



# User Manual UCD Console SW Version 3.5

# /// UNIGRAF

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### Edition

UCD-5XX UCD Console 3.5 User Manual, rev 45

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UCD-5XX products meet the essential health and safety requirements, are in conformity with and the CE marking has been applied according to the relevant EU Directives using the relevant section of the corresponding standards and other normative documents.

# Table of Contents

	Copyright	
	Notice	2
	Edition	2
	Company Information	2
	Trademarks	3
	Limited Warranty	3
	CE Mark	3
	Table of Contents	4
1.	About This Manual	6
	Purpose	
	Product and Software Version	
	Notes	
		-
2.	Introduction	
	Product Description	
	Safety and Operational Precautions	10
3.	Installation	.11
	Installation Package	.11
	Software Installation	
	Firmware Update Procedures	
	Firmware Downgrading	
	License Manager	
	UCD Console	
	Options	
	Detaching and Cloning Tabs	
4	Analyzer Operation	
4.		
	Functionality Tabs	
	Link Tab	
	HDCP Tab	
	Video Tab	
	Capture Tab	
	Link Analyzer Tab	
	Audio Tab	
	EDID/DisplayID Tab	40
	DPCD Tab	42
	SDP Tab	
	DSC Tab	45
	Panel Replay Tab	47
	FEC Tab	
	Source DUT Testing Tab	51
	USB-C Monitoring	54
	Status List	55
	Capabilities	
	DP Alt Mode	
	Power Source	
	Power Sink	60
	Cable Info	
	Controls	
	Bottom Panel	
5.	Generator Operation	
5.	•	
	Functionality Tabs	
	Link Tab	
	Pattern Generator Tab	
	Playback Tab	
	Audio Generator Tab	
	HDCP Tab	
	EDID/DisplayID Tab	
	DPCD Tab	
	SDP Tab	91

		00
	FEC Tab Panel Replay Tab	
	ALPM Tab	
	Sink DUT Testing Tab	
	Adaptive-Sync Tab	
	USB-C Monitoring	101
6.	Link Timeline Viewer	
	Wave Form and Symbol View Settings	
	FrameView Tab	107
	Event Selector View	108
	Event Details Tab	
	Wave Forms View Tab	
	Symbols View	
	Images Tab	
	Frame Image View	131
7.	Event Timeline Viewer	132
8.	Event Log	136
	Selecting Logged Events	137
	Event Transaction List	
	Customizing Transaction List	
	Event Details	
9.	EDIDDisplayID Editor	
	EDID Editor Features	
	Editing Tips	
10.	Packet Editor	
11.	Pattern Editor	152
12.	Image Converter	154
Append	lix A: Product Specification	155
	UCD-500	
	UCD-500 Gen2	
Append	lix B: Product Features	
	UCD-5XX Product Options	
Append	dix C: Predefined Timings	162
Append	lix D: Predefined Patterns	167
Append	lix E: Sink, Source and Repeater Tests	172
	Compliance Tests	175
	Running CTS Tests	
	Evaluating CTS Test Results	
	Test Report	180
	Audio Test Set	181
	CRC Based Video Test Set	182
	Link Config Tests	185
	Pixel Level Video Tests	
Annend	Jix F: VTP Pattern Language	
Append	General	
	Commands	
	Variables	195
Append	dix G: Firmware Recovery	197
	Downloading Tools	197
	Step 1	
	Step 2	
Append	dix H: Playlists and Scenarios	199
	Playlists	
	Scenarios	
	Parameters	
	Example	

# 1. ABOUT THIS MANUAL

### Purpose

This guide is a User Manual of UCD-5XX products. UCD-5XX are USB-connected video interface test units for use with a computer.

The purpose of this guide is to

- Provide an overview of the product and its features.
- Provide instructions for the user on how to install the software and the drivers.
- Provide instructions for the user on how to update the FW of the unit.
- Introduce the HW features of UCD-5XX units.
- Provide instructions for the user on how to use UCD Console software.

### **Product and Software Version**

This manual explains features found in UCD Console Software Bundle **3.5**. Please consult Unigraf for differences or upgrades of previous versions.

Please consult the Release Notes document in the installation package for details of the SW and FW versions and changes to previous releases.

Note: This version of the User Manual describes features in UCD Console software based on the functionality in Microsoft Windows and macOS operating systems.

### Notes

On certain sections of the manual, when important information or notification is given, text is formatted as follows. Please read these notes carefully.

Note: This text is an important note

Warning: This is a warning about a direct risk for the functionality of the device

# 2. INTRODUCTION

### **Product Description**

UCD-5XX products are high speed, USB 3.0 connected video interface test units.

*UCD Console* is a common graphical user interface (GUI) for Unigraf's UCD-5XX, UCD-4XX and UCD-3XX units. The outlook and details of UCD Console will vary depending on the capabilities of the connected unit and will reflect the features enabled.

The software package for UCD-5XX features a high-level Software Development Kit (SDK) called Test Software Interface (TSI) for use in automated testing. TSI allows for an easy integration of Production and R&D testing routines into an automated test system environment. Please refer to TSI documentation found in additional Unigraf manuals for more details.

#### **Product Features**

- UCD-500: DP 2.1 capable Reference Sink and Reference Source for verifying DP and USB-C connected devices with link rates up to 20 Gbps (UHBR20) using USB-C interface and 10 Gbps (UHBR10) using DP interface.
- **UCD-500 Gen2**: DP 2.1 capable Reference Sink and Reference Source for verifying DP and USB-C connected devices with link rates up to 20 Gbps (UHBR20)
- High resolution video up to 8K @60Hz, 16K @60Hz with DSC and audio
- Generate HDR formats such as Dolby Vision™, HDR10 and HDR10+
- 16 GB video frame buffer
- High speed USB 3.0 host PC interface

Please refer to Product Specifications in the appendix of this document for details.

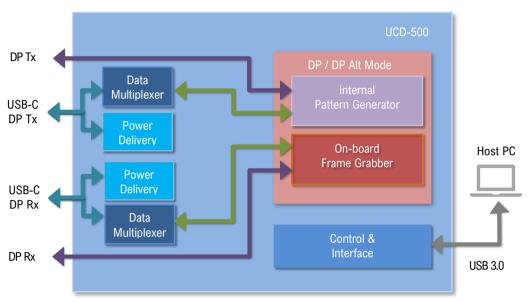
#### **Available Interface Roles**

UCD-500 products can operate in various interface role combinations. The used role is selected when UCD Console is launched.

Selection	UCD-500	UCD-500 Gen2
DisplayPort Sink and Source	•	•
USB-C DP Alt-Mode Sink and Source	•	•
DisplayPort Source and USB-C DP Alt-Mode Sink	•	•
USB-C DP Alt-Mode Source and DisplayPort Sink	•	•

### **Functional Description**

UCD-5XX units consist of a multimedia signal input stage, an internal pattern generator, a control stage with on-board frame buffer and a PC interface stage. In the Input Stage the signal is conditioned and converted to desired format. The Interface and Control stages are either passing the captured data directly to the USB interface or storing it to the frame buffer. The internal pattern generator is able to source a signal for testing sink and branch units. The Interface & Control stages are receiving instructions from the host PC to configure and control the functionality of the unit.



### UCD-5XX Functional Diagram

### **Delivery Content**

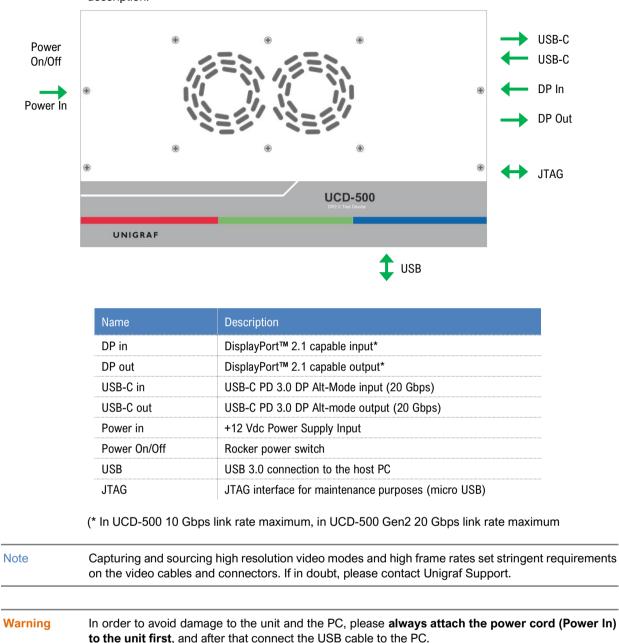
Please find below an image of the items included in UCD-5XX unit delivery



- 1. UCD-5XX Unit
- 2. AC/DC Power Supply (100 to 240 Vac 50/60Hz input, +12 Vdc output)
- 3. DisplayPort cable 0.5 meters length
- 4. Micro USB cable for FW update
- 5. Passive TBT4 cables, 0.5 and 1.0 meters length
- 6. USB 3.0 compliant cable for host PC connection

### Connections

The image below indicates the connections in **UCD-500** and **UCD-500 Gen2** unit and their description.



### Safety and Operational Precautions

Please find below the **Safety Precautions** for using the Unigraf UCD test instrument. Please also carefully read the **Notes and Warnings** within the text of this manual.

These **Precautions and Warnings** are provided to enable a safe use of the UCD test equipment. Therefore, Unigraf assumes no liability when the user fails to follow the expressed **Precautions and Warnings**.

- Use only Unigraf provided AC/DC Power Adapter. Please make sure that connectors and cabling to the Power Adapter are intact. In case there are any doubts about the condition of the Adapter or cabling, stop using it immediately.
- It is important to ensure that the used AC input voltage is within the specified range (100 to 240 Vac 50/60 Hz) and the fuses in the AC lines are of the specified type. If in doubt, do not connect the device.
- When installing the unit, connect the Power Adapter to the UCD device first, after that connect the AC plug. Please disconnect the USB cable to the controlling PC and remove cabling to DUT while connecting the power input cables.
- It is forbidden to open the housing of the UCD device without written permission from Unigraf. Failure to comply with this rule will void the warranty of the unit.
- UCD devices are intended for use as Electrical Test Instrument only. Use for other purposes is forbidden.
- Use UCD equipment only in its specified ambient temperature and humidity.
- In order to ensure that the UCD device and associated SW will operate properly, please ensure that the PC used for controlling the UCD device complies with the minimum requirement set by Unigraf.
- Please keep UCD software updated by regularly checking the updates on Unigraf download page (https://www.unigraf.fi/downloads/). Please update the device firmware to match the installed software.



### **Installation Package**

The UCD software installation package can be obtained from Unigraf download page at <u>https://www.unigraf.fi/downloads/</u>. Please, note that there are separate packages for Windows, macOS and Linux.

The installation package is a bundle between the components needed for UCD Console and for TSI SDK. The bundle contains the following items:

Drivers (installed during set up) UCD Console software (installed during set up) License Manager (installed during set up) Device configuration utility (installed during set up) Packet Editor (installed during set up) TSI SDK User Manuals including this document. In some cases, the firmware of the unit also needs to be updated. If in doubt, please contact Unigraf.

 Note:
 The software should be installed before connecting the UCD unit to the computer.

 Note:
 System administrator's privileges are required for performing installations.

### Software Installation

#### **Windows**

Install \*.exe file from the package.

Start installation by running application SoftwareBundle\_X.X.XXXX.exe.

The welcome page is displayed and shows the software package release version.

The user is also asked if he/she wants to:

Create a desktop shortcut

Install the Visual C++ redistributable (needs to be present on Windows)

Install Unigraf USB drivers

Confirm by selecting Next dialog button. Select Install to start the installation.

Select Finish to exit the installation dialog.

#### macOS

Install \*.pkg file from the package. This is a universal binary for ARM and Intel x86.

Start installation by running application SoftwareBundle\_X.X.XXXX.

Confirm by selecting Next dialog button. Select Install to start the installation.

Select Finish to exit the installation dialog.

Note: If you are downgrading, please remove the *Unigraf UCD Tools* folder from the *Applications* folder before starting installation.

Note: If installation fails, remove the *Unigraf UCD Tools* folder and any possible copies from the *Applications* directory and try again.

#### Linux

Linux extract the \*.tar.gz file. You will find two install scripts (install-libfuse.sh and install.sh).

In the Files app select each script in turn, right click and select *Properties* to open the *Properties dialog*. Toggle the *Executable as Program* button.

In the Files app open a terminal window by unselecting any selected files and right clicking and selecting *Open in Terminal* to run the scripts (order is important).

In the terminal type: sudo ./install-libfuse.sh

You will be prompted for your password.

Type: sudo ./install.sh

You will be prompted with:

Please proceed to 'Software & updates' application to tab 'Other Software' and uncheck checkboxes or remove 'cdrom' entry from /etc/apt/sources.list file, otherwise you will have problems during UCD Console package installation. If you are already done, enter the key 'y'. If not, enter 'n'.

For Ubuntu just enter y. For debian follow instruction.

You will then be prompted again with:

Please proceed to 'Software & updates' application to the first tab and set check box 'Officially supported (main)'. Otherwise you will have problems during UCD Console package installation. If you are already done, enter the key 'y'. If not - 'n'

For Ubuntu just enter y. For debian follow instruction

Answer y for additional prompts.

The Ucd Tool Installer Setup app should now be running.

Select Next>

Select radio button for Install for all users or Install just for me.

You are asked to Choose Installation Directory. Do NOT choose the default (/root/Unigraf/Unigraf UCD Tools at time of writing). Select a directory that is easy to access and remember.

Note the warning: Installing in existing directory. It will be wiped on uninstallation.

Select Next> Install and Finnish.

Navigate to the *Unigraf UCD Tools* directory under the installation directory and double click the app you want to run (*UCDConsole.AppImage* for example).

### **Firmware Update Procedures**

UCD Configuration Utility is used to load firmware to a UCD device. Optionally, the UCD Configuration Utility can be used to select firmware for specific operations. Contact Unigraf for details.

Note: Firmware update is a sensitive process. Please do not disconnect the device from the PC and do not power it off before the operation is completed unless specially requested. Avoid plugging and unplugging other USB devices when the firmware update is in progress.

To update the firmware or create a new configuration on a UCD-5XX device, perform the following steps:

Connect the UCD unit to a power supply and connect the USB cable.

Open UCD Console.

Select Tools > Firmware Update.

III UCD Config			$\times$
			///
Please select operation			
Enable advanced mode			
Enable patching (Internet connection is required)			
Included update files:			
Module BFBN of version F.1.1.9.0.N.1.5.2.0 Module MC3XX of version 0.35.22 Module MFMN422 of version F.1.0.63.N.1.10.128 Module MFMN500 of version F.3.5.11.0.N.3.6.86.0 Module MFMN500 of version F.0.7.14.0.N.3.6.84.0 Module PD of version 0.0.17 Module PDRX of version 1.4.6 Module PDRX of version 1.4.6 Module PDTX of version 1.4.6 Module PG of version 0.0.8 Module PX of version 0.0.11 Module UF of version 1.3.4 Module UX of version 2.6.1			
	< Back	Next >	Cancel

The first page of the utility shows the firmware component versions present in the bundle package (or possible installed separately). Select *Enable advanced mode* checkbox if you want to custom install (possibly to downgrade firmware for ex.). Select *Next* to proceed.

The Enable patching (Internet connection is required) check box is not relevant for UCD-5XX devices.

You are presented with a list of connected UCD devices. Select the device to update and Next.

### **Update UCD Modules**

A dialog lists the FW components available in the UCD device, the currently programmed FW version, and the FW to be installed. Select *Next*.

	III UCD Config	×
	UCD Modules Modules that should be updated are checked Current FW	FW to be installed
FW Module	Selected device: UCD-500 [2312C600]           MFMN500 F.0.7.14.0/N.3.6.84.0 [Existing F.0.7.14.0.0.0/N.3.5.192.0.0           UX 2.6.1 [No update needed. Existing 2.6.1]           UF 1.3.4 [No update needed. Existing 1.3.4]           PDRX 1.4.6 [Existing 1.4.5]           PDTX 1.4.6 [Existing 1.4.5]	20]
	< Back	<u>N</u> ext > Cancel

You will be presented with a summary for the update procedure. Select Start.

Update device firmware: MFMNS00: from F.0.7.14.0.0.0/N.3.5.192.0.0.0 to F.0.7.14.0/N.3.6.84.0 PDRX: from 1.4.5 to 1.4.6 PDTX: from 1.4.5 to 1.4.6 Change device configuration: No role changing operations selected.	UCD Config UCD Config Review the update operations to perform.	
MFMN500: from F.0.7.14.0.0.0/N.3.5.192.0.0.0 to F.0.7.14.0/N.3.6.84.0 PDRX: from 1.4.5 to 1.4.6 PDTX: from 1.4.5 to 1.4.6 Change device configuration: No role changing operations selected.	Operations selected:	
PDRX: from 1.4.5 to 1.4.6 PDTX: from 1.4.5 to 1.4.6 Change device configuration: No role changing operations selected.	Update device firmware:	
PDTX: from 1.4.5 to 1.4.6 Change device configuration: No role changing operations selected.	MFMN500: from F.0.7.14.0.0.0/N.3.5.192.0.0.0 to F.0.7.14.0/N.3.6.84.0	
Change device configuration: No role changing operations selected.	PDRX: from 1.4.5 to 1.4.6	
No role changing operations selected.	PDTX: from 1.4.5 to 1.4.6	
	Change device configuration:	
	No role changing operations selected.	
	< Back	Start Cancel

During the install you will be prompted to power cycle the device (power off, wait for 10 seconds and then power the device on again). Select *OK* to proceed. After the update finished select *Next* to see a summary and select *Finish* to complete.

Note: FW update procedure may take several minutes depending on the speed of the USB connection of the host PC.

### **Recovering from a Failed FW Update Procedure**

If FW Update procedure fails and cannot be re-initiated, refer to Appendix I of this manual for instructions on *Firmware Recovery*.

### **Firmware Downgrading**

Sometimes you may need an older bundle for which the firmware is a separate download.

Follow the procedure below:

- 1. Download the latest *Console 2 SW Bundle (2.4.XX)* from Unigraf download page at unigraf.fi/downloads.
- 2. Run the application *SoftwareBundle\_2.4.XX.exe* to install the package. Do not launch UCD Console application yet.
- 3. Download Console 2: FW Package 2.3.38 from the same download page.
- 4. Run the executable *FirmwarePackage\_2.3.38.exe* to copy UCD device FW to the proper folder on your PC.
- 5. Launch UCD Console.
- 6. Select Tools > Firmware Update to start the UCD Config utility.
- 7. In UCD Config select Enable advanced mode (see above).
- 8. Select Next to proceed as described in Update UCD Modules above.
- 9. Select the modules to be updated (see image below).
- 10. Select Next to proceed as described above.

III UCD Config	×
UCD Modules Modules that should be updated are checked	///
Selected device: UCD-500 [2312C600]	
<ul> <li>UX 2.4.0 [No update needed. Existing 2.6.1]</li> <li>UF 1.3.4 [No update needed. Existing 1.3.4]</li> <li>PDRX 0.10.16 [No update needed. Existing 1.4.6]</li> <li>PDTX 0.10.16 [No update needed. Existing 1.4.6]</li> </ul>	-
No updates for module MFMN500.	
< <u>B</u> ack <u>N</u> ext >	Cancel

# License Manager

#### Licensing

The features of UCD Console GUI are divided into groups based on the target use of the device. Most basic features can be used by default, and more advanced feature groups are enabled by dedicated licenses. When the licenses are present, the related part of the GUI will be shown, or the related control will be enabled.

Unigraf licenses are provided as strings of characters, **License Keys**. Each License Key enables a dedicated function in one device. Each device has its dedicated **Seed Number**. Each **License Key** is tied to one **Seed Number**. License Keys can be freely used in any number of PCs.

License keys are managed with **the UCD License Manager**. License manager can be found in the **Tools** menu of UCD Console.

Note: System administrator's privileges are required for accessing the licenses.

#### License Manager GUI

When run, License Manager will list the licensing enabled Unigraf devices. In the list of Devices please **Select** the device in question. The *serial number* and the *seed number* of your device are printed on a sticker attached to the bottom of the device.

The Rescan... button will re-detect connected UCD devices.

#### Managing Licenses

#### Seed Number

Each license is tied to a hardware unit with the help of the **Seed Number**. Each unit has a unique Seed Number. Seed Number of the selected unit can be found in the top of the dialog.

Seed Number of the selected device can be copied from dialog link for e.g., ordering Licenses.

stalled licenses:	
Name	Key
DP 2.0 LL CTS for testing Sink DUT	Q85C-
DP 2.0 LL CTS for testing Source DUT	OIEA- " " " I B B B P P B P P P B B B B B B B B B B
DisplayID CTS for testing Source DUT	1586- 5789
DisplayID CTS for testing Sink DUT	Q4MK-
DP 1.4 DSC CTS Sink DUT	VDSV-10 M MINI M I AND A MINI AND A AND A MINI AND A MI
DP 1.4 DSC CTS Source DUT	MSQF-MP M M M M M M M M M M M M M M M M M M
DP LL CTS 1.4 for testing Sink DUT	LM4T-W
DP LL CTS 1.4 for testing Source DUT	2L97-

#### Adding New License Keys

To add a new license key for a device, please enter the characters from the license sticker to the field for new licenses. The License Manager will automatically move the cursor across the edit boxes during typing. If the key is given in text format, copy it and paste to the leftmost box.

Once the license key is fully entered, click Install. The license is authenticated and if it is valid, the license will appear in the list of installed licenses. If the key fails to authenticate, an error message is displayed. If this happens, please make sure that the key has been typed correctly and that the seed number on the license key sticker matches the seed number displayed in UCD License Manager.

Please note that to avoid confusion, some letters will never appear in a license key because they resemble numbers: For example, capital 'G' and number '6' are very similar when printed with small font. When in doubt, use numbers.

Also, please note, that characters that cannot be part of valid license key are not accepted as input. When appropriate, an automatic conversion is applied while typing: For example, lower case letters are converted to upper case automatically.

#### Managing Installed Licenses

The Installed licenses list shows all installed licenses for the selected device. The list shows the name of the license and the actual license key characters.

Import:	Install licenses from an INI file for the currently selected device.
Export:	Save installed licenses for the currently selected device into an INI file for backup and distribution to other PCs. To export license(s), select the license(s) to be exported and then click the Export button. Please note that licenses from multiple devices can be exported into the same INI file.
Remove Selected:	Uninstall selected licenses. To uninstall a license, click on the license and then click the Remove Selected button

### **UCD** Console

UCD Console is graphical user interface (GUI) for UCD family test equipment for desktop use. UCD Console provides the user access to all features of the unit. UCD Console also includes powerful debugging and analysis tools enabling the user to monitor the status of the display interfaces and assist in problem detection.

In UCD Console the various features of the UCD unit are divided into interface specific screens and tabs. Each tab contains data and controls for a specific feature.

#### **Device Selection**

A shortcut of UCD Console can be found by default under Start Menu.

Once UCD Console GUI is launched, the dialog provides a list of Unigraf UCD devices connected in the PC. Please select the target device by double clicking on the appropriate row. If your device cannot be found in the list, please confirm the power and USB connection to the device and click the **Rescan**... button.

UCD Console	-		×
<u>F</u> ile <u>T</u> ools <u>W</u> indow <u>H</u> elp			
Devices:	Roles:		
UCD-500 [2150C473]	DisplayPort Source and Sink		
	DisplayPort Source and USB-C, DP Alt Mode Sink		
	DisplayPort Sink and USB-C, DP Alt Mode Source		
	USB-C, DP Alt Mode Source and Sink		
	Rescan Select	Clo	se

#### **Role Selection**

UCD-5XX features two alternative Sink interfaces (DP and USB-C), and in a similar way two alternative Source Interfaces. One Sink role and one Source role can be active at one time. Sink / Source role selection is done by selecting one of the four combinations during launch of UCD Console.

#### **Analyzer and Generator Operation**

Most UCD devices can be used with UCD Console as Analyzer (a Sink device) and as Generator (a Source device). The functionalities of the two operation modes can be found in separate tabs. This User Manual will explain both roles and all role functionalities.

JJ UCD	Console - I	UCD-500	2139C460	)]: Display	Port Sou	rce and	Sink								-	×	:
<u>F</u> ile <u>T</u> oo	ols <u>W</u> ind	low <u>H</u> el	р														
DP RX	DP TX	Event L	og														
Link	Video	Audio	EDID	DPCD	FEC	SDP	Source DUT Testing										
1.00	Charles						Unit Constitution	-									

### **Options**

Options can be found in Tools > Options.

Options	
Options Debug	
Capturing	
Image File Format	PPM ~
Audio File Format	WAV ~
Displays HDCP compliance:	One or more displays are not HDCP compliant
Folders	
Directory to save images and audi	o
C:/Users/Tester/Pictures/Saved Pi	ictures
DSC	
DSC temp folder	
C:\Temp\DSC	
DSC test content folder	
C:/ProgramData/Unigraf/DSC_co	ntent library
Keep auto-created DSC conter	
Keep auto-created DSC conter	it files
DUT Testing Options	
Include time info in Report log	IS
Do not show again test sequer	nce completed
	OK Cancel

#### Image File Format

You can save the captured frames either in PPM, BMP, JPG or PNG bitmap file format. In PPM format the files are stored with the captured color depth, with other formats the color depth is truncated to 8 bits per color.

#### Audio File Format

Audio files are stored in WAV format.

#### **Displays HDCP Compliance**

Information if controlling PC is HDCP compliant, i.e. if preview of HDCP encrypted content can be enabled. If the display is non-HDCP compliant or when connected to the PC using RDP (Remote Desktop Protocol) then users will be presented with a blue background with a banner stating 'HDCP unauthorized'. HDCP is currently only supported on Windows OS and not supported on MacOS and Linux.

#### **Folders**

Please select the directories in the PC for saving the captured images and audio

#### DSC

DSC temp folder	Folder for DSC Work files.
DSC test content folder:	Folder where DSC source bitmap files, related configuration files and DSC conversion tools are stored.
Keep auto-created DSC content files:	By default, the DSC compressed content is deleted after use. If selected, the content is not deleted

#### Warning:

Keeping the automatically created DSC compressed content will shorten the time needed for running the DSC compliance tests.

Please note, that the space needed for storing the full library **can be very large** (appr. 400 GBytes). Please make sure that the content will be stored in a medium that has the required space available.

#### **DUT Testing Options**

Configure DUT Testing reports.

Include time info in Report logs:

Include system date and time at the beginning of each event line in generated reports.

Do not show again test sequence completed:

Include system date and time in the beginning of each event line in generated reports.

# **Detaching and Cloning Tabs**

Most of the UCD Console tabs can be detached into a separate window for monitoring and controlling separate features simultaneously. To detach a tab **Right-click** on a tab and select **Detach Window**. To glue the tab back to the main window, click on the red **Close button** in the top right-hand corner of the window or press **<Alt> + F4** on the keyboard.

Tabs can also be cloned (duplicated) in order to e.g., monitor various areas of DisplayPort DPCD simultaneously without swapping addresses. To clone a tab **Right-click** on a tab and select **Clone Tab** or **Clone and Detach** to the two actions simultaneously.

C Event Log		Link Video Audio EDID DPCD SDP FEC DSC HDCP Source.DUTTesting Cepture Link-Analyzer
nk Pattern Generator Audio Generator Playback HDCP EDE	DRCD EFC Sink DIFF Section	Auto Record Snep Open Full Screen Fit Horizontally Scream 🛞 0 🔿 1 Disable Preview
NST Number of theams 23 INST Number of theams 23 INST Number of theams 23 CVT4056x2160 + 60Hz (R82) V X 85pc V + V5A C	Force EDD preferred timing after LT Use Timings from EDD Manage Tenings Stream 1	
Color Bars V RGB V	Color Bars V RGB V	
to options	ne options	
Farmel Bate         60:000         B         Pound Clarks         555:744         Adaptive System.           Active         4666         \$         1000         \$         5000         \$         1000         \$         \$         5         \$         1000         \$ <td< td=""><td>(·) Total 2200 C x 1125 C Sync polarity (·) x (·)</td><td></td></td<>	(·) Total 2200 C x 1125 C Sync polarity (·) x (·)	
nes Mel Tearlines : 1639 / 3227 Opp.	Dinan-Yangi Kengi	
0		Lindication and the second sec

# 4. ANALYZER OPERATION

When used as an *Analyzer*, the UCD-5XX device acts as DisplayPort or USB-C DisplayPort Alt Mode Sink or Receiver device.

Analyzer functionality related controls and dialogs can be used by selecting DP RX tab.

Please note that in UCD-5XX, *Generator* functionality is available simultaneously with Analyzer. Please find the description of Generator functionality later in this manual.

# **Functionality Tabs**

UCD Console features are presented in tabs. Some of the tabs are enabled by default, some only when an applicable license is included.

Note:

Some of the tabs are enabled by default, some only when an applicable license is included. Please refer to section *Appendix B Licensing* of this document for description of features and licensing.

### Link Tab

The Link tab contains the following panels: *Link Status, Link Training Result, Link Capabilities, VCP Table, Stream Info, HDCP Status, HDCP Configuration, Scrambler seed* and *HPD*.

	ory Layout	DP TX E	vent Log	DP RX											
ink HDCP	Video A	udio Lin	ik Analyzer	Capture		SDP	DSC	FEC	Source	DUT Testing	g Panel Replay	Cable Info			
Link Status Lanes (count = CR/SL/EQ VS/PE (level) FFE preset Error count (clic	:k to clear);	- 0000 0	1 2 0/1 0/1		○ 1.6	anes itrate, G 52	bps	○ 2 ○ 2.70		C	) 4		HDCP Status HDCP Active Authenticated Declared as HDCP cap. Gys loaded HDCP Configuration	2.X	
Bit rate: Framing mode: MST mode: DSC status:	8.1 Gbps	Link mode Scramblin SSC status FEC status	s: 8b/10 g: Enable s: Disab	b ed ed	<ul> <li>6.7</li> <li>eDI</li> <li>1.6</li> <li>4.3</li> </ul>	P Bitrate	<b>, Gbps</b> 2.16		0 2.43 6.75	2.7	0 (eDP only)	I S	HDCP Capable	2.X I	
Link Training Re Lanes (count = CR/SL/EQ VS/PE (level) FFE preset	4):	-	1 2 0/1 0/1	3 0/1 -	Inste	ad of 10	) Gbps, us	2 13.5 se:			20	(	FFFFh (DP)     FFFEh (eDP ASSR)     Custom 0x	0	
	8.1 Gbps	DS_ILA:			Enab eDP Sink cou	ole Fast I AUX Pre int: 2	LT eamble		SBM 🗹	FEC 🗹 T	PS4 V TPS3 V D Apply				
					VCP Table Stream # 0 1		Req.PBN / 266 266	Alloc.PBN 300 300	First slot 1 6	Slot num 5 5	HDCP Stream Statu Stream # Status 0 1 1	Type ype 0			
Stream Info	ITotal HStart		HSync VT 44 (+) 11		t VActive 1080	VSync 5 (+)	[VSC] Y	CEF CbCr4:2:0/	/ITU-R BT.	BPC	CRC (RGB/CrYCb) CA09 C5C5 A58B	MVID/		-	

#### **Link Status**

Link Status displays the status of the link training and the link parameters negotiated between UCD Sink and the Upstream Source. It also lists the status of other link modes. The data is retrieved from the DPCD status registers of the UCD Sink. The status is updated automatically.

Link Status					
Lanes (count :	= 4):	0	1	2	3
CR/SL/EQ					
VS/PE (level)		-/-	-/-	-/-	-/-
FFE preset		0	0	0	0
Error count (c	lick to clear):	0000	0000	0000	0000
ILA: E	Q_ILA:	CDS_ILA:		LT_FAIL:	
	20 Gbps			4 3 0 L /4	
Bit rate:	20 Gbps	Link mo	ode:	1200/1	32b
Bit rate: Framing mod		Link mo Scramb		Enable	
		-	ling:		ł

Lanes:	Indicates the number of lanes used for DisplayPort or DisplayPort Alt Mode.
CR/SL/EQ:	LED indicators for status of Clock Recovery / Symbol Lock / Channel Equalization for each of the four lanes
VS/PE (level):	Voltage Swing / Pre-emphasis level
FFE Preset:	TX Feed Forward Equalization (FFE) preset value (only with 128b/132b channel coding)
Error count:	Content of DPCD Error Count registers
ILA:	Status LED for Inter-Lane Alignment
EQ_ILA	Status LED for Inter-Lane Alignment on Equalization stage (only with 128b/132b channel coding)
CDS_ILA	Status LED for Inter-Lane Alignment on Clock and Data Switch stage (only with 128b/132b channel coding)
LT_FAIL	Status LED for Link Training failure (only with 128b/132b channel coding)
Bit rate:	Currently enabled link bit rate
Link mode:	Currently enabled channel coding (128b/132b or 8b/10b)
Framing mode:	Currently enabled Framing Mode (Normal or Enhanced) (only with 8b/10b channel coding)
Scrambling:	Status of link data scrambling (Enabled or Disabled)
MST mode:	Status of Multi-stream transport (Enabled or Disabled)
SSC Status:	Status of Spread-Spectrum Clock (Enabled or Disabled)
DSC Status:	Status of Display Stream Compression (Enabled or Disabled)
FEC status:	Status of Forward Error Correction function (Enabled or Disabled)

### Link Training Result

The result of the previous Link Training and values of some key parameters.

Link Training Result				
Lanes (count = 4): CR/SL/EQ	0	1	2	3
VS/PE (level)	-/-	-/-	-/-	-/-
FFE preset	0	0	0	0
ILA: EQ_ILA:	CDS_ILA:		LT_FAIL:	
Bit rate: 20 Gbp	s Link m	node:	128b/1	132b

Lanes:	Indicates the number of lanes used for DisplayPort or DisplayPort Alt Mode.
CR/SL/EQ:	LED indicators for status of Clock Recovery / Symbol Lock / Channel Equalization for each of the four lanes
VS/PE (level):	Voltage Swing / Pre-emphasis level
FFE preset:	TX Feed Forward Equalization (FFE) preset value (only with 128b/132b channel coding)
ILA:	Status LED for Inter-Lane Alignment
EQ_ILA	Status LED for Inter-Lane Alignment on Equalization stage (only with 128b/132b channel coding)
CDS_ILA	Status LED for Inter-Lane Alignment on Clock and Data Switch stage (only with 128b/132b channel coding)
LT_FAIL	Status LED for Link Training failure (only with 128b/132b channel coding)
Bit rate:	Currently enabled link bit rate
Link mode:	Currently enabled channel coding (128b/132b or 8b/10b)

### **Link Capabilities**

The Link capabilities panel allows the user to change the way the Sink capabilities are announced in the DPCD capability registers of the UCD Sink. To enable the change, please click *Apply*.

Link Capabilities			
Max Lanes			
○ 1	O 2	• 4	
Max Bitrate, Gb	pps		
0 1.62	○ 2.70	○ 5.4	10
0 6.75	8.10	○ 0 (	eDP only)
eDP Bitrate,	Gbps		
1.62	2.16 2.4	13 2.7	3.24
4.32	5.4 6.	75 8.1	
DP (128b/13	32b) Supported Bitrate	s, Gbps	
10	13.5	20	
Instead of 10	Gbps, use:	2.500 Gbps	~
Old DP 2.0 LT			
Force Cable S	tatus to Plugged		
🗌 Enable Fast Ll	r		
eDP AUX Prea	amble		
Sink count: 2 韋	MST SS SB	A 🗹 FEC 🗹 TPS4	🗹 TPS3 🗹 DSC
HPD pulse of	Apply		Apply

Max Lanes:	Maximum lane count used
Max Bitrate, Gbps	Maximum link rate used when 8b/10b link coding is selected in LT.
eDP Bitrate,Gbps	Available eDP bitrates.
DP (128b/132b) Supported Bitrates, Gbps	When checkbox is selected, 128b/132b link coding is supported. Link rates used when 128b/132b link coding is selected in LT. <b>Please observe the Note about the long HPD pulse below</b> .
Instead of 10 Gbps, use:	For supporting low link rate Source devices, the user can make UCD- 5XX sink PHY use a selectable lower link rate when performing "10 Gbps" link training in protocol level. Link rates are: 2.5 Gbps, 2.7 Gbps, 5.0 Gbps and 5.4 Gbps
Old DP 2.0 LT	When checked LT will follow initial DP 2.0 spec description. Otherwise, LT as per DP 2.1 specification
Force cable status to plugged:	UCD-400 RX device supports source device detection via AUX by default. Checking this on DPRX disables this behavior.
Enable Fast LT:	Indicates support for link training without AUX transactions.
eDP AUX Preamble	Use eDP AUX Preamble protocol.
Sink count	Selects the number of sinks capable of to transmitter.
MST:	When 8b/10b link coding enabled, indicate support for MST mode and Sideband MSG handling. When 128b/132b link coding enabled, indicate support for multi-stream transport and Sideband MSG.
SS SBM:	When selected, indicate support Sideband MSG while not supporting multi-stream transport. Valid only with 128b/132b channel coding and when "MST" is unchecked.
FEC (8b/10b):	Indicated support for Forward Error Correction feature when 8b/10b link coding is enabled
TPS4, TPS3:	Indicate support for Link Training Pattern Sequence 4 and 3.
DSC (8b/10b)	Select to enable Display Stream Compression (DSC) feature when 8b/10b link coding is enabled
HPD pulse on Apply:	Select to apply a Hot-Plug Detect (HPD) pulse automatically after updating the status. HPD pulse duration will be defined in the <i>Pulse HPD</i> field in <i>HPD</i> dialog in the bottom of the tab.

