx Output)
- BL_PWM_DIM (Possible Future RX input)
- BL_PWM_DIM (TX Output)
- Ground Ground

10.1 eDP Testing Connections

This section provides procedures on how to connect your eDP TCON panel or graphics source system to the M41d HBR3 Video Analyzer/Generator. You will use the Standard DisplayPort connectors for testing eDP (not the USB-C connectors). You will need an eDP to DP adapter cable and or an adapter board to make these connections.



eDP Source Test Connections



eDP Sink Test Connections

10.2 Fast Link Training

This section provides procedures on eDP fast link training. Once the fast link training has been achieved the Source or Sink test features supported by the M42d 80G Video Analyzer/Generator can be used.

Fast Link Training – Source Tests

Use the following procedure to test eDP fast link training on an eDP source device.

1. Navigate to the Rx Analyzer/Receiver from the Home screen of the M42d ATP Manager GUI



2. Within the Basic Analyzer, select the **Tools** button on the control menu, then select the **eDP** tab on the left-hand side of the Tools dialog box, as shown below.



3. Enable eDP and Fast Link Training using the Enabled buttons indicated below:



4. Select to enable or disable Spread Spectrum according to your test requirements.



Lane Count				
	1	2	4	
	Lin	k Ra	te	
1.62	2.16	5 2	.43	2.70
3.24	4.32	2 5	.40	8.10

Fast Link Training – Sink Tests

Use the following procedure to test eDP fast link training on an eDP sink device.

1. Access the Fast Link Training controls from the Generator panel and the Tools tab.



2. Select the Fast Train tab on the right as indicated by the arrow on the above screen shot.

The Link Train window shows the **Current Status** in the top panel, and the control options within the bottom panel.

3. Toggle on or off **Spread Spectrum**, **Synchronous Clock**, and **FEC** (Forward Error Correction) at the top of the window according to your test requirements, as demonstrated below

DSC:011	IMG:TVBarH		P-Rate:297.00Mn2 1	H-Rate: 50.00h2 SOutpu
50p @ 30 1	Hz 16 : 9	3840x2160 P	rogressive RGB-8bpc	
at	Pattern	Audio	Tools	Topology
S	pread Spectrum 🖉 📼	Synchrono	us Clock 🔍	FEC 💁
		Current St Main Stream: USB Lane Count: 4 La	C TX enable	1

4. Select the Lane Count, Link Rate, Voltage Swing, Pre-Emphasis and the Test Pattern in accordance with your eDP test requirements. See below.



5. Click on the Fast Train button to initiate the link training. Then click on the Refresh button, as shown below

Spread Spectrum 🖉	Synchronous Clock 💌 📃	FEC 🚾	Disconnect
	Current Status Main Stream: USB-C TX enabled		Refresh
	Lane Count: 4 Lanes Link Rate: 13.50Gbps Lane 1: CR done, EQ done, SLock of Lane 2: CR done, EQ done, SLock of Lane 3: CR done, EQ done, SLock of Lane 4: CR done, EQ done, SLock of Inter-lane Alignment: Yes	done [ffe0] done [ffe0] done [ffe0] done [ffe0]	DP/USBC 2.0 Generator
Adaptive Training	Non-Adaptive Training	Fast Training	
Lane Count124	Link 1.62 2. 3.24 4.	Rate (Gbps) 16 2.43 2.70 32 5.40 8.10	
Voltage Swing Level	Pre-en 0	nphasis Level 1 2 3	
Test Pattern TPS2 TPS3 TPS4		AST TRAIN	

Fast Link Training – Monitoring the Fast Link Training Transactions on the Aux Channel

Refer to the ACA section **Monitoring the DisplayPort auxiliary channels with the ACA utilities** for procedures in monitoring the eDP fast link training and ALPM Aux Channel transactions associated with the eDP negotiations. A sample screen shot is shown below.