Note:	Please note that deviating from to the rules set in DP 2.1 Specification, UCD-5XX allows selection of maximum link rate for 8b/10b coding also when support for 128b/132b link coding is enabled.
Note:	When changing link coding capability of the Sink device (8b/10b vs 128b/132b), please make sure to

When changing link coding capability of the Sink device (8b/10b vs 128b/132b), please make sure to issue a Long HPD Pulse after applying new setting or make sure that "HPD pulse on Apply" is selected before applying the change

### **Scrambler Seed**

Scrambler seed (8b/10	b) —	
● FFFFh (DP)		
O FFFEh (eDP ASSR)		
O Custom 0x	0	4

Selection of the value to which the Linear Feedback Shift Register (LFSR) is reset during scrambler reset.

Used only when 8b/10b link coding is enabled.

#### **HDCP Status & Configuration**

HDCP Status	
HDCP	2.X
Active	
Authenticated	
Declared as HDCP capable	
Keys loaded	
HDCP Configuration	
	2.X
HDCP Capable	$\checkmark$

Copy of HDCP status and controls on HDCP tab.

#### **HDCP Stream Status**

HDCP Str	eam Sta	itus
Stream #	Status	Туре
0		Type 0
1		Type 0
2		Type 0
3		Type 0

Shows HDPC status for each stream.

#### **Stream Info**

Stream Info

Stream Info is achieved from the Main-Stream Attributes (MSA) of the monitored stream. Frame rate is measured by UCD Local Sink

The content of Stream Info table can be copied by right-clicking on the table and selecting Copy.

Framerate	HTotal	HStart	HActive	HSync	VTotal	VStart	VActive	VSync	CEF	BPC	CRC (RGB/CrYCb)	VFREQ	DSC CRC (Eng. 0 1 2)
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A

Framerate:	Vertical refresh rate
HTotal:	Horizontal total of transmitted main video stream, measured in pixel count.
HStart:	Horizontal active start from leading edge of HSync, measured in pixel count
HActive:	Horizontal active, number of active pixels in video line
HSync:	HSync width, measured in pixel count. (+)/(-) positive / negative sync.
VTotal:	Vertical total of transmitted main video stream, measured in line count.

VStart:	Vertical active start from leading edge of VSync, measured in line count.
VActive:	Vertical active, number of active lines in video frame
VSync:	VSync width, measured in line count. (+)/(-) positive v.s. negative sync.
CEF:	Used color mode: Color format + subsampling / colorimetry
BPC:	Color depth in bits per color (BPC)
CRC (RGB/CrYCb):	16-bit Cyclic redundancy check (CRC) value per color component calculated from active pixels. Value order in YCbCr color format: Cr, Y, Cb.
VFREQ:	Video Frequency (128b/132b channel coding only)
MVID/NVID:	Mvid and Nvid video time stamp values (8b/10b channel coding only)
DSC CRC:	16-bit Cyclic redundancy check (CRC) calculated from compressed pixel stream. Value order: Engine 0, 1, 2.

### **VCP** Table

VCP Table shows allocation of Virtual Channel Payload for active virtual channels.

The contents of VCP Table can be copied by right-clicking on the table and selecting Copy.

Stream #	VCPID	Req.PBN	Alloc.PBN	First slot	Slot num
0	1	532	605	0	5
1	2	532	605	5	5
2	з	532	605	10	5
з	4	532	605	15	5

Port#:	Port number where the virtual channel is directed.
SID:	Stream identification number of the virtual channel
Req.PBN:	Requested PBN (payload bandwidth number) value for the virtual channel
Alloc.PBN:	PBN value allocated for the virtual channel
First slot:	Time slot where the first VC Payload for the virtual channel is stored
Slot num:	Number of VC Payload slots reserved for the virtual channel.

### HPD

HPD Cable HPD	Assert Deassert Pulse HPD 500 msec 🔹 Short Pulse 750 usec <table-cell></table-cell>					
Cable:	LED indicates that the hardware has detected an upstream cable.					
HPD:	LED indicates that the HPD signal is Asserted (logical "high").					
Assert:	Click to re-activate the HPD line (set to logical "high").					
Deassert:	Click button to set HPD line to logical "low" (de-asserted) and hence no HPD pulse can be generated.					
Pulse HPD:	Click to apply an HPD Pulse with programmable duration. Duration will be defined in the provided field.					
Short Pulse:	Click to apply a short pulse with programmable duration. Duration will be defined in the provided field.					

### **HDCP** Tab

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the UCD device.

Nemory Layout Event Log DP TX	Terminal DP RX			
Link HDCP Video Audio I	EDID DPCD SDP DSC FEC	Source DUT Testing Link Analyzer	Capture Cable Info	
HDCP 2.3				
Status	Configuration			
General	HDCP Capable			
Active	Keys			
Authenticated Declared as HDCP capa	Production			
Keys loaded	Gracsimile - "Test" - R1			
SST Mode: Type N/A	Facsimile - "Test" - R2			
By stream	O None			
Stream 0 Typ	e 0			
Stream 1 Type Unkno				
Stream 2 Type Unkno				
Stream 3 Type Onkno	wn			
HPD		C	able Information	
Cable HPD Assert	Deassert Pulse HPD 500	Length, msec Short Pulse	TX: RX:	

#### **Status**

The status field indicates the HDCP status of the UCD device.

Active:	The link between UCD and the upstream source has been encrypted.
Authenticated:	The HDCP handshake between the UCD and the sink unit has been completed successfully.
•	The UCD unit recognizes HDCP handshake messages.
Keys loaded:	The HDCP keys are loaded to the UCD unit.
SST Mode Type	Type when in SST mode and in Link mode 8b/10b.
Stream status	Shows HDPC status on each stream.

### Configuration

```
HDCP Capable: To disable HDCP, uncheck the box.
```

### Keys

Select between Production or Facsimile HDCP keys. To remove the keys, select None.

# Video Tab

nk	Video	Audio	EDID	DPCD	SDP	FEC	DSC	HDCP	Source	DUT Testing	Capture	Link Analyzer		
	Auto		F	lecord		Snap		Open	1	Full Screen	E F	it Horizontally	Stream: 🖲 0 🔾 1	Disable Preview
Vide	0													
						-	-	-				_		-
														,
													(1858 x 1120) RGE	B (0x8B; 0x8B; 0x88
12:5	53.42.158	8.136.00	0: 409	6 x 2160	8 60.0	000 Hz,	RGB 8	bpc, Fra	me#2184	4.				
MV 2 Live	24030, NN	/ 32768, / frame	HT 44	00, VI 22 4.89 Hz.	150, HZ	4096,	VA 216	0, HS 21	6, VS 8	2, HSW 88,	VSW 10.			

Video tab is the Preview window for the captured video stream.

#### **Disable / Enable Preview**

Click the button to start or stop capturing video frames.

#### **Stream**

When Multistreaming (MST) is enabled, the monitored stream can be selected here.

Stream: 🖲 0 🔾 1

#### **Video Status**

The details of the captured video are presented below the preview window.

11:33.16.830.100.000: 4096 x 2160 @ 60.000 Hz, YCbCr4:2:2 8 bpc (Colorimetry: ITU-R BT.601), Frame≇30671. MV 35, NV 6797440, HT 4400, VT 2250, HA 4096, VA 2160, HS 216, VS 82, HSW 88, VSW 10. Live preview frame rate: 6.12 Hz.						
First row:	Cursor location, pixel value at cursor location in YCbCr and RGB					
Second row:	Time stamp, Color mode, color depth, frame counter.					
Third row:	Mvid, Nvid, Horiz Total, Vert Total, Horiz Active, Vert Active, Horiz Start, Vert Start, Hor Sync Width, Vert Sync Width.					
Fourth row:	Live preview frame rate.					

Note: HDCP preview is only available on UCD Console for Windows operating system.

Please note that UCD test equipment are able to capture video at full frame rate. *Live preview frame rate* indicates the rate of updating captured video on UCD Console preview screen. Live preview frame rate is limited e.g., by the USB communication between UCD test equipment and the PC.

### **Override Color Detection**

Auto

Captured video will be by default automatically converted to RGB 8 bpc for preview and saving based on the information in video metadata.

By clicking Auto button a dialog opens for overriding the automatic conversion. Captured image data will be interpreted based on the values set in the dialog.

/// Override Cold	or Detection	×
Override auto-	letected color parameters	
Color space:	YCbCr4:4:4	~
Colorimetry:	ITU-R BT.601	~
Bits per color:	Auto-detect	~
Clear all		
	ОК	Cancel

Color space:	Define as which format captured data will be interpreted. (Auto-detect, RGB, YCbCr4:4:4, YCbCr4:2:2, YCbCr4:2:0)
Colorimetry:	Define as which colorimetry captured data will be interpreted. (ITU-R BT.601, ITU-R BT.709, ITU-R BT.2020)
Bits per color	Define as which color depth captured data will be interpreted. (Auto-detect, 6, 8, 10, 12, 16)

Note: Please note that the color mode selection applies to the preview window only. All internal functions use the raw image data as captured from the input channel.

#### **Frame recording**

Record

Clicking the button opens a dialog for definition of number of frames recorded.

/// Record				×
Number of live frames to record:	10	-	ОК	Cancel

Recorded frames are stored by default in C:/Users/<Current user>/Pictures. Please refer to Tools > Options where the location of this folder can be customized.

#### Open

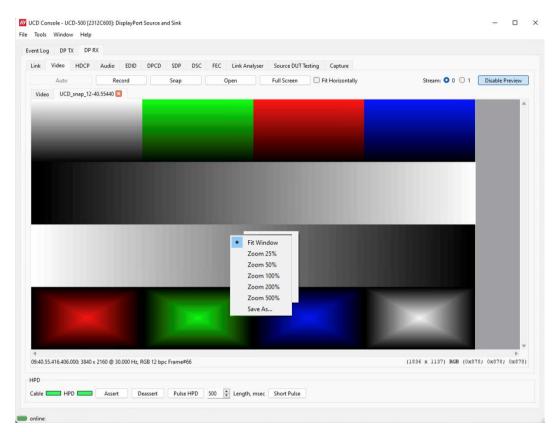
Open

Open folder where captured frames are stored. Please refer to Tools > Options where the location of this folder can be customized.

#### **Snap Frame**

Snap

When clicked, one frame of the incoming video is captured and shown in a new tab. Each click captures a new frame and opens a new tab.



Color Information of the captured frame can be evaluated by placing the mouse cursor on top of the preview image.

Info field in the lower right side of the bottom panel lists:

- Location of the cross cursor on the bitmap stating from the upper left corner
- The intensity of the RGB and YCbCr components of the pixel on the cursor location in hexadecimal values

#### Zoom

Zoom level of the captured frame can be altered by right clicking on top of the preview image and selecting between

- Fit Window
- Zoom 25%, 50%, 100%, 200%, and 500%

#### **Save Frame**

The captured frame current tab can be saved to a bitmap file in the PC by right clicking on top of the preview image and selecting **Save as...** The format and storage location can be selected in the opening dialog. The available bitmap formats are BMP, JPG, PNG, and PPM.

Note: In PPM format the files are stored with the captured color depth, with other formats the color depth is truncated to 8 bits per color.

The selections in Tools > Options menu define if the frame bitmap will be stored as captured from the display interface or if the color mode conversion selected for preview will be applied.

### **Full Screen**

Full Screen

Preview captured video full screen, scaled to vertically fit the screen.

Double-click on the screen or press <Esc> to exit full screen mode.

#### **Preview DSC Decompressed Stream**

In order to capture and preview DSC compressed video DSC must be enabled in *Link Capabilities* dialog in Link tab.

Select Enable Preview to verify that DSC compressed stream is received.

Click the Snap button to capture one frame and start the decompressor (offline in the PC). Once the decompression is ready, the frame is shown, and Log lists the details of the compressed image.

fools Window Help			
t Log DP TX DP RX			
nk Video HDCP Audio EDID DPCI	D SDP DSC FEC Link Analyzer Sou	urce DUT Testing Capture	
Auto	Snap Open Full	Screen 🗌 Fit Horizontally	Stream: O 0 O 1 Disable Preview
Video			
		The second second second	an a
Compared and the second second			
		California California	
	DSC RAW I	Data	
	Click Snap button to decompress an	ad proving a frame	
	Citck Shap button to necompress an	iu preview a name.	
09:33.18.847.475.000: 3840 x 2160 @ 30.6 MV 15, NV 11261760, HT 4000, VT 2191, HJ Live preview frame rate: 18.07 Hz.	00 Hz, RGB 12 bpc, Frame#4511. 1 3840, VA 2160, H5 112, VS 28, H5W 32.	VSW -5.	
Live preview frame rate: 18.07 Hz.			
D			
ble HPD Assert Deassert	Pulse HPD 500 😨 Length, msec Sho	ort Pulse	
line			
line D Console - UCD-500 (2312C600): DisplayPort Source	e and Sink		- 0
	and Sink		- 0
D Console - UCD-500 [2312C600]: DisplayPort Source	and Sink		- 0
D Console - UCD-500 [2312C600]: DisplayPort Source Tools Window Help		urce DUT Testing Capture	- 0
D Console - UCD-500 [2312C600]: DisplayPort Source Gools Window Help rt Log DP TX DP RX nk Video HDCP Audio EDID DPC	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C600]: DisplayPort Source fools Window Help ht Log DP TX DP RX ht Video HDCP Audio EDID DPC Auto Record	D SDP DSC FEC Link Analyzer So		Full Screen
D Console - UCD-500 [2312(2600); DisplayPort Source           D Console - WCD-500 [2312(2600); DisplayPort Source           Middow         Help           tLog         DP TX           k         Video           HOCP         Audio           EDID         DP CC           Audio         EBID           Video         HCCP           Video         EBIC           Video         UCD_snap; 12-28:38242	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C600]: DisplayPort Source fools Window Help ht Log DP TX DP RX ht Video HDCP Audio EDID DPC Auto Record	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C600] DisplayPort Source Tools Window Help at Log DP TX DP RX ak Video HDCP Audio EDID DPC Auto Record VIGEO UCD, may, 12-233624 2 UNICRAF	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C600]: DisplayPort Source fools Window Help tLeg DP TX DP RX k Video HOCP Audio EDID DPC Auto Record Video UCD_snip, 12-283824 2 UNIGRAF Viscon Record	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 (2312/2600): DisplayPort Source fools Window Help It log DP TX DP RX k Video HOCP Audio EDID DPC Auto Record Video UCD, sovp. 12-283/242 (2) UNICRAF Window HOCP Audio EDID DPC	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C600] DisplayPort Source Tools Window Help at Log DP TX DP RX ak Video HDCP Audio EDID DPC Auto Record VIGEO UCD, may, 12-233242 VIGEO RECORD	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 (2312 C600): DisplayPert Source fools Window Help titleg DP TX DP RX k Video HOCP Audio EDD DPC Auto Record Video UCD, snap, 12-28, 3624 2 UNI G RAF	D SDP DSC FEC Link Analyzer So		
D Console - UCD-500 [2312C8005 DisplayPert Source Tel Lg DP Tx DP Rx nk Video HDCP Audio EDD DPC Audio EDD DPC Video UCD_snep_12-253622 2 VIDI IG RAF Statistics Source Sou	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 (2312 C600): DisplayPert Source fools Window Help titleg DP TX DP RX k Video HOCP Audio EDD DPC Auto Record Video UCD, snap, 12-28, 3624 2 UNI G RAF	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tel Lg DP Tx DP Rx nk Video HDCP Audio EDD DPC Audio EDD DPC Video UCD_snep_12-253622 2 VIDI IG RAF Statistics Source Sou	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tel Lg DP Tx DP Rx nk Video HDCP Audio EDD DPC Audio EDD DPC Video UCD_snep_12-253622 2 VIDI IG RAF Statistics Source Sou	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tel Lg DP Tx DP Rx nk Video HDCP Audio EDD DPC Audio EDD DPC Video UCD_snep_12-253622 2 VIDI IG RAF Statistics Source Sou	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tel Lg DP Tx DP Rx nk Video HDCP Audio EDD DPC Audio EDD DPC Video UCD_snep_12-253622 2 VIDI IG RAF Statistics Source Sou	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C600]: DisplayPert Source Totols Window Help At Lig DP TX DP RX Nk Video HDCP Audio EDD DPC Auto Record VIDEO LINE, 12-23-8042 [ VIDEO LINE, 12	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPert Source foots Window Help at Log OP Tr DP RX Nk Video HDCP Audio EDD DPC Auto Record Video UCD_anip: [1:2:33:802] C UT I G RA F	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tele D P R Hep at Log DP R DP R Auto P R CONTRACT Video UCD_snep_12-233624 2 VID IG RAF VID IG	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C8005 DisplayPert Source Tele D P R Hep at Log DP R DP R Auto P R CONTRACT Video UCD_snep_12-233624 2 VID IG RAF VID IG	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPed Source Tools Window Help at Log DP TX DP RX Nk Video HDCP Audio EDD DPC Auto Record Video UCD_anep.12-23.8042 C UT I G RA F UT I G RA F UT I G RA F I Statesemman.gp = 10 fataseemman.gp = 10 fataseemman.gp = 10 fataseemman.gp = 0 File Source I S	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2112C000] DisplayPort Source Solo Window Help at Log DP TX DP R w Video HDCP Audio EDID DPC Audio EDID DPC UNICRAF UNICR	D SDP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPed Source Tools Window Help at Log OP TX DP RX w Video HDCP Audio EDD DPC Auto Record Video UCD_snep.[1:2-338042 ] UNI GRAF Faitness_Hall, QD faitness_Hall, QD for each subscription and the subscription the subscription and the subscription the subscription and the subscription the subscription and the subscription faitness_Hall, QD faitness_Hall, QD faitness faitness_Hall, QD faitness fait	D SOP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPed Source Tools Window Help at Log OP TX DP RX w Video HDCP Audio EDD DPC Auto Record Video UCD_snep.[1:2-338042 ] UNI GRAF Faitness_Hall, QD faitness_Hall, QD for each subscription and the subscription the subscription and the subscription the subscription and the subscription the subscription and the subscription faitness_Hall, QD faitness_Hall, QD faitness faitness_Hall, QD faitness fait	D SOP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2112C000] DisplayPort Source Solo Window Help at Log DP TX DP R w Video HDCP Audio EDID DPC Audio EDID DPC UNICRAF UNICR	D SOP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPed Source Total Source - UCD-500 [2312C800]: DisplayPed Source Total Source - UCD-500 [2312C800]: DisplayPed Source at up OP TX DP RX total OP RX DP RX Auto Record Video UCD_snep.[12-23.8042] UVIC RAF UVIC R	D SOP DSC FEC Link Analyzer So Snap		
D Console - UCD-500 [2312C800]: DisplayPed Source Total Source - UCD-500 [2312C800]: DisplayPed Source Total Source - UCD-500 [2312C800]: DisplayPed Source at up OP TX DP RX total OP RX DP RX Auto Record Video UCD_snep.[12-23.8042] UVIC RAF UVIC R	D SOP DSC FEC Link Analyzer So Snap		

# Capture Tab

UCD device has an internal frame buffer that can be used for continuous capture of video data. In addition, audio and metadata can be captured and saved for later analysis. Video can be stored as RGB or RAW data.

UCD Console - UCD-500 [2232C529]: DisplayPort Source and Sink Tools Window Help	- 0	
DP RX DP TX Event Log		
Link HDCP Video Audio EDID DPCD SDP FEC DSC Source DUT Testing Capture Link Analy	er	
Start Open Timeline Viewer Open stor	ge folder	
Buffered Capture Options Capture 5 • frames and save them in BIN v format Capacity of buffer: : Capacity of buffer: : Capacity of MSB	frames	
Events: HPD AUX SDP VB-ID MSA Link Pattern AUX BW VFRA	E INFO	
Audio: 🗌 Enabled		
Status: Capture stopped.		
HPD Cable HPD Assert Deassert Pulse HPD 500 🗘 Length, msec Short Pulse		

Start / Stop:	Start or Stop capturing
Capture N frames:	The number of video frames captured.
Format:	Selection of the format of the saved video frame bitmaps. BIN, PPM, BMP, BIN + PPM, BIN + BMP.
Capacity of buffer:	The number of video frames that can be stored to UCD frame buffer using current video signal format
Align to MSB	Store binary data aligned to the Most Significant Bit (MSB). When this is left unchecked the binary data is aligned to the Least Significant Bit (LSB).
Events:	Please refer to chapter Event Log for details of the captured events
Status:	Status of the capture.
Open Timeline Viewer	Open Event Timeline Viewer to view the captured data. Refer to chapter seven of this manual for detailed instructions.
Open storage folder:	Data save folder is defined in menu Tools > Options. Captured video, audio and data is saved in a subfolder of this folder. The name of the subfolder is "buffered_capture_yyyymmdd_hhmmss" (e.g., buffered_capture_20210301_130532).

Note:

Video Preview needs to be disabled to use Data Capture functionality.

# Link Analyzer Tab

Capture of Main-link Data Events and AUX Transactions for evaluation with Link Timeline Viewer. Please refer for details to chapter Link Timeline Viewer later in this manual for more details.

	Console - Uo ols Windo			ispiny Port 3	ource and a	2016										
р тх	DP RX	Event Lo	a													
Link		Video	Audio	EDID	DPCD	Capture	SDP	FEC	DSC	Source DI	IT Testina	Link Analy:	ter			
	Hoer	Haco	Addio	2010	0100	cupture	501	100	050	Jource Dr	/ iciting					
	Start											Open Timeline	e Viewer	Open storage folde	r	
	fain Link Ca		ms: MB	_												
	mount: 2							Desit	tion: Sta	and the						
	ource: TPS				~			~ Posit	tion: sta	iπ ∨						
3	ource: IPS	I V Posi	tion: Initia	91 L I	~	1										
E	vents Captu	re Options:														
	-		_	SDP		VB-ID								VFRAME INFO		
	] HPD		- L	_ SDP		] AR-ID		□ MS	A	🗆 🗆	ink Patter	m 🗆 AL	IX_BW	U VFRAME INFO		
~	tus: Idle															
Sta	tus: Idle															
HPD				-												
					essert	Pulse HPD	500	÷ι	ength, m	isec Shoi	t Pulse					
	e 💶 HF	PD 🔲	Assert	Dec				kinnid								
HPD Cabl	e 💶 HF	PD 💶	Assert	Det				<u></u>								
		PD <b></b>	Assert					Lound J								

Start	Start capturing main link data defined by Main Link Capture Options
Open Timeline Viewer	Open Link Timeline Viewer. For detailed description of Link Timeline Viewer, please refer to chapter six of this manual.
Open storage folder	Open folder in the PC where capture data is stored. Folder is the video storage folder defined in <i>Tools</i> > <i>Options</i> .
	Captured video, audio and data is saved in a subfolder of this folder. The name of the subfolder is "capture_yyyymmdd_hhmmss). (e.g. capture_20210215_093351).

### **Main Link Capture Options**

Amount: The amount of data logged to buffer. Buffer size 4 GBytes maximum.

### **Trigger Point Options**

Main Link Capture Options:		
Amount: 1 🗘 O MB 🖲 GB		
Trigger: Start of TPS1/TPS2/TPS3/TPS4 ~	Position:	Start 🗸
Source: TPS1 v Position: Initial LT v		Start
		25%
		50%
		75%
		End

Start of data capture can occur without defined trigger of triggered by a predefined signal combination.

The Position drop-down list at the upper right shows where in the trigger event it will start capture.

First select the event block from the *Trigger* drop-down list and use context sub-menus to select detail.

Trigger	Source	Position
No active trigger	_	_
Start of TPS1 / TPS2 / TPS3 / TPS4	TPS1, TPS2, TPS3, TPS4	Initial LT, After ALPM, Initial LT or After ALPM
Exit of TPS1 / TPS2 / TPS3 / TPS4	TPS1, TPS2, TPS3, TPS4	Initial LT, After ALPM, Initial LT or After ALPM
Trigger	Source	Mask (hex)
VB-ID with the MASK – any change, match, selected bit transition	Any VB-ID change VB-ID match with VB-ID Mask Change of any bit in VB- ID that is set in VB-ID mask	Set M <i>ask</i> value in hex format.
VB-ID on TYPE – BS/SR/CPBS/CPSR	BS, SR, CPBS, CPSR	—
Trigger	Options	HB0 (hex), HB1 (hex)
SDP Type received – HB0 and/or HB1 match	Match on HB0, HB1 can be any value Match on HB1, HB0 can be any value Match on HB0 and HB1	Set HB0/HB1 values in hex format.
Trigger	Source	Options
MSA – any change, change by mask, match by mask	Any MSA change Change of any MSA attribute set in mask Match of any MSA attribute set in mask	MVid, NVid, HTotal, VTotal, HActive, VActive, HSyncW, VSyncW, HSyncP, VSyncP, HSyncS, VSyncS, MISC0, MISC1
Any AUX transition	_	Initial LT, After ALPM, Initial LT or After ALPM
Trigger	Туре	Address (hex)
AUX read or write of specific address	AUX native write AUX natve read	Set address in hex format.
Trigger		
ACT (Allocation Change Trigger)		

Note:

If you want to capture during link training and you have set the trigger accordingly, you can initiate link training by clicking *Pulse HPD* at the bottom of the window.

#### **Events**

The following events can be included in the captured data.

#### <u>HPD</u>

Status and status changes of Hot Plug Detect (HPD) signal

#### <u>AUX</u>

AUX Channel transactions.

#### <u>SDP</u>

Secondary-data Packets received in the Main-Link. Click the .... button to open the *Event Filter Dialog.* The dialog enables filtering of SDP packets. In the dialog, the reference to Packet Type Value is indicated in square brackets "[]".

Event Filter Dial	og			
DP RX SDP filterin	ıg:			
Enable logging o	f following packet	s [IDs in hex]:		
Audio_TimeSt	amp [1] 🗌 Aud	io_Stream [2]		
Extension [4]	Extension [4] Audio_CopyManagement [5]			
ISRC [6]	VSC	[7]		
Camera Generio				
🗹 CG0 [8]	🗹 CG1 [9]	🗹 CG2 [A]	🗹 CG3 [B]	
CG4 [C]	🗹 CG5 [D]	🗹 CG6 [E]	🗹 CG7 [F]	
VSC_EXT_CTA	[21]	Adaptive-Sync SD	P [22]	
	⊠ A\ ⊠ At			
MPEG Source DRM [80 + 7	:e [80 + 5] 🗌 N' 7]	ISC VBI [80 + 6]		
Select all				
Enter packet type	as hex value sepa	rated by comma:		
0x0, 0xF				
			OK Cancel	

#### VB-ID

Vertical Blanking ID packets. Click the button to open the *Event Filter Dialog*. The dialog enables definition of which bit changes will be logged.

VBID filtering	Disabled On set On clear On any
VBLANK	0 0 0 0
FIELD_ID	$\circ$ $\circ$ $\circ$
INTERLACE	$\circ$ $\circ$ $\circ$
NO_VIDEO	$\circ$ $\circ$ $\circ$
NO_AUDIO	$\circ$ $\circ$ $\circ$
HDCP_SYNC	$\circ$ $\circ$ $\circ$
COMPRESSED	$\circ$ $\circ$ $\circ$
RESERVED	$\circ$ $\circ$ $\circ$
On MVID change	
On MAUD change	
🔿 Log all	Log on change

### **MSA**

Log Main Stream Attributes. Click the button to open the *Event Filter Dialog*. The dialog enables definition of which events will be logged.

III Event Filter D	ialog		×
MSA filtering			
Enable logging	MSA packet on ch	ange in:	
MVID	NVID	HTOTAL	VTOTAL
HSTART	VSTART	MSP HSP	HSW HSW
VSP	VSW	HWIDTH	
	MISC1		
O Log all		Log on char	nge
			OK Cancel

### Link Pattern:

Detect link patterns. Click the .... button to open the *Event Filter Dialog*. The dialog enables definition of which patterns will be logged.

W Event Filter Dialog		×
DP RX Link Pattern filtering:		_
Start           TPS1           TPS2           TPS3           TPS4           Active video           ML_PHY_SLEEP           ML_PHY_SLEEP           Custom pattern (80 bit)           CP2520.1           CP2520.2           PR857           PR8531           Custom pattern (80 bit)		
Type: Bytes (8bit, hex)		
	0	
OK	Cancel	

#### AUX\_BW:

Capture AUX Channel signal details.

### VFRAME INFO

Dimensions of the catured frame measured by the Sink

# Audio Tab

Audio tab has a preview of the audio signal format and the controls for audio playback and recording. Up to eight channels will be shown based on the received audio stream.

UCD Console - UCD-500 ile Tools Window He	[2232C529]: USB-C, DP Alt N	fode Source and Sink				- 🗆 ×
USB-C RX USB-C TX	Event Log					
PDC Video Link	HDCP Audio ED	ID DPCD SDP FEC	DSC Source DUT Testing			
Spectrum: 60 dB 🗸	Record (ms) 5000	÷	Refresh No audio playback	~	Stream: 🖲 0 🔘 1	Disable Preview
	<b>, , , ,</b>					<b>, , , ,</b> ,
				· · ·		
	<b>, , , ,</b>		<b>₩₩₩</b>			<b>7 7 7 7</b>
						186 msec
			.			
	hus.					22050 Hz
2 channels: 44100 Hz: 16	5 bits Frame#73 (lost frames (	0)				
HPD					PD	
Cable HPD	Assert Deasse	ert Pulse HPD 500	Length, msec Short Puls	e	DUT Attached	Detach Reconnect

The audio signal format is shown in three ways.

- The 'oscilloscope' panel displays the waveforms of the received audio channels.
- The frequency spectrum of the audio is shown in the lower panel. The range of the spectrum display is from 0 to 1/2 of the input sampling rate. The amplitude scale of the spectrum display can be selected between 'Linear' to 100 dB.
- The input audio mode field (in the bottom of the dialog) indicates detected audio mode in the input stream and the number of audio packets captured.

### **Enable Preview / Disable Preview**

This button controls capturing the audio data.

#### **Select Monitored Stream**

When Multistreaming (MST) is enabled, the monitored stream can be selected from **Current Stream** selection in the bottom of the dialog.

Note: Please note that if the captured audio signal is constant, and audio signal frequency and audio sampling rate (e.g. 1000 Hz audio and 32 KHz sampling) match audio preview sampling rate, the 'oscilloscope' panel will seem static. Signal capture can be verified by ensuring that Frame # below the panels is increasing.

### **Playback Device Selection**

No audio playback 🛛 🗸 🗸

The captured audio can be played back in the PC. The combo-box defines the audio device in the host PC through which the captured audio is played. By default, *No audio playback* is selected.

Note: Please note that the audio capabilities of the audio playback device of the PC are not automatically reflected in the audio capabilities description in UCD device EDID. Since UCD devices are not performing any audio format conversion, it might occur that the source provides an audio format that the selected playback device is not supporting. In case a conflict occurs, please change manually the EDID content, or disable audio playback to monitor the waveforms in UCD Console.

#### **Refresh Audio Device List**

Refresh

Click here to re-read the list of audio devices after making changes to the host PC configuration.

#### **Start Audio Recording**

Record (ms) 5000 ≑

The captured audio can be recorded in the PC using Waveform Audio File Format, WAV (\*.wav) format. Recording duration is defined in milliseconds (ms). The folder where the audio file will be saved can be selected in Tools > Options.

# EDID/DisplayID Tab

EDID/DisplayID Tab provides tools for accessing the EDID/DisplayID data presented to the connected Source Device. There are three basic functions:

- Load and save data files on the host PC.
- Edit contents in Editor Mode or Hex Edit Mode.
- Read and write to EDID/DisplayID memory for up to 4 virtual ports.

### **EDID/DisplayID Files**

	HDCP Video Audio		DPCD	SDP DSC FEC Source DUT Te	sting Cable Info EDID/DisplayID	
		Link Analyzer Capture	DPCD	SDP DSC FEC Source DUT Te	sting Cable Info EDID/DisplayID	
EDID	DisplayID					
Add I	tem 💌 Remove Item Filter			Read mod	de:      12C Read      SBM Read      Virtual Sink #1      Show Read	d Only 🗹 Recurse
1			0.	ditor Text EDID		
Vame						
	Vendor & Product ID			Name	Value	<u>^</u>
	EDID Structure Version and Re-	vision Numbers	0	Header	Dx00FFFFFFFFFF00	
>	Basic Display Parameters / Fea	tures	1	Extension Block Count N	2	
	Color Characteristics Established Timings I		2	Checksum	0x1C	
	Established Timings I			ID Manufacturer Name		
	Manufacturer's Timings		3	Vendor & Product JD	UFG	
	Standard Timings: Identificatio	n	4	ID Product Code	0x4036	
	Preferred Timing Block 18 byte descriptor 2		5	ID Serial Number	3900643	
	18 byte descriptor 3			Vendor & Product ID		
	18 byte descriptor 4		6	Vendor & Product ID->Week & Year of Manufacture or I	Week & Year of Manufactured	
Y C	Info		7	Week of Manufactured Vendor & Product ID->Week & Year of Manufacture or F	52	
>	Data block collection			Year of Manufacture	2014	~
	Detailed Timinas		~	00 01 02 03 04 05 05 0	07 08 09 0A 0B 0C 0D 0E 0F	^
Feat	tures CTA v3				00 (54 (c7) (36 (40) e3 (84 (3b) (00)	
	Name	Value	0		83a5fb1a2574fa228	
1 N	fax Resolution	15360 x 8640			1610081008180 a9 c0	
	CK 14	60.11			10 00 a0 £0 70 3e 80 30 20	
2 1	6K Max Frame Rate	60 Hz	- 0		a 56 5e 00 a0 a0 a0 29 50	
3 1	0K Max Frame Rate	60 Hz	0		0001a00000fd0038	
4 8	K Max Frame Rate	60 Hz	(	000060 (Hble8636000a202	02020202000000fc	
5 4	K Max Frame Rate	60 Hz	(	000070 005543442435303	0 20 44 50 31 0a 20 02 1c	
			- 0	000080 02 03 12 71 83 4f 00 0	00 29 0f 7f 07 15 06 55 3d	
6 2	K Max Frame Rate	60 Hz	(	000090 lf c0 00 00 00 00 0	00 00 00 00 00 00 00 00 00 00	
7 ⊦	IDR Static	Disabled	. (		00 00 00 00 00 00 00 00 00	
		Disablad		0000B0 00 00 00 00 00 00 00 00 0	0 00 00 00 00 00 00 00 00 00 00 00 00 0	

#### Analyzer Operation

# UNIGRAF

∠ Enable D	rispidyitz				
	Remove Item Filter			Read mode: O I2C Read () SBM Read Virtual Sink #1 V Shu	ow Read Only 🗹 Recurs
Name			Editor Text DisplayID		
<ul> <li>Section</li> </ul>			Name	Value	^
> Dat	ta Block		0 Version	2	
			1 Revision	0	
			2 Bytes in section	164	
			3 Display Product Type Identif	None of the listed primary use cases; generic display	
			4 Extension Count	0	
			5 Checksum	0x5D	
			6 Block Revision	0	
			Data Block->Product Identification Data     Number of Payload Bytes in     Data Block->Product Identification Data	BLOCK 19	
Features	Name	Value			~
1 Max Res		15360 x 8640		4 05 06 07 08 09 0A 0B 0C 0D 0E 0F )(00)(13)a4)(C0)(00)(36)(40)(a3)(84)(3b)(00)	
	v Frame Rate	60 Hz		3442353030218114001070	
2 16K Max			000020 08 00 10 70 0	800244a57fcc4a288521000	
-		60 Hz			
3 10K Max	x Frame Rate	60 Hz	000030 45 54 00 80 0	080008005ff2600093f3f1f	
		60 Hz 60 Hz	000030 455400800 000040 1f00e07f0	0 80 00 80 05 ff 26 00 09 3f 3f 1f 0 00 22 00 3e b2 90 1f 88 ff 1d 4f	
3 10K Max	x Frame Rate		000030 455400800 000040 1f00e07f0 000050 0007801f0	080008005ff2600093f3f1f	
3 10K Max	x Frame Rate		000030 45540780 000040 1£07607£0 000050 007601£0 000060 08££274£0 000070 003596740	9 00 00 00 05 F 26 00 09 F 27 F 9 00 20 00 50 20 0 F 86 F 24 F 9 F 10 7a 00 60 00 00 00 6a 22 9 F 10 7a 00 6c 00 70 00 07 9 F 30 F 00 F 00 F 21 F5	
3 10K Max	x Frame Rate		000030 455400800 000040 1£00e07£0 000050 0007801£0 000060 08££274£0 000070 003595740 000080 00e700070	9 60 70 60 75 77 27 70 90 77 27 17 9 60 72 60 76 80 77 80 77 80 77 9 60 77 80 76 80 77 80 78 9 77 80 74 70 78 78 70 80 78 9 77 80 74 70 78 70 80 70 70	

With *Load...* and *Save as...* a file can be read and written from the PC. Please note that the program does not alter the contents of the file or verify its integrity during load and save operations.

Note:	Four blocks (512 bytes) of EDID code are read. If the device does not support all four blocks, the
	non-supported data is zeroed.

The *Enable DisplayID* checkbox, when checked, informs generator devices that DisplayID data is available.

The Text EDID and Text DisplayID tabs allow viewing data in tree form.

#### **EDID/SDisplayID Editor**

Please see the description in Chapter EDID/DisplayID Editor later in this document.

# **DPCD** Tab

DPCD tab is a tool for monitoring and editing the DPCD registers of the UCD Sink.

| leo                                    | HDCP  | A  | udio   
   
   
  | EDI   | D   | DPCD   |   | SDP   
   
   | DSG   
    |  | EC  
   
  | Link A  | nalyser   | So   | urce DUT Testing  | Cap  | pture   |  |   
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   | -   
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  |   |   |  | Link Configurat   | tion   |   |  |   
   | Loa  | d  | Save   |   | Report  |
| 04<br>00<br>03<br>00<br>00<br>00<br>00 | 04 00<br>07 00<br>00 00<br>00 00<br>00 00<br>00 00        | 000<br>000<br>000<br>000<br>000<br>000<br>000  | 00 0<br>00 0<br>00 0<br>00 0<br>00 0<br>00 0   
   
   
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  | 0<br>0<br>0<br>0<br>0<br>0<br>0   |   |  | LINK_BW_SET<br>0x00100 := 0x04<br>LINK_BW_SET<br>Value = 4 (0x0<br>NOTE: Decode<br>LINK_BW_SET  | 1<br>= RESEF<br>14)<br>ed as M/<br>= 13.5G   | AIN_LIN   | ne (UHBR13.5)  |   
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  | 0<br>0<br>0<br>0<br>0<br>0<br>0   |   |  | MAIN_LINK_CH<br>0x02206 := 0x03<br>8b/10b_SUPP  | iannel,<br>3<br>Orted =  | CODIN<br>= 1  | IG [RO]  |   
   |  |  |  |   |   |
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|  | 100<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00<br>00 | 100<br>00 01 02<br>00 01 02<br>00 07 00<br>00 00 00<br>00 00 00<br>00 00 00<br>00 00 00<br>00 00 00<br>2200<br>14 1e 40<br>00 00 00<br>00 00 | 100         ♥         N           00         01         02         03           00         04         02         03           00         07         00         00           00         07         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           2200         ♥         N           00         01         02         03           14         1e         48         10           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00           00         00         00         00 <td>100         ♥         Number           00         01         02         03         04         0           00         01         02         03         04         0           00         01         02         03         04         0           00         07         00         00         00         00           00         00         00         00         00         00           00         00         00         00         00         00           00         00         00         00         00         00         00           00         00         00         00         00         00         00         00           00         00         00         00         00         00         00         00           2200         ♥         Number         Number         Number         Number           00         01         02         03         04         0         00         00           00         00         00         00         00         00         00         00         00         00         00         00         00         &lt;</td> <td>100         ♥         Number of By           00         01         02         03         04         05         06           00         01         02         03         04         05         06           00         01         02         03         04         05         06           00         07         00         00         00         00         00         00           00         &lt;</td> <td>100         Number of Bytes: 0           00         01         02         03         04         05         06         07           00         01         02         03         04         05         06         07           00         01         00</td> <td>100         Number of Bytes: 0x         100           00         01         02         03         04         05         06         07         08           00         01         02         03         04         05         06         07         08           00         01         02         03         04         05         06         07         08           00         01         00         00         00         00         00         00         00           00         01         00         00         00         00         00         00         00           00</td> <td>100         Number of Bytes: 0x         100           00         01         02         03         04         05         06         07         08         09         00<td>100         Number of Byte: 0x         100         2           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         00</td><td>100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         07         00</td><td>100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0.0         00<td>100         Number of Bytes: 0x         100         Image: 0x         &lt;</td><td>100         Number of Bytes: 0x         100            00         01         02         03         04         05         06         07         08         00         08         0C         0D         0E         0F           01         01         02         03         04         05         06         07         08         00</td><td>100         Image: Number of Bytes: 0x         100         Image: Number of Bytes: 0x         100</td><td>100         S         Number of Byte: 0x         100         S           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         0E         0F         0E         0F         0E         0F         0F</td><td>100          <ul> <li>Number of Bytes: 0x</li> <li>100</li> <li>100</li></ul></td><td>100         S         Number of Bytes: 0x         100         S           100         S         Number of Bytes: 0x         100         S           100         O         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         UMUK, BW, SET         Doc100         Coc0100         Coc0100</td><td>100         ♥         Number of Bytes: 0x         100         ♥           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0         0         00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0D</td><td>100         Number of Bytes: 0x         100         C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         07         00         00         00         00         00         0D         0D</td><td>100         Number of Byte: 0x         100         Image: Configuration configuratindefiguratendefiguration configuratendefiguratindefiguration conf</td><td>Loa<br/>100   Number of Bytes: 0x 100  Link, GW, SET  Link, GW, SET</td><td>Load  10   Number of Bytes: 0x 100   Link Configuration Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  2200   Number of Bytes: 0x 100   Link Configuration Link, SW_SET  Coold  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Link, SW_SE</td><td>Load         Save           100         Image: Number of Bytes: 0x         100</td><td>Load         Save           10         Number of Bytes: 0x         100         Image: 100 miniput 100</td></td></td> | 100         ♥         Number           00         01         02         03         04         0           00         01         02         03         04         0           00         01         02         03         04         0           00         07         00         00         00         00           00         00         00         00         00         00           00         00         00         00         00         00           00         00         00         00         00         00         00           00         00         00         00         00         00         00         00           00         00         00         00         00         00         00         00           2200         ♥         Number         Number         Number         Number           00         01         02         03         04         0         00         00           00         00         00         00         00         00         00         00         00         00         00         00         00         < | 100         ♥         Number of By           00         01         02         03         04         05         06           00         01         02         03         04         05         06           00         01         02         03         04         05         06           00         07         00         00         00         00         00         00           00         < | 100         Number of Bytes: 0           00         01         02         03         04         05         06         07           00         01         02         03         04         05         06         07           00         01         00 | 100         Number of Bytes: 0x         100           00         01         02         03         04         05         06         07         08           00         01         02         03         04         05         06         07         08           00         01         02         03         04         05         06         07         08           00         01         00         00         00         00         00         00         00           00         01         00         00         00         00         00         00         00           00 | 100         Number of Bytes: 0x         100           00         01         02         03         04         05         06         07         08         09         00 <td>100         Number of Byte: 0x         100         2           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         00</td> <td>100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         07         00</td> <td>100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0.0         00<td>100         Number of Bytes: 0x         100         Image: 0x         &lt;</td><td>100         Number of Bytes: 0x         100            00         01         02         03         04         05         06         07         08         00         08         0C         0D         0E         0F           01         01         02         03         04         05         06         07         08         00</td><td>100         Image: Number of Bytes: 0x         100         Image: Number of Bytes: 0x         100</td><td>100         S         Number of Byte: 0x         100         S           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         0E         0F         0E         0F         0E         0F         0F</td><td>100          <ul> <li>Number of Bytes: 0x</li> <li>100</li> <li>100</li></ul></td><td>100         S         Number of Bytes: 0x         100         S           100         S         Number of Bytes: 0x         100         S           100         O         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         UMUK, BW, SET         Doc100         Coc0100         Coc0100</td><td>100         ♥         Number of Bytes: 0x         100         ♥           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0         0         00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0D</td><td>100         Number of Bytes: 0x         100         C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         07         00         00         00         00         00         0D         0D</td><td>100         Number of Byte: 0x         100         Image: Configuration configuratindefiguratendefiguration configuratendefiguratindefiguration conf</td><td>Loa<br/>100   Number of Bytes: 0x 100  Link, GW, SET  Link, GW, SET</td><td>Load  10   Number of Bytes: 0x 100   Link Configuration Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  2200   Number of Bytes: 0x 100   Link Configuration Link, SW_SET  Coold  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Link, SW_SE</td><td>Load         Save           100         Image: Number of Bytes: 0x         100</td><td>Load         Save           10         Number of Bytes: 0x         100         Image: 100 miniput 100</td></td> | 100         Number of Byte: 0x         100         2           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         02         03         04         05         06         07         08         09         0A         00           00         01         00 | 100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C           00         07         00 | 100         Number of Bytes: 0x         100         P           00         01         02         03         04         05         06         07         08         09         0.0         00 <td>100         Number of Bytes: 0x         100         Image: 0x         &lt;</td> <td>100         Number of Bytes: 0x         100            00         01         02         03         04         05         06         07         08         00         08         0C         0D         0E         0F           01         01         02         03         04         05         06         07         08         00</td> <td>100         Image: Number of Bytes: 0x         100         Image: Number of Bytes: 0x         100</td> <td>100         S         Number of Byte: 0x         100         S           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         0E         0F         0E         0F         0E         0F         0F</td> <td>100          <ul> <li>Number of Bytes: 0x</li> <li>100</li> <li>100</li></ul></td> <td>100         S         Number of Bytes: 0x         100         S           100         S         Number of Bytes: 0x         100         S           100         O         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         UMUK, BW, SET         Doc100         Coc0100         Coc0100</td> <td>100         ♥         Number of Bytes: 0x         100         ♥           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0         0         00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0D</td> <td>100         Number of Bytes: 0x         100         C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         07         00         00         00         00         00         0D         0D</td> <td>100         Number of Byte: 0x         100         Image: Configuration configuratindefiguratendefiguration configuratendefiguratindefiguration conf</td> <td>Loa<br/>100   Number of Bytes: 0x 100  Link, GW, SET  Link, GW, SET</td> <td>Load  10   Number of Bytes: 0x 100   Link Configuration Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  2200   Number of Bytes: 0x 100   Link Configuration Link, SW_SET  Coold  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Link, SW_SE</td> <td>Load         Save           100         Image: Number of Bytes: 0x         100</td> <td>Load         Save           10         Number of Bytes: 0x         100         Image: 100 miniput 100</td> | 100         Number of Bytes: 0x         100         Image: 0x         < | 100         Number of Bytes: 0x         100            00         01         02         03         04         05         06         07         08         00         08         0C         0D         0E         0F           01         01         02         03         04         05         06         07         08         00 | 100         Image: Number of Bytes: 0x         100 | 100         S         Number of Byte: 0x         100         S           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         0E         0F         0E         0F         0E         0F         0F | 100 <ul> <li>Number of Bytes: 0x</li> <li>100</li> <li>100</li></ul> | 100         S         Number of Bytes: 0x         100         S           100         S         Number of Bytes: 0x         100         S           100         O         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F         UMUK, BW, SET         Doc100         Coc0100         Coc0100 | 100         ♥         Number of Bytes: 0x         100         ♥           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0         0         00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0D | 100         Number of Bytes: 0x         100         C           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         01         02         03         04         05         06         07         08         09         0A         0B         0C         0D         0E         0F           00         07         00         00         00         00         00         0D         0D | 100         Number of Byte: 0x         100         Image: Configuration configuratindefiguratendefiguration configuratendefiguratindefiguration conf | Loa<br>100   Number of Bytes: 0x 100  Link, GW, SET  Link, GW, SET | Load  10   Number of Bytes: 0x 100   Link Configuration Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  2200   Number of Bytes: 0x 100   Link Configuration Link, SW_SET  Coold  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Coold  Link, SW_SET  Link, CHANNEL_CODING_SET = 128b/132b  Link, SW_SET  Link, SW_SE | Load         Save           100         Image: Number of Bytes: 0x         100 | Load         Save           10         Number of Bytes: 0x         100         Image: 100 miniput 100 |

The *DPCD Decoder* panels on the right show the interpretation of the DPCD byte selected on the monitoring windows. The selected byte is shown with a green background.

Save:	Select DPCD content to a binary DPCD Data file (*.DPD).
Load:	Select previously saved binary DPCD Data file (*.DPD).
Report:	Save parsed content of selected DPCD register ranges as HTML file
Refresh:	Re-read the data from the DPCD registers to the window in question
Write Changes	Write the portion of data shown in the window in question to the DPCD registers.
Set Reference	Store currently shown data as a reference for comparison

When the data is *Refreshed* from the DPCD registers the changed bytes will be highlighted with **blue** color. The fields edited by the user will be highlighted with **red** color.

Note: - User control like Link Training or mode changes will modify the content of the DPCD registers - During a reboot of the UCD device the DPCD registers will be returned to their default values

## **SDP** Tab

In SDP Tab shows the *Secondary-Data Packets* sent by the Source device. Click *Refresh* to update the data. Show/hide the SDP data by clicking *Packet Info* button. The divider line can be draged to adjust the pane size.

SD	P CRC1	6 error counter	s (128b/13	12b)																		
SD	OP CRC1	6	ms (count count (clic	= 2): :k to clear):	0 00		3															
2 3 4 5 6 7 8 9 10 11 12 13 14 15	ATS ASP EXT ACM ISRC CGP0 CGP1 CGP2 CGP2 CGP3 CGP4 CGP5 CGP6 CGP7 PP5	Header           00         01         02         03           00         01         17         48           09         02         00         01         17         48           99         04         57         CA         20         51         16           99         04         57         CA         20         51         16         00 </th <th>00 00 0 00 AA A BC 91 9 00 00 9 00 00 9 00 00 9 2B FE 0 00 00 2 96 95 9 A2 58 2 91 BD 8 B4 D8 0 02 A0 0 49 24 0 F5 A9 0 E5 A9 0 10 B1 0 10</th> <th>01         00         00         0           20         92         0.0         2           20         16         44         1           55         80         30         0         0           00         00         00         0         0           01         ED         00         0         0           01         ED         00         0         0           02         93         75         1         1           02         96         3         99         2           02         97         31         1         1           02         98         73         1         1           02         98         73         1         1           03         98         7         1         1           04         97         1         1         1           05         98         7         1         1           05         10         98         1         1           05         10         10         10         1           05         10         10         10         1     &lt;</th> <th>00         01           AA         EO           E4         18           C1         F9           C1         F0           C1         F0           C2         56           C0         0           C1         F0           C2         56           C3         56           C4         FD           C5         CD           C5         CD           C4         FD           C5         CD           C5         CD           C4         FD           C5         CD           C6         34</th> <th>00         00         00           CB         23         0           CB         23         0           OA         FC         2           OD         00         0           OD         00         00           OD         00         00</th> <th>0         0.1         0.0           0         0         0         0           10         0.0         0         0           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           11         10         10         10           11         10         10         10           11         10         10         10           11         10         10         10</th> <th>0         0         0         0           0         0         0         0         0           0         0         0         0         0           0         0         0         0         0           0         0         0         0         0           7         7         2         9         1           1         0         0         0         0           9         0         0         0         0           9         0         0         0         0           1         0         0         0         0           1         0         0         0         0           1         0         0         0         0           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2</th> <th>D1 00 30 59 25 1 59 25 1 50 25 1 50 25 1 50 5 50 00 00 00 00 00</th> <th>58 88 DF F4 FE 0E 8A C9 31 84 FB D0 C6 5A 10 6A C1 96 34 02 72 37 0A 97 54 1E 74 61 05 40 12 63 87 19 14 63 15 12 16 74 16 74 17 12 17 12 17 12 18 12 18</th> <th>00 00 EE DD 97 91 00 8F 6D 47 60 40 6D 47 83 55 83 CF 91 13 23 00 90 8D 90 8D 83 53 83 42 85 55 83 42 85 85 85 85</th> <th><ul> <li>58</li> <li>86</li> <li>10</li> <li>7 CB</li> <li>2A</li> <li>7 DD</li> <li>2A</li> <li>48</li> <li>7 11</li> <li>34</li> <li>8 34</li> <li>8 34</li> <li>9 EA</li> <li>4F</li> <li>34</li> <li>2 C6</li> <li>6F</li> <li>9B</li> <li>5 25</li> </ul></th> <th><ul> <li>88 00</li> <li>49 61</li> <li>37 AD</li> <li>53</li> <li>30 B4</li> <li>92 A5</li> <li>0F 9A</li> <li>14 DE</li> <li>65 0D</li> <li>89 2D</li> <li>BF 4B</li> <li>93 80</li> <li>63 D5</li> <li>5A</li> <li>6B 23</li> </ul></th> <th>00 : 40 : CD ( 63 : 28 : 58 1 8C J 68 2 04 1 8C 3 04 1 8C 3 8C 3</th> <th>58 88 73 2A 09 12 2A D5 72 73 77 08 85 58 85 58 84 99 95 88 80 03 79 28 80 20 E0 50 01 89 89 85 88</th> <th>00 ( 29 5 8A 2 27 1 25 1 31 1 05 4 5F 5 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2</th> <th>00 58 93 2<i>n</i> 93 2<i>n</i> 95 E7 9 6E 33 15 97 22 33 E4 55 79 98 B4 61 54 36 54 36 55 79 55 75 57 95 57 8 57 8 57</th> <th>88 97 28 EC 06 3D 5 88 88 86 28 6 28 6 28 6 28 28 28 28 28 28 28 28 28 28 28 28 28</th> <th>00 0 0 A6 0 B0 6 7F 1 76 A 99 6 03 5 68 2 C3 8 AA F A6 5. E0 6 D7 8 48 8 26 2</th> <th>0 E 3 5 5 7 E E D D F D D 8 8 3 B D</th> <th></th> <th></th>	00 00 0 00 AA A BC 91 9 00 00 9 00 00 9 00 00 9 2B FE 0 00 00 2 96 95 9 A2 58 2 91 BD 8 B4 D8 0 02 A0 0 49 24 0 F5 A9 0 E5 A9 0 10 B1 0 10	01         00         00         0           20         92         0.0         2           20         16         44         1           55         80         30         0         0           00         00         00         0         0           01         ED         00         0         0           01         ED         00         0         0           02         93         75         1         1           02         96         3         99         2           02         97         31         1         1           02         98         73         1         1           02         98         73         1         1           03         98         7         1         1           04         97         1         1         1           05         98         7         1         1           05         10         98         1         1           05         10         10         10         1           05         10         10         10         1     <	00         01           AA         EO           E4         18           C1         F9           C1         F0           C1         F0           C2         56           C0         0           C1         F0           C2         56           C3         56           C4         FD           C5         CD           C5         CD           C4         FD           C5         CD           C5         CD           C4         FD           C5         CD           C6         34	00         00         00           CB         23         0           CB         23         0           OA         FC         2           OD         00         0           OD         00         00           OD         00         00	0         0.1         0.0           0         0         0         0           10         0.0         0         0           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           10         10         10         10           11         10         10         10           11         10         10         10           11         10         10         10           11         10         10         10	0         0         0         0           0         0         0         0         0           0         0         0         0         0           0         0         0         0         0           0         0         0         0         0           7         7         2         9         1           1         0         0         0         0           9         0         0         0         0           9         0         0         0         0           1         0         0         0         0           1         0         0         0         0           1         0         0         0         0           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2           1         0         0         6         2	D1 00 30 59 25 1 59 25 1 50 25 1 50 25 1 50 5 50 00 00 00	58 88 DF F4 FE 0E 8A C9 31 84 FB D0 C6 5A 10 6A C1 96 34 02 72 37 0A 97 54 1E 74 61 05 40 12 63 87 19 14 63 15 12 16 74 16 74 17 12 17 12 17 12 18	00 00 EE DD 97 91 00 8F 6D 47 60 40 6D 47 83 55 83 CF 91 13 23 00 90 8D 90 8D 83 53 83 42 85 55 83 42 85 85 85 85	<ul> <li>58</li> <li>86</li> <li>10</li> <li>7 CB</li> <li>2A</li> <li>7 DD</li> <li>2A</li> <li>48</li> <li>7 11</li> <li>34</li> <li>8 34</li> <li>8 34</li> <li>9 EA</li> <li>4F</li> <li>34</li> <li>2 C6</li> <li>6F</li> <li>9B</li> <li>5 25</li> </ul>	<ul> <li>88 00</li> <li>49 61</li> <li>37 AD</li> <li>53</li> <li>30 B4</li> <li>92 A5</li> <li>0F 9A</li> <li>14 DE</li> <li>65 0D</li> <li>89 2D</li> <li>BF 4B</li> <li>93 80</li> <li>63 D5</li> <li>5A</li> <li>6B 23</li> </ul>	00 : 40 : CD ( 63 : 28 : 58 1 8C J 68 2 04 1 8C 3 04 1 8C 3 8C 3	58 88 73 2A 09 12 2A D5 72 73 77 08 85 58 85 58 84 99 95 88 80 03 79 28 80 20 E0 50 01 89 89 85 88	00 ( 29 5 8A 2 27 1 25 1 31 1 05 4 5F 5 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2 7D 2	00 58 93 2 <i>n</i> 93 2 <i>n</i> 95 E7 9 6E 33 15 97 22 33 E4 55 79 98 B4 61 54 36 54 36 55 79 55 75 57 95 57 8 57 8 57	88 97 28 EC 06 3D 5 88 88 86 28 6 28 6 28 6 28 28 28 28 28 28 28 28 28 28 28 28 28	00 0 0 A6 0 B0 6 7F 1 76 A 99 6 03 5 68 2 C3 8 AA F A6 5. E0 6 D7 8 48 8 26 2	0 E 3 5 5 7 E E D D F D D 8 8 3 B D		
																					¢	>

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#### SDP CRC16 error counters (128b/132b)

SDP CRC16 error co	ounters (128b/132b)					
SDP CRC16	Streams (count = 4):	0	1	2	3	
SDP CKC10	Error count (click to clear):	00	00	00	00	

SDP CRC16:	Shows if connected DP Source device supports SDP CRC16. Green light indicates that the source supports SDP CRC 16.
Streams:	Streams from 0 to 3.
Error count (click to clear):	Shows error counter values on each lane. Click the row to clear the error counters.

The following packets are recognized:

- Audio\_TimeStamp
- Audio\_Stream
- Extension
- Audio\_CopyManagement
- ISRC (International Standard Recording Code)
- Video Stream Configuration (VSC)
- Camera Generic 0
- Camera Generic 1
- Camera Generic 2
- Camera Generic 3
- Camera Generic 4
- Camera Generic 5
- Camera Generic 6
- Camera Generic 7
- Vendor-Specific Infoframe packet
- AVI InfoFrame packet
- Source Product Descriptor InfoFrame packet
- Audio InfoFrame packet

- MPEG Source InfoFrame packet
- Dynamic Range and Mastering InfoFrame
- Picture Parameter Set (PPS)

### **Saving SDP Packets**

Packets can be saved in a file in binary format. Click **Save** and in the dialog select the packet types of choise. File name will be of format *ATS\_2022-07-28T15\_54\_24.bin*, where *ATS* is the packet type and *2022-07-28T15\_54\_24* the time stamp.

Saved packets can be evaluated and edited using *Packet Editor*. Please see section *Packet Editor* later in this document

# **DSC** Tab

DSC tab contains status of the Display Stream Compression (DSC) feature, and definition of DSC support capabilities that UCD-5XX defines in its DPCD register.

e <u>T</u> ools <u>W</u> indow <u>H</u> elp		rce and Sink				
ISB-C RX USB-C TX Event L	Log					
PDC Link HDCP Video	o Audio EDID DI	PCD SDP DSC FEC	Source DUT Testing			
DSC Capable (8b/10b)	DSC Enabled					
DSC Major Version:	1	DSC Minor Version:	2	]		
RC block size:	65536 bytes	<ul> <li>RC buffer size, in blocks:</li> </ul>	4	]		
Bits per Pixel Increment:	1/16 bpp	V Block Prediction:	Supported ~			
Throughput mode 0:	340MP/s	Throughput mode 1:	340MP/s ~			
Line buffer depth:	16 bits	✓ Maximum Slice Width:	2560	]		
Supported Color Depths	Supported Color form	ats H-Slice Capabilities				
🗹 8 Bits per color channel	RGB	I Slice / DSC Sink	10 Slice / DSC Sink			
10 Bits per color channel	VCbCr 4:4:4	2 Slice / DSC Sink	12 Slice / DSC Sink			
☑ 12 Bits per color channel	Simple YCbCr 4:2:2	4 Slice / DSC Sink	16 Slice / DSC Sink			
	Native YCbCr 4:2:2					
	VCbCr 4:2:0	8 Slice / DSC Sink	24 Slice / DSC Sink			
Г	Auto-Apply HPD pu	lse on Apply Reset	Refresh Apply			
E	Auto-Apply 🗌 HPD pu	lse on Apply Reset	Refresh Apply			
C	Auto-Apply 🗌 HPD pu	lse on Apply Reset	Refresh Apply			
C	Auto-Apply 🗌 HPD pu	lse on Apply Reset	Refresh Apply	]		
E	] Auto-Apply 🗌 HPD pu	lse on Apply Reset	Refresh Apply	]		
E	] Auto-Apply  ☐ HPD pu	lse on Apply Reset	Refresh Apply	]		
C	] Auto-Apply ☐ HPD pu	lse on Apply Reset	Refresh Apply	]		
C	] Auto-Apply ☐ HPD pu	Ise on Apply Reset	Refresh Apply			
C	] Auto-Apply [] HPD pu	Ise on Apply Reset	Refresh Apply			
C	] Auto-Apply   HPD pu	tse on Apply Reset	Refresh Apply			
C	] Auto-Apply   ☐ HPD pu	ise on Apply Reset	Refresh Apply			
C	] Auto-Apply [] HPD pu	tee on Apply Reset	Refresh Apply			
C	] Auto-Apply [] HPD pu	tee on Apply Reset	Refresh Apply			
	] Auto-Apply □ HPD pu	te on Apply Reset	Refresh Apply			
нро		Pulse HPD 500 C Lengt		Status PPC Status DUT Attached	Detach Reconnect Cable	

#### **Enabling DSC**

Enabling DSC feature is controlled by the connected source device. When connected, a source verifies corresponding registers in DPCD of UCD-5XX sink to find out if DSC capability is declared.

DSC Capable	UCD-5XX sink is declared as DSC capable. Control is only in use with 8b/10b link coding.
DSC Enabled	Connected source has enabled DSC

### Enabling 16K capability for DSC

UCD-5XX sink can support throughputs other than the default value (340 MP/s). To do so, users need to select required 'Throughput mode 0' for 4:4:4 and Simple 4:2:2 modes or 'Throughput mode 1' for for Native 4:2:2 and Native 4:2:0 modes. The DP DSC Source device may then use this information to identify possible supported configurations. In order to give an opportunity to the DP DSC Source to enable DSC with 16K resolution, it is necessary to increase the declared DSC throughput at the sink. It should be set to 1000 MP/s.

🗹 DSC Capable (8b/10b)	DSC Enable	d			
DSC Major Version:	1		DSC Minor Version:	2	
RC block size:	65536 bytes	~	RC buffer size, in blocks:	4	
Bits per Pixel Increment:	1/16 bpp	~	Block Prediction:	Supported	~
Throughput mode 0:	340MP/s	~	Throughput mode 1:	340MP/s	~
Line buffer depth: Supported Color Depths Ø 8 Bits per color channel Ø 10 Bits per color channel Ø 12 Bits per color channel	600MP/s 650MP/s 700MP/s 750MP/s 800MP/s 800MP/s 900MP/s 900MP/s 1000MP/s 170MP/s	~	Maximum Sice Width: H-Slice Capabilities I Slice / DSC Sink 2 Slice / DSC Sink 4 Slice / DSC Sink 6 Slice / DSC Sink 8 Slice / DSC Sink 2 8 Slice / DSC Sink 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 12 Slice / DS 2 16 Slice / DS 2 20 Slice / DS	C Sink C Sink C Sink
	Auto-Apply 🗌 HF	D pulse c	n Apply Reset	Refresh	Apply

### **DSC Support Capabilities**

The various controls in this tab change the content of UCD-5XX sink DPCD register address range (0x00061 through 0x0006F) related to DSC. Please click **Apply** to enable the change.

Apply:	Write changes to the DPCD registers of UCD Sink
Refresh:	Re-read the content of UCD Sink DPCD and update the control status.
Reset:	Reset the content of DSC related DPCD registers in UCD Sink (0x00060 through 0x0006F) to the default values as defined in UCD firmware.

# Panel Replay Tab

Panel Replay consists of two main panels: Panel Replay and Panel Self Refresh.

The *Status* panels show if *Panel Replay* and *Panel Self Refresh* are enabled, and if so, the statuses are reflected in the color widgets below them.

Panel Replay and Panel Self Refresh Capabilities can be modified in the Capabilities panels and applied by clicking the Apply buttons (when enabled),

nk HDCP	Video	Audio	Link Analyzer	Captur	DPCD	SDP	DSC	FEC	Source D	UT Testing	Cable Info	Panel Rep
Panel Replay												
Status					Capabilities							
Self refresh	status:		D	isabled	✓ Panel Re	play	Sele	ctive Up	date Granul	arity Needed	DSC deco	ode in PR
Active fram	e CRC error:				Selective	Update	🗹 SU Y	Granula	rity Extend	ed Caps	Asynch V	ideo Timing
RFB storage					Early Tra	nsport	DSC	CRC of	multiple SU	regions	Link OFF	
	OP uncorrecta				PR selective	update )	( granulai	rity:	On	e-line address		~
AS SDP mis	ssing and not	disabled:			PR selective	1	-		On	e-line address		~
					-SU Y gran	1.0		· ·		e-line address	2	
						ululity cx	□ 15			24	40	
									_			
					10		16			30	48	
					12		18				54	
					14		20			36	64	
												Apply
												Apply
Panel Self Re	fresh											Apply
Panel Self Re Status	fresh				Capabilities							Apply
			D	isabled	Capabilities PSR suppor				PSR 1 is not	supported		Apply
Status	status:		D	isabled		ts:			PSR 1 is not	supported		Apply
Status Self refresh Link CRC er RFB storage	i status: rror: e error:				PSR suppor PSR Setup T	ts: 'ime (us):			330			Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	status: rror: e error: SDP uncorrec				PSR suppor PSR Setup T PR selective	ts: 'ime (us): update )	K granulaı	ity: (	330 One-line ad	dress		Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	i status: rror: e error:				PSR suppor PSR Setup T PR selective PR selective	ts: "ime (us): update ) update )	K granulaı 7 granular	ity: (	330	dress		Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	status: rror: e error: SDP uncorrec				PSR suppor PSR Setup T PR selective PR selective	ts: "ime (us): update ) update ) ning Req	K granulaı 7 granulaı uirement	ity: (	330 One-line ad	dress		Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	status: rror: e error: SDP uncorrec				PSR suppor PSR Setup T PR selective PR selective Link Trai	ts: update ) update ) ning Req inate for	K granulaı Y granulaı uirement PSR2 SU	ity: ( ity: ( of Sink	330 One-line ad	dress		Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	status: rror: e error: SDP uncorrec				PSR suppor PSR Setup T PR selective PR selective Link Trai Y-coordi	ts: update ) update ) ning Req inate for dinates sl	K granulai 7 granulai uirement PSR2 SU nall adher	ity: ( ity: ( of Sink e	330 One-line ad	dress		Apply
Status Self refresh Link CRC er RFB storage PSR2 VSC S	status: rror: e error: SDP uncorrec				PSR suppor PSR Setup T PR selective PR selective Link Trai	ts: update ) update ) ning Req inate for dinates sl	K granulai 7 granulai uirement PSR2 SU nall adher	ity: ( ity: ( of Sink e	330 One-line ad	dress		Apply

Panel Replay has Status and Capabilities panels.

The Statuses shown are

Self refresh status: Disabled, Inactive, Active

Active frame CRC error: Colored for error

RFB storage error: Colored for error

PSR VSC SDP uncorrectable error: Colored for error

AS SDP missing and not disabled: Colored for condition

#### The *Capabilities* panel has:

Checkboxes for:

Panel Replay

Selective Update

Early Transport

Selective Update Granularity Needed

SU Y Granularity Extended Caps

DSC CRC of multiple SU regions

DSC decode in PR

Asynch Video Timing

Link OFF

#### Combo boxes for:

PR selective update X granularity

PR selective update Y granularity.

These can have values: One-line address, Two-line address, Four-line address, Eightline address, 16-line address.

Grouping for A SU Y granularity extended capability: checkboxes for selections

Press Apply to configure and check the HDP pulse on Apply if desired.

Panel Self Refresh has Status and Capabilities panels.

The Statuses shown are

Self refresh status: Disabled, Inactive, Active Link CRC error: Colored for error RFB storage error: Colored for error PSR VSC SDP uncorrectable error: Colored for error SU PSR capability change: Colored for change

The *Capabilities* panel has:

Combo boxes for:

PSR supports:	PSR 1 and PSR 2 (SU and Y-coor)
	PSR 1 is not supported
	PSR 1 is supported
	PSR 1 and PSR 2 (SU)
	PSR 1 and PSR 2 (SU and Y-coor)
	PSR 1 and PSR 2 (SU, Y-coor and Early Transport)

PSR Setup Time (us): 330, 275, 220, 165, 110, 55, 0

PR selective update X granularity

PR selective update Y granularity.

These can have values: One-line address, Two-line address, Four-line address, Eightline address, 16-line address.

Checkboxes for:

Link Training Requirement of Sink Y-coordinate for PSR22 SU SU coordinates shall adhere Do not update AUX FRAME SYNC Press Apply to configure.

UCD-5XX User Manual • UCD Console 3.5

# **FEC** Tab

FEC tab contains control of the FEC (Forward Error Correction) feature, Error Detection table and FEC Status Log.

_			D-500 [2 w Help	2232C529]: L	JSB-C, DP	Alt Mode	Source an	nd Sink				-		×
USE	3-C RX	USB	C TX	Event Log										
P	DC	Video	Link	HDCP	Audio	EDID	DPCD	SDP	FEC	DSC	Source DUT Testing			
										FF	EC Status Log			
	⊡ FE	EC Capal	ole (8b/1	0b) 🗹 Ger	nerate HDP	on Chan	ige 🗖	FEC	Enabled					
	Error	Counter	s (DPCD)											
				Lane #	) Lane#	1 Lane	#2 Lane	#3	Sum					
	Unco	rrected	block err	ors -	-	-	-		-					
			ck errors		-	-	-		-					
	Bit er			-			-		1					
		y block e		-	-	-	-		-					
	Parity	y bit erro		-	-	-	-		•					
		⊠ E	nable ag	gregated err	ors	Update	CI	lear Co	unters					
										l	Clear Log			
H	PD									_	PD			
С	able 🗖	HP	D 📃	Asser	t D	eassert	Pulse	HPD	500	Leng	gth, msec Short Pulse DUT Attached Detach	Re	connect	
	nline													

### **Enabling FEC**

Enabling FEC feature is controlled by the source device. When connected, Source verifies corresponding registers in Sink DPCD to find out if sink is FEC capable. *FEC Status Log* lists FEC events

FEC Capable:	UCD-5XX Sink is declared as FEC capable. Control is only in use with 8b/10b link coding.
Generate HPD on change:	When selected, UCD-5XX Sink generates an HPD to establish a new connection after the change to make sure that connected Source re-reads the FEC capability status
FEC Enabled:	LED to indicate if the source has enabled FEC
Enable aggregated errors	Declare that UCD-5XX Sink is able to indicate aggregated errors in counters
Update:	Read FEC Error Counters from DPCD
Clear Counters:	Clear FEC Error Counters in DPCD.