:	🖸 ACA Remote Control — 🗆 🗙					
ſ	DISCONNEC	r s	TART PAUSE Eve	nts Options Scroll-lock Cle	ır Save -	Þ
	Total Event	s: 240				
0	DPPRE	11	+17:17:09.776770	Precharge/Sync Count: 32	Start Time: +17:17:09.896126	^
1	DNAT	11	+17:17:09.776770	> R:200 SINK_COUNT L=8	o Type: Native	
2	DPPRE	13	+17:17:09.776770	Precharge/Sync Count: 32	Direction: Reply	
3	DNAT	13	+17:17:09.776770	> R:200 SINK_COUNT L=8	Command: ACK	
4	DPPRE	11	+17:17:09.776844	Precharge/Sync Count: 32	Reply to Read Request.	
5	DNAT	11	+17:17:09.776844	<pre>< ACK 41 00 77 77 05 03 00 0</pre>	00200 · SINK COUNT	
6	DPPRE	13	+17:17:09.776844	Precharge/Sync Count: 32	Bit Name Value Description	
7	DNAT	13	+17:17:09.776844	< ACK 41 00 77 77 05 03 00 0		
8	DPPRE	11	+17:17:09.896051	Precharge/Sync Count: 32	SINK_COUNT 1 Bits 7 + 5:	0
9	DNAT	11	+17:17:09.896051	> R:200 SINK_COUNT L=8	6 CP_READY Y(1)	
1	0 DPPRE	13	+17:17:09.896052	Precharge/Sync Count: 32	00201 · DEVICE SERVICE IRO VECTOR	
1:	1 DNAT	13	+17:17:09.896052	> R:200 SINK_COUNT L=8	Bit Name Value Description	
1:	2 DPPRE	11	+17:17:09.896126	Precharge/Sync Count: 32	· · · · · · · · · · · · · · · · · · ·	
1	3 DNAT	11	+17:17:09.896126	<pre>< ACK 41 00 77 77 05 03 00 0</pre>	0 REMOTE_CONTROL_COMMAND_PENDING N(0)	
1	4 DPPRE	13	+17:17:09.896126	Precharge/Sync Count: 32	1 AUTOMATED_TEST_REQUEST N(0)	
1!	5 DNAT	13	+17:17:09.896126	< ACK 41 00 77 77 05 03 00 0	$2 CP_{IRQ} N(0)$	
1	6 DPPRE	11	+17:17:10.289181	Precharge/Sync Count: 32	4 DOWN REP MSG RDY N(0)	
1	7 DNAT	11	+17:17:10.289181	> R:200 SINK_COUNT L=8	5 UP REQ MSG RDY N(0)	
1	8 DPPRE	13	+17:17:10.289181	Precharge/Sync Count: 32	6 SINK_SPECIFIC_IRQ N(0)	
1	9 DNAT	13	+17:17:10.289181	> R:200 SINK_COUNT L=8	7 0 Reserved	
20	0 DPPRE	13	+17:17:10.289255	Precharge/Sync Count: 32		
2:	1 DNAT	13	+17:17:10.289255	< ACK 41 00 77 77 05 03 00 0	00202: LANEO_I_STATUS: Bit Name	
2:	2 DPPRE	11	+17:17:10.289256	Precharge/Sync Count: 32		
2:	3 DNAT	11	+17:17:10.289256	<pre>< ACK 41 00 77 77 05 03 00 0</pre>	0 LANEO CR DONE Y(1)	
2	4 DPPRE	11	+17:17:13.939544	Precharge/Sync Count: 32	1 LANE0_CHANNEL_EQ_DONE Y(1)	
2	5 DNAT	11	+17:17:13.939544	> R:200 SINK_COUNT L=8	2 LANE0_SYMBOL_LOCKED Y(1)	
2	6 DPPRE	13	+17:17:13.939544	Precharge/Sync Count: 32	3 0 Reserved	~
2	7 DNAT	13	+17:17:13.939544	> R:200 SINK_COUNT L=8	 ANKET CK 10 MK 13: < ACK 41 00 77 77 05 03 00 00 	

10.3 Advanced Link Power Management (ALPM)

This section provides procedures on testing eDP ALPM on eDP source and sink devices.

ALPM – Source Tests

Use the following procedure to test eDP ALPM on an eDP source device.

1. Navigate to the Rx Analyzer/Receiver from the Home screen of the M42d ATP Manager GUI.

quantum <mark>data</mark>				
Control	Compliance	Editors	Other	
		-		
Generato	r Receiver	ACA Rem Contro	note ol	
Capture Cor	ntrol HEAC			

2. Within the Rx Analyzer, Select the **Tools** button on the control menu, then select the **ALPM** tab on the left-hand side of the Tools dialog box, as shown below.



3. Within this window, view the **States** diagram on the top of the **Tools** panel and the **State Transaction History** at the bottom.

Note: You may need to zoom in or out on the diagram, which can be done using the magnifying glass icons at the bottom right of the panel as shown above

ALPM – Sink Tests

Use the following procedure to test eDP ALPM on an eDP sink device.

1. Access the ALPM controls from the Generator panel and the Tools tab, as shown below.



2. Select the ALPM button on the left indicated by the arrow on the above screen shot.

The ALPM window shows the current state on the left side of the panel.

3. Select the activation buttons on the right side of the window underneath **Press to Cause Event** to cause transitions to the various ALPM states.

The following table describes the ALPM **Activation** function buttons.

ALPM State Transition Buttons		
Activation Buttons	Function	
	Disables the streaming of audio and video over the main link. The link is trained and the source is sending either an idle pattern or a	
Disable Av Stream	ML_PHY_LOCK pattern. Causes a transition to the 1a state: Active NoStream.	
Enable AV Stream	Enables the streaming of audio and video over the main link. The	
⇔ Enable AV Stream	link is trained and the source is sending an AV stream. Causes a transition to the 1 state: Active.	
Disable Main Link	Disables the Main Link.	
← Disable Main Link		
Enable Main Link	Enables the Main Link.	
🗢 Enable Main Link		
Set DPCD Sleep	Puts the ALPM sink in the Sleep state by writing to DPCD registers	
⇔ Set DPCD Sleep	over the Aux Channel.	
Set DPCD Wake	Puts the ALPM sink in the Wake state by writing to DPCD registers over the Aux Channel.	
⇔ Set DPCD Wake		
ML Phy Sleep	Puts the ALPM sink in the Sleep state by sending K-character	
⇔ ML_PHY_SLEEP	sequence over the Main Link.	
ML Phy Standby	Puts the ALPM sink in the Standby state by sending K-character	
⇔ ML_PHY_STANDBY	sequence over the Main Link.	
Aux Phy Wake	Puts the ALPM sink in the Standby state by writing a bit sequence	
⇔ AUX_PHY_WAKE	over the Aux Channel.	



The example below demonstrates the Set DPCD Sleep event being activated

Fast Link Training – Monitoring the ALPM Transactions on the Aux Channel

Refer to the ACA section **Monitoring the DisplayPort auxiliary channels with the ACA utilities** for procedures in monitoring the eDP ALPM Aux Channel transactions associated with the eDP negotiations. A sample screen shot is shown below.