# Source DUT Testing Tab

Please refer to Appendix E later in this document for a description of the tests available.

erminal Memory Layout Event Log DP	PRX								
Link HDCP Video Audio Link Ana	alyzer Capture DPCE	SDP DSC FEC	Source DUT Testing Panel Replay	Cable Info EDID;	/DisplayI	)			
All tests	Name				Pass	Fail	Skip Runs	Last status	1
DP 2.1 LL CTS	V DP 2.1 LL CTS				0	0	0 0		
DP 1.4 LL CTS			ing AUX Read after HPD Plug Event (3200	(21	0	0	0 0		
HDCP 2.3 CTS 1A			g AUX Read after HPD Plug Event		0	0	0 0		
HDCP 2.3 CTS 1B HDCP 2.3 CTS 3A		Device HPD Event Pulse Ler			0		0 0		
		Device IRQ_HPD Pulse Leng			0	-	0 0		
HDCP 2.3 CTS 3B CRC Video Tests		Device Inactive HPD / Inacti			0		0 0		
Audio Test		Receiver Capability and EDID			0	-	0 0		
Link Config Tests		Receiver Capability Read upo			0	-	0 0		
Pixel Level Video Tests		ead Failure #1: I2C-Over-AU			0		0 0		
HDR10+ Distribution Device Tests		ead Failure #2: I2C-Over-AU			0	-	0 0		
HDR10+ SSTM Tests for Source		Device Detection upon HPD			0		0 0		
HDR10+ 331M lesis for source		ad on IRQ_HPD Event after			0	-	0 0		
			ad interval during Link Training		0	-	0 0		
		s UHBR AUX read interval ve			0		0 0		
			FFE Request, different AUX read interval fo	r 10 EQ loop	0	-	0 0		
			or Source DUT before link training		0	-	0 0		
			or Source DUT during link training just afte		0		0 0		
			orted Lane Counts and 8b10b Link Speeds		0	-	0 0		
		sful Link Training Upon HPD			•		0 0		
			st of Higher Differential Voltage Swing du				0 0		
			Lower Link Rate/Bandwidth #1: Iterate at Lower Link Rate/Bandwidth #2: Iterate at			-	0 0		
			Request of a Higher Pre-emphasis Setting				0 0		
			ower Link Rate/Bandwidth Due to Loss of !				0 0		
			Lower Link Rate #1: Iterate at Maximum		0	-	0 0		
			Lower Link Rate #2: Iterate at Minimum \		0		0 0		
			lue to Failure in Channel Equalization Sequ			-	0 0		
			Simultaneous Request for Differential Vo			-	0 0		~
Run Checked Select  Configure	e Import Expo	rt 🗌 Stop on Failure I	Repeats: 1 🗘 Delay time, sec 1	•		Save Re	oort Clear Sele	cted Clear A	AII.
[2024-12-02, 09:09:23.188]: 0000.00									^
[2024-12-02, 09:09:23.188]: 0000.00 [2024-12-02, 09:09:23.188]: 0000.00		asure timings and che Ldth is correct	ck params						
[2024-12-02, 09:09:23.188]: 0000.00		sight is correct							
[2024-12-02, 09:09:23.188]: 0000.00									
[2024-12-02, 09:09:23.188]: 0000.00 [2024-12-02, 09:09:23.188]: 0000.00		is ignored							
[2024-12-02, 09:09:23.188]: 0000.00		nchronization							1
[2024-12-02, 09:09:23.203]: 0000.02	2.387: Expected f	rame with crc : 0xb	69e, Oxb33e, Oxlab3						
[2024-12-02, 09:09:23.203]: 0000.02 [2024-12-02, 09:09:23.203]: 0000.02		thering information							~
HPD			Cable Informati	on					
Cable HPD Assert Dea	assert Pulse HPD	00 msec 🗘 Short Pul:	e 750 usec 🗢 TX: RX:						

Select the tests for execution by checking checkboxes or by clicking the test name. *All tests* item on the left-hand side is really just for viewing all tests available. Select the desired test category (ex. *DP* 1.4 LLCTS) when running tests.

Run/Run Checked:	Select to start selected/checked tests. Once tests are running the <i>Run Checked</i> button is relabeled <i>Abort</i> to stop the test sequence if desired.
Select:	Includes three sets of options: <i>Select All, Clear All, Invert All</i> for changing the tests current selections; <i>Save</i> (checked items), <i>Load</i> (and check relevant items), <i>Remove</i> (named tests list) for handling named templates; <i>Import</i> (check all items contained in file) and <i>Export</i> (save all checked items to file) for loading and saving file-based templates. Do not confuse <i>Import and Export</i> with those below: These are for setting and saving tests to run.
Configure:	Opens a test parameters dialog for the selected test set. Make sure a test category other than <i>All</i> tests is selected. Refer to <i>Test Parameters</i> below for details.
Import:	Load saved test parameter files (*.td or *.json) for into UCD Console. Select <i>Configure</i> to see current parameters. Loading *.td files to UCD Console is currently unreliable.
Export:	Save test parameters for later use or for use in test automation. For saving parameters for later use in UCD Console, either format can be used. For saving parameters for TSI scripting, please use *.td files. For use with Python applications, please use *.json files.
Stop on Failure:	Stops execution of tests if one fails.
Repeats:	Number of times to repeat the selected test sequence.
Delay time:	Delay in seconds between individual tests.

On completion of each test the result of the test is displayed in the table columns on the right. For each test the table lists the number *Pass*, *Fail*, *Skips*, *Runs and Last Status* (status of last run).

Save Report:	Select to generate a HTML report file. This will also open a tab in the default browser and display the results.
Clear Selected:	Clear the test results of the <b>selected</b> (not checked) tests results. A subsequently saved report will not include these test results.
Clear All:	Clear the test log view and the outstanding results.

#### **Test Parameters**

Each test suite has a dedicated set of test parameters. Select *Configure* to launch the parameters dialog for the selected tests.

See Appendix E for parameter descritptions for each test category.

#### **Saving Test Parameters**

Test parameters can be saved in various ways.

- Export parameters in Source DUT Testing tab to a \*.td file for later use in UCD Console or with TSI scripting or sharing.
- Export parameters in *Source DUT Testing* tab to a \*.json file for later use in UCD Console or with Python applications or sharing.
- Save parameters in *Configure* dialog as Presets to be later used in Console. See description below.

#### **Presets**

All *Configure* dialogs selected parameters can be saved and loaded via *Presets* dropdown menu. Select *Save* or *Load* for named internal configuration parameter sets. Select *Remove* to delete a named internal set. Select *Import* and *Export* for loading and saving parameter sets from and to external files. Note that *Import*ing and *Export*ing \*.json files here have a different format than importing those described above

Presets 💌	
Save	
Load Remove	;
Import	
Export	

# **USB-C** Monitoring

When UCD-5XX device is in USB-C DP Alt-Mode Sink or Source role, the following interface specific tabs are available.

Console - UCD-500 [2232C53	31]: USB-C, DP Alt Mode Source a	and Sink	¢					-	
CRX USB-CTX Event I	0.0								
HDCP Audio ED	ND DPCD SDP FEC	DSC	Source DUT Testing Capture Link Ana	lyzer Link 1	Video				
Status List			Capabilities DP Alt Mode Power Source	e Power Sink	Cable Info	Controls			
▼ TE Status		^	Initial Role	CC Pull-up					
Data Role	Up facing port (UFP)		O DFP/SRC O UFP/SNK	O Defaut					
Power Role	Sink		O DPP/SRC O DPP/SINK @ DRD/DRP	-					
VConn	Off			O 1.5A					
E-Marked Cable	Unknown		Reject PR Swap	3.0A					
DP Alt Mode	"C": DP v1.4a 4 lanes			Try Behavior					
PD Contract	Fixed 3.00 A / 5.00 V		Reject DR Swap	O Try Sink					
<ul> <li>PD Contract</li> </ul>				O Try Source					
Power Source			Reject VCONN SWAP						
- PDO Type	Fixed			None					
- PDO voltage	5.00 V		UCD-500 Identity						
- PDO max current	3.00 A		USB Type-C Spec: USB Type-C S	opec Release 2.2					
Power Sink			Power Delivery Spec: PD rev 3.1 v1	.7					
- RDO max current	0.45 A		Vendor ID: 0x16A6						
- RDO oper current	0.45 A Yes		Product ID: 0x500						
<ul> <li>No USB suspend</li> <li>USB comm capable</li> </ul>	ves No		Accessories						
- Capability mismatch	No								
- Give back	No		Audio Accessory Debug Ac	cessory					
<ul> <li>Available source PDO</li> </ul>									
PDO 1	Fixed 3.00 A / 5.00 V								
PDO 2	Fixed 3.00 A / 9.00 V								
<ul> <li>Bus Electrical Status</li> </ul>									
Vbus voltage	5.42 V								
Vbus current	A 80.0								
CC1 voltage	0.00 V	~							
D Control		Orient	ation						
Send PR_SWAP Send DR_S	WAP Send VCONN_SWAP	0 <b>cc</b>	C1   C2 Cable Orientation: Flipped						
)							PD		
	ssert Deassert Puls		500 + Length, msec Short Pulse				DUT Attached	Detach F	Reconn

In *USB-C Power Delivery* tab () operator can evaluate the status of the USB-C connection and USB Power Delivery Contract, the various roles adopted, and the configuration of the DP Alternate Mode.

The user can set the initial PD Contract roles for the UCD-5XX device and the optional USB-C PD Contract capabilities. Controls allow the user also to swap Power and Data roles.

USB-C Monitoring dialog is divided into four panels. The upper left panel is a Status List indicating statuses of both port partners, UCD-5XX device, and the connected DUT.

The tabs on the right panel configuration dialogs of various USB-C interface functions.

The two bottom panels indicate status of the cable connection and PD Control controls for role swaps.

# **Status List**

In Status List the information is presented in foldable sections. Each section contains information related to one feature of USB-C interface or PD protocol. The user can fold out the sections needed for the task in question.

▼ TE Status	
Data Role	Up facing port (UFP)
Power Role	Sink
VConn	Off
E-Marked Cable	Unknown
DP Alt Mode	"C": DP v1.4a 4 lanes
PD Contract	Fixed 3.00 A / 5.00 V
▼ PD Contract	
Power Source	
- PDO Type	Fixed
- PDO voltage	5.00 V
- PDO max current	3.00 A
Power Sink	
- RDO max current	0.80 A
- RDO oper current	0.80 A
- No USB suspend	Yes
- USB comm capable	No
- Capability mismatch	No
- Give back	No

#### TE Status:

UCD-5XX internal status (Data role, Power Role, VConn, E-marked cable, DP Alt Mode, PD Contract status)

PD Contract:

Details of the PD Contract (Power Source: PDO Type, PDO Voltage, PDO max current; Power Sink: RDO max current, RDO operating current, USB statuses)

▼ Available source PDO		1
PDO 1	Fixed 3.00 A / 5.00 V	
PDO 2	Fixed 3.00 A / 9.00 V	
<ul> <li>Bus Electical Status</li> </ul>		
Vbus voltage	5.45 V	
Vbus current	0.06 A	
CC1 voltage	0.03 V	
CC2 voltage	1.67 V	l.
VCONN voltage	0.00 V	
VCONN current	0.00 A	
SBU-1 voltage	0.26 V	
SBU-2 voltage	2.61 V	
▼ Internal Load		
10 Ohm	Disabled	
Overcurrent protection		
- 10 Ohm OCP	Triggered	

Available source PDO:	Available source PDO offered by UCD-5XX (PDO 1, PDO 2)
Bus Electrical Status:	(Vbus voltage, Vbus current, CC1 voltage, CC2 voltage, VCONN voltage, VCONN current, SBU-1 voltage, SBU-2 voltage)
Internal load:	UCD-5XX internal load feature enabling status and over current protection status indicator (10 Ohm, Overcurrent protection)

Supports USB gen2, Pin Assignments supported as DFP_D and UFP_D, DPAM Version)         TE DP Alt Mode Status:       UCD-5XX internal DP Alternate mode status (Status, Multi- function preferred, HPD state, Select DP v1.3, Select USB gen2, Pin Assignment, Cable UHBR 13.5 support, Cable Active Component, DPAM Version)         DUT Alt Mode Status:       Status of the connected USB-C port partner gained from status update messages (Status, Multi-function preferred, HPD State, Power low, No DPAM Suspend)         ▼ DUT Discovery	DUT Discovery	DUT information (data capable as host, data capable as device, product type, USB vendor ID, USB product ID, BCD device, SVID0, SVID1)
function preferred, HPD state, Select DP v1.3, Select USB gen2,         Pin Assignment, Cable UHBR 13.5 support, Cable Active         Component, DPAM Version)         DUT Alt Mode Status:         Status of the connected USB-C port partner gained from status update messages (Status, Multi-function preferred, HPD State, Power low, No DPAM Suspend)         • DUT Discovery         • Dut Discovery         • Dut Capable as Host       N/A         Data Capable as Device       N/A         Poduct Type       N/A         USB Vendor ID       N/A         SVIDO       N/A	DP Alt Mode support:	Supports USB gen2, Pin Assignments supported as DFP_D and
update messages (Status, Multi-function preferred, HPD State, Power low, No DPAM Suspend)           • DUT Discovery            Data Capable as Host         N/A           Data Capable as Powice         N/A           Data Capable as Powice         N/A           Product Type         N/A           USB Vendor ID         N/A           USB Vendor ID         N/A           USB Product ID         N/A           SUDD         N/A           SUPDTSISSigenD         no	TE DP Alt Mode Status:	function preferred, HPD state, Select DP v1.3, Select USB gen2, Pin Assignment, Cable UHBR 13.5 support, Cable Active
Data Capable as DeviceN/AData Capable as DeviceN/AProduct TypeN/AYold VarianN/AUSB Vendor IDN/AUSB Product IDN/ASchoor DoviceN/ASVID0N/ASVID0N/ASVID0N/ASVID1N/A• DAt Mode support-• Dat Mode support-• Dip Ats Mode support-• Dip Di Songment supported-• Dip Dino• Dip Di Songment supported-• Dip Di Status-• Dip Di Ats Mode Status-• Dip Di Ats Mode Status-• Dip Di Ats Mode Status-• Dip Att Mode Status-Select Dip VI.3yesSelect Dip VI.3yesSelect Dip VI.3yesSelect Dip VI.3-Select Dip VI.4-Select Dip VI.4-Select Dip VI.4-Select Dip VI.4-Selec	DUT Alt Mode Status:	update messages (Status, Multi-function preferred, HPD State,
Data Capable as DeviceN/AProduct TypeN/AVSB Vendor IDN/AUSB Vendor IDN/AUSB Product IDN/ABCD DeviceN/ASVID0N/ASVID0N/ASVID1N/A• DP Alt Mode supportN/A• DP Alt Mode supportyesSupports DP v1.3yesSupports USB gen2no• DFP_Dno• UFP_Dyes• DFP_Dyes• DFP_Dyes• DFP_Dyes• DFPA MensionVersion 2.1 or higher• TE DP Alt Mode StatusStatusStatusActiveMulti-function preferednoHPD stateassertedSelect USB gen2noPin Assignmentversion 2.1 or higher* TE DP Alt Mode StatusStatusStatusActiveMulti-function preferednoHPD stateassertedSelect USB gen2noPin AssignmentVersion 2.0 or earlierCable Active ComponentPasive -or-cable type is unknownDPAM VersionVersion 2.0 or earlier• DUT DP Alt Mode StatusDFP_D is connected.• DUT DP Alt Mode StatusDFP_D is connected.• DUT DP Alt Mode StatusDFP_D is connected.• DUT DP Alt Mode StatusPS_D is connected.• DUT DP Alt Mode StatusMulti-function prefered• DUT DP Alt Mode StatusPS_D is connected.• DUT DP Alt Mode StatusPS_D is connected.<	▼ DUT Discovery	
Product TypeN/AUSB Vendor IDN/AUSB Product IDN/ABCD DeviceN/ASVID0N/ASVID0N/AVD1N/AO PAIL Mode supportVSupports DP v1.3yesSupports DP v1.3yesSupports USB gen2noPin Assignment supportedversion 2.1 or higherOFP_DnoOFP_DyesOPAIL Mode StatusyesStatusActiveMulti-function preferednoHPD statesesretedSelect USB gen2noPin Assignment"C" DP v1.4 a lanesCable UHBR 13.5 SupportNot Supported• DTU PA It Mode StatusSupportedStatusNot SupportedSelect USB gen2noPin Assignment"C" DP v1.4 a lanesCable UHBR 13.5 SupportNot Supported• DUTD Alt Mode StatusSuported• DUTD Alt Mode StatusSuported.• DUTD Alt Mode StatusFP_D is connected.• DUTD Alt Mode StatusDFP_D is connected.• DUTD Alt Mode StatusSuported.• DUTD Alt Mode StatusNormal operation.	Data Capable as Host	N/A
VAUSB Vendor IDN/AUSB Product IDN/ABCD DeviceN/ASVID0N/ASVID0N/ASVID1N/AV PAlt Mode supportVIA* DPAlt Mode supportnoPin Assignment supportedno- DFP_Dno- UFP_Dyes- DFP_Dyes- DPAlt Mode StatusVersion 2.1 or higher* TE DP Alt Mode StatusactiveStatusActiveSelect USB gen2noPD AltaassertedSelect USB gen2noPin Assignment"C": DP v1.4s 4 lanesSelect USB gen2noPin Assignment"C": DP v1.4s 4 lanesCable UHBR 13.5 SupportNot Supported* DTDP Alt Mode StatusSupportedSelect USB gen2noSelect USB gen2noPin Assignment"De v1.4s 4 lanesCable UHBR 13.5 SupportNot SupportedCable UHBR 13.5 SupportDe sole 0.0 creatier• DUTDP Alt Mode StatusSelect US gen2• DUTDP Alt Mode StatusSelect US gen2• DUTDP Alt Mode StatusSelect US gen2• DUTDP Alt Mode StatusSelect US ported.• DUTDP Alt Mode StatusSelect US ported.	Data Capable as Device	N/A
USB Product IDN/ABCD DeviceN/ASVD0N/ASVD1N/ASVD1N/ASVD1N/A* DP4 Mode support** DP4 Mode supportyesSupports DP v1.3noSupports USB go2no• DFP_Dno• UFP_Dyes• DPA Mode Status** TE DP Alt Mode StatusVersion 2.1 or higher• TE DP Alt Mode StatusActive• TE DP Alt Mode StatussestedStatusActiveSelect DP v1.3yesSelect DP v1.3Not SupportedTOT DP Alt Mode StatusYesSelect DP v1.3yesSelect DP v1.4 at lanesyesSelect DP v1.3 SupportYes in a vision 2.01 eraitingDPAM versionyes in a vision 2.01 eraitingPUT DP Alt Mode StatusPS_D is connected.Multi-function preferednot relevantHDT Stateyes werdenPOWE lowyes werdenPower lowNormal operation.Power lowNormal operation. <tr< td=""><td>Product Type</td><td>N/A</td></tr<>	Product Type	N/A
BCD DeviceN/ASVID0N/ASVID1N/ASVD1N/A• DP Alt Mode supportyesSupports DP v1.3yesSupports USB gen2noPin Assignment supportedyes- DFP_Dno- DFP_Dyes- DPA UM Mode Statusyesion 2.1 or higher• TE DP Alt Mode StatusyesStatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable Active ComponentPasive -or- cable type is unknownDPAM VersionPasive -or- cable type is unknownDPAM VersionDFP_D is connected.Auti-function preferedno relevantSalue Active ComponentDFP_D is connected.Auti-function preferedno relevantAuti-function preferedno relevantPDAM VersionDFP_D is connected.PDAM VersionDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	USB Vendor ID	N/A
SVID0N/ASVID1N/ASVID1N/A• DP Att Mode supportyesSupports DS gen2noPin Assignment supported DFP_Dno- UFP_Dyes- DPAM VersionVersion 2.1 or higher• TE DP Alt Mode Status-StatusActiveMulti-function preferednoHPD statesesretdSelect DP v1.3yesSelect DP v1.4yesSelect DP v1.3yesSelect DP v1.3yesSelect DP v1.4yesSelect DP v1.5yesSelect DP v1.6yesDPAM VersionyesDPAM VersionyesPAM VersionyesSelect DP v1.4yesSelect DP v1	USB Product ID	N/A
SVID1N/ADP Alt Mode supportyesSupports DS 9a2noPin Assignment supported DFP_Dno- UFP_Dyes- DPAM VersionVersion 2.1 or higherT E DP Alt Mode Status-StatusActiveMulti-function preferednoSelect DP v1.3yesSelect DP v1.3yesSupportedC': DP v1.4a 4 lanesCable Active ComponentPassive -or- cable type is unknownDPAM VersionVersion 2.0 or earlierPUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	BCD Device	N/A
DP Alt Mode supportSupports DP v1.3yesSupports USB gen2noPin Assignment supported DFP_Dno- UFP_Dyes- DPAM VersionVersion 2.1 or higher* TE DP Alt Mode StatusActiveMulti-function preferednoMulti-function preferednoSelect DP v1.3yesSelect DP v1.3yesSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPasive -or- cable type is unknownDPAM VersionVersion 2.0 or earlier• DUT DP Alt Mode StatusSilve -or- cable type is unknown• DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateSertedPower lowNormal operation.	SVID0	N/A
Supports DP v1.3yesSupports USB gen2noPin Assignment supported DFP_Dno- UFP_Dyes- DPAM VersionVersion 2.1 or higher• TE DP Alt Mode StatusActiveMulti-function preferednoMulti-function preferednoSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedDPAM VersionVersion 2.0 or earlier• DUT DP Alt Mode StatusPorsion 2.0 or earlier• DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferedno relevantHPD stateSelect USB gen2Not SupportedNot SupportedCable UHBR 13.5 SupportNot SupportedDPAM VersionPersion 2.0 or earlier• DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	SVID1	N/A
buports USB gen2 no Pin Assignment supported - DFP_D no - UFP_D yes - DPAM Version Version 2.1 or higher ▼ TE DP Alt Mode Status Status Active Multi-function prefered no HPD state select USB gen2 no Select USB gen2 no Pin Assignment C'' DP v1.4a 4 lanes Cable UHBR 13.5 Support Not Supported Cable Active Component Pasive -or- cable type is unknown DPAM Version VERSION PUT DP Alt Mode Status Status DFP_D is connected. Multi-function prefered not relevant Multi-function prefered select USB gen2 Not Supported Cable Active Component DFP_D is connected. Multi-function prefered select USB gen2 Not Supported PDAM Version VERSION PDAM Version VERSION PDAT Version VERSION PORT VERSION PDAT VERSION P	<ul> <li>DP Alt Mode support</li> </ul>	
DFP_D         no           UFP_D         yes           DPAM Version         Version 2.1 or higher           TE DP Alt Mode Status         Active           Multi-function prefered         no           HPD state         asserted           Select DP v1.3         yes           Select USB gen2         no           Pin Assignment         "C": DP v1.4a 4 lanes           Cable UHBR 13.5 Support         Not Supported           PDTD P Alt Mode Status         Select USB gen2           View Component         Posive -or- cable type is unknown           DPAM Version         Version 2.0 or earlier           V DUT DP Alt Mode Status         Size connected.           Status         DFP_D is connected.           Multi-function prefered         not relevant           HPD state         asserted	Supports DP v1.3	yes
DFP_Dno- UFP_Dyes- DPAM VersionVersion 2.1 or higherT E DP Alt Mode StatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive -or- cable type is unknownDPAM VersionDFP_D is connected.Multi-function preferednot relevantMulti-function preferedNot SupportedDPAM VersionSelect USB and assertedPut DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	Supports USB gen2	no
· UFP_Dyes· DPAM VersionVersion 2.1 or higherT E DP Alt Mode Status> TE DP Alt Mode StatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive -or- cable type is unknownDPAM VersionDFP_D is connected.Multi-function preferednot relevantMulti-function preferedMot supported.Put DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	Pin Assignment supported	
• DPAM VersionVersion 2.1 or higherTE DP Alt Mode StatusActiveStatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive -or - cable type is unknownDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	- DFP_D	no
TE DP Alt Mode StatusStatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive -or- cable type is unknownDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	- UFP_D	yes
StatusActiveMulti-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive -or- cable type is unknownDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	- DPAM Version	Version 2.1 or higher
Multi-function preferednoHPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable QHBR 13.5 SupportYesion - cable type is unknownDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	▼ TE DP Alt Mode Status	
HPD stateassertedSelect DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable Active ComponentPassive-or- cable type is unknownDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	Status	Active
Select DP v1.3yesSelect USB gen2noPin Assignment"C": DP v1.4a 4 lanesCable UHBR 13.5 SupportNot SupportedCable QHBR 13.5 SupportVersion versionDPAM VersionVersion 2.0 or earlier▼ DUT DP Alt Mode StatusDFP_D is connected.StatusDFP_D is connected.Multi-function preferednot relevantHPD stateassertedPower lowNormal operation.	Multi-function prefered	no
Select USB gen2     no       Pin Assignment     "C": DP v1.4a 4 lanes       Cable UHBR 13.5 Support     Not Supported       Cable Active Component     Passive -or- cable type is unknown       DPAM Version     Version 2.0 or earlier       ▼ DUT DP Alt Mode Status     DFP_D is connected.       Status     DFP_D is connected.       Multi-function prefered     not relevant       HPD state     asserted       Power low     Normal operation.	HPD state	asserted
Pin Assignment     "C": DP v1.4a 4 lanes       Cable UHBR 13.5 Support     Not Supported       Cable Active Component     Passive -or- cable type is unknown       DPAM Version     Version 2.0 or earlier       • DUT DP Alt Mode Status     DFP_D is connected.       Status     DFP_D is connected.       Multi-function prefered     not relevant       HPD state     asserted       Power Iow     Normal operation.	Select DP v1.3	yes
Cable UHBR 13.5 Support     Not Supported       Cable Active Component     Passive -or- cable type is unknown       DPAM Version     Version 2.0 or earlier <ul> <li>DUT DP Alt Mode Status</li> <li>Status</li> <li>DFP_D is connected.</li> <li>Multi-function prefered</li> <li>not relevant</li> <li>PDe State</li> <li>Power Iow</li> <li>Normal operation.</li> </ul>	Select USB gen2	no
Cable Active Component     Passive -or- cable type is unknown       DPAM Version     Version 2.0 or earlier <ul> <li>DUT DP Alt Mode Status</li> </ul> Status     DFP_D is connected.       Multi-function prefered     not relevant       HPD state     asserted       Power low     Normal operation.	Pin Assignment	"C": DP v1.4a 4 lanes
DPAM Version     Version 2.0 or earlier <ul> <li>DUT DP Alt Mode Status</li> </ul> <ul> <li>DFP_D is connected.</li> <li>Multi-function prefered</li> <li>not relevant</li> <li>HPD state</li> <li>asserted</li> <li>Power low</li> <li>Normal operation.</li> </ul>	Cable UHBR 13.5 Support	
▼ DUT DP Alt Mode Status           Status         DFP_D is connected.           Multi-function prefered         not relevant           HPD state         asserted           Power low         Normal operation.		
Status     DFP_D is connected.       Multi-function prefered     not relevant       HPD state     asserted       Power low     Normal operation.		Version 2.0 or earlier
Multi-function prefered     not relevant       HPD state     asserted       Power low     Normal operation.		
HPD state asserted Power low Normal operation.		
Power low Normal operation.		
NO UPPIN Suspend UPP_U/ UP Sink device has no preference for entry into low power state		
	No DPAM Suspend	UFP_U/ UP Sink device has no preference for entry into low power state

# Capabilities

Initial Role          Initial Role         DFP/SRC       UFP/SN         Reject PR Swap         Reject DR Swap         Reject VCONN SWAP	K () DRD/DRP	CC Pull-up Defaut 1.5A 3.0A Try Behavior Try Sink Try Source None				
UCD-500 Identity Power Delivery Spec: Vendor ID: Product ID: Product Type:	PD rev 3.0 v1.2 0x16A6 0x500 unspecified					
Accessories	Debug Acco	essory				
Initial Role:	Defines the ro				ı the start o	f PD
	communicatio	n (both powe	r and data r	ole).		
Initial Role: Reject Swaps: CC Pull-up:		n (both powe : role swap re that Source u	r and data r quests from ses to adve	ole). I the conne rtise the cu	ected port p urrent sourc	oartner.
Reject Swaps:	communication Allow or reject Control of Rp	n (both powe role swap re that Source u ype-C operat	r and data r quests from ses to adve ion and in F	ole). n the connertise the cu PD Rev 2.0	ected port p urrent sourd operation.	partner. ce capability
Reject Swaps: CC Pull-up:	communication Allow or reject Control of Rp f in initial USB T Control the US	n (both powe role swap re that Source u Type-C operat SB-C PD role	r and data r quests from ses to adve ion and in F that UCD-5>	ole). n the conn rtise the cu PD Rev 2.0 (X initially	ected port p urrent sourd operation.	partner. ce capability
Reject Swaps: CC Pull-up: Try Behavior:	communication Allow or reject Control of Rp t in initial USB T Control the US handshake.	n (both powe role swap re that Source u Type-C operat SB-C PD role	r and data r quests from ses to adve ion and in F that UCD-5>	ole). n the conn rtise the cu PD Rev 2.0 (X initially	ected port p urrent sourd operation.	partner. ce capability
Reject Swaps: CC Pull-up: Try Behavior: UCD-500 Identity:	communication Allow or reject Control of Rp t in initial USB T Control the US handshake.	n (both powe role swap re that Source u ype-C operat B-C PD role ation providec	r and data r quests from ses to adve ion and in F that UCD-5> I by UCD-5>	ole). In the connective the curve PD Rev 2.0 (X initially (X.	ected port p urrent sourd operation.	partner. ce capability

Note: Please note that UCD-500 does not support any physical connections for the Accessory functions. The selections enable only behavioral simulation.

# **DP Alt Mode**

Controls and capability settings for DisplayPort Alternate Mode.

Enter 2 lane mode (D):	Restart mode discovery and advertise support for mode D (2 DP lanes + USB SS).
Enter 2 lane mode (C,E):	Restart mode discovery and advertise support for modes C and D (4 DP lanes).
Exit DP Alt Mode:	Exit DP Alternate mode.
Disable DP Alt Mode:	Exit DP Alternate mode and advertise no DP Alternate mode support.
Auto enter on connect:	Start mode discovery after connection and enter DP Alternate mode if suitable configuration is found.
Multi-function preferred:	When entering DP Alternate Mode, select mode D.
Align DP and USB Data Roles	When selected, before entering to DP Alternate Mode, DP role and USB Data role will be aligned to match the role selected for the UCD device, i.e. DFP in Generator role and UFP in Analyzer role.
DPAM 2.1 Control	Enable or Disable.

### **DP Alt Mode Capabilities**

Supported Pin Assignments declared in DisplayPort Capabilities discover message. Separate for UFP\_D (DisplayPort sink) and DFP\_D (DisplayPort source)

# **Power Source**

Definition of Power Data Objects (PDO) for UCD-5XX when acting as Power Source Port.

					Cable Ir		EPR S	Source	LFIN	er Sink	FOW	Sourc	Power	OP Alt Mode	Capabilities D
															SPR PDOs
t,	Min Voltage, mV	ŧ,	ax Voltage, mV	Ma	e Power, mW		Current, %	Peak	tage, nV		Current, mA		De	PDO Typ	Source PDOs
							~	100	E	5000	•	3000	~	Mandatory	PDO1
- A - V	0	*	)	<b>\$</b> 0		0	~	100	-	9000	•	3000	~	Fixed	PDO2
	0	×	)	÷ 0		_	-	100		9000	L		~		

PDO Type: Definition of power source type (Disabled, Fixed, Variable or Battery)

Note: The requirement is that Sources shall supply at least one fixed supply capable of supplying vSafe5V

Note: Please note that UCD-5XX devices are not able to simulate as Source the electrical behavior of Variable and Battery source types.

Refresh	Re-read status from UCD-5XX
Apply	Program new values to UCD-5XX
Send PDO	Send a Source Capabilities message
Load PDO	Load a stored Power Source PDO configuration from file.
Save PDO	Store current Power Source PDO configuration to a file

# **Power Sink**

Controls and Definition of Power Data Objects (PDO) for UCD-5XX when acting as Power Sink Port.

Capabilities	DP Alt Mode	Power Source	Power Sink	EPR Source	EPR Sink	Cable Info	Controls	
Controls	SPR PDOs							
Flags								
Give b	oack flag							
No US	B suspend							
PDO type	priority	Max Operation	Current					
Prefer hi	gher voltage 🗸	450	<b>•</b>					
	grier voltage -	450	-					
	gher voltage	430						
Give back	5			Back flag in	its <i>Reque</i>	est Data Ol	bject	
Give back No USB s	flag:	UCD-5XX	sets <i>Givel</i>	<i>Back</i> flag in SB Suspen				ect
· · · · <b>-</b> -	flag: uspend:	UCD-5XX UCD-5XX Setting of advertised	C sets <i>Givel</i> C sets No U f the policy	SB Suspen used for a e Device. (	d flag in it utomatic :	ts Request selection f	Data Obje rom availa	ble PDOs

PDO Type: Definition of power source type (Disabled, Fixed, Variable or Battery)

Capabilities	DP Alt Mode	Power	Source	Powe	r Sink	EPR So	ource	EPR	Sink	Cable In	fo	Controls	s
Controls	SPR PDOs												
Sink PDOs	РДО Тур	e	Oper C m		Volta m		Max P m		Max	Voltage, mV	Mir	n Voltage, mV	
PDO1	Mandatory	~	450	•	5000	•							
PDO2	Disabled	$\sim$	0	*	0	*	0		0		0		*
Refresh	Apply	Load	PDO	Save P	DO								

Note: The requirement is that Sinkss shall supply at least one fixed supply capable of supplying vSafe5V

Refresh	Re-read status from UCD-5XX
Apply	Program new values to UCD-5XX
Load PDO	Load a stored Power Source PDO configuration from file.
Save PDO	Store current Power Source PDO configuration to a file

# Cable Info

Cable Info tab displays the information received from the cable as a response to *Discover Identity* command sent to SOP'.

Capabilities	DP Alt Mode	Power Source	Power Sink	EPR Source	EPR Sink	Cable Info	Controls		
ID 2B 60 1C 00	00 00 00 01 00 1A	15 43 20 08 11 00	00 00 00 00 00 0	0 00			Refresh		
USB Vendor	ID		2B1D	XID Assigned b	by USB-IF 0x0	0000000			
Modal opera	ation supported	1	/es						
Product Typ	e	1	Passive Cable						
USB Comm	unications Capabl	le as USB Device	no	bcdDevice	0x0001				
USB Communications Capable as USB Host			no	USB product I	D 0x151A				
USB SuperSp	beed Signalling Su	ipport F	Reserved, shall n	ot be used					
VBUS throug	gh cable	1	٩٥						
VBUS Currer	nt Handling Capal	bility 5	iΑ						
SSRX2 Direct	SSRX2 Directionality Support			d					
SSRX1 Direct	tionality Support	F	xed						
SSTX2 Direct	ionality Support	F	ixed						
SSTX1 Direct	ionality Support	F	ixed						
Cable Termi	nation Type	N	CONN not requ	ired					
Cable Laten	Cable Latency <10r								
USB Type-C	plug to USB Type-	-A/B/C/Captive l	JSB Type-C						
Firmware Ve	rsion	1							
Hardware Ve	ersion	1							

Note:

Please note that cable info can only be read when in Down Facing Port role. Please click *Refresh* after changing roles.

# Controls

Control tab includes miscellaneous controls related to UCD behavior as a USB-C PD Port Partner.

Capabilities	DP Alt Mode	Power Source	Power Sink	Cable Info	Controls			
-PD Contract	settings		USB Communication Capable					
🗹 Automat	tically negotiate p	ower contract	As PD Source					
USB Internal	load		As PD Sink	:				
🗌 10 Ohm								

#### PD Contract Settings

Automatically negotiate power contract: When selected UCD will start power contract negotiation if suitable configuration is found.

#### **USB** Internal Load

Current Load feature that only applicable when UCD-5XX is operating as Power Sink role. Only fixed current value in around 900mA is able to be sinked by UCD-5XX.

# **Bottom Panel**

HPD				
Cable 💶 HPD 🗖	Assert Deassert Pulse HPD 500 msec 🔷 Short Pulse 750 use			
Cable	Cable status			
HPD:	HPD status			
Assert / Deassert:	Manually Assert or Deassert.			
Pulse HPD:	Manually pulse HPD. Set the lenght in milliseconds.			
1 0130 TH D.	Manually perform a short pulse. Set the length in milliseconds.			

Note:

Please note that UCD-5XX is not automatically Attached to the connected port partner even if the cable is connected physically. The user needs to click the Attach button manually to make the connection.

### PD Control

PD Control

Send PR_SWAP Send DR_SW	AP Send VCONN_SWAP
Send PR_SWAP:	Send PR_Swap message to request an exchange of power roles.
Send DR_SWAP:	Send <i>DR_Swap</i> message to request an exchange DFP and UFP operation between Port Partners while maintaining the direction of power flow over Vbus.
Send VCONN_SWAP:	Send VCONN_Swap message to request an exchange of Vconn Source.

### <u>PD</u>

PD				
DUT Attached	Detach Reconnect			
DUT Attached:	Indication that <i>Attach</i> event is detected by the Source port in one of its CC lines. Type of USB-C cable detected.			
Detach:	Manually Detach USB-C port partners.			
Reconnect:	Restart USB-C Source-to-Sink attach procedure.			

# 5. GENERATOR OPERATION

When used as a *Generator*, the UCD device acts as DisplayPort or USB-C DisplayPort Alt Mode Source or Transmitter device. Generator functionality related controls and dialogs can be used by selecting *DP TX* tab.

Please note that in most UCD-5XX Series units *Analyzer* functionality is available simultaneously with Generator functionality. Please find description of Analyzer functionality earlier in this manual.

# **Functionality Tabs**

UCD Console features are presented in tabs. Standard tabs are similar in all functional roles, Interface Specific tabs present features and controls that are only available for a particular interface.

Some of the tabs are enabled by default, some only when an applicable license is included.

Note:

Some of the tabs are enabled by default, some only when an applicable license is included. Please refer to Appendix B Licensing of this document for description of features and licensing

### Link Tab

The link tab shows the status and control items for the DisplayPort link.

erminal Memory Lay	out DP T	<b>FX</b> Event	t Log										
Link Pattern Genera	ator Play	back Au	dio Genera	tor H	HDCP DI	PCD F	EC Sink	DUT Testing	Adaptive-	Sync P.	anel Replay Cable I	nfo SDP E	DID/DisplayID ALPM
Link Status					Link Config	guration						H	HDCP Status
Lanes (count = 4):		0 1	2	3	DP Lane	Count (8	b/10b)	DP Bitrate (8	8b/10b), Gb	ps			2
CR/SL/EQ	-	للتعلم لمتعا			0	1 () 2	• 4	0 1.62 (	2.70 0 5	5.40 () 6	.75 🖲 8.10	,	Active E
VS/PE (level)		-//-		-/-	DBL	Course (A)	00h (400h)	DD Biteste (	201- (1221-)	Char			Authenticated
FFE Preset		0 0	0	0			28b/132b)	DP Bitrate (1					Keys loaded
Error count (click to re	<u>.ad):</u>		-	-	0	1 () 2	• 4	0 10 0	13.5 • 20			,	Authenticated stored Km
ILA: EQ_ILA:	CDS_I	LA:	LT_FAIL:		Addition	al DP Bitr	ate (8b/10b)	, Gbps					HDCP Configuration
Bit rate: 13.5	Sbps Lin	nk Mode:	128b/132	2b	0 2.16		0	.43	O 3.2	4	0 4.32		
Framing mode: -	Sci	rambling:	Enabled										Enable Encryption
MST mode: Enab	ed SS	C status:	Disabled		eDP Bitra	ate, Gbps							Authenticate
DSC status: Disat		C status:	Enabled		0 1.62		0 2.16	O 2		0 2.7			Use stored Km
LTTPR status: Inact	ive			_	0 4.32		0 5.4	06	.75	8.1			
	2	Send ACT	Force upo	date	Link Opt	ions							Scrambler seed (8b/10b)
Link Overrides					Eorce	DP (128	b/132b)			d DP 2.0	LT V Try eDP		Auto
Voltage Swing (level):	• 0	01	2 0	3			ning Mode			EC (8b/10		. (	FFFFh (DP)
Pre-emphasis (level):	© 0	01 0					-	supported (8b)			b/132b) eDP AUX		FFFEh (eDP ASSR)
				~			Sbps, use				e Default	(	Custom 0x 0
FFE pre-sets:	0 ~	0 ~				ad of 10 C	opps, use	2.500 Gbps	~ L	TIPK MOD	e Default ~		
			Apply	1	Downspr	ead							
Link Pattern					Enabl	e SSC	Amp (%/	10) 0,5		\$ Fre	eq (Hz) 31500		
Active Video		~											
	Apply										Link Training	Fast LT	
	Арріу				VCP Table					HDCP St	ream Status		
					Stream # \	/CPID Re	q.PBN Alloc	PBN First slot	olot num	Stream #	Status Type		
					0	1	532 53	2 0	5	0	Type 0		
					1	2	532 53	2 5	5	1	Type 0		
					2		532 53		5	2	Type 0		
					3	4	532 53	2 15	5	3	Type 0		
Stream Info													
Framerate HTot	al HStart	HActive	HSync	VTota	VStart	VActiv	e VSync	CE	F	BPC	CRC (RGB/CrYCb)	VFREQ	DSC CRC (Eng. 0 1 2)
60.000 220	0 192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy	RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000 220		1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy		8	B69E B33E 1AB3	148500000	N/A
						1000	5 (+)	RGB/Legacy	DCD mode	8	B69E B33E 1AB3	148500000	N/A
60.000 220 60.000 220		1920 1920	44 (+) 44 (+)	1125 1125	41 41	1080 1080	5 (+) 5 (+)	RGB/Legacy		8	B69E B33E 1AB3	148500000	N/A

#### **Link Status**

Link Status displays the status of the link training and the link parameters negotiated between the connected Sink and UCD Source. It also lists the status of other link modes. The data is retrieved from the DPCD status registers of the connected Sink. The status is updated automatically, but in case it seems that the update is delayed, please click on the *Force update* button.

Link Status					
Lanes (count =	4):	0	1	2	3
CR/SL/EQ					
VS/PE (level)		-/-	-/-	-/-	-/-
FFE Preset		0	0	0	0
Error count (cl	ick to read):	-	-	-	-
ILA: EC	Q_ILA: 💶 (	CDS_ILA:		LT_FAIL:	
Bit rate:	20 Gbps	Link Mo	de:	128b/1	132b
Framing mode	s -	Scramb	ling:	Enable	d
MST mode:	Enabled	SSC stat	us:	Disable	ed
DSC status:	Disabled	FEC stat	us:	Enable	d
LTTPR status:	Inactive				

Lanes:	Indicates the number of lanes used for DisplayPort or DisplayPort Alt Mode.
CR/SL/EQ:	LED indicators for status of Clock Recovery / Symbol Lock / Channel Equalization
VS/PE (level):	Voltage Swing / Pre-emphasis level
FFE preset:	TX Feed Forward Equalization (FFE) preset value (only with 128b/132b channel coding)
Error count:	Content of DPCD Error Count registers
ILA:	Status LED for Inter-Lane Alignment
EQ_ILA	Status LED for Inter-Lane Alignment on Equalization stage (only with 128b/132b channel coding)
CDS_ILA	Status LED for Inter-Lane Alignment on Clock and Data Switch stage (only with 128b/132b channel coding)
LT_FAIL	Status LED for Link Training failure (only with 128b/132b channel coding)
Bit rate:	Currently enabled link bit rate
Link mode:	Currently enabled channel coding (128b/132b or 8b/10b)
Framing mode:	Status of Enhanced Framing symbol sequence (only with 8b/10b)
Scrambling:	Status of link Data Scrambling (Enabled or Disabled)
MST mode:	Status of the Multistreaming (MST) mode
SSC status:	Status of Spread-Spectrum Clock (SSC) function
DSC Status:	Status of Display Stream Compression (DSC) function
FEC status:	Status of Forward Error Correction (FEC) function.
LTTPR Status:	Status of Link Training-tunable PHY Repeater (LTTPR) function

Send ACT:	Force sending an Allocation Change Trigger (ACT) sequence over the Main-Link
Force update:	Re-read statuses to update the panel

### **Link Configuration**

Set target capabilities for the link training. Click Link Training or Fast LT to apply.

DP Lane Coun	it (8b/10b)	DP Bitrate (8b/10	b), Gbps			
010	2 🖲 4	○ 1.62 ○ 2.70	○ 5.40 〇	6.75 🖲	8.10	
DP Lane Coun	t (128b/132b)	DP Bitrate (128b/	132b), Gbps			
010	2 🖲 4	○ 10 ○ 13.5	20			
Additional DP	Bitrate (8b/10b), G	ibps				
0 2.16	0 2.43	3	3.24		0 4.32	
eDP Bitrate, G	bps					
0 1.62	0 2.16	0 2.43	0	2.7	0 3.24	1
O 4.32	0 5.4	0 6.75	۲	8.1		
Link Options						
Force DP (	128b/132b)		Old DP 2	2.0 LT	✓ Try eDP	
C Enhanced	Framing Mode		FEC (8b/	10b)	Force el	OP
🗹 Max Link B	andwidth Policy su	pported (8b/10b)	Try DP (1	28b/132b	) 🗌 eDP AU	K Preamble
Instead of	10 Gbps, use 2.5	00 Gbps	✓ LTTPR M	lode Defa	ault	$\sim$
Downspread						
Enable SSC	C Amp (%/10)	0,5		Freq (Hz)	31500	÷
					ink Training	Fast LT

Set target capabilities for the link training. Click Link Training or Fast LT to apply.

DP Lane Count (8b/10b):	Lane count used when 8b/10b link coding is selected in LT
DP Bitrate (8b/10b), Gbps:	Link rate used when 8b/10b link coding is selected in LT
DP Lane Count (128b/132b):	Lane count used when 128b/132b link coding is selected in LT
DP Bitrate (128b/132b), Gbps:	Link rate used when 128b/132b link coding is selected in LT
Additional DP Bitrate (8b/10b), Gbps	Additional bit rates available.
eDP Bitrate, Gbps	Bitrates available for eDP.
Force DP (128b/132b):	UCD-5XX Source uses only 128b/132b link layer protocol, no fall back to 8b/10b link layer.
Enhanced Framing Mode:	Enable Enhanced Framing Mode
Max Link Bandwidth Policy supported (8b/10b):	When checked, UCD supports Link Training Flow with Maximum Link Data Bandwidth Policy (only in 8b/10b coding)
FEC (8b/10b):	Enable Forward Error Correction feature (only in 8b/10b coding)
LTTPR:	Select to enable Link Training Tunable PHY Repeater (LTTPR) protocol support
Old DP 2.0 LT:	When checked LT will follow initial DP 2.0 specification, otherwise, LT is per DP 2.1 specification
FEC (8/10b)	Enable Forward Error Correction feature (only for 8b/10b coding).
Try DP (128b/132b):	UCD-5XX Source checks capabilities of the connected Sink and, if it supports 128b/132b link layer protocol, it starts Link Training with 128b/132b link layer. If LT fails it falls back to 8b/10b link layer protocol.
Try eDP	Try to link with eDP.
Force eDP	Force eDP linking.
eDP AUX Preamble	Use eDP AUX Preamble protocol when linking.
Instead of 10 Gbps, use:	For supporting low link rate Sink devices, the user can make UCD- 5XX source PHY to use a selectable lower link rate when performing '10 Gbps' link training in protocol level.
	Link rates are: 2.5 Gbps, 2.7 Gbps, 5.0 Gbps and 5.4 Gbps
LTTPR Mode	Select LTTPR mode: Default, Ignore, Transparent, Non-Transparent.

Enable SSC:	Enable down spreading of link frequency (SSC).
<i>Amp (</i> ‰):	SSC Spreading Amplitude (0.1% to 2.5% in 0.01% steps).
Freq (Hz):	SSC Modulation frequency (30 to 33 kHz).

### **Link Overrides**

			4	Apply
FFE pre-sets:	0 ~	0 ~	0 ~	0 ~
Pre-emphasis (level):	٥ ۱	O 1	O 2	03
Voltage Swing (level):	0	01	O 2	03
Link Overrides				

Voltage Swing (level):	Override Voltage Swing level selected during link training
Pre-emphasis (level):	Override Pre-emphasis levels selected during link training
FFE pre-sets:	TX Feed Forward Equalization (FFE) preset value (only with 128b/132b channel coding)

Click **Apply** to validate changes.

### **Link Pattern**

Select between Active video and audio, Idle pattern, or special bit patterns.

Active Video	Transmit Video Pattern, Audio and Metadata
Idle Pattern	Link is active but no stream data is being transmitted
Training Pattern 1	Send Link Training Pattern Sequence 1 (TPS1)
Training Pattern 2	Send Link Training Pattern Sequence 2 (TPS2)
Training Pattern 3	Send Link Training Pattern Sequence 3 (TPS3)
Training Pattern 4	Send Link Training Pattern Sequence 4 (TPS4)
PRBS7	Send PRBS7 Link Quality Test Pattern
HBR2 (CP2520 1)	Send HBR2 Compliance pattern CP2520 1.
SER (Symbol Error Rate)	Send Symbol Error Rate Measurement pattern
Force Video	Reference Source will continue Video pattern transmission on the previously established link configuration regardless of the link status.
Force Idle	Reference Source will continue Idle pattern transmission on the previously established link configuration regardless of the link status.
HBR2 (CP2520 2)	Send HBR2 Compliance pattern CP2520 2.
PRBS9	Send PRBS9 Link Quality Test Pattern
PRBS11	Send PRBS11 Link Quality Test Pattern
PRBS15	Send PRBS15 Link Quality Test Pattern
PRBS23	Send PRBS23 Link Quality Test Pattern
PRBS31	Send PRBS31 Link Quality Test Pattern
Link square pattern	Send Square Sequence Pattern. The number of continuous 1s followed by continuous 0s is given as a parameter. 0x00 represents one set of 1s and 0s, 0xFF represents 256 1s and 0s.

Click **Apply** to validate the selection.

Note: Please note that except for *Active Video* and *Idle Pattern*, Link Training will NOT be initiated on such events as cable re-plug, Long HPD pulse and IRQ\_HPD pulse due to link loss.

After using the special bit patterns, in order to return to the default operation mode, please select *Active Video* and click *Apply.* 

### **Scrambler Seed**

Scrambler seed (8b/10b)	
O Auto	
FFFFh (DP)	
O FFFEh (eDP ASSR)	
O Custom 0x	0 🔹

Selection of the value to which the Linear Feedback Shift Register (LFSR) is reset during scrambler reset. Used only when 8b/10b link coding is enabled.

### **HDCP Status & Configuration**

HDCP Status	
	2.X
Active	
Authenticated	
Keys loaded	
Authenticated stored Km	
HDCP Configuration	
	2.X
Enable Encryption	
Authenticate	
Use stored Km	$\checkmark$

Copy of HDCP status and controls on HDCP tab.

### **HDCP Stream Status**

Shows HDCP stream status for each stream.

HDCP Str	eam Sta	itus
Stream #	Status	Туре
0		Type 0
1		Type 0
2		Type 0
3		Type 0

### **SDP Configuration**

SDP Configuration	
Split SDP	

Enable SDP Splitting.

Note

Selecting this configuration option does not guarantee that SDP splitting will occur for a given configuration of the Video and Audio pattern generators. SDP splitting will take place when it makes sense and required for SDP splitting conditions are met.

#### **Stream Info**

Stream Info

Framerate	HTotal	HStart	HActive	HSync	VTotal	VStart	VActive	VSync	CEF	BPC	CRC (RGB/CrYCb)	VFREQ	DSC CRC (Eng. 0 1 2)
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A
60.000	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	148500000	N/A

Stream Info is achieved from the Main-Stream Attributes (MSA) of the monitored stream. Frame rate is measured by UCD Local Sink

The content of Stream Info table can be copied by right-clicking on the table and selecting Copy.

Framerate	Vertical refresh rate
HTotal	Horizontal total of transmitted main video stream, measured in pixel count.
HStart	Horizontal active start from leading edge of HSync, measured in pixel count.
HActive	Horizontal active, number of active pixels in video line
HSync	HSync width, measured in pixel count. (+)/(-) positive / negative sync.
VTotal	Vertical total of transmitted main video stream, measured in line count.
VStart	Vertical active start from leading edge of VSync, measured in line count.
VActive	Vertical active, number of active lines in video frame
VSync	VSync width, measured in line count. (+)/(-) positive v.s. negative sync.
CEF	Used color mode: Color format + subsampling / colorimetry
BPC	Color depth in bits per color (BPC)
CRC (RGB/CrYCb)	16-bit Cyclic redundancy check (CRC) value per color component calculated from active pixels. Value order in YCbCr color format: Cr, Y, Cb.
VFREQ:	Video Frequency (128b/132b channel coding only)
MVID/NVID:	Mvid and Nvid video time stamp values (8b/10b channel coding only)
DSC CRC	16-bit Cyclic redundancy check (CRC) calculated from compressed pixel stream. Value order Engine 0, 1, 2.

### **VCP Table**

VCP Tabl	e				
Stream #	VCPID	Req.PBN	Alloc.PBN	First slot	Slot num
0	1	532	532	0	5
1	2	532	532	5	5
2	3	532	532	10	5
3	4	532	532	15	5

VCP table shows allocation of Virtual Channel Payload for active virtual channels.

The content of VCP Table can be copied by right-clicking on the table and selecting Copy.

Port#:	Port number where the virtual channel is directed.
SID:	Stream identification number of the virtual channel
Req.PBN:	Requested PBN (payload bandwidth number) value for the virtual channel
Alloc.PBN:	PBN value allocated for the virtual channel
First slot:	Time slot where the first VC Payload for the virtual channel is stored
Slot num:	Number of VC Payload slots reserved for the virtual channel.

# Pattern Generator Tab

Link Pattern Generator								
	Audio Generator SDP Playba	ck HDCP DPCD I	EC Sink DUT Test	ting Adaptive-Sync F	Panel Replay Cable Info	EDID/DisplayID	ALPM	
Auto-Apply Apply All	MST Number of streams 4 🗘	Force EDID preferred tim	ing after LT 🗌 Use	Timings from EDID Mana	ge Timings			
Total bitrate : 14.256 / 77.374	Gbps.							
Pattern Generator Status								
Timing	Pattern CEF	BPC	Status	CRC (RGB/CrYCb/012)				
1920 x 1080 @ 60Hz	Color Bars RGB/Legacy RGB		OK	B69E B33E 1AB3				
1920 x 1080 @ 60Hz	Color Bars RGB/Legacy RGI		OK	B69E B33E 1AB3				
1920 x 1080 @ 60Hz	Color Bars RGB/Legacy RGB		OK OK	B69E B33E 1AB3				
1920 x 1080 @ 60Hz	Color Bars RGB/Legacy RGI	3 mode 8	UK	B69E B33E 1AB3				
Stream 0					^			
CTA 1920 x 1080 @ 60Hz (	VIC 16) 🗸 🍸 8 bpc 👻 🖲 VES	A O CTA Pattern Scroll	ing					
Color Bars	✓ RGB < ✓	Enable	lorizontally 0 🗘	pixels				
no options		\	/ertically 0 🗘	pixels				
Contraction (		E	very 0 🗘	frame				
	Pixel Clock 148,500MHz		10.000					
Active 1920 🗘	Vertical Horizonta 1080 Pront Porch 88		Horizontal Start 192	Vertical				
	harmonic design of the second			41				
L	1125 🗘 Sync Width 44 🗘		larity 🗹 (+)	V (+)				
Blanking 280	45 Back Porch 148	36	Ap	oply				
Stream 1								
CTA 1920 x 1080 @ 60Hz (	/IC 76) 🗸 🍸 8 bpc 🗸 🖲	VESA () CTA						
	~ RGB ~							
Color Barr	NGU							
Color Bars								
no options								
no options	Pixel Clock 148,500MHz							
no options Frame Rate 60,000Hz Horizontal	Vertical Horizonta		Horizontal	Vertical				
no options Frame Rate 60,000Hz Horizontal Active 1920	Vertical Horizonta 1080 🗘 Front Porch 88 🗘	4	Horizontal Start 192	Vertical				
no options Frame Rate 60,000Hz Horizontal	Vertical Horizonta	4	Start 192					
no options Frame Rate 60,000Hz Horizontal Active 1920 Total 2200	Vertical Horizonta 1080 🗘 Front Porch 88 🗘	4 🗘 5 🗘 Sync Pol	Start 192 🗘	41	~			
no options Frame Rate 60,000Hz Horizontal Active 1920 Total 2200	Vertical Horizonta 1080 C Front Porch 88 C 1125 Sync Width 44 C	4 🗘 5 🗘 Sync Pol	Start 192 🗘 larity 🗹 (+)	41 🗘	×			

Note:

The actual number of streams sent will be negotiated between the source and the sink during link training.

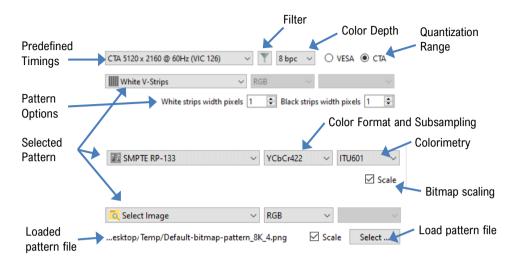
The video modes that can be used in MST streams are limited by the overall capabilities of the DisplayPort link and the connected DisplayPort Sink or Branch device.

Auto-Apply:	New settings are being validated when the user is clicks <i>Apply</i> . Automatic validation is applied when <i>Auto-Apply</i> is checked. When <i>Select DSC Image</i> pattern is being streamed and an incompatible <i>Horizontal and Vertical Active</i> timings are set, the user is presented with a dialog: <i>H-Active and V-Active don't match with DSC data. Do you</i> <i>want to upload image?</i> See <u>Sourcing DSC Compressed Patterns</u> .	
Apply All:	Apply recent changes to all streams. When Select DSC Image pattern is being streamed and an incompatible Horizontal and Vertical Active timings are set, the user is presented with a dialog: H-Active and V-Active don't match with DSC data. Do you want to upload image? See <u>Sourcing DSC Compressed Patterns</u>	
MST	Enable multi-stream transport mode. In 8b/10b link mode, select between SST and MST transport modes. In 128b/132b link coding mode, enable single stream output without stream allocation using Sideband messages if checkbox is cleared.	
Number of streams	Set number of steams via combo box.	
Force EDID preferred timing after LT	UCD reads the EDID of the connected Sink and after next LT enables to Stream 0 the timing listed in 18 byte descriptor 1 in VESA block of the sink's EDID.	
Use timings from EDID	UCD reads the EDID of the connected Sink and lists only timings that are featured there.	
Manage Timings:	Please see chapter Manage Timings later in this manual	

Total bitrate:Used link payload / Total link capability in GbpsPattern Generator Status panel shows the Timing, Pattern (Name), CEF (color format and<br/>subsampling and colorimetry), BPC (bits per color), Status, and CRC value, for each active stream.

### Pattern

Configuration of the video sent in the corresponding stream (Controls vary between selected pattern type)



### Predefined Timings

The list includes a set of common fixed video timings. Please find a list of the timings with their major details in <u>Appendix C</u> of this document. With the *Manage Timings* function the user can add timings to the list and select which timings are shown in the selection.

### Color Format, Subsampling and Color Depth

The table below lists the available color modes and related available color depths.

Selection	Color Format	Subsampling	Available Color Depths
RGB:	RGB	4:4:4	6, 8, 10, 12 and 16 bpc
YCbCr444:	YCbCr	4:4:4	8, 10, 12 and 16 bpc
YCbCr422:	YCbCr	4:2:2	8, 10, 12 and 16 bpc
YCbCr420:	YCbCr	4:2:0	8, 10, 12 and 16 bpc
Y-Only:	Y	4:0:0	6, 7, 8, 10, 12, 14 and 16 bpc
RAW:	RAW	N/A	6, 7, 8, 10, 12, 14 and 16 bpc

### Quantization Range

VESA:Patterns are sent with Full Range color values (0 to 255 with 8 bpc)CTA:Patterns are sent with Limited Range color values (16 to 235 with 8 bpc)

Quantization range selection is enabled based on the type of pattern selected.

### Video Pattern

The selection includes a set of predefined patterns and a possibility to load user defined custom patterns. Please find a description of the available predefined patterns in <u>Appendix D</u> of this document. By selecting **Disabled** you can have the links activated but no video data transferred.

Note:

When MST mode is selected, full selection of test patterns is available only in virtual channel 0

#### **Filter**

Filter timings by specific vendors and resolutions. Timings can be sorted by Vendor ID or width.

/// Form	×
Timing Filtering	
Enable	
Filter by vendor	
Unigraf Other	
Filter by resolution	
2k and less 4k 8k and more	e
Sort timings by: Vendor ID \vee	
Cancel App	ly

#### Custom Image Patterns

BMP, PNG, JPG and SVG files can be loaded from the PC to be used as custom images.

Please refer to *Link Pattern* in description of Generator role *Link tab* earlier in this manual for sending special binary patterns in the link instead of video.

#### **Bitmap Scaling**

When bitmap patterns are used, they can be used either in their original resolution, aligned to top left corner (=un-check *Scale*), or upscaled or downscaled to match the selected video resolution (=check *Scale*).

#### Pattern Options

Some of the predefined patterns include additional configuration parameters. The controls for the parameters appear below the pattern selection when the pattern in question has been selected. Please find a description of patterns options in <u>Appendix D</u> of this document.

#### **Pattern Scrolling**

When Pattern Scrolling is enabled, the pattern is moved horizontally and vertically between display scans. The function is available for all patterns except the following: Color Bars, Chessboard, Solid Color, Solid colors (white, red, green, blue), White V-Strips, Motion Pattern, DSC Pattern.

Pattern Scr	olling		
🗹 Enable	Horizontally	10	pixels
	Vertically	10	pixels
	Every	1	frame

Enable:	Enable or disable pattern scrolling
Horizontally X pixels:	Horizontal step of the pattern movement in pixels (values in range -1270128, for YCbCr 4:2:2 even values). 0 = no movement, positive values = pattern moves to the right.
Vertically Y pixels:	Vertical step of the pattern movement in pixels (even values in range –1270128, for YCbCr 4:2:0 even values). 0 = no movement, positive values = pattern moves up.
Every N frame:	Delay of pattern movement in display frames (values in range $0255$ ). 0 = no movement, 1 = move every frame, n = move every n:th frame.

Note:

Please click *Apply* to enable changes or check *Auto-Apply*.

### **Sourcing DSC Compressed Patterns**

UCD Pattern Generator function is able to source DSC content originating from pre-created DSC compressed files. DSC compressed pattern files can be created with a separate tool called *DSC Compressor*. It can be launched from Tools > DSC Compressor.

DSC Compressor							
File to compress							
Source File: C:/Tem	p/DSC/unigraf_	_default_image_16k.	ppm				
16384 x	8640, RGB 24bp	φ					
Sink DSC capability re	egisters (DPCD	range 0x60 -> 0x6f,	hex)				
		=					
0f 21 03 03 eb 07 01 (	00 00 1f 0e 11 0	8 07 00 00				l	Jpdate
	_						
Compression Option	5	Output resolutions					
Color space YCbCr 4:2:2		· · · · · · · · · · · · · · · · · · ·		1		0 0 0 0 0 0 0	
YCbCr 4:2:2	~	2560 x 1600 2880 x 240	^	Compressi	on ratio:	8bpc -> 6bpp (2.7 to 1)	
Color depth		2880 x 288		Horizontal	slices:	4 Slices	
8	~	2880 x 480		Vertical slic	ces:	Custom	
Resize mode		2880 x 576		Custom ve	ertical slices size:		
		2880 x 1440			and sheet sheet		
O Scale		3840 x 2160 4096 x 2160			1	108	-
Crop		4090 x 2160		-YUV Cold	or range		
O Scale and Crop		5120 x 2880			2	● CTA	
O beare and crop		7680 x 4320		O Full		C LA	
OSC Version: 1	.2 ~	10240 x 4320	~				
Line Buffer Depth:	) bits 🗸 🗸	Refresh	Custom		Open storage folder	Start Compressio	n
							Close

Select the source bitmap file in Source File field. Define the Output Resolution, the color depth, compression ratio and number of horizontal and vertical slices in the frame.

Source File:	Source bitmap file to be compressed (JPG, PNG, PPM)
Sink DSC capability registers:	Click <i>Update</i> to read DPCD registers 0x60 to 0x6f from the connected Sink device
Color Space:	Color space of the output compressed file (RGB, YCbCr 4:4:4, 4:2:2, 4:2:0, Simple 4:2:2)
Color depth:	Color space of the output compressed file (8, 10, 12, 16)
Output resolution:	Resolution of the output compressed file
Resize mode:	The way the DSC image is created from the Source file
Compression ratio:	Used compression ratio
Horizontal slices:	Nr. of slices horizontally (1 to 24 Slices)
Vertical slices:	Vertical slices (1 to 24 Slices, Custom) Custom vertical slices size: minimum 1, recommended 108
YUV Color range:	Selection of color range between Full range (Full) (0 to 255 at 8 bpc) and Limited Range (CTA) (16 to 235 at 8 bpc)
Refresh:	Refresh the list after adding a custom resolution
Custom:	Create a custom output resolution
DSC Version:	DSC version used (1.1, 1.2)
Line Buffer Depth:	Line buffer bit depth used to generate the bitstream. (8 to 16 bits, default 9 bits)
Open storage folder:	Open DSC temp folder defined in Tools > Options
Start Compression:	Start the compression process

The result of the compression process is saved in the same folder as the source file. The start of the file name is the same as the source bitmap file; resolution and color format are added to the end of the file name.

Example: unigraf\_default\_image\_16k.ppm >> unigraf\_default\_image\_16k\_1920x1080\_YUV422\_FULL\_bpc8\_bpp6.dsc

To use the created DSC file in Pattern Generator, select pattern:

CTA 1920 x 1080 @ 60Hz (VIC 16)	~	Y	8 bpc	~	O VES	A 🖲 CTA
🟹 Select DSC Image	~	УСЬС	r422	~	ITU601	`

Select DSC Image and click Select ... to open file selection dialog.

When a DSC image is selected as the pattern, UCD Console will automatically enable the resolution and the color mode matching the DSC image. If the connected Sink device declares support for DSC in its DPCD, UCD Console enables DSC.

When Select DSC Image pattern is being transmitted and incompatible Horizontal and Vertical Active timings are set (Via Apply or Apply All), the user is presented with a dialog: H-Active and V-Active don't match with DSC data. Do you want to upload image?

/// Warr	ling	×
?	H-Active and V-Active don't match with DSC data. Do you want to upload image?	
	Yes No	

Above, "Do you want to upload image?" is misleading and will be changed to "Continue to transmit image?".

If you select No, the new settings will not be applied.

If you select *Yes*, the Pattern will continue to be transmitted. DSC data is transferred in the active window. To transfer all DSC data without loss, active video should be large enough for DSC compressed data (DSC\_pic\_height \* DSC\_pic\_lenght / compression\_ratio). MSA H-active should also not be less than DSC pic\_height.

MSA V-active parameters can be reduced without DSC corruption until active video area is no longer large enough to pass all DSC data.

MSA V-active and H-active can be increased until HW limitation (pixel clock limit) and link bandwidth are reached.

### Preview DSC image

To preview an DSC image before it is applied to the pattern generator, select the eye icon. CRC and DSC CRC values are indicated in the preview image.

Stream 0 CTA 1920 x 1080 @ 60Hz (VIC 76) C Select DSC Image 1920x1080_VUV422_BPY_bpc8_bpp112_2sl	YCbCr422 V ITU601	isa ⊚ cta Ƴ	Stream 1 CTA 1920 x 1080 @	60Hz (VIC 76)	✓ ▼ 8 E ✓ RGB	npc ∨ ⊙ VE	SA () CTA
Frame Rate 60.000 © Pixel Clock 148, Active 1920 © x 1080 © Total 2200 © x 1125 © Back Porch 148 © x ja6 ©	500 € Adaptive-Syn Sync width 44 € Sync polarity ☑ (+) Front Porch 88 €		540 × 480 348 × 480 800 × 600	1280 × 768 1280 × 800 1280 × 960	80 × 720 80 × 1050 1920 × 1080	n 44 ♥ ity ☑ (+) h 88 ♥	x 5 👽 x 🗹 (+) x 4 🗣
Start 192 🗲 x 41 🖶	Status: OK	CRC (CrYCb) DSC CRC (Eng	. 012)	0xA653 (	x2BA8 0xC4D6	ок	

#### **Manage Timings**

Custom timings can also be created and edited with pop-up *Timing Editor*. Launch the editor by clicking **Manage Timings**.

	Select All New	Delete	Timing Editor					
Name	Description	^	Description					
🛾 🔒 CVT 3840 x 2160 @ 144Hz [RB3]			Standard	СТА				
🛾 🔒 CVT 3840 x 2160 @ 60Hz [RB1]			ID	105				
🔒 CVT 3840 x 2160 @ 60Hz [RB2]			Frame Rate	30,000				
] 🔒 CVT 3840 x 2160 @ 60Hz [RB3]			Pixel Clock	297,000 Horizo			Verito	
] 🔒 CTA 3840 x 2160 @ 60Hz (VIC 97)			Active	3840	ital	x	2160	11
GTA 3840 × 2160 @ 24Hz (VIC 93)			Total	4400	-	x	2250	
CTA 3840 x 2160 @ 25Hz (VIC 94)			Start	384	\$		82	
CTA 3840 x 2160 @ 30Hz (VIC 95)			Sync width	88	*		10	
CTA 3840 x 2160 @ 50Hz (VIC 96)			Sync polarity	✓ (+)			<b>⊻</b> (+)	
CTA 3840 x 2160 @ 24Hz (VIC 103)			Back Porch	296	-		72	
CTA 3840 x 2160 @ 25Hz (VIC 104)			Front Porch	176	÷.		8	
🔒 CTA 3840 x 2160 @ 30Hz (VIC 105)			176 88	296 FrontP				
CTA 3840 x 2160 @ 50Hz (VIC 106)			10 VSY 72	NC BackP				
CTA 3840 x 2160 @ 60Hz (VIC 107)			F H	Ba			2	250
CTA 3840 x 2160 @ 48Hz (VIC 114)			Fron Con C	C	ACTIVE VI	DEO	216	50
CTA 3840 x 2160 @ 48Hz (VIC 116)			P.	P.				
CTA 3840 x 2160 @ 100Hz (VIC				4400	3840	_		
CTA 3840 x 2160 @ 100Hz (VIC				440(				
CTA 3840 x 2160 @ 120Hz (VIC						Sav	/e Re	evert

### **Customizing Timings List**

The list of timings that are shown on the pull-down menu in Pattern Generator and Link tabs can be limited by un-checking the checkbox in the left edge of *Name* column. The timings will remain in the list and can be brought back to the pull-down menu, when needed.

### **Editing Timings**

Video timing Name and Description are shown in the list. Lock icon  $\mathbf{a}$  indicates that a timing is a fixed timing which cannot be edited or deleted. Custom timings are indicated with a head icon  $\mathbf{1}$ .

New:	Create a new custom timing based on the selected fixed timing.
Delete:	Delete the selected custom timing
Save:	Save changes in the selected custom timing.
Revert:	Undo all changes

The dialog will make a sanity check for the values entered and will warn the user for any combinations that cannot be used.

# **Playback Tab**

*Playback* Tab is for running predefined *Playlist* files. Playlists contain *Scenarios* which define timing, video pattern, audio content, related metadata packets and duration. Import playlists by clicking *Import.* 

erminal Memory Layout Event Log DP RX DP TX	
Link     Pattern Generator     Audio Generator     SDP     Playback     HDCP       Import     Import     Metadata     HDR10+ Test     Adaptive-Sync       Sample Content     > Basic Video & Audio Example - DP.txt       > Frame Rate Example - DP.txt       > DSC Example - DP.txt       > HDR & Metadata Example - DP.txt       > Grayscale - DP.txt       > HDR10+ SSTM Example - DP.txt	DPCD     FEC     Sink DUT Testing     Adaptive-Sync     Cable Info     EDID/DisplayID     Par       Selected Sequence       Source:o. & Audio Example - DP.txt (Playlist)     Select     Editor       Video       Source: -       Amount: -       Horizontal       Vertical       Total     -       Frame Rate, Hz:       Color Depth, BPP:       Color Encoding:       Active       Sync Width -       Sync Width -
Run         Skip           Packets data size: U sytes.         Audio data size: U sytes.           Audio data size: O bytes.         Memory layout: OK.           CLProgram Files/Unigraf UCD         Tools/Resources/playback/content/Basic/Image1.jpg: 8 bpc           CAProgram Files/Unigraf/Unigraf UCD         Tools/Resources/playback/content/Basic/Image2.jpg: 8 bpc           Image upload succeeded!         Loaded playback scenario           = Scenario starded (60000 ms) #1/5 > Flip-flop Silent         =           = Scenario stopped (60000 ms) #1/5 > Flip-flop Silent         Playlist stopped.	Audio Source: - Amount: - Compressed: - Amount of channels: - Sampling: - Packets Source: - Amount: - Status: Forcibly stopped Cable Information

Term	Functionality
Playlist	Playlists specifie the UCD devices and output for content. It lists Scenarios to be played and their duration.
Scenario	Scenarios allow users to select specific sequences of video frames, metadata packets and audio that are to be played and their order.
	Playlists and Scenarios are text files that can be edited using any text editor.
Advanced Playlists	Unigraf UCD devices can be used as a compatibility test tool for dedicated standards such as Dolby Vision™ and HDR10+. Contact Unigraf for details.

### Note:

Note that Playlists and Scenarios are technology dependent. Provided examples for HDMI and DisplayPort are somewhat different.

#### **Common Tab**

Sample playlists are included in UCD Console. Select a sequence (a scenario) from the playlists and press *Run* (or double click it) to play the sequence.

Common	Metadata	HDR10+ Test	Adaptive-Sync	
	ole Content			
✓ B		lio Example - DP.t	xt	
	Flip-flop Silent			
	Flip-flop with I	PCM Audio		
	Flip-flop with I	AC3 Audio		
	Philips 1920x1	080p + 1kHz		
	Philips 3840x2	160p + 1kHz		
> F	rame Rate Examp	ole - DP.txt		
> D	SC Example - DP	.txt		
> H	IDR & Metadata I	Example - DP.txt		
> G	irayscale - DP.txt			
> H	IDR10+ SSTM Exa	ample - DP.txt		
	Run		S	škip

The *Run* lable changes to *Stop* a *Scenario* is being played. Press *Stop* to stop playing the scenario. Press *Skip* to skip to next scenario while playing.