DISCONNECT START PAUSE Events Options Scroll-lock Clear Save = • Total Events: 240 0 DPPRE 11 +17:17:09.776770 Precharge/Sync Count: 32 • Start Time: +17:17:09.896126 1 DNAT 11 +17:17:09.776770 > R:200 SINK_COUNT L=8 • Type: Native 2 DPPRE 13 +17:17:09.776770 > R:200 SINK_COUNT L=8 • Direction: Reply 3 DNAT 13 +17:17:09.776744 > R:200 SINK_COUNT L=8 • Command: ACK 4 DPPRE 11 +17:17:09.776844 > ACK 41 00 77 77 05 03 00 00 • 6 DPPRE 13 +17:17:09.776844 > ACK 41 00 77 77 05 03 00 00 • SINK_COUNT 6 DPPRE 11 +17:17:09.896051 Precharge/Sync Count: 32 • SINK_COUNT 1 9 DNAT 11 +17:17:09.896051 > R:200 SINK_COUNT L=8 • 6 CP_READY Y(1) 10 DPPRE 13 +17:17:09.896052	- 🗆 X
• Total Events: 240 0 DPPRE 11 +17:17:09.776770 Precharge/Sync Count: 32 • Start Time: +17:17:09.896126 1 DNAT 11 +17:17:09.776770 > R:200 SINK_COUNT L=8 • Direction: Reply 2 DPPRE 13 +17:17:09.776770 > R:200 SINK_COUNT L=8 • Direction: Reply 3 DNAT 13 +17:17:09.776744 Precharge/Sync Count: 32 • Command: ACK 4 DPPRE 11 +17:17:09.776844 Precharge/Sync Count: 32 • 00200: SINK_COUNT 5 DNAT 11 +17:17:09.776844 Precharge/Sync Count: 32 • 00200: SINK_COUNT 6 DPPRE 11 +17:17:09.896051 Precharge/Sync Count: 32 • SINK_COUNT 9 DNAT 11 +17:17:09.896051 Precharge/Sync Count: 32 SINK_COUNT 1 10 DPPRE 13 +17:17:09.896052 Precharge/Sync Count: 32 • 6 CP_READY Y(1) 10 DPPRE 13 +17:17:09.896052 > R:200 SINK_COUNT L=8 6 CP_READY	Q
0 DPPRE 11 +17:17:09.776770 Precharge/Sync Count: 32 Start Time: +17:17:09.896126 1 DNAT 11 +17:17:09.776770 > R:200 SINK_COUNT L=8 Direction: Reply 2 DPPRE 13 +17:17:09.776770 Precharge/Sync Count: 32 Direction: Reply 3 DNAT 13 +17:17:09.776770 Precharge/Sync Count: 32 Command: ACK 4 DPPRE 11 +17:17:09.776844 Precharge/Sync Count: 32 Command: ACK 5 DNAT 11 +17:17:09.776844 Precharge/Sync Count: 32 00200: SINK_COUNT 6 DPPRE 13 +17:17:09.776844 Precharge/Sync Count: 32 Direction: Reply 7 DNAT 13 +17:17:09.776844 Precharge/Sync Count: 32 Direction: SINK_COUNT 8 DPPRE 11 +17:17:09.896051 Precharge/Sync Count: 32 SINK_COUNT 9 DNAT 11 +17:17:09.896052 Precharge/Sync Count: 32 SINK_COUNT 6 10 DPPRE 13 +17:17:09.896052 Precharge/Sync Count: 32 00201: DEVICE_SERVICE_IRQ_VECTOR 11 DNA	
1 DNAT 11 +17:17:09.776770 > R:200 SINK_COUNT L=8 Image: Command: ACK 2 DPPRE 13 +17:17:09.776770 Precharge/Sync Count: 32 Direction: Reply 3 DNAT 13 +17:17:09.776770 > R:200 SINK_COUNT L=8 Direction: Reply 4 DPPRE 11 +17:17:09.776744 Precharge/Sync Count: 32 Direction: Reply 5 DNAT 11 +17:17:09.776844 Precharge/Sync Count: 32 Direction: Reply 6 DPPRE 13 +17:17:09.776844 Precharge/Sync Count: 32 Direction: Reply 7 DNAT 13 +17:17:09.776844 Precharge/Sync Count: 32 Direction: Reply 9 DNAT 13 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	^
2 DPPRE 13 +17:17:09.776770 Precharge/Sync Count: 32 Direction: Reply Command: ACK 3 DNAT 13 +17:17:09.776700 > R:200 SINK_COUNT L=8 4 DPPRE 11 +17:17:09.776744 Precharge/Sync Count: 32 Reply to Read Request. 5 DNAT 11 +17:17:09.776844 Precharge/Sync Count: 32 00200: SINK_COUNT 6 DPPRE 13 +17:17:09.776844 Precharge/Sync Count: 32 Bit Name Value D 7 DNAT 13 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	
3 DNAT 13 +17:17:09.776770 > R:200 SINK_COUNT L=8 Reply to Read Request. 4 DPPRE 11 +17:17:09.776844 Precharge/Sync Count: 32 00200: SINK_COUNT 5 DNAT 11 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	
4 DPPRE 11 +17:17:09.776844 Precharge/Sync Count: 32 5 DNAT 11 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	
5 DNAT 11 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	
6 DPPRE 13 +17:17:09.776844 Precharge/Sync Count: 32 Bit Name Value D 7 DNAT 13 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	
7 DNAT 13 +17:17:09.776844 < ACK 41 00 77 77 05 03 00 00	Description
8 DPPRE 11 +17:17:09.896051 Precharge/Sync Count: 32 SINK_COUNT 1 B 9 DNAT 11 +17:17:09.896051 > R:200 SINK_COUNT L=8 6 CP_READY Y(1) 10 DPPRE 13 +17:17:09.896052 Precharge/Sync Count: 32 00201: DEVICE_SERVICE_IRQ_VECTOR 11 DNAT 13 +17:17:09.896126 Precharge/Sync Count: 32 00201: DEVICE_SERVICE_IRQ_VECTOR 12 DPPRE 11 +17:17:09.896126 Precharge/Sync Count: 32 Device Service_IRQ_VECTOR	
9 DNAT 11 +17:17:09.896051 > R:200 SINK_COUNT L=8 6 CP_READY Y(1) 10 DPPRE 13 +17:17:09.896052 Precharge/Sync Count: 32 00201: DEVICE_SERVICE_IRQ_VECTOR 11 DNAT 13 +17:17:09.896052 > R:200 SINK_COUNT L=8 Bit Name Value D 12 DPPRE 11 +17:17:09.896126 Precharge/Sync Count: 32 Device_service_irquector Bit Name Value D	Bits 7 + 5:0
10 DPPRE 13 +17:17:09.896052 Precharge/Sync Count: 32 00201: DEVICE_SERVICE_IRQ_VECTOR 11 DNAT 13 +17:17:09.896052 > R:200 SINK_COUNT L=8 DEVICE_SERVICE_IRQ_VECTOR 12 DPPRE 11 +17:17:09.896126 Precharge/Sync Count: 32 DEVICE_SERVICE_IRQ_VECTOR	
11 DNAT 13 +17:17:09.896052 > R:200 SINK_COUNT L=8 Bit Name Value D 12 DPPRE 11 +17:17:09.896126 Precharge/Sync Count: 32 Bit Name Value D	
12 DPPRE 11 +17:17:09.896126 Precharge/Sync Count: 32	Description
13 DNAT 11 +17:17:09.896126 < ACK 41 00 77 77 05 03 00 00 0 REMOTE_CONTROL_COMMAND_PENDING N(0)	
14 DPPRE 13 +17:17:09.896126 Precharge/Sync Count: 32 1 AUTOMATED TEST REQUEST N(0)	
15 DNAT 13 +17:17:09.896126 < ACK 41 00 77 77 05 03 00 00 2 CP_IKQ N(0)	
16 DPPRE 11 +17:17:10.289181 Precharge/Sync Count: 32 4 DOWN REP MSG RDY N(0)	
17 DNAT 11 +17:17:10.289181 > R:200 SINK_COUNT L=8 5 UP REQ MSG RDY N(0)	
18 DPPRE 13 +17:17:10.289181 Precharge/Sync Count: 32 6 SINK_SPECIFIC_IRQ N(0)	
19 DNAT 13 +17:17:10.289181 > R:200 SINK_COUNT L=8 7 0 R	Reserved
20 DPPRE 13 +17:17:10.289255 Precharge/Sync Count: 32	
21 DNAT 13 +17:17:10.289255 < ACK 41 00 77 77 05 03 00 00 Bit Name Value D	Description
22 DPPRE 11 +17:17:10.289256 Precharge/Sync Count: 32	
23 DNAT 11 +17:17:10.289256 < ACK 41 00 77 77 05 03 00 00 0 LANEO_CR_DONE Y(1)	
24 DPPRE 11 +17:17:13.939544 Precharge/Sync Count: 32 1 LANE0_CHANNEL_EQ_DONE Y(1)	
25 DNAT 11 +17:17:13.939544 > R:200 SINK_COUNT L=8 2 LANE0_SYMBOL_LOCKED Y(1)	
26 DPPRE 13 +17:17:13.939544 Precharge/Sync Count: 32 3 0 R	Keserved V
27 DNAT 13 +17:17:13.939544 > R:200 SINK_COUNT L=8	