#### Status Log

Scenario commands are listed in the Status Log.

Run	Skip
Packets data size: 0 bytes.	•
Audio data size: 0 bytes.	
Memory layout: OK.	
C:\Program Files\Unigraf\Unigraf UCD	
Tools\Resources\playback\content\Basic\Im	age1.jpg: 8 bpc
C:\Program Files\Unigraf\Unigraf UCD	
Tools\Resources\playback\content\Basic\Im	age2.jpg: 8 bpc
Image upload succeeded!	
Loaded playback scenario	
== Scenario started (60000 ms) #1/5 > Flip	-flop Silent
== Scenario stopped (60000 ms) #1/5 > Fli	
Playlist stopped.	

#### Selected Sequence

Run sequence details are shown in the Selected Sequence panel.

ource: Philip	s FHD.tx	t (Scenario)			Select	Editor
Video						
Source:Un	igraf UC	D Tools/Reso	urces/pl	ayba	ck\content\Basic\	Philips.svg
Amount: -						
Horizontal		Vertical		Mi	isc	
Total	2200	Total	1125	Fra	me Rate, Hz:	60
Start	192	Start	41	Co	lor Depth, BPP:	8
Active	1920	Active	1080		lor Encoding:	
					R Frame Rate, Hz:	-
Sync Width	44	Sync Width	5	Mν	/RR:	-
Amount: 1					back\content\Basi	c\1kHz.wa
Compressed:	No				hannels: <b>2</b>	
Sampling:	44100		Bit dept	:h:	16	
Packets						
Source: -						
Source: - Amount: -						

#### **Scenario Editor**

Press the *Editor* button int the *Selected* Sequence panel above to launch the *Scenario Editor to edit* Scenario details. Refer to *Appendix H: Scenarios and Playlists* later in this manual for details.

// Sce	nario Editor				×
Video					
Path:	goldenGat	e0.ipa			Select
	4 files found				
			C		
		/ 10/12bit data to 10			
		me numbers during			
	_	0 x 2160 @ 30Hz (V		RGB ~	10 bpc 🗸
DSC:	HCActive:		HCBlank	:	
	VTotal:		VStart:		
	VActive:		VSync:		
	Frame rate:				
Packe	ets				
Path:	frames_00	)0.bin			Select
	4 files found				
Audio	,				
Path:					Select
	 Compres	se 🔲 Little Endia	44100 Hz 🗸 🗸	2 channels ~	16 bits V
	ng order				
3:180	0:0,2:512;				
Gene	ral				
🗌 Er	nable scrambl	er Loading color	(R,G,B): 52,127	7,150 HDC	P: None $\vee$
				ОК	Cancel

### Metadata Tab

<u>///</u> Dialog	X
CTA 1920 x 1080 @ 60Hz (VIC 0)	60fps
RGB444 ~ 8 bpc	~
Metadata	Add Delete
Comment Content folder C:/Users/juha.eskola/AppData/Local/Unigraf/UCD Console\Playback Please select a content folder	Browse
	Play Export Cancel

First you are asked to select the folder where the generated content will be stored.

/// Con	tent folder X	
1	A folder for generated content must be selected. Press the Browse button to select.	
	ОК	

#### Click Browse ... to select the folder.

Content folder			
C:/Users/juha.eskola/AppData/Local/Unigraf/UCD Console\Playback			Browse
Please select a content folder			
	Play	Export	Cancel

#### **Timing details**

The uppermost part of the window shows the timing details. Please, note that the timing is set on the pattern generator tab. You can change the color mode (RGB444, YUV444, YUV422, YUV420) and color depth (8 bpc, 10 bpc, 12 bpc, 16 bpc).

CTA 1920 x 1080 @ 60Hz (VIC 0)	60fps
RGB444 ~	8 bpc ~

#### Metadata

In metadata section you can add and delete metadata packets.

Metadata			
			Add
			Delete

#### <u>Comment</u>

You can add comments after there dashes in the comment field.

Comment	

#### HDR10+ Test Tab

Please refer to HDR10+ CTS User Manual for detailed description of the tab.

#### **Adaptive-Sync tab**

Common	Metadata	HDR10+ Test	Adaptive-Sync	
Generate.				Delete

Click *Generate* to generate custom Adaptive-Sync scenarios. Custom Scenario Generator window will open.

		Scenario duration		
	*	Step duration, sec	1.00	*
	*	Step duration, cycles	2	÷.
rame rate	$\sim$	Frame repetition	1	÷.
		Duration in secon	ds	
ames: 10 🗘			O Custom	Select
			O Custom	Select
ames: 10 🜩			O Custom	Select
			O Custom	Select
			Custom	Select
	rame rate	rame rate $\vee$	Step duration, cycles           rame rate         Frame repetition           Duration in second	Step duration, cycles         2           rame rate         Frame repetition         1           Duration in seconds         Duration in seconds         1

First you are asked to select the floder where the generated content will be stored.

/// Con	tent folder X
1	A folder for generated content must be selected. Press the Browse button to select.
	ОК

Click Browse... to select the folder.

Available memory: 1879048192 bytes; 141 frames			
Content folder			
C:/Users/Tester/AppData/Local/Unigraf/UCD Console\Playback			Browse
equence of 17 frames			
	Play	Export	Cancel

#### **Timing details**

The uppermost part of the window shows the timing details. Please, note that the timing is set on the pattern generator tab. You can change the color mode (RGB444, YUV444, YUV422, YUV420) and color depth (8 bpc, 10 bpc, 12 bpc, 16 bpc).

💯 Custom Scenario Generator	×
CTA 1920 x 1080 @ 60Hz (VIC 76)	60fps
EDID [HDMI Forum VSDB; HDR Static MDB; HDR10+ VSVDB; Dolby Vision VSVDB]           RGB444         V         8 bpc	~

#### Adaptive-Sync settings

In the Adaptive-Sync section you can set the transition and scenario duration parameters. Different transition types are Fixed frame rate, Min and max and Gradual.

When *fixed frame rate* is selected, the scenario is played at the minimum frame rate set in the first field. In scenario duration, select how many times frame is repeated.

Adaptive-Sync					
Transition			Scenario duration		
Min frame rate, fps	48	-	Step duration, sec	1,00	*
Max frame rate, fps	60	*	Step duration, cycles	2	*
Transition type	Fixed frame rate	~	Frame repetition	1	-
			Duration in second	ds	

When *min and max* is selected, the output scenario will alter the framerate between the two values set in the drop down menus. You can also set the duration for step in seconds and select how many times frames are repeated.

Transition			Scenario duration		
Min frame rate, fps	48	•	Step duration, sec	1,00	
Max frame rate, fps	60	•	Step duration, cycles	2	
Transition type	Min and max	~	Frame repetition	1	\$

When *gradual* is selected, the frame rate is changed with each frame. For example, when min frame rate is set at 20 and max is set at 60 and the scenario has 40 frames, frame rate would be incremented by 1 with each frame.

Info at the bottom of the segment shows the minimum and maximum values for VRR framerate defined in EDID, and the base frame rate set in the pattern generator.

Transition			Scenario duration		
Min frame rate, fps	48	•	Step duration, sec	1,00	A T
Max frame rate, fps	60	*	Step duration, cycles	2	Ť
Transition type	Gradual	~	Frame repetition	1	¢

### <u>Video</u>

Video		
● Spinner Fast ✓ Frames: 10 💠	○ Custom	Select
	2 Ø	
<spinners></spinners>		
Available memory: 1879048192 bytes; 141 frames		
Content folder		
C:/Users/Tester/Desktop		Browse
Sequence of 17 frames		
	Play Export	Cancel

The section at the bottom shows details of the output video. The default pattern is a spinner. You can select the speed of the spinner video from the predefined options in the drop-down menu or you can set a number of frames it takes for the spinner to rotate a full circle. You can also select a custom video. The supported file types are .jpg, .png, .gif, .bmp, .tiff, .ppm and .tif

Available memory is shown in bytes and frames. Below, the folder selected for the sequence is shown. You can change the folder by clickin Browse... Lastly, the duration of the sequence is shown in frames.

You can export the scenario by clicking *Export*. When exporting, you are asked to select a location for the export. The content folder will be automatically created in the chosen location. The folder inlcudes the image files, packets and scenario parameters.

You can play the scenario by clickin *Play.* When the scenario starts playing, the scenario generator window will close. You can now inspect the progress in the log in the palyback tab as shown below.

Stop	
C:\Users\Tester\Desktop\VKR\-generated-\frame0009.svg: 8 bpc	^
C:\Users\Tester\Desktop\VRR\-generated-\frame0010.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0011.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0012.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0013.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0014.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0015.svg: 8 bpc	
C:\Users\Tester\Desktop\VRR\-generated-\frame0016.svg: 8 bpc	
Image upload succeeded!	
Loaded packet(s)	
Loaded playback scenario	
== Scenario started (3600000 ms) #1/1	

### Audio Generator Tab

Audio generator allows the user to play LPCM audio generated internally or from files in WAV format.

To load internally generated audio, select **Generate audio**, and adjust the controls to the desired audio format.

/// UCD Console - UCD-500 [2	2312C600]: Display	Port Source and Sin	k					-		$\times$
File Tools Window Hel	р									
DP RX DP TX Event	Log Memory	Layout Terminal								
Link Pattern Generate	or Playback	Audio Generator	HDCP	EDID	DPCD	FEC	Sink DUT Testing	Adaptive-Sync	Cable 4	Þ
Audio Status Audio Ioaded: 2 chann	els @ 44100 Hz, 10	5 bits								
Play Control Play Sto	Source: Status:									
Audio Content <ul> <li>Generate Audio</li> </ul>										
Waveform:	Sine ~	Bits/Sample:	16	~						
Signal Frequency:	1000 🗘	Amplitude(%):	60	~						
Sample Rate (Hz):	44100 ~	Channels:	2	~						
C Load Audio from Fil	e									
Path: -										
Compressed			Open WAV	/ file						
HPD				Cabl	e Informa	tion				
Asserted				TX	: RX	:				
online										

To load an audio file from your PC, select Load audio from file, click the **Open WAV file...** button, browse and select the file and click **Open**.

The Compressed checkbox indicates that the audio loaded from the selected file is compressed.

To play the selected audio content, click the Play button.

The content will be looped until the Stop button is clicked.

Audio Status in the top of the tab indicates the type of the currently played audio content.

#### Audio Content

Sent audio can be generated internally or used a WAV file loaded from the PC.

In case of a WAV audio file, the parameters stored in the file will be used. When generating audio internally, the user sets the details of the LPCM Audio signal.

Waveform Selection of audio waveform: Sine, Sawtooth, Square, or Incremental

Signal Frequency	Setting audio signal frequency in Hz
Sample Rate (Hz)	Selection of audio sampling rate: 32000, 44100 (default), 48000, 88200, 96000, 176400, 192000
Bits/Sample	Selection of sample bit depth: 16, 24
Amplitude(%)	Selection of audio amplitude: 10%, 20%,, 90%, 100%
Channels	Selection of sent audio channels: 1, 2,, 7, 8. When selecting 1 or 2 audio channels '1 and 2 channel LPCM Audio mode' is used and when 3 and more channels '3- to 8-channel LPCM Audio mode' is used.

### **HDCP** Tab

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the UCD device.

Memory Layout Event Log DP TX Link Pattern Generator Audio Gene HDCP 2.3		Playback FEC Sink DUT Testing Cable Inf	o Adaptive-Sync
Status General Active Authenticated Keys loaded SST Mode: Type N/A By stream Stream 0 Type 0 Stream 1 Type Unknown Stream 2 Type Unknown Stream 3 Type Unknown	Configuration Keys Production Facsimile - T1-R1 Facsimile - T1-R2 None Configuration type All streams By stream Type Value (SST/All streams) Type 0 Type 1	Control Control Label Encryption Label Encryption Label Encryption Label Encryption Label For Type Value Label For Type 0 Type 0 Type 1 Stream 1 Type 0 Type 1 Stream 2 Type 0 Type 1 Type 1 Type 0 Type 1 Type 1 Type 0 Type 1 Ty	
HPD Asserted		Cable Information TX: RX:	

#### **Status General**

The status fields indicate the HDCP status of the UCD device.

Active:	The stream between UCD and the downstream sink has been encrypted.
Authenticated:	HDCP handshake between the UCD and the sink unit has been completed successfully.
Keys loaded:	HDCP keys are loaded to the UCD unit.
Km is stored:	Master Key (Km) is stored.
SST Mode Type	Type when in SST mode and in Link mode 8b/10b.

#### **Status By stream**

Stream status shows HDCP status on each stream.

#### **Configuration Control**

Enable encryption:	Check to enable the encryption of the stream between UCD and the downstream sink.
Authenticate:	Perform the HDCP initiation handshake between the UCD and the sink unit.
Use stored Km:	Use stored Master key (Km)

#### **Configuration type**

Select to configure HDCP for All streams at once or By stream.

#### By stream

Select and configure streams.

### **Type Value (All streams)**

Select Type 0 or Type 1. Type 1 ensures that content encryption is done with HDCP version 2.2 or higher.

### **Configuration Keys**

Select Production or Facsimile HDCP keys. To remove the keys, select None.

# EDID/DisplayID Tab

The EDID/DisplayID Tab provides tools for accessing the EDID/DisplayID data of the connected sink device.

There are three basic functions:

- Load and save the data files on the host PC.
- Edit data contents either in *Editor Mode* or in *Hex Edit Mode*.
- Read and write data to the connected sink. Up to 4 virtual channels can be accessed.

### **EDID/DisplayID Files**

1

With Load... and Save As... a file can be read into the editor or written to a file from the PC.

	d Item 🔻 Remove Item Filter			Read n	node:   I2C Read  SBM Read  Virtual Sink #1  Virtual Sink #1	Only 🗹 Recurs
Na	me		^ Edit	tor Text EDID		
	VESA			Name	Value	^
	> Vendor & Product ID				0x00FFFFFFFFFF00	
	EDID Structure Version and Revision		0	Header	UXUUFFFFFFFFUU	
	> Basic Display Parameters / Features Color Characteristics	5	1	Extension Block Count N	2	
	> Established Timings I		2	Checksum	0x1C	
	> Established Timings II			ID Manufacturer Name	UFG	
	<ul> <li>Manufacturer's Timings</li> <li>Standard Timings: Identification</li> </ul>			Vendor & Product ID ID Product Code		
	<ul> <li>Preferred Timing Block</li> </ul>		4	Vendor & Product ID	0x4036	
	> 18 byte descriptor 2			ID Serial Number Vendor & Product ID	3900643	
	> 18 byte descriptor 3		6	Туре	Week & Year of Manufactured	
~	18 byte descriptor 4			Vendor & Product ID->Week & Year of Manufacture o Week of Manufactured	52	
	Info			Vendor & Product ID->Week & Year of Manufacture o	r N 52	
	> Data block collection			Year of Manufacture Vendor & Product ID->Week & Year of Manufacture of	<sub>r N</sub> 2014	
Fe	eatures CTA v3		9	Version	1	~
	Name	Value	^	00 01 02 03 04 05 06	07 08 09 0A 0B 0C 0D 0E 0F	^
1	Max Resolution	15360 x 8640	000	0000 <b>00</b> fffffffffff	0054c73640e3843b00	
2	16K Max Frame Rate	60 Hz	000	0010 34180104e53d23	78 3a 5f bl a2 57 4f a2 28	
3	10K Max Frame Rate	60 Hz	000		4f810081c08180a9c0	
3					d0 00 a0 £0 70 3e 80 30 20	
4	8K Max Frame Rate	60 Hz			1a565e00a0a0a02950	
5	4K Max Frame Rate	60 Hz			00001a00000fd0038	
6	2K Max Frame Rate	60 Hz			202020202000000150	
-		r 11.1			30204450310a20021c 00 29 0f 7f 07 15 06 55 3d	
7	HDR Static	Enabled			00 00 00 00 00 00 00 00 00 00	
8	HDR Dynamic	Disabled			00 00 00 00 00 00 00 00 00	
	HDR10+	Disabled			00 00 00 00 00 00 00 00 00	
9			501			
	Dolby Vision	Disabled	000	00C0 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00 00	

	rn Generator Playback	Audio Generator HD	CP DPCD FEC Sink DUT Testing Ca	ible Info Adaptive-Sync SDP EDID/DisplayID				
DID Di	splayID							
isplayID Re	ad:      Disabled      Try	DisplayID, else EDID 🔘 Rea	d both DisplayID and EDID					
Add Item	<ul> <li>Remove Item Filter</li> </ul>		Read	mode:      I2C Read      SBM Read      Virtual Sink #1      Show Read Only      Rec	curse			
Name			Editor Text DisplayID					
✓ Section			Name	Value	^			
✓ Data		- Diada	0 Block Revision	0				
	Product Identification Data Display Parameters Data B		Product Identification Data Block					
	Display Interface Features		Product Identification Data Block	19				
	Type VII Timing – Detailed		2 Manufacturer/Vendor ID Field Product Identification Data Block	0x00C0A4				
	Type X Timing – Formula-l Adaptive-Sync Data Block		3 Serial Number Field Product Identification Data Block	3817093888				
	CTA DisplayID Data Block		Size of Product ID String	7				
			Product Identification Data Block	/ 				
			Product Identification Data Block	UCD-500				
			6 Product ID Code LSB Product Identification Data Block->Product ID Code	Field 0x36	5			
			7 Product ID Code MSB	0x40				
			Product Identification Data Block->Product ID Cod					
			8 Product Identification Data Block->Week & Year of Manu Week of Year Manufactured					
					~			
			00 01 02 02 04 05 0		~			
				5 07 08 09 0A 0B 0C 0D 0E 0F 0 (	v			
Features			000000 <b>20</b> a4 02 00 <b>20</b> 00 1	3 a4 c0 00 36 40 e3 84 3b 00	v			
Features	Name	Value	000000 <b>20</b> a4 02 00 <b>20</b> 001 000010 <b>34</b> 0£075543442	3 4 C 00 36 40 63 64 3b 00 3 55 50 50 21 61 13 00 10 70	•			
	Name		000000 <b>20</b> a4 02 00 20001 000010 <b>340£07554344</b> 2 000020 0800107008002	3 a4 c0 00 36 40 e3 84 3b 00	•			
1 Max Res	olution	15360 x 8640	000000 20 a4 02 00 20 00 1 000010 34 0F 07 55 43 44 2 000020 08 00 10 70 68 00 2 000030 45 54 00 60 00 60 0	3 44 c0 00 36 49 63 64 35 00 4 55 39 39 21 63 14 00 10 70 4 45 57 fe c4 a2 65 52 10 00	•			
1 Max Res			000000 20 44 02 00 20 00 1 000010 34 07 07 55 43 44 2 000020 08 00 10 70 08 00 2 000030 45 54 00 60 00 50 0 000040 18 00 60 75 00 10 2	) 44 CO (O) 55 40 63 54 55 00 9 55 CO (O) 25 40 63 55 00 9 65 CO (O) 25 55 00 9 66 (C) 45 25 55 00 9 66 (C) 45 26 69 55 10 9 66 (C) 45 26 60 (C) 45 25 11	•			
1 Max Res 2 16K Max	olution	15360 x 8640	000000 20 a4 02 00 20 00 1 000010 34 02 07 25 63 44 2 000020 08 00 10 70 68 08 2 000030 45 54 07 80 00 00 000040 12 00 60 72 00 00 2 000050 00 07 60 12 00 42 1	3 a4 c7 (0) 35 40 a3 64 35 (0) 3 53 50 49 24 63 15 (0) (0) 70 9 4a 57 fc c4 a2 65 22 10 (0) 9 (0) 56 fc 26 (0) 99 37 57 15 2 (0) 5c b2 59 15 65 ft 14 45	•			
1 Max Res 2 16K Max 3 10K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz	000000         20         a4         02         00         20         01           000010         30 (E) (P) (S) (4) (4) (2)         00	3 44 c0 (0) 35 40 63 43 50 (0) 3 53 50 50 21 51 56 (0) 10 70 3 44 57 56 c4 22 65 52 10 (0) 9 60 55 67 56 00 19 37 57 17 2 60 56 65 50 14 55 64 14 9 7 a (0) 66 (0) 77 60 65 42				
1 Max Res 2 16K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz 60 Hz	000000         20 a4 02 00 20 ft           000010         36 (ft (7) 55 (ds) (d) 20 (ds) (ds) (ds) (ds) (ds) (ds) (ds) (ds)	3 a c 0 0 3 4 a 3 4 3 0 3 5 3 0 7 2 6 1 5 0 0 1 7 3 5 3 0 7 2 6 1 5 0 0 1 7 9 6 5 f c 4 2 6 5 1 0 0 9 6 5 f c 4 2 6 5 1 6 6 9 7 3 0 6 0 7 0 6 5 1 6 9 7 3 0 6 0 0 7 0 6 5 7 1 6 0 6 f 1 6 6 0 7 0 6 0 7 0 6 0 6 1 6 1 6 0 6 1 1 6 0 6 0 6 f 1 6 6 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 6 1 6 0 6 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 6 1 6 0 6 1 0 7 0 6 0 6 0 6 1 0 6 0 7 0 6 0 6 0 6 1 0 6 0 7 0 6 0 6 0 6 1 0 6 0 7 0 6 0 7 6 1 0 6 0 7 0 6 0 7 6 1 0 6 0 7 0 7 0 7 0 7 0 7 0 7 0 7 0 7				
1 Max Res 2 16K Max 3 10K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz 60 Hz	000000         20         a4         02         00         20         12           000010         30 (E) (F) (S) (4) (4) (2)         00         00         10         00         10         00         10         00         10         00         10	3 4 0 0 3 4 0 3 4 3 0 3 5 0 0 2 4 1 4 0 1 7 4 6 7 0 4 2 1 5 1 0 0 1 7 9 6 7 0 0 2 1 1 4 0 1 0 7 9 6 7 0 4 2 1 5 2 0 0 1 7 9 7 0 0 0 0 7 0 1 1 6 1 1 4 7 9 7 0 0 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 2 1 1 9 6 0 0 7 1 3 1 1 0 1 1 2 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
1 Max Res 2 16K Max 3 10K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz 60 Hz	000000         20 a4 02 00 20 ft           000010         36 (ft (7) 55 (ds) (dg) 20 (ds) 2	3 4 0 0 3 4 0 3 4 3 0 3 5 0 0 2 4 1 4 0 1 7 4 6 7 0 4 2 1 5 1 0 0 1 7 9 6 7 0 0 2 1 1 4 0 1 0 7 9 6 7 0 4 2 1 5 2 0 0 1 7 9 7 0 0 0 0 7 0 1 1 6 1 1 4 7 9 7 0 0 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 2 1 1 9 6 0 0 7 1 3 1 1 0 1 1 2 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
1 Max Res 2 16K Max 3 10K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz 60 Hz	000000         20         a4         02         00         20         12           000010         30 (E) (F) (S) (4) (4) (2)         00         00         10         00         10         00         10         00         10         00         10	3 4 0 0 3 4 0 3 4 3 0 3 5 0 0 2 4 1 4 0 1 7 4 6 7 0 4 2 1 5 1 0 0 1 7 9 6 7 0 0 2 1 1 4 0 1 0 7 9 6 7 0 4 2 1 5 2 0 0 1 7 9 7 0 0 0 0 7 0 1 1 6 1 1 4 7 9 7 0 0 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 2 1 1 9 6 0 0 7 1 3 1 1 0 1 1 2 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
1 Max Res 2 16K Max 3 10K Max	olution < Frame Rate < Frame Rate	15360 x 8640 60 Hz 60 Hz	000000         20         a4         02         00         20         12           000010         30 (E) (F) (S) (4) (4) (2)         00         00         10         00         10         00         10         00         10         00         10	3 4 0 0 3 4 0 3 4 3 0 3 5 0 0 2 4 1 4 0 1 7 4 6 7 0 4 2 1 5 1 0 0 1 7 9 6 7 0 0 2 1 1 4 0 1 0 7 9 6 7 0 4 2 1 5 2 0 0 1 7 9 7 0 0 0 0 7 0 1 1 6 1 1 4 7 9 7 0 0 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 0 1 1 2 9 4 0 0 7 0 1 1 0 1 1 2 1 1 9 6 0 0 7 1 3 1 1 0 1 1 2 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 0 1 1 2 1 1 9 6 0 0 0 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				

At the top the *DisplayID* tab dialog are radio buttons to control how DisplayID data is read: *Disabled, Try DisplayID, else EDID,* and *Read both DisplayID and EDID.* These have no effect when downloading from the sink unless the sink supports DisplayID protocol.

The contents of the device EDID/DisplayID file are not modified, or their integrity checked during load and save operations.

Note: Four blocks (512 bytes) of EDID code are read. If the device does not support all four blocks, the non-supported data values are set to zero.

In the Editor Panes (upper right pane), the *Text EDID* and Text *DisplayID* tabs allow viewing data in tree form.

#### **EDID/DisplayID Editor**

Please see the description of the EDID editor in Chapter EDID/DisplayID Editor later in this document.

## **DPCD** Tab

DPCD tab is a tool for monitoring and editing the DPCD registers of the connected DisplayPort or DisplayPort Alt Mode Sink.

ink Pat	tern Generator	Audio Generator	HDCP	EDID	DPCD	FEC	ink DUT Testing			
								Load Save	D.	port
.ddress : 0x	1	Number of Bytes: 0x	100	\$				Load Save	Ke	ροπ
		-					Receiver Capability			
		3 04 05 06 07					MAX_LANE_COUNT [RO]			
000000		1 01 00 03 80					0x00002 := 0xE4 MAX_LANE_COUNT = 4			
		0 00 00 00 00					ENHANCED_FRAME_CAP = 1			
		0 00 00 00 00					TPS3_SUPPORTED = 1 POST_LT_ADJ_REQ_SUPPORTED = 1			
		8 a4 le ca 47 0 00 00 00 00								
		0 00 00 00 00 00								
		3 eb 07 01 00								
		0 00 00 00 00								
		0 00 00 00 00 00								
		0 00 00 00 00 00					J			
	_	0 00 00 00 00	00 00	00 00	00 00 00	00				
Set Referen								Refresh	Write C	nange
ddress : 0x	200 🗧	Number of Bytes: 0x	100	-						
	00 01 02 03	3 04 05 06 07	08 09	OA OB	OC OD OE	OF	Link/Sink Device Status			
000200	41 00 77 7	7 0d 03 00 00	00 00	00 00	00 00 00	00	0x00203 := 0x77			
000210	00 80 00 8	0 00 80 00 80	00 00	00 00	00 00 00	00	LANE2_CR_DONE = 1 LANE2_CHANNEL_EQ_DONE = 1			
000220	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00	LANE2_SYMBOL_LOCKED = 1			
000230	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00	LANE3_CR_DONE = 1 LANE3 CHANNEL EQ DONE = 1			
000240	9e b6 3e b3	3 b3 la 20 00	00 00	00 00	00 00 00	00	LANES_CHANNEL_CO_DONE = 1 LANES_SYMBOL_LOCKED = 1			
000250	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00				
000260	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00				
000270	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00				
	04 00 80 0	0 00 00 00 00	00 00	00 00	00 00 00	00				
000280	00 00 00 00	0 00 00 00 00	00 00	00 00	00 00 00	00	×			
								Refresh	Write C	hange
	ce									

The *DPCD Decoder* panels on the right show the interpretation of the DPCD byte selected on the monitoring windows. The selected byte is shown with a green background.

Save:	Select DPCD content to a binary DPCD Data file (*.DPD).
Load:	Select previously saved binary DPCD Data file (*.DPD).
Report:	Save parsed content of selected DPCD register ranges as HTML file
Refresh:	Re-read the data from the DPCD registers to the window in question
Write Changes	Write the portion of data shown in the window in question to the DPCD registers.
Set Reference	Store currently shown data as a reference for comparison

When the data is *Refreshed* from the DPCD registers the changed bytes will be highlighted with **blue** color. The fields edited by the user will be highlighted with **red** color.

### **SDP** Tab

SDP CRC16 signature generation is an optional feature in the standard. A 128b/132b DP-capable DP Source device that supports SDP CRC16 shall generate an SDP CRC16 signature and place it in the SDP.

III DP TX UCD Console - UCD-500 [2312C600]: DisplayPort Source and Sink

Link	Pattern Gene	rator	Audio Ger	nerator	SDP	Playback		
SDP Str	C 16 (128b/132k CRC16 Error Ge eams itus: Injected eams: 🔽 0	nerator – Injected	•	No erro	r	-		
SDP Type: 0x 1 Ignore Type Audio_TimeStamp Generate								

The CRC 16 (128b/132b) checkbox enables SDP CRC16.

The SDP CRC16 Error Generator groupbox is for selecting streams and type for injection.

The SDP Type edit control determines the type of SDP that gets the signature.

The *IgnoreType* checkbox is for any type.

Selecting Generate will inject the signature into the next SDP of the selected type.

The Split SDP checkbox allows SDP to be split into non-contiguous data packets.

## FEC Tab

Forward Error Correction (FEC) can be enabled if connected sink supports it. For debugging purposes, error injection to main link is possible. There is an error type for each standard sink DPCD error counter.

Enable FEC	UCD will verify if connected sink supports FEC and begins the handshake for enabling FEC. Only available with 8b/10b link coding.				
Disable FEC	UCD will start the FEC disable handshake. Only available with 8b/10b link coding.				
Prefer FEC Enabled	If selected, and the connected sink supports FEC, UCD will start the FEC Enable Sequence after a successful connection. Only available with 8b/10b link coding.				

UCD Console - UCD-500 [2318C573]: DisplayPort Source and Sink \_ × Eile Tools Window Help Event Log DP TX DP RX Link Pattern Generator Audio Generator HDCP EDID FEC Sink DUT Testing DPCD FEC Enabled Prefer FEC Enabled Enable FEC Disable FEC FEC Status Log Error Generator Current link is 8b/10b Sink FEC Status: Decode Enable Detected Number of errors to generate for Lanes: 0 😨 0 💿 0 💿 Generate errors of type: Corrected parity 1 error ~ Delay between steps (in microseconds): 100 🔹 Apply Sink Error Counters (DPCD) 
 Lane #0
 Lane #1
 Lane #2
 Lane #3
 Sum

 Uncorrected block errors
 0
 0
 0

 Corrected block errors
 0
 0
 0
 Bit errors 0 0 0 0 Parity block errors 0 Parity bit errors 0 Enable aggregated errors Update Clear Counters Debug FEC Sequencing Send FEC Enable Sequence Send FEC Disable Sequence Sink FEC Status: Decode Enable Detected Clear Log HPD Asserted

#### Error Generator 8b/10b Link Coding

Selections will set how many errors will be inserted into one FEC block, and to which link symbols. There are five options:

Uncorrected block	3 symbol errors with 3 error bits together
Corrected block	2 symbol errors with 2 error bits together
Corrected parity	2 parity byte errors with 2 error bits together
Corrected block 1 error	1 symbol error with 1 error bit together
Corrected parity 1 error	1 parity byte error with 1 error bit together

Note: FEC must be enabled and running before errors can be added. Link training will reset sink FEC error counters.

### Error Generator 128b/132b Link Coding

Selections will set how many errors will be inserted into one FEC block, and to which link symbols. There are five options:

Uncorrected block	3 symbol errors with 3 error bits together
Corrected block 4 errors	2 symbol errors with 4 error bits together
Corrected block 2 errors	1 symbol errors with 2 error bits together

Each lane can have its individual error amount. Errors can be injected to even and odd decoders by using Lane #0 and Lane #1 counters when link is configured to one lane.

Apply	Start error injection
Enable aggregated errors	Enables FPGA logic that can calculate FEC errors sum across all active lanes.
Update	Read sink DPCD FEC error counter registers
Clear counters	Clear sink DPCD FEC error counter registers



Note: When using 128b/132b link coding the errors are inserted to Pre-coded RS block right after PHY Sync symbol (Pls see the illustration above). Because of this, on the RX side the number of bit errors will differ from the errors that are inserted on TX side, since pre-coding removal is XOR of the previous bit with the current bit.

# Panel Replay Tab

Pattern Generator Audio Generator SDF	P Playback HDCP DPCD	FEC Sink DUT Testing Ad	aptive-Sync Ca	able Info EDID/DisplayID	Panel Replay A	LPM
rrent Pattern Capabilities	Configuration					
nel Replay: Supported	Mode: PR ~					Apply
R/PSR2 support: PSR2	Early transport		1 E	nable CRC check	Main-link rer	mains ON during PSR1/PS
II frame CRC: Supported	HPD_IRQ on missing AS SDP		Пн	IPD_IRQ on RFB storage error	Self refresh r	
lective Update: Supported lective Update CRC: Supported	HPD_IRQ on uncorrectable V			IDP_IRQ on active frame CRC er		
rly Transport: Supported	Frame Capture			U: Region scan line capture		
the current pattern does not support early transport selective update CRC, please select another one)	Frame 1 Frame 2					
ommand	Region 1		1	Region 2		
Disable						
Inactive mode						
	X coordinate	0	• •	K coordinate	300	•
Active mode						
Full-screen update						
Selective update	Y coordinate	0	• ١	r coordinate	300	•
atus						
ommand Status: No command						
atus: Active mode	Width	100	• ۱	Width	100	٢
ror: Y gran limit is violated						
	Height	100	÷ 1	Height	100	٢
	History					
		SU region index in fra Frame index during SU: CRC R: 0x0000 CRC G: 0x0000	me: 0 0			
		CRC B: 0x0000 CRC Valid: No				
		Block 2: Upper left corner X: 2	00			
		Upper left corner Y: 2 Width: 100	00			
		Height: 1000 SU region index in fra	ma - 1			
		Frame index during SU:	0			
		CRC R: 0xb07e CRC G: 0xf9ef				
		CRC B: 0xe945 CRC Valid: Yes				
		Block 3: Upper left corner X: 0				
		Upper left corner Y: 0 Width: 100				
		Height: 100				
		SU region index in fra Frame index during SU:	1			
		CRC R: 0x0000 CRC G: 0x0000				
		CRC B: 0x0000 CRC Valid: No				
		Block 4:				
		Upper left corner X: 3 Upper left corner Y: 3	00			
		Width: 100 Height: 100				
		SU region index in fra Frame index during SU:	me: 1			
		CRC R: 0xa3a6				
		CRC R: 0xa3a6 CRC G: 0x4634 CRC B: 0x9039 CRC Valid: Yes				

**Current Pattern Capabilities** panel displays what features are supported. Selecting different patterns in the *Pattern Generator* will affect supported features shown here. For example *Patter Generator* pattern *Color Bars* will disable *Early Transport* capability wheras *Color Squares* will enable it.

**Command** panel has the following functions (reflected in the Status panel below it):

Disable	Disable Panel Replay.
Inactive mode	Set mode to inactive.
Active mode	Set mode to active.
Full-screen update	Transmit Full-screen update.
Selective update	Transmit selective update (shown in Command Status and History).

Status panel reflects the Command Status, Status and Error.

Command Status will show Selective update when Active mode and Selective update buttons have been selected (see above); otherwise it will display No command.

Status will show state: Disable, Inactive mode or Active mode.

Error will show No error, Incorrect command or an error message.

History panel displays results from applying commands in the command panel (see above).

The **Configuration** panel allows users to configure *Panel Replay* behavior. The *Mode* combo box allows mode selection: *PR*, *PSR1*, *PSR2*. *Configuration* checkboxes available are: *Early transport:* can be set when supported in *Current Pattern Capabilities* 

HPD\_IRQ on missing AS SDP HPD\_IRQ on uncorrectable VSC SDP error Enable CRC check HPD\_IRQ on RFB storage error HPD\_IRQ on actaive frame CRC error Main-link remains ON during PSR1/PSR2 Self refresh unlock SU extended Y granularity Frame Capture SU:Region scan line capture

The available parameters for Frame1 and Frame 2 for Region 1 and Region 2 are:

X coordinate	X coordinate of region
Y coordinate	Y coordinate of region
Width	Width of region
Height	Height of region

These are the transmitted blocks sent when *command Selective update* is pressed (see above).

The Apply button is used to set the Configuration panel state.

## **ALPM Tab**

Terminal Memory Layo	ut DP TX Event Log			
Link Pattern Generate	or Playback Audio Gene	erator HDCP DPCD	FEC Sink DUT Testing	EDID/DisplayID ALPN
Link Status	Link Control		Errors	
ACTIVE	Enable ALPM		AUX_PH	Y_WAKE_ACK not received
ALW_SLEEP	Power-on			
FW_SLEEP	O Power-off			
FW_STANDBY	○ Automatic Power-off d	uring each vertical blanking	Click to clear	
Power-off entering		Power-off exiting		
ML_PHY_SLEEP Additional sequences PHY hold pattern len	ML_PHY_STANDBY	AUX-less      tLFPS_Cycle, ns 20      LFPS_Cycle Count 16      tSilence, ns 120	AUX_PHY_V	ke UX_PHY_WAKE_ACK /AKE retries 0
		ML_PHY_LOCK_1 time, us	100 🗘 🔿 TPS1 🔿 T	TPS2 🔿 TPS3 💿 TPS4
		ML_PHY_LOCK_2 time, us	0	TPS2 O TPS3  TPS4
				Default

UCD Console - UCD-500 [2312C600]: DisplayPort Source and Sink

Link Status panel shows current ALPM status.

*Link Control* panel is for enabling ALPM and for setting ALPM state. Note that ALPM is only available in 8b/10b SST mode.

*Power-off entering* offers two modes via radio buttons *ML\_PHY\_SLEEP* and *ML\_PHY\_STANDBY*. *Additional sequences* and *PHY hold pattern length, symbols* can be set via the combo boxes.

*Power-off exiting* offers two methods via the *AUX-less* and *AUX\_wake* radio buttons. Parameters for each can be set via the widgets in the respective groups.

If the AUX\_wake method is selected and AUX\_PHY\_WAKE\_ACK is checked and the sink does not respond with AUX\_PHY\_WAKE\_ACK, the Errors group AUX\_PHY\_WAKE\_ACK not received indicator will be lit.

*ML\_PHY\_LOCK\_1* and *ML\_PHY\_LOCK\_2* times may be set along with their patterns: TPS1 – TPS4. *ML\_PHY\_LOCK\_2* is available if TPS1 is selected for *ML\_PHY\_LOCK\_1*.

# Sink DUT Testing Tab

Refer to *Appendix E* for descriptions of the tests available. The tests are presented in a split view, the left being test categories and the right being the tests within.

All tests	Name	Pass	Fail	Skip	Runs	Last status	
DP 2.1 LL CTS	V DP 2.1 LL CTS	0	0	0	0	Last Status	
P 1.4 LL CTS	5.2.1.8 Illegal AUX Request Syntax	0	0	0	0		
DCP 2.3 CTS 2C	5.2.1.9 Glitch Rejection	0	0	0	0		
DCP 2.3 CTS 3C	5.2.1.10 Interleaved EDID and DPCD Receiver Capability Read	0	0	0	0		
	5.2.1.11 Downstream Stop on MOT Reset	0	0	0	0		
	5.2.1.12 Downstream Stop on Timeout	0	0	0	0		
	5.2.2.1 Sink Organizationally Unique Identifier (OUI)	0	0	0	0		
	5.2.2.2 Sink Count	0	0	0	0		
	5.2.2.3 Sink Status	0	0	0	0		
	5.2.2.5 DPCD Address Range	0	0	0	0		
	5.2.2.6 Number of Receiver Ports	0	0	0	0		
	5.2.2.7 Main-Link Channel Coding	0	0	0	0		
	5.2.2.8 ESI Field Mapping	0	0	0	0		
	5.2.2.9 Sink Device Symbol Error Count 5.2.2.10 Verification of DPCD reset values on upstream device disconnect and power-on reset	0		0	0		
	5.3.1.1 Successful Link Training at All Supported Lane Counts and Link Speeds	0	0	0	0		
	5.3.1.1 Successful Link training at Air Supported Lane Counts and Link Speeds		0	0	0		
	5.3.1.2 Successful Link Training with Reddest of Higher Differential Votage swing During Clock Recovery Sec 5.3.1.3 Successful Link Training to a Lower Link Rate/Bandwidth Due to Clock Recovery Lock Failure During		0	0	0		
	5.3.1.4 Successful Link Training with Reguest of a Change to Pre-Emphasis and/or Voltage Swing Setting D.		0	0	0		
						Clear	
Run Selected Select Configu	re Import Export Stop on Failure Repeats: 1 👽 Delay time, sec 1 👽		Save	a Report	Clear Selected	Ciedi y	
Ryn Selected Select • Configu	re Import Export Stop on Failure Repeats: 1 <b>Q</b> Delay time, sec <b>1 Q</b>		Save	≥ Report	Clear Selected		
Run Selected Select • Config.	re Import Export Stop on Failure Repeats: 1 9 Delay time, sec 1 9		Save	₽ Report	Luear selected		
Bun Selected Select  Configu	re Import Export Stop on Failure Repeats: 1  Q Delay time, sec 1  Q		Save	Report	Luear selected		

Select the tests for execution by checking checkboxes or by clicking the test name. *All tests* item on the left hand side is really just for viewing all tests available. Select the desired test category (ex. *DP* 1.4 LL CTS) when running tests.

Run/Run Checked:	Select to start selected/checked tests. Once tests are running the <i>Run Checked</i> button is relabeled <i>Abort</i> to stop the test sequence if desired.
Select:	Includes three sets of options: <i>Select All, Clear All, Invert All</i> for changing the tests current selections; <i>Save</i> (checked items), <i>Load</i> (and check relevant items), <i>Remove</i> (named tests list) for handling named templates; <i>Import</i> (check all items contained in file) and <i>Export</i> (save all checked items to file) for loading and saving file-based templates. Do not confuse <i>Import and Export</i> with those below: These are for setting and saving tests to run.
Configure:	Opens a test parameters dialog for the selected test set. Make sure a test category other than <i>All</i> tests is selected. Refer to <i>Test Parameters</i> below for details.
Import:	Load saved test parameter files (*.td or *.json) for into UCD Console. Select <i>Configure</i> to see current parameters. Loading *.td files to UCD Console is currently unreliable.
Export:	Save test parameters for later use or for use in test automation. For saving parameters for later use in UCD Console, either format can be used. For saving parameters for TSI scripting, please use *.td files. For use with Python applications, use *.json files.
Stop on Failure:	Stops execution of tests if one fails.
Repeats:	Number of times to repeat the selected test sequence.
Delay time:	Delay in seconds between individual tests.

On completion of each test the result of the test is displayed in the table columns on the right. For each test the table lists the number *Pass*, *Fail*, *Skips*, *Runs and Last Status* (status of last run).

Save Report:	Select to generate a HTML report file. This will also open a tab in the default browser and display the results.
Clear Selected	Clear the test results of the <b>selected</b> (not checked) tests results. A subsequently saved report will not include these test results.
Clear All:	Clear the test log view and the outstanding results.

#### **Test Parameters**

Each test set has its dedicated set of test parameters. To open a dialog for defining the parameters click *Configure*.

Description of parameters for each test set can be found within the description of tests in Appendix E of this document.

#### **Saving Test Parameters**

Test parameters can be saved in various ways.

- Export parameters in Sink DUT Testing tab to a \*.td file for later use in UCD Console, to run TSI scripts, or to share test parameters with someone. Presently importing \*.td files into UCD Console is unreliable.
- Export parameters in *Sink DUT Testing* tab to a \*.json file for later use in UCD Console, to run Python scripts, or to load test parameters into UCD Console.
- Save parameters in *Configure* dialog as Presets later to be used in UCD Console. See description below.

#### **Presets**

All *Configure* dialogs selected parameters can be saved and loaded via *Presets* dropdown menu. Select *Save* or *Load* for named internal configuration parameter sets. Select *Remove* to delete a named internal set. Select *Import* and *Export* for loading and saving parameter sets from and to external files. Note that *import*ing and *Export*ing \*.json files here have a different format than importing those described above.

Presets 🔻	
Save	
Load	•
Remove	•
Import	
Import Export	

# Adaptive-Sync Tab

Adaptive-Sync feature is available for Stream 0.

UCD Console - UCD-500 [2312C600]: DisplayPort Source and Sink           File         Tools         Window         Help	- C	) X
DP RX DP TX Event Log		
Link Pattern Generator Playback Audio Generator HDCP EDID DPCD FEC Sink DUT Testing Cable Info	Adaptive-Sync	
Status Enabled: Error: No error Settings Auto-enable if supported by sink		^
Fixed Average VTotal       ✓         Target refresh rate, Hz:       60         Divide by 1.001       Divide by 1.001		
Increase, lines: 100 1.481 ms		
Decrease, lines: 100 1.481 ms Refresh Apply		~

	Auto enabled if supported by Sink:	The feature is enabled based on connected Sink status
	Disabled:	Feature is disabled unless Auto Enabled box is checked. Please see the note below.
	Adaptive Total, constant refresh rate:	Added blank lines
	Adaptive Total, Square pattern:	Added blank lines, min; Added blank lines, max; Period, frames.
	Adaptive VTotal, Zigzag pattern:	Added blank lines, min; Added blank lines, max; Increase, lines; Decrease, lines.
	Fixed Average VTotal:	Target refresh rate, Hz; Increase, lines; Decrease, lines
Note:	supports Adaptive-Sync, but the sele	<i>d if supported by Sink</i> is selected and the connected Sink device ected mode is <i>Disabled</i> , then Adaptive-Sync is enabled in mode <i>e</i> " with 0 (zero) added blank lines. Control dialog will be updated

# **USB-C** Monitoring

When USB-C DP Alt Mode Reference Source role is in use, the following interface specific tabs are available.

• USB-C Power Delivery (PDC)

When UCD-5XX is used in *DP Alt Mode Reference Source* role, *USB-C Power Delivery* (PDC) tab is available. The content of *USB-C Power Delivery* tab is similar to the tab available when in UCD-5XX is used in *DP Alt Mode Reference Sink* role.

Please refer to chapter USB-C Monitoring in section 4. Analyzer Operation earlier in this document.

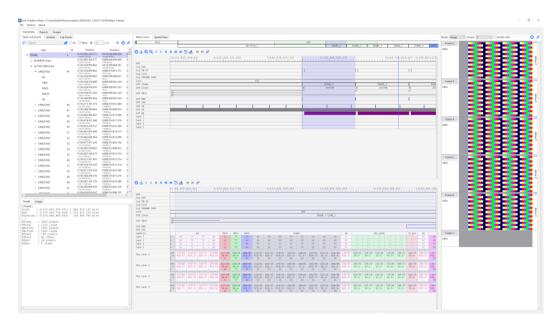
UCD Console - UCD-500 [2232C531]: USB-C, DP Alt Mode Si File Tools Window Help	ource and Sink		- 🗆 X
USB-C RX USB-C TX Event Log			
PDC Link Pattern Generator Audio Generator	Playback HDCP EDID DPCD FEC	Sink DUT Testing	
Status List	Capabilities DP Alt Mode Power Source	e Power Sink Cable Info Controls	
TE Status     Data Role     Down facing port (I     Power Role     Source     VConn     On	Initial Role	CC Pull-up O Defaut O 1.5A	
E-Marked Cable Yes DP Alt Mode "C": DP v1.4a 4 Iane	Reject PR Swap	© 3.0A	
PD Contract Fixed 3.00 A / 5.00 V	Reject DR Swap	Try Behavior O Try Sink	
Power Source - PDO Type Fixed	Reject VCONN SWAP	Try Source     None	
- PDO voltage 5.00 V - PDO max current 3.00 A Power Sink		Spec Release 2.2	
- RDO max current 0.45 A - RDO oper current 0.45 A - No USB suspend Yes	Power Delivery Spec:         PD rev 3.1 v1           Vendor ID:         0x16A6           Product ID:         0x500	.7	
- USB comm capable No - Capability mismatch No - Give back No	Accessories	ccessory	
Available source PDO     PDO 1 N/A     PDO 2 N/A			
Bus Electrical Status        Vbus voltage			
PD Control Send PR_SWAP Send DR_SWAP Send VCONN_SWA	Orientation © CC1 O CC2 Cable Orientation: Stra	aight	
HPD Asserted			PD DUT Attached Detach Reconnect
online			L

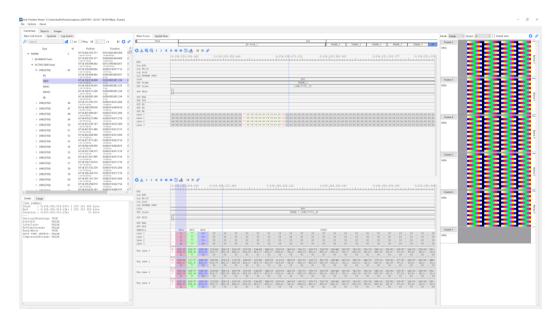
# 6. LINK TIMELINE VIEWER

Link Timeline Viewer is a tool for evaluating the content and timing of data captured with Link Analyzer.

Link Timline Viewer main panel contains two tabs:

- *FrameView* provides the user ability to evaluate events within the captured data and their occurrence in time scale.
- *Images* lets the user view video frame images decoded from the captured data.





Note:

When using Link Timeline Viewer with MST, it's possible that all information for all streams are not fitted in the default window size. Below you can see how different streams are presented in *Wave Form View* and *Symbol View.* To make room for either of the view areas, please scale the areas from the area shown with the red box. You can also remove lines from both views to accommodate necessary information from all streams. Please refer to next chapter for detailed instructions.

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F2 F3 F4		F6	F7	F8	F9	F10	F11	F12			F15	F16	F17	F18	F19	F20	F21	F22	F23	F24	F25	F26	F27
F2 F3 F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19	F20	F21	F22	F23	F24	F25	F26	F27
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1 SDP						_															<u> </u>		
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Phy Lane 1	0.3+	K28.0+	D18.0+	D18.7-	D1.7+	D28.6-	D20.2-	D12.5-	D25.3+	D14.6-	D2.1+	K27.7-	K27.7-	K28.2-	K28.3+	K28.6-	K27.7+	K30.7+	K28.0+	K30.7+	D26.
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### UNIGRAF

# Wave Form and Symbol View Settings

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#### **Gear Icon**



Fhy Lane 1

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The gear icon under the scroll bar allows users to select which events are shown in *Wave Form and Symbol View*. Click the red circle to remove events.



You can select which VBID bits are shown by clicking the pen tool.

JJ VBID edit	or ×
I Bit 0	
Bit 1	
Bit 2	
🗹 Bit 3	
☑ Bit 4	
Bit 5	
Bit 6	
Bit 7	
Accept	Cancel

#### **Save Icon**

Ł

By clicking the Save icon you can save, load and remove settings selected with the gear icon. You can also import and export .json files and reset settings to default.

-		
O Ŧ	€, Q, < >	<b>«</b>
his	Save	þ
AU	Load	> [
Li	Remove	
Li	Import	
VB	Export	
MS.	Reset to default	
SDP		_

#### Zooming



You can zoom in/out with the magnifying glass icons. The zooming in/out option applies to *Wave Form View* only.

#### **Scrolling**

You can use the arrow keys to move in the timeline. One arrow moves the timeline one interval, two arros move it 10 intervals and three arrows move it 100 intervals.

Alternatively, you can scroll by clicking, holding and dragging.

#### **Clock icon**



With the clock icon you can move to a time point. Enter the values and press OK.

Move to time point X				
Enter bit offset:				
1 376 340,937				
[-0:000.503.315.999 : 0:002.516.579.823 ]				
Enter time:				
169 917 890,804				
[-0:062.137.505.894 : 0:310.687.507.793 ]				
OK Cancel				

#### **Eraser**



The eraser icon deletes all made measurements on the timeline.

#### **Move to Previous or Next Interval**

Move back interval and Move next interva

### Sync Data

Sync data for views.

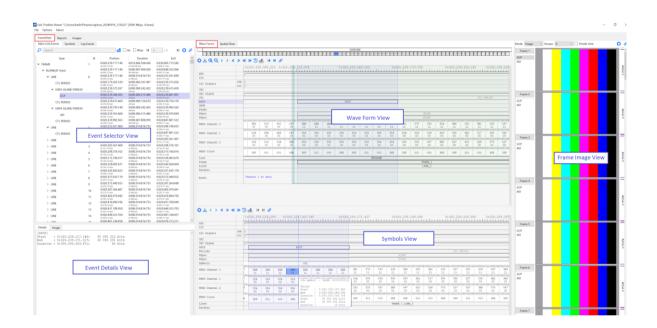
Not synchronized. Synchronized.

# FrameView Tab

FrameView tab consists of five areas shown below.

- Event Selector View
- Event Details View
- Wave Form View
- Symbols View
- Frame Image View

Each of these areas will be described in detail in the upcoming chapters. However, it is worth noting that all these areas are sycnchronized and actions in one area will affect the information shown in other areas.



# **Event Selector View**

#### **Main Link Events**

Main Link Events lists events, packets and symbols occurring during the time span of the captured data. By selecting items in Main Link Events, the user can easily locate the items of interest and get the Wave Form View and Symbol View panels focused for evaluating the item. In Event Selector the events are presented as a folding list of detected items. When opened, each frame lists video lines detected, and further the events detected during each of the lines.

O Search			🔄 🛃 🗌 Aa 🗌 R	Exp 14 0 /0	ыО
Type	Id	Position	Duration	End	^
✓ LINE	0	0:016.616.178.997	0:000.014.752.772	0:016.630.931.769	
BS		0:016.616.178.997	0:000.000.004.938	0:016.616.183.935	
VBID		0:016.616.183.936	0:000.000.001.233	0:016.616.185.169	
MVID		0:016.616.185.170	0:000.000.001.234	0:016.616.186.404	
MAUD		0.016.616.186.405	0.000.000.001.233	0:016.616.187.638	
MSA		0.016.616.199.985	0:000.000.011.110	0:016.616.211.095	
SDP_84	0	0:016.616.224.676	0:000.000.014.813	0:016.616.239.489	
SDP_01	1	0.016.616.259.243	0:000.000.014.813	0:016.616.274.056	
> LINE	1	0:016.630.931.770	0:000.014.816.968	0:016.645.748.738	
> LINE	2	0:016.645.748.739	0:000.014.821.907	0:016.660.570.646	
> LINE	3	0:016.660.570.647	0:000.014.809.561	0:016.675.380.208	
> LINE	4	0.016.675.380.209	0:000.014.812.029	0:016.690.192.238	
> LINE	5	0:016.690.192.239	0:000.014.816.969	0:016.705.009.208	
> LINE	6	0:016.705.009.209	0:000.014.813.264	0:016.719.822.473	
> LINE	7	0:016.719.822.474	0:000.014.816.968	0:016.734.639.442	

The timing format used in Timeline Viewer consists of two timings based on *time* and *bits*.

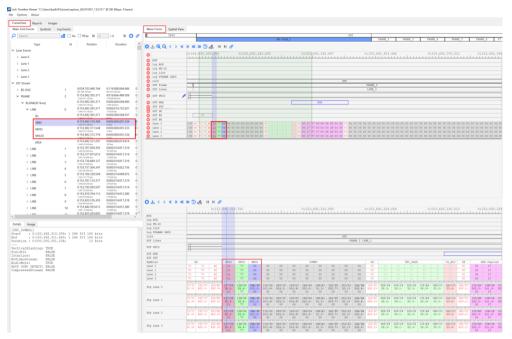
The time format is shown as follows:

seconds:milliseconds.microseconds.nanoseconds.picoseconds

The timing format is demonstrated in the image below where you can see the time format on top and the bit format under it with a smaller grey font.

Туре		Id	Position	Duration	End
>	BS-IDLE	1		0:118.983.568.333 963 771 120 bits	0:153.603.409.463 1 244 193 059 bits
>	FRAME	2	0:153.603.409.464 1 244 193 060 bits	0:016.667.883.866 135 010 450 bits	0:170.271.293.330 1 379 203 509 bits
+		-	0.170 271 202 221	0.016 667 800 040	M-196 020 192 271

When clicking on a Frame, a Line, an Event, or a Symbol, both *Wave Form View* and *Symbols View* are focused on the item, and the time stamp of the item is indicated with light blue color highlighting as shown in the image below.



Event Selector timing details are shown in the columns are the following:

Туре:	Type of item. FRAME, LINE, or name of Event
ld:	Event's occurrence number
Position:	Start of the event from start of the captured data
Duration:	Duration of the event
End:	End of the event from start of the captured data

Under Main Link Events, there are two types of event categories: Lane events and SST/MST Stream.

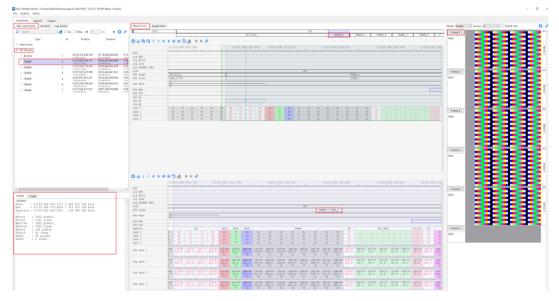
Main Link Events Symb	ols Log Event	s		
Cos: frame		🗌 🛃 🗌 Aa 🗌 RE	xp 🛛 0 /0	ÞI 🗘
Туре	Id	Position	Duration	End
✓ Lane Events				
> Lane 0				
> Lane 1				
> Lane 2				
> Lane 3				
✓ SST Stream				
> FRAME(bad)	1	0:000.004.514.795	0:007.348.683.898	0:007.35
> FRAME	2	0:007.353.198.694	0:016.667.892.509	0:024.02
> FRAME	3	0:024.021.091.204	0:016.667.887.570	0:040.68
> FRAME	4	0:040.688.978.775	0:016.667.887.571	329 582 169 0:057.35
> FRAME	5	329 582 170 bits 0:057.356.866.347	135 010 480 bits 0:016.667.887.570	464 592 645 0:074.02
> FRAME	6	464 592 650 bits 0:074.024.753.918	135 010 480 bits 0:016.667.892.509	599 603 125 0:090.65
> FRAME	7	599 603 130 bits 0:090.692.646.428	135 010 520 bits 0:016.667.887.570	734 613 645 0:107.3€
> FRAME	8	734 613 650 bits 0:107.360.533.999	135 010 480 bits 0:016.667.887.571	869 624 125 0:124.02
> FRAME	9	869 624 130 bits 0:124.028.421.571	135 010 480 bits 0:016.667.887.570	1 004 634 6 0:140.65
> FRAME	10	1 004 634 610 bits 0:140.696.309.142 1 139 645 090 bits	135 010 480 bits 0:016.667.892.509 135 010 520 bits	1 139 645 0 0:157.36 1 274 655 6
<		0 457 354 304 653	0.045 553 003 534	>

### Lane Events

Lane events shows events such as SST, TPS1, TPS3 and TPS4 for each lane.

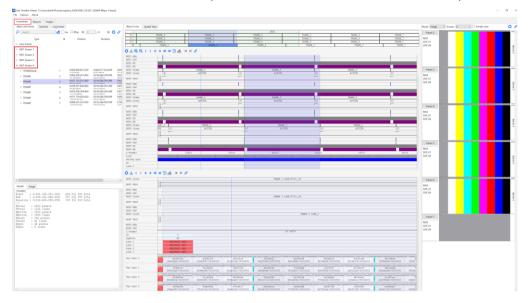
#### SST Stream

You can find all the captured frames under "SST Stream". When clicking on a Frame in the Event Selector, the frame is highlighted and shown in Wave Form View and Symbols View as shown below. Event details are shown in Event Details View in the lower left corner.



### **MST Stream**

When using Link Timeline Viewer in MST mode, the streams are shown in the event selector as in the image below. Click on each stream to inspect its events. All aspects of the events found under different streams include the same aspects as in the SST mode described in the chapter above.



### Search

You can search events by typing its name in the Search bar and pressing enter. The found events are highlighted and shown in *Wave Form View* and *Symbol View*.

🔎 frame		X 🗗 🗌	Aa 🗌 RExp 📕 📑	1 / 9 🕨	ζ
Туре	Id	Position	Duration	End	
> Lane Events					
<ul> <li>SST Stream</li> </ul>					
> FRAME(bad)	1	0:000.009.259.063	0:002.207.395.066	0:002.216.654.129	
✓ FRAME(bad)	2	0:002.216.654.130	0:014.399.524.866	0:016.616.178.996 134 593 909 bits	
✓ ACTIVE(972 lines)		0:002.216.654.130 17 955 280 bits	0:014.399.524.866	0:016.616.178.996 134 593 909 bits	
✓ LINE(5760)	0	0:002.216.654.130 17 955 280 bits	0:000.014.812.030	0:002.231.466.160 18 075 259 bits	
SR		0:002.216.654.130 17 955 280 bits	0:000.000.004.937 40 bits	0:002.216.659.067	
VBID		0:002.216.659.068 17 955 320 bits	0:000.000.001.233	0:002.216.660.301	
MVID		0:002.216.660.302 17 955 330 bits	0:000.000.001.234	0:002.216.661.536 17 955 339 bits	
MAUD		0:002.216.661.537 17 955 340 bits	0:000.000.001.233	0:002.216.662.770 17 955 349 bits	
SDP_02	0	0:002.216.675.117 17 955 450 bits	0:000.000.014.813 120 bits	0:002.216.689.930	
BE		0:002.218.582.484 17 970 900 bits	0:000.000.001.233	0:002.218.583.717	
> LINE(5760)	1	0:002.231.466.161 18 075 260 bits	0:000.014.823.140 120 070 bits	0:002.246.289.301 18 195 329 bits	
> LINE(5760)	2	0:002.246.289.302 18 195 330 bits	0:000.014.804.623	0:002.261.093.925 18 315 249 bits	
( )		0.003 361 003 036	0.000 014 816 068	∩·∩∩ว ว75 Q1∩ QQA >	>

Main Link Events	Symbols Log Events	
🔎 frame	📉 📈 📈 Aa 🗌 RExp 🔰 0 / 0	N 🗘
Aa:	Makes search function case sensitive.	
RExp:	Use regular expressions.	

Use regular expressions.

### -

Click the enter icon to apply filters.

### Ô

The gear icon opens Configure search window. In addition to settings described above, you can select which colums are shown in Main Link Events window.

Configure search	×
Case Sensitive	
Use regular expression	
Columns:	
🗹 Туре	
⊡ Id	
Position	
Duration	
🗹 End	
Apply	-

### Symbols Tab

Symbols view lists all the PHY level events found in the capture made. Wheres Main Link Events is structured in a tree format, Symbols view is presented in a list format containing all symbols from the capture.

Filter					🛃 🗌 Aa 🗌 RExp	0
Search				🛃 🗌 Aa 🗌 RExp	M 0 /0 M	0
Type	Id	Position	Lane		Value	^
BE		2 159 324 484 bits	0	00000000		
BS		2 172 208 161 bits 17 595 260 bits	0	00000000		
MVID		2 172 214 333 bits 17 595 310 bits	0	0x00		
MAUD		2 172 215 568 bits 17 595 320 bits	0	0x00		
BE		2 174 136 515 bits	0	00000000		
BS		2 187 025 130 bits	0	00000000		
MVID		2 187 031 302 bits	0	0x00		
MAUD		2 187 032 537 bits	0	0x00		
BE		2 188 953 484 bits	0	00000000		
BS		2 201 837 161 bits	0	00000000		
MVID		2 201 843 333 bits	0	0x00		
MAUD		2 201 844 568 bits	0	0x00		
RF		2 203 765 515 bits	0	00000000		~

Туре:	Type of item.
ld:	Event's occurrence number
Position:	Start of the event from start of captured data
Lane:	The main link lane for Symbol

Value:

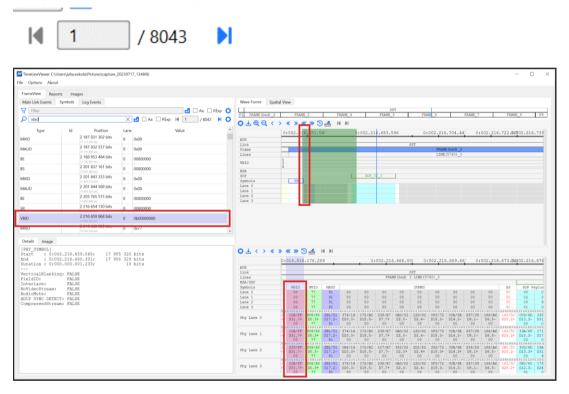
#### Filter

You can filter symbols by typing the event name in the Filter bar. The screenshot below shows an example of VBID event search.

Main Link Events	Symbols	Log Events				
Vb Vb					🗙 🛃 🗌 Aa 🗌 RExp	0
Search				🔁 🗌 Aa 🗌 RExp	0 / 0 ▶	0
Туре	Id	Position	Lane		Value	^
VBID		11 357 095 694 bits 91 994 430 bits	0	060000000		
VBID		11 371 907 725 bits	0	060000000		
VBID		11 386 733 335 bits 92 234 500 bits	0	0Ь0000000		
VBID		11 401 550 305 bits	0	0Ь0000000		
VBID		11 416 352 459 bits	0	060000000		
VBID		11 431 169 428 bits	0	0Ь0000000		
VBID		11 445 981 459 bits	0	0Ь0000000		
VBID		11 460 794 725 bits	0	0Ь0000000		
		the same state section.				

### Search

Whereas filtering simply lists all the symbols matching the search word, *Search* will find all searched symbols and when selected, shows them on *Wave Form View* and *Symbol View*. You can browse through the found symbols by using the arrow keys:



### **Event Details Tab**

The event details are shown in the window in the lower left corner. The event details consists of two tabs: *Image* tab and *Details* tab.

#### **Details Tab**

The information shown in the Details tab depends on the event selected.

#### **Frame**

Details Image
[FRAME]         Start       : 0:203.253.553.972; 1 646 360 990 bits         End       : 0:219.921.436.604; 1 781 371 429 bits         Duration:       0:016.667.882.632; 135 010 440 bits             HTotal       : 2200 pixels         VTotal       : 1125 lines         HActive       : 1920 pixels         VActive       : 1080 lines         HStart       : 192 pixels         VStart       : 41 lines         HSync       : 5 lines         Total pixel count 6220800

For frames the details include the following parameters:

- Start, End and duration
- HTotal and VTotal
- HActive and VActive
- HStart and VStart
- HSync and VSync
- Total pixel count

The above mentioned parameters can be set for the transferred pattern in the pattern generator tab. For detailed information, please refer to UCD-4XX/UCD-5XX user manual.

#### Line

For example, in the image below we can see that the line is part of blanking as the value for VerticalBlanking is set as TRUE. Also, AudioMute is set as FALSE so audio is being transferred.

```
Details
       Image
[LINE]
Start
        : 0:153.249.911.010; 1 241 329 710 bits
        : 0:153.264.671.438; 1 241 449 269 bits
End
Duration : 0:000.014.760.428;
                                 119 560 bits
       1
VBID
                  0x1
VerticalBlanking: TRUE
FieldID:
                FALSE
Interlace:
                FALSE
NoVideoStream: FALSE
AudioMute:
                FALSE
HDCP SYNC DETECT: FALSE
CompressedStream: FALSE
         119
MVID
                   0x77
     44
1
MAUD
                  0x2c
META
                  0x1
Pixel Count = 0
```

#### **MSA**

Details	Image								
	: 0:153.	249.943.108;	1 241 329 880 bits 1 241 329 969 bits 90 bits						
FIELD	DEC	HEX	BITS						
NVid HActive VActive HTotal VTotal	1080 2200 1125 192 41 th 5 th 44 32	0x8000 0x780 0x438 0x898 0x465 0xC0 0x29 0x5 0x2C	00100000 0000000						
MISC1.In	nterlaced '		clock and main video stream clock are asynchronous. al Even: Number of lines per interlaced frame (consisting of two fields) is an						
odd numb MISC1.St		o Attribute:	No 3D stereo video in-band signaling						
MISC.Colorimetry Format Value: 1 0x1 00000001 MISC.Colorimetry Format: RGB unspecified color space (Legacy RGB mode), 8 bpc, 8bpc									
00 00 00 98 C0 80	00 00 00 17 17 17 17 77 77 77 77 08 00 07 00 98 C0 80 80 04 00 04 00 65 29 38 20 00 00 00 2C 05 00 00								

### <u>SDP</u>

SDP events contain several different kinds of events all with individual details shown. The image below shows an audio stamp event.

```
Details Image
[SDP]

        Start
        : 0:034.894.928.816;
        282 650 160 bits

        End
        : 0:034.894.943.629;
        282 650 279 bits

        Duration
        : 0:000.000.014.813;
        120 bits

Secondary-data Packet
HBO (ID) 0x00
HB1 (Type) 0x01 Audio_TimeStamp
HB2 0x17
нв3
                        0x48
PB0
                       0x00
0x67
PB1
PB2
                        0x35
PB3
                       0xD1
Header checksum OK
Data checksum OK
                      0x0000012C 300
0x00008000 32768
Maud
Naud
                       0xB4
0xB4
PB4
PB5
PB6
                        0xB4
PB7
PB8
                       0xB4
0x7F
                       0x7F
0x7F
0x7F
0x7F
PB9
PB10
PB11
```

### PHY Symbol

Events such as *BS, VBID* and *MVID* will be shown under [PHY\_SYMBOL] title. For example, in the image below we see the event details for *VBID* event.

Details	Imag	ge										
[PHY_SY	MBOL	]										
Start	:	0:1	70.2	271.2	98.270	; 1	1	379	203	550	bits	
End	:	0:1	70.2	271.2	99.503	; 1	1	379	203	559	bits	
Duratio	n :	0:00	00.0	000.0	01.233	;				10	bits	
Vertica	lBla	nkiı	ng:	TRUE								
FieldID	:			FALS	E							
Interla	ce:			FALS	E							
NoVideo	Stre	am:		FALS	Е							
AudioMu	te:			FALS	E							
HDCP SY	NC D	ETE(	CT:	FALS	Е							
Compres	sedS	trea	am:	FALS	Е							

### PHY Area

PHY Area events shows *TPS* events. In the image below you can see a *TPS1* event and its start, end and duration.

Details	Image						
[PHY AR	EA]						
Start	: 0:	000.000.000.000	;		0	bits	
End	: 0:	000.854.703.667	; 6	923	129	bits	
Duratio	n : 0:	000.854.703.667	; 6	923	130	bits	
TPS1							

### **Image Tab**

Image tab shows the frame captured with active area. Please note that Images are shown only shown when a frame is selected.

SST Stream		0.000.009.259.063	0:002.207.395.066	0:002.216.654.129
> FRAME(bad)	1	75 000 bits	17 880 280 bits	17 955 279 bits
> FRAME(bad)	2	0:002.216.654.130 17 955 280 bits	0:014.399.524.866 116 638 630 bits	0:016.616.178.996 134 593 909 bits
> FRAME	3	0:016.616.178.997	0:016.666.123.615	0:033.282.302.612
> FRAME	4	0:033.282.302.613	0:016.666.111.268	0:049.948.413.881
> FRAME	5	0.049.948.413.882	0:016.666.119.911	0:066.614.533.793
> FRAME	6	0.066.614.533.794	0:016.666.122.379	0:083.280.656.173
> FRAME	7	0.083.280.656.174	0:016.666.114.973	0:099.946.771.147
> FRAME	8	0:099.946.771.148	0:016.666.117.441	0:116.612.888.589
> FRAME(bad)	9	809 586 050 Here 0:116.612.888.590 944 584 470 Here	134 998 420 bin 0:004.740.585.679 38 399 580 bin	044 584 469 hits 0:121.353.474.269 982 984 629 hits
etails Image				
etails Image				

# Wave Forms View Tab

Wave Forms View consists of two tabs: Wave Forms and Spatial View. Image for SST mode.

#### **Wave Forms**

			SST						
F1 FRAME (bad) 2	FRAME_3	FRAME_4	FRAME_5		FRAME_6	FRAME	<u>5</u> 7	FRAME_8	F9
ዕ∓ଶ୍ଟ <	> « » « » 🖱	🚣 I4 DI							
	-0:030.339.98905	06.067.997.96	0:042.475.	985.71	0:078.883	.973.47(		0:142.998.66	8.898
AUX									
Link				SST					
Frame		1 F2 FRAME	3 FRAME 4	FRAME_5	FRAME_6	FRAME_7	FRAME_8 F	Э	
Lines		ACTIVE ACTIV	E ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE /		
VBID	034	r	r 1	r	- r	r	r		
MSA									
SDP									
Symbols									
Lane 0									
Lane 1									
Lane 2									
Lane 3									

Events of the AUX channel.
Link state (TPS1, TPS2, TPS3, TPS4, SST, MST etc.)
Frame and line number
Location of VBID events
Location of MSA and SDP events
Control and special symbols
Decoded data and control symbols

The scroll bar on the top of the panels shows all captured frames of the bulk. As no triggers were set on the example capture shown in the image below, the first frame is not captured fully. Please, note that this view cannot be zoomed in.

Wave Forms Spatial	View							
			SST					
F1 FRAME (bad) 2	FRAME_3	FRAME_4	FRAME_5	FRAME	_6	FRAME_7	FRAME_8	F9
$O \pm Q Q \langle \rangle$	« » « » 🖱	<u>na</u> 14 N						

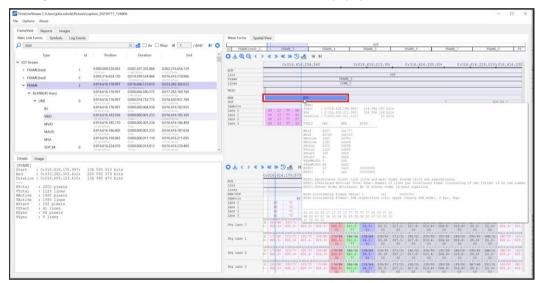
You can select a frame by double-clicking on it. After a frame is selected, it turns into light purple (shown in SST mode) and *Wave Form View* will be focused to view this frame.