10.4 Alternate Scrambler Seed

The DP 2.0 eDP-capable module supports the alternate scrambler seed. Currently the feature is supported only through the command line. Use the following procedures to activate the alternate scrambler seed for an eDP source.

1. Access the command line interface through the ATP GUI Manager console or a terminal program such as PUTTY as shown below.



- 2. Enter qd for the login.
- 3. Enter qd for the password.

The following screen appears.

P 10.30.196.32 - PuTTY		Х	J
Debian GNU/Linux 5.0 xpscope-4a login: qd Password:		^	
Last login: Sat Mar 23 03:28:20 CDT 2019 from xpscope on pts/1 Linux xpscope-4a 2.6.26-2-686 #1 SMP Sun Mar 4 22:19:19 UTC 2012 i686			
The programs included with the Debian GNU/Linux system are free softw the exact distribution terms for each program are described in the individual files in /usr/share/doc/*/copyright.	are;		
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law. #dp14c-scope>			
		-	

4. To enable alternate scrambler, type the following command:



5. To disable alternate scrambler, type the following command:

```
- -
                                                                                х
Putty 10.30.196.32 - Putty
Debian GNU/Linux 5.0
xpscope-4a login: qd
Password:
Last login: Sat Mar 23 07:07:19 CDT 2019 from 10.30.196.30 on pts/2
Linux xpscope-4a 2.6.26-2-686 #1 SMP Sun Mar 4 22:19:19 UTC 2012 1686
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
#dp14c-scope>assr 0 enable
dptx0: ASSR Enabled
#dp14c-scope>assr 0 disable
dptx0: ASSR Disabled
#dp14c-scope>
```

10.5 Backlight Control

This section describes backlight control and provides procedures for using the M41d HBR3 Video Analyzer/Generator to control the backlight of an eDP TCON panel subsystem.

There are two methods of controlling the backlight: 1) Aux control messages, 2) control backlight thought direct connection leads.

Backlight Control Test Connections

This subsection provides procedures on how to connect the M42d 80G Video Analyzer/Generator to your eDP display panel for backlight control. You will use the Standard DisplayPort connector and the eDP header pin block and a special Teledyne LeCroy provided cable assembly.

- 1. Connect the provided cable from the eDP System Panel using the eDP connector.
- 2. Connect the other end with the standard DP connector and the eDP header block the provided cable to the M42d. Refer to the diagrams below.

Note: The eDP header block is used for controlling the backlight of an eDP display. The pinout and functions are shown below.

eDP Pin Configurations:



- BL_Enable (Possible Future Rx input)
- BL_Enable (Tx Output)
- BL_PWM_DIM (Possible Future RX input)
- BL_PWM_DIM (TX Output)



eDP Sink Test Connections

Backlight Control – Sink Tests

Use the following procedure to test eDP backlight on an eDP sink device.

1. Access the **Backlight** controls from the **Generator** panel and the **Tools** tab. Refer to the screen below.



The following table describes the Tx Backlight Controls.

Tx Backlight Control Fields		
Use Capabilities Yes No	Use Capabilities – Enables or disables the Backlight control feature.	
Control Mode Controlled by PWM eDP Pin V Disabled Controlled by DPCD Controlled by PWM eDP Pin PWM Duty-Cycle x DPCD Set DPCD Frequency Set	 Control Mode – Select how the backlight is controlled. Options available are: Disabled - Controlled by DPCD Controlled by PWM eDP Pin PWM Duty-Cycle x DPCD Set DPCD Frequency Set 	
Brightness (0 - 65535) (* 255 *	Brightness – Set the brightness of the backlight.Note: Must be in Controlled by DPCD mode	

Tx Backlight Control Fields				
<pre>PWM Duty Cycle (0 - 100%)</pre>	PWM Duty Cycle – The Duty Cycle control can be modified in percentages from 0 to 100%. The percentage of the Duty Cycle controls the percentage of the voltage high period.			
Pre-Scaling Frequency Divider (1 - 255) (1)	Pre-Scaling Freq Divider – The Pre-Scaling Frequency Divider is used to pre-scale the backlight PWM Cycle frequency.			
PWM Generator Divider Pn (1 - 16) (1 0)	PWM Generator Divider Pn - The PWM Generator Divider is used to create backlight dimming PWM signal.			
Appendices

Appendix A. Licenses

Many of the features of the M42d require a specific license to operate. This appendix will demonstrate how to apply a license, as well as list the available licenses.

To obtain a license for the M42d, contact Teledyne Support, accessible at http://quantumdata.com/support.html

Applying Licenses

To apply a license:

1. Upload the license file (.lic) using the Navigator by clicking **Instruments**, then selecting **Licenses** and clicking **Apply ATP License**. Alternatively, you can access this by selecting the **Other** tab on the GUI home screen and selecting **Apply ATP License**. Both are shown below.

Note: As the license file will likely be saved to your PC, it is recommended to use the remote host ATP Manager for this function. All screenshots are based on this GUI, though they are both similar.

Using the Navigator:

T ATP Manager					
🕾 Navigator					
Captures	Connect	Name		IP Address	
Compliance	Disconnect	💷 M42d Te	est	10.30.196.195	
Compliance	Add				
ACA	Edit				
EDID/DPCD	Delete				
Form	Infor <mark>t</mark> ion				
	Con <mark>re</mark> ▶				
Imag	Insta. 🔹 🕨				
Instruments	Licenses •	Genera	JID File		
Other	Misc ▶	Apply	License		
		Apply ATP	⁹ License		
		Apply Den	no License	9	
Help 🛛 🕨					
Import					
Exit					

Using the GUI:



2. A file explorer will appear, as shown below. Navigate to the correct directory of the previously downloaded license, select the .lic file, and click **Open**.

🛪 Open							\times
$\leftarrow \rightarrow \land \uparrow$	> This	PC > Desktop	v U	© Search	Desktop		
Organize • No	ew folder						?
- Ouick accord	^	Name		[Date modif	ied	
Desktop	*	M42d-CB-total.lic		5	5/27/2021	11:06 PN	N
🕹 Downloads	*						
Documents	*						
Note: Pictures	*						
import0611	~	<)
	File nam	ne:	~ *.	lic			\times
				Open		Cancel	

3. A confirmation will appear, and you must reboot the device for the changes to take effect.

Verifying Current Licenses

Use the following procedure to check the licenses that are currently applied to your M42d instrument.

- 4. Using either the embedded M42d GUI or Remote Host PC ATP Manager, open the Navigator.
- 5. Select the **Instruments** tab.
- 6. Choose the instrument that you are looking up and select Information on the left-hand side bar.

The Remote ATP Manager will automatically connect to the specified device, if not already connected.

🔭 ATP Manage	er					_	\Box ×
🖫 Navigator			- 8	👦 Apps			- 0
Captures	Connect	Name	IP Address		quantum	data	
Compliance	Disconnect	💷 M42d Test	10.30.196.195	Control	Compliance	Editors	Other
Compliance	Add						^
ACA	Edit						
EDID/DPCD	Delete				¥		
Formats	Information			Ge	nerator	Receiver	
	Configure 🕨						
Images	Insta'l ⊳						
Instruments							
Other	Misc ▶				TT		
		-		ACA	Remote	Capture Control	
				·			
Help ▶					Chan la chan l		
Import							
Exit				ŀ	IEAC		~

M42d Video Analyzer/Generator - User Guide

The **About** window will appear, which has various information about the device, and has the **Licensed Features** listed toward the bottom of the report, as demonstrated below.

Abo	ut	\times
**	<pre>M-Series Test Platform Version: 6.30.2 M4PMU Version: 0x07 DP 2.0 Protocol Analyzer [29480038034c,pca:8,pcb:3,sn:20170017,] at 1 [DDR 4096MB]: Gateware: [Version: 4.27.132 Build Number: 1 (06/08/2021 17:17:21 CST) PCB: 2/C rev=1 Firmware: [Version: 6.30.2 Build Number: 113029 (qd 06/14/2021 16:14:25 CDT) M42d] PD [Version Tx:11, Rx:11] System Information: System SN : [A301081ED0E83CC6::N/A] Date : [Tue Jul 6 08:58:45 CDT 2021] SN : [N/A::N/A] Main Board : ["Super Server"] CPUx6 : [6.158.10 "Intel(R) Core(TM) i5-9400 CPU @ 2.90GHz"] DDR : [7 GB + 512 MB] HD : [NVME SSD 465 GB (500107862016 bytes)] OS : [Linux M4XX-95a7 5.4.31 #3 SMP Tue May 5 12:08:24 CDT 2020 x86_64 x86_0 GUI manager : [Version 6.30.2_34492_202106141601] 1 : [lo inet 127.0.0.1/8 scope host lo] 2 : [eno2 inet 10.30.196.195/24 brd 10.30.196.255 scope global noprefix: PCIE3 : [] HDM SRC CT: [4.13.3] HDM SRC CT: [4.8.0] HDM SRC CT: [4.8.0] HDM SRC CT: [1.0.4] HDC : CT : [4.8.0] HDM SC Checksums: HDC t RX Key: 6bfaa9d92d1865a1d1a90e1709f1dec6 R. X Key: 81efd4be37c2fd04523829c492ead82b HDU RX Key: 83d55306babfd754e7a71d73c9ae4cd0 HDC x TX Key: 80d53306e29dd5c7db7154b362c Viscanced Ecotymes</pre>	¢ 1
	Licensed: 21 [Part of 95-00259 DP Auxiliary Channel Analyzer, M42] Licensed: 21 [Part of 95-00261 M42d DP 1.4 DP Auxiliary Channel Analyzer, M42] Licensed: 32 [Part of 95-00226 DisplayPort Capture/Analysis, M42] Licensed: 33 [Part of 00-00259 M42d DP 2.0 HDCP 2.3 Function, M42] Licensed: 33 [Part of 00-00261 M42d DP 1.4 HDCP 2.3 Function, M42] Licensed: 42 [95-00214 DP HDCP 2.3 Compliance Test - Source, M42] Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Sink, M42] Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Sink, M42] Licensed: 48 [Part of 95-00213 DisplayPort CT Package 2 LLCT 1.2 Core - Sink, M42] Licensed: 48 [Part of 95-00232 DisplayPort CT Package 3 LLCT HBR3 Source Tests, M42] Licensed: 50 [Part of 00-00259 M42d DP 2.0 Video Generator Function, M42] Licensed: 50 [Part of 00-00259 M42d DP 2.0 Video Generator Function, M42] Licensed: 50 [Part of 00-00261 M42d DP 1.4 Video Generator Function, M42] Licensed: 51 [Part of 00-00261 M42d DP 1.4 Video Generator Function, M42] Licensed: 51 [Part of 00-00261 M42d DP 1.4 Video Analyzer Software, M42] Licensed: 55 [Part of 95-00226 DP 1.4 Display Stream Compression (DSC) Rx Analysis, M4 Licensed: 56 [Part of 95-00226 DP 1.4 Display Stream Compression (DSC) Rx Analysis, M4 Licensed: 61 [Part of 95-0023 DisplayPort TT Package 4 LLCT 1.4 - Sink Tests, M42] Licensed: 61 [Part of 95-0023 DisplayPort HBR3 Link Layer Sink Compliance Tests, M42] Licensed: 61 [Part of 95-0023 DisplayPort HBR3 Link Layer Sink Compliance Tests, M42] Licensed: 61 [Part of 95-00233 DisplayPort HBR3 Link Layer Sink Compliance Tests, M42] Licensed: 68 [95-00259 M42d DP 2.0 USB-C Alt Mode Enable, M42]	د د ا
	SAVE TO FILE CLOSE	

Additionally, you can save this instrument information report as a .txt file. This is necessary when contacting Teledyne support regarding licenses, as they will ask you to send the report for a number of reasons, including:

- The instrument information report includes the hash codes necessary to write a new license for your specific instrument.
- The new license overwrites the current license; the new license is appended to a list of the current licenses on the instrument, which Teledyne support can obtain from the instrument information report.

Save the Instrument Information Report by selecting the **SAVE TO FILE** button at the bottom left of the report window, as shown below.

Abo	ut	\times
	HDCP Key File MD5 Checksums: HDCP 1.x RX Key: 6bfaa9d92d1865a1d1a90e1709f1dec6 HDCP 1.x TX Key: 8lefd4be37c2fd04523829c492ead82b HDCP 2.x RX Key: 85d55306babfd754e7a71d73c9ae4cd0 HDCP 2.x TX Key: f092c7036330e29ddd5c7db7154b362c	^
Ŧ	Licensed Features Licensed: 21 [Part of 95-00259 DP Auxiliary Channel Analyzer, M42] Licensed: 21 [Part of 95-00261 M42d DP 1.4 DP Auxiliary Channel Analyzer, M42] Licensed: 32 [Part of 95-00226 DisplayPort Capture/Analysis, M42] Licensed: 33 [Part of 00-00259 M42d DP 2.0 HDCP 2.3 Function, M42] Licensed: 33 [Part of 00-00261 M42d DP 1.4 HDCP 2.3 Function, M42] Licensed: 42 [95-00214 DP HDCP 2.3 Compliance Test - Source, M42] Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Source, M42] Licensed: 43 [95-00217 DP HDCP 2.3 Compliance Test - Source, M42] Licensed: 47 [Part of 95-00216 DisplayPort CT Package 2 LLCT 1.2 Core - Sink, M42] Licensed: 48 [Part of 95-00213 DisplayPort CT Package 3 LLCT HBR3 Source Tests, M42] Licensed: 48 [Part of 95-00232 DisplayPort HBR3 Link Layer Source Compliance Tests, M42] Licensed: 50 [Part of 00-00259 M42d DP 2.0 Video Generator Function, M42] Licensed: 50 [Part of 00-00261 M42d DP 1.4 Video Generator Function, M42] Licensed: 51 [Part of 00-00261 M42d DP 1.4 Basic Video Analyzer Software, M42] Licensed: 51 [Part of 95-00226 DP 1.4 Display Stream Compression (DSC) Rx Analysis, M42] Licensed: 56 [Part of 95-00225 DP 1.4 FEC/DSC Tx, M42] Licensed: 61 [Part of 95-00226 DP 1.4 FEC/DSC Tx, M42] Licensed: 61 [Part of 95-00226 DP 1.4 FEC/DSC Tx, M42]	v
		>
	SAVE TO FILE	LOSE

License Listing

This appendix provides a listing of all licenses available for the M42d.

The licenses and this listing are subject to revisions. Check current licenses and product ordering codes at https://www.quantumdata.com/m42d.html under the **Options** tab, shown below.



To obtain a license, contact Teledyne Support, accessible at http://quantumdata.com/support.html.

Part Number (SKU)	Description	License Keys
00-00259	quantumdata M42d DisplayPort 2.0 UHBR-20 Video	21:33:50:51:68:69:110:111
	Analyzer/Generator	
	- Base DP 2.0 functionality includes UHBR video generation,	
	basic analysis and ACA	
	- With both DP and USB-C ports enabled	
00-00261	quantumdata M42d DisplayPort 2.0 HBR3 Video	21:33:50:51:68:69
	Analyzer/Generator	
	- Base DP 1.4 functionality includes HBR3 video generation, basic	
	analysis and ACA	
	- With both DP and USB-C ports enabled	
Options		
95-00221	M42d Upgrade 00-00261 to enable UHBR rates	103
	- Requires 00-00261	
95-00222	M42d Passive Probing Main Link and Aux Channel	104
	- Requires 00-00259 or 00-00261	
95-00225	M42d DP Enhanced Sink Functional Tests	56:101:105:112:107
	- Includes DSC (for DP 1.4), LTTPR (and Panel Replay if 00-00259 or 95-00221)	
	- LTTPR and Panel Replay will be available in a future release	
95-00226	M42d DP Enhanced Source Functional Tests	32:55:102:106:108:113:109

	- Includes Capture Analysis, DSC (for DP 1.4), LTTPR (and Panel	
	Replay if 00-00259 or 95-00221)	
	- LTTPR and Panel Replay will be available in a future release	
95-00227	M41d/M42d DP EDID/DisplayID Sink Compliance Test Suite	73
	- Requires (00-00259 or 00-00261) and 95-00225, Or:	
	- Requires 00-00260 and 95-00220	
95-00228	M41d/M42d DP EDID/DisplayID Source Compliance Test Suite	76
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	
95-00209	M4 Series Rackmount Kit	N/A
	- Requires 00-00258 or 00-00259 or 00-00260 or 00-00261	
95-00212	M41d/M42d Embedded DisplayPort (eDP) option	70
	- Requires 00-00259 or 00-00261, Or:	
	- Requires 00-00260	
95-00213	M41d/M42d DP 1.4 Link Layer & FEC Source Compliance Test	35:48:93
	Suite	
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	
95-00214	M41d/M42d DP HDCP 2.3 Source Compliance Test Suite	33:43
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	
95-00215	M41d/M42d DP 1.4 DSC & FEC Source Compliance Test Suite	71
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	
95-00216	M41d/M42d DP 1.4 Link Layer & FEC Sink Compliance Test	47:61:94
	Suite Requires (00,00259 or 00,00261) and 95,00225. Or:	
	Prequires (00-00253 01 00-00201) and 35-00225, 01.	
05 00317	- Requires 00-00200 and 95-00220	22.42
95-00217	Requires (00.00250 or 00.00261) and 05.00225. Or	33:43
	- Requires (00-00259 of 00-00261) and 95-00225, OT:	
05 00340	- Requires 00-00260 and 95-00220	70
95-00218	M41d/M42d DP 1.4 DSC & FEC SINK Compliance Test Suite	12
	- Requires (00-00259 or 00-00261) and 95-00225, Or:	
	- Requires 00-00260 and 95-00220	
95-00232	M41d/M42d DP 2.0 Link Layer Source Compliance Test Suite	115
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	
95-00233	M41d/M42d DP 2.0 Link Layer Sink Compliance Test Suite	116
	- Requires (00-00259 or 00-00261) and 95-00225, Or:	
	- Requires 00-00260 and 95-00220	
95-00234	M41d/M42d DP Adaptive Sync Source Compliance Test Suite	117
	- Requires (00-00259 or 00-00261) and 95-00226, Or:	
	- Requires 00-00260 and 95-00219	

95-00235	M41d/M42d DP Adaptive Sync Sink Compliance Test Suite	118
	- Requires (00-00259 or 00-00261) and 95-00225, Or:	
	- Requires 00-00260 and 95-00220	

Appendix B. Configurable LTTPR Capability Registers

As covered in **Chapter 8 LTTPR Testing**, while emulating LTTPR for testing of a source, many LTTPR capability registers within the DPCD are modifiable. This appendix lists those registers that can be edited.

Note: For more information on the registers, including field values, see the **VESA DisplayPort 2.0 Standard** document.

See **8.2 Modifying DPCD of Emulated LTTPR** for specific instructions on accessing the DPCD Editor, saving custom configurations, and opening them upon startup. A screenshot of the LTTPR tab of the DPCD editor is below.

Base	F0000h	LTTPR_FIELD_DATA_STRUCTURE_REV	Nev	v Open Save	
DSC	F0001h F0002h	8b/10b_MAX_LINK_RATE_PHY_REPEATER			<no file="" name=""> <not connected=""></not></no>
PR	F0003h	PHY_REPEATER_MODE		LTTPR	FIELD_DATA_STRUCTURE_REV
Sink	F0004h F0005h	MAX_LANE_COUNT_PHY_REPEATER PHY REPEATER EXTENDED WAKE TIMEOUT	Bit	Field Name	Field Value
eDP	F0006h	MAIN_LINK_CHANNEL_CODING_PHY_REPEATER	7-4	Major Revision	0
Ext	F0007h	PHY_REPEATER_128B/132B_RATES	3-0	Minor Revision	a 0
LTTPR	\leq				

LTTPR Capability Registers:

See the following table for the configurable registers.

DPCD Address	Register	Field(s)
F0000h	LTTPR_FIELD_DATA_STRUCTURE_REV	Minor Revision Number Major Revision Number
F0001h	8b/10b_MAX_LINK_RATE_PHY_REPEATER	MAX_LINK_RATE (Gbps per lane)
F0002h	PHY_REPEATER_CNT	Count: Indicates the number of LTTPRs that are present. Up to eight LTTPRs are supported.
F0003h	PHY_REPEATER_MODE	Mode: Indicates the mode in which an LTTPR is operating.
F0004h	MAX_LANE_COUNT_PHY_REPEATER	MAX_LANE_COUNTReserved
F0005h	PHY_REPEATER_EXTENDED_WAKE_ TIMEOUT	 EXTENDED_WAKE_TIMEOUT_ REQUEST EXTENDED_WAKE_TIMEOUT_GRANT
F0006h	MAIN_LINK_CHANNEL_CODING_PHY_ REPEATER	128b/132b SUPPORTEDReserved

DPCD Address	Register	Field(s)
F0007h	PHY_REPEATER_128B/132B_RATES	 10 Gbps/lane Support 13 5 Gbps/lane Support
		 20 Gbps/lane Support
		 Reserved

The following tables are the configurable registers for each individual LTTPR. The only significant changes among the tables are the register address for each LTTPR.

LTTPR1

DPCD Address	Register	Field(s)
F0020h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT
F0021h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED Reserved
F003Dh	IEEE_OUI	
F0040h	Device Identification String	
F0046h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F0047h- F0048h	Firmware/Software Revision	Major RevisionMinor Revision

DPCD Address	Register	Field(s)
F0070h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER2	IntervalEXT_RX_CAP_FIELD_PRESENT
F0071h	TRANSMITTER_CAPABILITY_PHY_ REPEATER2	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED

DPCD Address	Register	Field(s)
		 Reserved
F008Dh	IEEE_OUI	
F0090h	Device Identification String	
F0096h	Hardware Revision	 Hardware Major Revision
		 Hardware Minor Revision
F0097h-	Firmware/Software Revision	 Major Revision
F0098h		Minor Revision

DPCD Address	Register	Field(s)
F00C0h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER3	IntervalEXT_RX_CAP_FIELD_PRESENT
F00C1h	TRANSMITTER_CAPABILITY_PHY_ REPEATER3	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_SUPPORTED Reserved
F00DDh	IEEE_OUI	
F00E0h	Device Identification String	
F00E6h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F00E7h- F00E8h	Firmware/Software Revision	Major RevisionMinor Revision

DPCD Address	Register	Field(s)
F0110h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT

DPCD Address	Register	Field(s)
F0111h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED
		 PRE_EMPHASIS_LEVEL_3_ SUPPORTED
		 Reserved
F012Dh	IEEE_OUI	
F0130h	Device Identification String	
F0136h	Hardware Revision	 Hardware Major Revision
		 Hardware Minor Revision
F0137h-	Firmware/Software Revision	 Major Revision
F0138h		 Minor Revision

DPCD Address	Register	Field(s)
F0160h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT
F0161h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED Reserved
F017Dh	IEEE_OUI	
F0180h	Device Identification String	
F0186h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F0187h- F0188h	Firmware/Software Revision	Major RevisionMinor Revision

DPCD Address	Register	Field(s)
F01B0h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT
F01B1h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED Reserved
F01CDh	IEEE_OUI	
F01D0h	Device Identification String	
F01D6h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F01D7h- F01D8h	Firmware/Software Revision	Major RevisionMinor Revision

DPCD Address	Register	Field(s)
F0200h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT
F0201h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED Reserved
F021Dh	IEEE_OUI	
F0220h	Device Identification String	
F0226h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F0227h- F0228h	Firmware/Software Revision	Major RevisionMinor Revision

DPCD Address	Register	Field(s)
F0250h	TRAINING_AUX_RD_INTERVAL_PHY_ REPEATER1	IntervalEXT_RX_CAP_FIELD_PRESENT
F0251h	TRANSMITTER_CAPABILITY_PHY_ REPEATER1	 VOLTAGE_SWING_LEVEL_3_ SUPPORTED PRE_EMPHASIS_LEVEL_3_ SUPPORTED Reserved
F026Dh	IEEE_OUI	
F0270h	Device Identification String	
F0276h	Hardware Revision	Hardware Major RevisionHardware Minor Revision
F0277h- F0278h	Firmware/Software Revision	Major RevisionMinor Revision