Wave Forms Spa	ial View					
			SST			
F1 FRAME (bad) 2	FRAME_3	FRAME_4	FRAME_5	FRAME_6	FRAME_7	FRAME_8 F9
<b>○</b> ± €	> « » « » 🕑 🛃					
	0:016.616.169.687		016.616.198.	82( 0:016.616.	209.25: 0:016.	516.219.068016.616.230
AUX						
Link				SST		
Frame				FRAM	E_3	
Lines				LIN		
VBID	0 3 4					
MSA				MSA		
SDP						
Symbols	BS					
Lane 0	00 BC 7C 7C BC 01 77 91	00 00 00 00 00 00 00	00 5C 5C 00 17 7	7 08 98 04 65 00 2C	FD 00 00 00 00 00 00	00 00 00 5C 80 80 01 00 C
Lane 1	00 BC 7C 7C BC 01 77 91	00 00 00 00 00 00 00	00 5C 5C 00 17 7	7 00 C0 00 29 00 05	FD 00 00 00 00 00 00	00 00 00 5C 04 04 00 00 C
Lane 2	00 BC 7C 7C BC 01 77 91	00 00 00 00 00 00 00	00 5C 5C 00 17 7	7 07 80 04 38 00 00	FD 00 00 00 00 00 00	00 00 00 5C 4B D7 00 00 C
Lane 3	00 BC 7C 7C BC 01 77 91	00 00 00 00 00 00 00	00 5C 5C 00 17 7	7 00 80 00 20 00 00	FD 00 00 00 00 00 00	00 00 00 5C 18 D1 00 00 C

When you hover the cursor over the timeline, the timestamp of that position on the timeline is shown as illustrated in the image (shown in SST mode) below.

														SS	T																			
F1 FRAME (bad) 2		FF	JAME_3				FRA	ME_					FRA	ME_S	5			F	RAM	Е <u>6</u>				F	RAME	_7				FR	AME	8		F
〕 ± € Q <	> <	x »	<b>«</b>	» :	<b>b</b> m	<b>e</b> n	M	M																										
	d:	016.	616.	177.	950:	16.0	516.	188	.38	31			0:0	)16.	. 61	5.2	01.7	707	0:0	016.	.61	6.2	09.	253		0:0	016	.61	6.2	19.	06:60	16.	616	.23
AUX			- •			-										3					•			-				•			•			
Link												T					SST												_				_	
Frame																					FF	RAME	_3											
Lines																					L	INE	0											
VBID	034			-				_	_	_	_	t		_	_		_	_	_	_	_			_	_		_	_	_		_	_	_	
MSA												t-						MSA																
SDP	11											i-																						
Symbols												T																						
Lane 0	00	BC 7C	7C B0	01	77 9	1 00	00	00 0	0 0	0 0	00 0	d0	5C	5C	00 1	7 7	08	98	04	65 (	00 2	2C F	D 00	00	00	00 00	0 00	00 0	00	00	5C 8	80 8	0 01	00
Lane 1	00	BC 7C	7C B0	01	77 9	1 00	00	00 0	0 0	0 0	00 0	do	5C	5C	00 1	7 7	00	C0	00	29 (	00 0	)5 F	D 00	00	00	0 00	0 00	00 0	00	00	5C (	04 0	4 00	00
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When you mouse hover over an event in *Wave Form View*, a popup shows details of the event.



When doble-clicking on timeline or within the perimeters of *Wave Forms View*, *Symbol View* is focused on the location, and the event is selected in *Event Selector View* as shown in the image below. The green vertical line in *Wave Form View* shows the position of the selected event.

ys         ul         Number         Duration		About															
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The image below further shows you how the different areas of the Timeline Viewer align when you double click on a frame in *Wave Form View*.

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→ FRAME(bad) tals image AME() trt : 0:069,948.411 : 0:006.614.533 tation : 0:016.666.112 title : 1220 pixels title : 1220 pixels title : 1220 pixels art : : 132 pixels art : : 141 lines art : : 41 lines	3.793; 53	0.099.946.771.148 add 5dd 5dd 5dd 5dd 5dd 5dd 5dd 5dd 5dd	0:004.740.585.679	0:121.353.474.269 662 954 629 bes	AUX Link Lines MSA/SDP Symbols Lane 0 Lane 1 Lane 2 Lane 3	0:049,948,411 80 77 80 77 80 77 80 77 11 1180 11 1100 10 100 10 100 100	.024 B8 2 7C 2 7C 2 7C 3	VBID           BC         01           BC         03.0+           BC         0.0+           BC         0.0+           BC         0.0+           BC         0.0+	85T NVID MAUD 77 91 77 91 77 91 09c/1c 0A8/04 09c/1c 0A8/04 04.0- 77 91	FRAME 00 00 00 00 00 00 255/38 200 027.1- D2 00 256/38 122 D27.1+ D2 00 264/38 122 264/38 122	5 LINE_0 0 00 10 00 10 00 10 00 10 00 110111000 1102 282/48 .4+ D14.2- 10 00 1022 282/48 .4- D14.2- 1000111000 1020110000 10201000 10200000 102000 102000 1020000 102000 102000 1020000 102000 102000 1020000 102000 102000 102000 10200000 1020000 10200000 1020000 10200000 1020000000 1020000000 102000000000 1020000000000	Dimeny 00 00 182/CB D14.6- 00 182/CB D14.6- 00 182/CB	00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 05 05,3-1 00 00 05,3+1 00 00 00 00 00 00 00 00 00 00 00 00 00

### Measuring

The ruler tool allows users to measure the distance between two points on the timeline. When you right click on the timeline, a point will appear. Right click again on the timeline and the distance between the two points will be shown as illustarted in the image below.

ameView Reports Im	ages														
ain Link Events Symbols	Log Events				Wave Forms Spat	ial View									
vbid		X 🛃 🗌	Aa 🗌 RExp 🛛 🗍	1 / 8042 🕨 🔇	F1 FRAME (bad) 2	TRAME		FRAME 4	83	2					_
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> LINE(5760)	1119	0:033.193.410.674	0:000.014.816.969	0:033.208.227.643		0:033.23	.1240.3983	.252.533.54	. 0:0	33.274.76	3.229	0:03	33.298.7610	:008.31	4.
> LINE(5760)	1120	0.033.208.227.644	0:000.014.823.140	0:033.223.050.784	AUX	-		-				-			-
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> LINE(5760)	1121	269 112 490 bits		209 232 359 Mits	Frame		FRAME_3							FRAME	4
> LINE(5760)	1122	0:033.237.856.644	0:000.014.816.968	0:033.252.673.612	Lines	LINE(5	60)_1122	LINE (576	0)_1123	INE (5750)_1	124	LINE_0	LIN	5_1	
> LINE(5760)	1123	0.033.252.673.613	0.000.014.812.030	0.033,267,485,643	VBID				0:000.024.50	9.862					
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> LINE(5760)	1124	0.033.267.485.644	0:000.014.816.968	0:033.282.302.612 ~	SDP										
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ticalBlanking: FAL ddD: FAL erlace: FAL ddeoStream: FAL loMute: FAL pressedStream: FAL 0 0 0 0	5E 5E 5E 5E 5E 5E 60				AUX Link Lines MSA/SDP Symbols Lane 0 Lane 1 Lane 1 Lane 2	0:033.21 80 80 80 80 80 80 80 80 80 80 80 80 80	7.858.097 BS 7C 7C 7C 7C 7C 7C 33 K28.3+ K2	7C BC 7C BC 7C BC 7C BC 7C BC 7C BC 8.3- K28.5+	VBID MVI 00 77 00 77 00 77 00 77	SST 91 91 91 91 91 91 91 91 91 91 91 91	PRAME 3 LINE 96 21 19 05 96 21 19 05 10 05 206/96 251/2 226/96 251/2 D22.4- D1.14	(5760)_1122 FEC_PAIR DF F A4 0F F A4 01111511011011101 1155/0F 100 031.6- 026	15 PA 16 24 17 PA 16 24 16 PA 16	CD_ADJ 40 40 1001101010 2AC/4C D12.2-	F 0110

### Zooming In

When you zoom in a little, the area shown in *Wave Form View* is highlighted with light green color as illustrated in the image below.

			SST			
1 FRAME (bad) 2	FRAME_3	FRAME 4	FRAME 5	FRAME 6	FRAME 7 FRAME	8 F9
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	0:001.693.4590.400	9.811.528.86	0:047.535	.823.063	0:074.165.7370.202	2.283.806
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Frame	FRAME (bad) 2	FRAME_3	FRAME_4	FRAME 5	FRAME_6	FRAM
Lines	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACTIVE	ACT
VBID	0 m 3			r.	n n	
MSA					1	
SDP						
Symbols						
Lane 0						
Lane 1						
Lane 2						
Lane 3						

When you zoom in more, the frames shown in *Wave Form View*, are highlighted in green in the scroll bar as shown in the image below.

				SST						
F1 FRAME (bad) 2	FRAME_3	FRAME_4		FRAME_5		FRAME_6	FRAME	7	FRAME_8	F9
⊅±€€<>	« » « » 🙂 🚜	IA DI								
	0:017.820.410.12: 0:	024.481.575.58	0:0	31.142.741.0	51	0:050.	902.708.406	0:044.46	5.071.98: 0:05	1.126.23
AUX	•									
Link		S	ST							
Frame		FRAME_3					FRAME_4			
Lines		ACTIVE			В		ACTIVE			В
VBID	3			0:000.024	509.862					_
MSA	•									1
SDP										
Symbols										
Lane 0										
Lane 1										
Lane 2										
Lane 3										

When zoomed in more, *Wave Form View* shows the events in small vertical lines as shown in the image below. When you want to zoom into a certain event, make sure to keep the cursor on top of the event you want to inspect more in detail.

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× 1	INE	0	0.016.616.178.997	0.000.014.752.772	0.016.630.931.769		AUX	1:010.347.	430.72	° •		+ 0	010.050	0.072.03	0.0	010.039.	0/0.10	0:0	10.745	.005.45	10.700	.200
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		1	134 504 580 bits 0:016.630.931.770	0:000.014.816.968	134 304 679 bits 0:016.645.748.738																	
		2	0.016.645.748.739	0.000.014.821.907	0:016.660.570.646																	
		3	0.016.660.570.647	0.000.014.809.561	0:016.675.380.208																	
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MISC1 0			00000				Phy Lane 1	D12.4- 00	D10.6- 17	D30.3*	D21.1- 00	D16.4- C0	D17.5- 00	D12.6- 29	D17.3- 00	D13.2- 05		00	00	D16.7*	00	0
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When zoomed in more, the area shown in *Symbols View* is highlighted in *Wave Form View* with green color as shown in the image below.

meView Reports Images	- Country				Wave Forms	Contribution											
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vbid		X 🛃 L	Aa 🗌 RExp 📢 📗	973 / 8042 🕨	F1 FRAME (b	ad)_2	FRAME_3		FRAME_4		FRAME_5	F2.	AME_6	F	RAME_7	FRA	ME_8
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<ul> <li>BLANK(45 lines)</li> </ul>		0:016.616.178.997	0:000.666.590.772	0:017.282.769.769			16.616.1			0.0	16.616.19	1 06/ 0	0 6.616.	204.325	0+014	6.616.217.0	016 616
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The image below shows a view of one frame in *Wave Form View* when zoomed in on a frame level. You can see the blank area and active in this view.

			SST			
F1 FRAME	(bad)_2 FRAME_3	FRAME_4	FRAME_5	FRAME_6	FRAME_7	FRAME_8 F9
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	0:047.985.795.522	0:053.271.555.813	0:056.377.755.68	0:060.573.735.77;	0:064.769	0:068.965.6
AUX			· · ·			
Link			SSI			
Frame			FRAME_S			
Lines	BLANK		ACT	LVE		BLANK
/BID	3					
ASA						
IDP						
Symbols						
Lane O						
Lane 1						
Lane 2 Lane 3						

If you zoom in closer, into a line level view, you begin to see the lines the frame consists of.

F1 FRAME	(bad) 2		RAME 3			FRAM	E 4		-		FRAME	SST 5			FRAME 6		_	FR	JAME 7		_	FRA	1E 8		FS
	> <b>« » «</b>		_						-			-													-
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The lines shown in *Wave Form View* are symbols that match the ones shown in *Symbols View*. When you zoom in close enough, you can see the symbols in both views as shown in the image below.

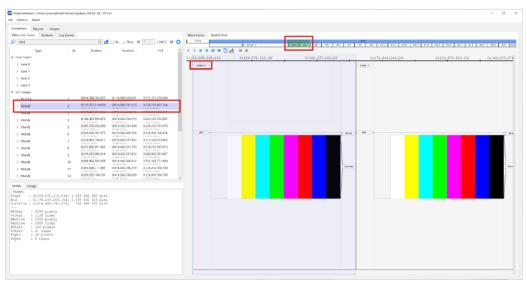
FRAME (bad)									SST										
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<b>⊥ &lt; &gt; ≪</b> x nk	0:0	49.948.	405.718	0:049.	948.410	.18; .	0:	:049.948	.414.6	4' 0: SST	:049.94	8.418.7	80	•			.57 <sup>°</sup> 0:	049.948	.42
x nk	0:0	49.948.		0:049.	948.410	.18;	0:	:049.948	.414.6		:049.94	8.418.7	80	•	0:049.9		.57 <sup>°</sup> 0:	049.948	. 42
X nk A/SDP	0:0	49.948. 8 4 LINE	405.718	0:049.	•	.18:	0:	:049.948		SST	:049.94			FR				049.948	. 42
K hk A/SDP mbols	0:0	49.948. s 4 line FE	405.71{ (5760)_11	0:049.	Pixels	-			B	SST		VBID	MVID	FR	AME 5 LI	INE_0	DUMMY		. 42
K hes A/SDP mbols he 0	0:0	49.948. E 4 LINE FE F7	405.71{ (5760)_11	0:049.	Pixels	00	00	BC	B 7c	SST IS 7C	BC	VBID 01	MVID 77	FR MAUD 91	AME 5 LI	INE_0 00	DUMMY 00	00	
( hes h/SDP hebols he 1	0:0	49.948. E 4 LINE FE F7 F7	405.71 (5760)_11 00 00	0:049.	Pixels 00 00	00	00	BC BC	1 7 7 7 7	85T 1C 7C	BC BC	VBID 01 01	MVID 77 77	FR MAUD 91 91	AME 5 LI 00 00	INE_0	DUMMY 00 00	00	. 42
A hk hes A/SDP ebols he 0 he 1 he 2	0:0	49.948. E 4 LINE FE F7 F7 F7	405.71 (5760)_11 00 00 00	0:049.	Pixels 00 00 00	00	00	BC BC BC	B 7C 7C 7C	85T 15 7C 7C 7C	BC BC BC	VBID 01 01 01	MVID 77 77 77	FF MAUD 91 91 91 91	AME 5 LI	INE_0	DUMMY 00 00 00	00	. 42
k hes h/SDP hbols he 0 he 1 he 2	0:0 FRAM	49.948. E 4 LINE FE F7 F7 F7 F7 F7	(5760)_11 (5760)_11 00 00 00 00	0:049.	Pixels 00 00 00 00	00	00 00 00	BC BC BC BC	8 7C 7C 7C 7C	85 7C 7C 7C 7C	BC BC BC BC	VBID 01 01 01 01	MVID 77 77 77 77 77	FF MAUD 91 91 91 91	AME 5 LI	INE_0 00 00 00 00	DUMMY 00 00 00	00 00 00	
K hes A/SDP abols he 0 he 1 he 2 he 3	0:0 FRAM 00 00 00 00 11100 1/31 7.1-	49.948. E 4 LINE FE F7 F7 F7	405.71( (5760)_11 00 00 00 00 00 0A5/05 D5.0+	0:049. 24 00 00 00 169/A9 D9.5-	Pixels 00 00 00 101100001 21D/FD D29.7-	00 00 00 1101001001 24B/2B D11.1-	00 00 00 1011010011 32D/62 D2.3-	BC BC BC BC	8 7C 7C 7C 7C	85 7C 7C 7C 7C 7C 7C	BC BC BC BC	VBID 01 01 01 361/1E D30.0+	MVID 77 77 77 77 09C/1C D28.0+	FF MAUD 91 91 91 91 0AB/04 0AB/04 0A.0-	AME 5 LI	00 00 00 00 2D2/82 D2.4+	DUMMY 00 00 00 285/45 D14.2-	00 00 00 18E/CE D14.6-	010 01 D1
K hes A/SDP abols he 0 he 1 he 2 he 3	0:0 FRAM	49.948. E 4 LINE FE F7 F7 F7 F7 F7 F7 K23.7+	405.71 (5760)_11 (5760)_11 (5760)_11 (5760)_11 00 00 00 00 00 00 00 00 00 00 00 00 0	0:049. 24 00 00 00 00 100/01010 169/A9 D9.5- 00	Pixels 00 00 00 101100001 21D/FD D29.7- 00	00 00 00 110:001001 24B/2B D11.1- 00	00 00 00 1011010011 32D/62 D2.3- 00	BC BC BC 283/BC K28.5+	B 7C 7C 7C 7C 33C/7C K28.3-	85T 7C 7C 7C 7C 0C3/7C K28.3+	BC BC BC 17C/BC K28.5-	VBID 01 01 01 361/1E D30.0+ 01	MVID 77 77 77 77 09C/1C D28.0+ 77	FR MAUD 91 91 91 1101010100 0AB/04 D4.0- 91	AME 5 LI	00 00 00 00 00 00 00 00 00 00 00 2D2/82 D2.4+ 00	DUMMY 00 00 00 00 00 00 00 00 00 28E/4E D14.2- 00	00 00 00 18E/CE D14.6- 00	010 0 DI
K hk Hes A/SDP Hbols He 0 He 1 He 2 He 3 Y Lane 0	0:0 FRAM	49.948. E 4 LINE FE F7 F7 F7 F7 F7 F7 K23.7+	405.71( (5760)_11 (5760)_00 00 00 00 00 00 00 00 00 00	0:049. 24 00 00 00 00 100/01010 169/A9 D9.5- 00	Pixels 00 00 00 21D/FD D29.7- 00 00 00001110 1E2/FD	00 00 00 110:001001 24B/2B D11.1- 00	00 00 00 1011010011 32D/62 D2.3- 00	BC BC BC 203/BC K28.5+	E 7C 7C 7C 7C 3C/7C 828.3-	85T 7C 7C 7C 7C 0C3/7C K28.3+	BC BC BC 17C/BC K28.5-	VBID 01 01 01 1000011011 361/1E D30.0+ 01	MVID 77 77 77 77 09C/1C D28.0+ 77	FF MAUD 91 91 91 91 110010100 0AB/04 D4.0- 91 001010101	AME 5 LI	00 00 00 00 00 00 00 00 00 00 00 2D2/82 D2.4+ 00	DUMMY 00 00 00 00 00 00 00 00 00 28E/4E D14.2- 00	00 00 00 18E/CE D14.6- 00	0100/ 02 DJ
K ik ies v/SDP whols ie 0 ie 1 ie 2 ie 3 y Lane 0	0:0 FRAM	49.948. E 4 LINE FE F7 F7 F7 F7 F7 F7 F7 F7 F7 F7	405.71( (5760)_11 (5760)_11 (5760)_11 00 00 00 00 00 00 00 00 00	0:049. 24 00 00 00 169/A9 D9.5- 00 169/A9 169/A9 D9.5-	Pixels 00 00 00 10110001 21D/FD D29.7+ 162/FD D29.7+	00 00 00 1101001001 248/28 D11.1- 00 1101001001 248/28 D11.1-	00 00 00 00 00 00 00 00 00 00 00 00 00	BC BC BC 283/BC K28.5+	B 7C 7C 7C 7C 33C/7C K28.3-	SST 7C 7C 7C 7C 0C3/7C K28.3+ 33C/7C	BC BC BC 17C/BC K28.5-	VBID 01 01 01 361/1E D30.0+ 01 01005/1E D30.0-	MVID 77 77 77 77 77 77 77 77 77 77 77 77 77	FF MAUD 91 91 91 91 91 91 91 91 91 91 91 91 91	00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00 00 00 00 00 00	DUNMY 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 185/CE D14.6- 00 185/CE D14.6-	1000 01 1000 3°
K hk Hes A/SDP Hbols He 0 He 1 He 2 He 3 Y Lane 0	0:0 FRAM 00 00 00 00 00 00 00 11100 1/31 7.1- 00 11100 1/31 7.1-	49.948. E 4 LINE FE F7 F7 F7 F7 K23.7+	405.71( (5760)_11 00 00 00 00 00 00 00 00 00	0:049. 24 00 00 00 00 169/A9 D9.5- 00 169/A9 D9.5- 00	Pixels 00 00 00 10110001 21D/FD D29.7- 00 152/FD D29.7+ 00	00 00 00 1000000 248/28 D11.1- 00 248/28 D11.1- 00	00 00 00 1011010011 32D/62 D2.3- 00 0D2/62 D2.3+ 00	BC BC BC 283/BC K28.5+ 00111100 17C/BC R28.5-	E 7C 7C 7C 33C/7C X28.3-	85 7C 7C 7C 7C 0C3/7C 0C3/7C K28.3+	BC BC BC 17C/BC K28.5- 110000101 283/BC R28.5+	VBID 01 01 01 361/1E D30.0+ 01 01 011100100 095/1E D30.0- 01	MVID 77 77 77 0901100100 090710 D28.0+ 77 001110010 350710 D28.0- 77	FF MAUD 91 91 91 91 0ABJ/04 D4.0- 91 00101011 354/04 D4.0+ 91	AME 5 LI 00 00 00 00 00 00 00 00 00 00 00 00 00	NE_0 00 00 00 00 2D2/82 D2.4+ 00 12D/82 D2.4- 00	DUMMY 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 1182/CE D14.6- 00 1111001110 1182/CE D14.6- 04.6-	1000 01 0100 3' D:
K hk hes hols he 0 he 1 he 2 he 3 y Lane 0 y Lane 1	0:0 FRAM	49.948. E 4 LINE FE F7 F7 F7 F7 K23.7+ 111010000	405.71( (5760)_11 (5760)_11 00 00 00 00 00 00 00 00 00 00 00 00 0	0:049. 24 00 00 00 00 00 169/A9 D9.5- 00 169/A9 D9.5- 00 169/A9	Pixels 00 00 00 10110001 21D/FD D29.7- 00 00001110 152/FD D29.7+ 00	00 00 00 248/28 D11.1- 00 110001001 248/28 D11.1- 00	00 00 00 00 00 00 00 00 00 00 00 00 00	BC BC BC 283/BC K28.5+ 00111100 17C/BC K28.5-	E 7C 7C 7C 33C/7C 828.3- 100001101 0C3/7C K28.3+	857 7C 7C 7C 0C3/7C K28.3+	BC BC BC 17C/BC X28.5-	VBID 01 01 01 361/15 D30.0+ 01 095/15 D30.0- 01	MVID 77 77 77 0011100100 09C/1C D28.0+ 77 35C/1C D28.0- 77	FF MAUD 91 91 91 91 91 91 91 91 91 91 91 91 91	AME 5 LI 00 00 00 255/38 D27.1- 00 00 001001001 264/38 D27.1+ 00	00 00 00 00 00 00 00 00 00 00 00 00 00	DUNMY 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 188/CE D14.6- 00 188/CE D14.6- 00	100 01 D: 100 3 <sup>°</sup> D:
K kk viss visDP ubols ie 0 ie 1 ie 2 ie 3 y Lane 0 y Lane 1	0:0 FRAM 00 00 00 00 1/31 7.1- 00 11100 1/31 7.1- 1/31 7.1-	49.948. E 4 LINE FE F7 F7 F7 F7 K23.7+	405.71( (5760)_11 (5760)_11 00 00 00 00 00 00 00 00 00 00 00 00 0	0:049. 24 00 00 00 169/A9 D9.5- 00 169/A9 D9.5- 00 169/A9 D9.5- 00	Pixels 00 00 00 10110001 12D/FD D29.7- 00 00001110 122/FD D29.7+ 00	00 00 00 1101001001 248/28 D11.1- 00 1101001001 248/28 D11.1- 00	00 00 00 1911910911 32D/62 D2.3- 00 010919100 002/62 D2.3+ 00 010919100 002/62 D2.3-	BC BC BC 283/BC K28.5+ 00111100 17C/BC R28.5-	E 7C 7C 7C 33C/7C X28.3-	85 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C	BC BC BC 17C/BC K28.5-	VBID 01 01 01 01 036.1/1E 030.0+ 01 011100100 095/1E 030.0- 01 010055/1E 030.0-	MVID 77 77 77 77 001110100 00C/1C D28.0- 77 73 00110011 35C/1C D28.0- 77	FF MAUD 91 91 91 91 1101010100 0AB/04 D4.0- 91 001101011 354/04 D4.0+ 91 001101011 354/04 D4.0+	AME 5 LI 00 00 00 110110100 2259/3B D27.1+ 00 001001100 264/3B D27.1+ 00 00101100 264/3B D27.1+	00 00 00 00 00 00 00 00 00 00 10100110 12D/82 D2.4- 00 1010001 12D/82 D2.4- 00	DUNMY 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 1185/CE D14.6- 00 1185/CE D14.6- 00	100 01 01 01 01 01 01 01 01 01 01 01 01
K kk viss visDP ubols ie 0 ie 1 ie 2 ie 3 y Lane 0 y Lane 1	0:0 FRAM 00 00 00 11/31 7.1- 00 11/31 7.1- 00 11/31 7.1- 01 11/31 7.1- 01 11/31 7.1- 01 11/31 7.1- 01 11/31 7.1- 01 11/31 7.1- 10/31 11/31 7.1- 10/31 11/31 7.1- 10/31 11/31 17/31 17/31 11/31 17/31 1 1 1 1 1 1 1 1 1 1 1 1 1	49.948. 49.948. 5 4 LINE FE F7 F7 F7 F7 R23.7+ 111010100 057/F7 K23.7-	405.71 (5760)_11 (5760)_11 00 00 00 00 00 00 00 00 00	0:049. 24 00 00 00 00 169/A9 D9.5- 00 169/A9 D9.5- 00	Pixels 00 00 21D/FD 22D/FD D29.7- 00 000001110 152/FD D29.7+ 00	00 00 00 00 248/28 D11.1- 00 110001001 248/28 D11.1- 00	00 00 00 101101011 32D/62 D2.3- 00 010010100 002/62 D2.3+ 00	BC BC BC BC 283/BC K28.5+ 001111010 17C/BC K28.5- 001111010 17C/BC K28.5-	E 7C 7C 7C 33C/7C K28.3- 100001100 0C3/7C K28.3+	SST 7C 7C 7C 7C 7C 828.3+ 33C/7C 828.3- 33C/7C 828.3- 33C/7C 828.3-	BC BC BC BC 8C 8C 828.5- 116006181 283/BC 828.5+ 116006181 283/BC 828.5+	VBID 01 01 01 01 361/1E D30.0+ 01 001100100 095/1E D30.0- 01 095/1E D30.0- 01	MVID 77 77 77 77 09C/1C D28.0+ 77 35C/1C D28.0- 77 73	FR MAUD 91 91 91 91 91 91 91 91 91 91 91 91 91	AME 5 LI 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00 00 00 00 00 00	DUMMY 00 00 00 00 285/4E D14.2- 00 00 1110016 285/4E D14.2- 00 00 1110016 285/4E D14.2- 00	00 00 00 185/CE D14.6- 00 185/CE D14.6- 00 185/CE D14.6- 00	010 0 01 01 01 01 01 01 01 01 01 01 01 01 01
X nk mes mois me 0 ne 1 ne 2 ne 3 y Lane 0 y Lane 1	0:0 FRAM 00 00 00 1/131 7.1- 00 11/31 7.1- 00 11/31 7.1- 00 11/31 7.1- 00 11/31 1.71- 00 1.11- 00 1.11- 00 1.11- 00 1.11- 1.11- 00 1.11- 1	49.948. 49.948. E 4 LINE FE F7 F7 F7 F7 R23.7+ 111010130 057/F7 R23.7- 111010130	405.71( (5760)_11 00 00 00 00 00 00 00 00 00 00 00 00 0	0:049. 24 00 00 00 00 1000 169/A9 D9.5- 00 169/A9 D9.5- 00 169/A9 D9.5- 00	Pixels 00 00 00 10110001 1210/FD D29.7- 00 102001110 122/FD D29.7+ 00 102001110 122/FD D29.7+ 00	00 00 00 24B/2B D11.1- 00 10000000 24B/2B D11.1- 00 10000000 24B/2B D11.1- 00	00 00 00 00 00 00 00 00 00 00 00 00 00	BC BC BC BC 283/BC X28.5+ 00111100 17C/BC X28.5- 00111100 17C/BC X28.5-	E 7C 7C 7C 001110011 33C/7C K28.3- 1100001100 0C3/7C K28.3+ 1100001100 0C3/7C K28.3+	85 7C 7C 7C 7C 7C 828.3+ 0011100110 33C/7C K28.3- 0011110011 33C/7C	BC BC BC BC 17C/BC K28.5- 110000011 283/BC K28.5+ 110000011 283/BC K28.5+	VBID 01 01 01 361/1E D30.0+ 01 011100100 095/1E D30.0- 01 01050100 095/1E	MVID 77 77 77 77 0901100100 09C/1C D28.0- 77 35C/1C D28.0- 77 35C/1C D28.0- 77	FF MAUD 91 91 91 91 91 91 91 04.0- 91 05101011 354/04 D4.0+ 91 05101011 354/04 D4.0+ 91	AME 5 LI 00 00 00 110110100 258/3B D27.1+ 00 264/3B D27.1+ 00 264/3B D27.1+ 00	00 00 00 00 00 00 00 00 00 00 00 00 00	DUNMY 00 00 00 285/45 D14.2- 00 001100000 285/45 D14.2- 00 001100000 285/45 D14.2- 00	00 00 00 01 1185/CE D14.6- 01 188/CE D14.6- 01 188/CE D14.6- 01	010 00 0E DJ 010 00 37 DJ 010 00 37 DJ
x	0:0 FRAM 00 00 00 1/31 7.1- 00 1/31 7.1- 00 1/31 7.1- 00 1/31 7.1- 00 1/31 7.1- 00	49.948. 49.948. 5 4 LINE FE F7 F7 F7 F7 R23.7+ 111010100 057/F7 K23.7-	405.71( (5760)_11 (5760)_1	0:049. 24 00 00 00 00 169/A9 D9.5- 00 169/A9 D9.5- 00	Pixels 00 00 21D/FD 22D/FD D29.7- 00 000000000000000000000000000000000	00 00 00 24B/2B D11.1- 00 10000000 24B/2B D11.1- 00 10000000 24B/2B D11.1- 00	00 00 00 101101011 32D/62 D2.3- 00 010010100 002/62 D2.3+ 00	BC BC BC BC 283/BC K28.5+ 001111010 17C/BC K28.5- 001111010 17C/BC K28.5-	E 7C 7C 7C 001110011 33C/7C K28.3- 1100001100 0C3/7C K28.3+ 1100001100	SST 7C 7C 7C 7C 7C 828.3+ 33C/7C 828.3- 33C/7C 828.3- 33C/7C 828.3-	BC BC BC BC 17C/BC K28.5- 11600010 283/BC K28.5+ 11600010 283/BC K28.5+	VBID 01 01 01 01 361/1E D30.0+ 01 01 011100100 0955/1E D30.0- 01 011100100 0955/1E D30.0- 01 011100100 011100100 01100100000000	MVID 77 77 77 77 0901100100 09C/1C D28.0- 77 35C/1C D28.0- 77 35C/1C D28.0- 77	FF MAUD 91 91 91 91 91 91 91 91 91 91 91 91 91	AME 5 LI 00 00 00 258/38 D27.1- 00 00 00101100 264/38 D27.1+ 00 264/38 D27.1+ 00 258/38	00 00 00 00 00 00 00 00 00 00 00 00 00	DUMMY 00 00 00 285/4E D14.2- 00 001100015 285/4E D14.2- 00 001100015 285/4E D14.2- 00 001100015 285/4E D14.2- 00 00110015 285/4E D14.2- 00 00 00100015 285/4E	00 00 00 01 1185/CE D14.6- 01 188/CE D14.6- 01 188/CE D14.6- 01	010 00 02 03 10 00 37 03 010 00 37 01 010 00 00 00

### **Spatial View**

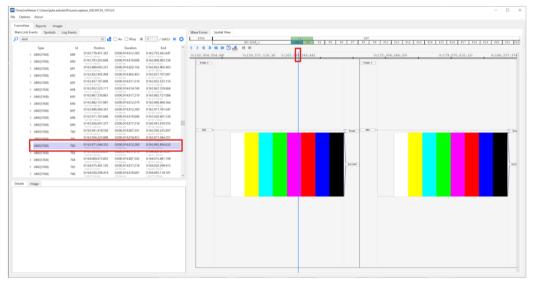
Spatial view shows the geometry of the frame.

_		ola/Pictures/jo	apture_20230724_1019	523									- 🗆 ×
File Options	About												
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	nts Symbols	Log Events				Wave Forms	Spatial View						
🔎 vbid			×	As REep P	( 1 / 34953 N 🔇	7794		55-IDLE 1	22 23 24 25 2	6 27	887 28 29 210 211 212	F13 F14 F15 F16 F17 F18	F19 F20 F21 F22
	Тура	Id	Position	Duration	End	< > <b>« »</b>	« » 🕄 🛃 🛛	ны					
✓ Lane Events						0:	156.525.963.078	0:159.571.118.36	0:166.237.682.28		0:172.904.246.20	0:179.570.810.12	0:186.237.374
> Lane 0						From 2					From 3		
> Lane 1													
> Lane 2													
> Lane 3													
✓ SST Stream													
> BS-IDLE		1	0:034.588.782.007 201178 20144	952 TET BREWIN	0:153.571.210.838								
> FRAME		2	0.153.571.210.839		0.170.237.603.354								
> FRAME		3	0.170.237.603.355	0:016.666.392.516	0.186.903.995.871								
> FRAME		4	0.186.903.995.872	0.016.666.396.219	0.203.570.392.091								
> FRAME		5											
> FRAME		6	0.220.236.787.077 1.787.825.789.855 0.236.903.196.877	0:016.666.409.799 124 P80 510 altr 0:016.666.394.985	0.236.903.196.876	MA				Nask	HUA -		No
> FRAME		7	0.253.569.591.863	0.016.666.393.750	0253569591362								
> FRAME		8	0.270.235.985.614		0.286.902.383.067								
> FRAME		9	0.286.902.383.068	0:016.666.388.812	0.303.568.771.880								
> FRAME		10	2.222.919-03.62 0.303.568.771.881	0.016.666.396.219	0.320,235,168,100								
> FRAME		11	0.320.235.168.101	0.016.666.398.688	0.336.901.556.789					ActiveD			Antar
> FRAME		12		0.016.666.396.219									
> FRAME		13	2.722.3 54 (22.15)	124 892 405 525	1.80.90.129 tot								
Details Im	age												
End : Duration : HTotal VTotal EActive VActive HStart VStart BSync	0:170.237.601	1.3547 1 3	243 932 250 bits 778 930 619 bits 34 998 370 bits										

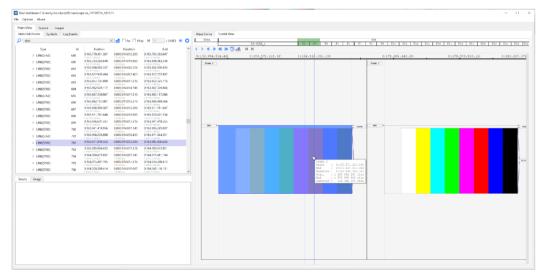
If you select a frame in *Event Selector* the frame will be shown in *Spatial View* as shown in the image below.



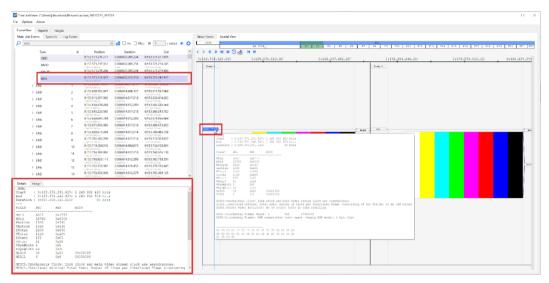
If you double-click on the timeline, the line on that time stamp will be selected in the *Event Selector View* as illustrated in the image below.



When you hover a cursor on top of the frame, frame details will be shown. Frame details include the start, end and duration of the frame.



When you hover your mouse over an event shown next the frame, details of that event will be show in a popup window. If you double-click on the event, it will be selected in the *Event Selector* and its details will be shown in the *Event Details*.



## Symbols View

In addition to *Wave Form View*, *Symbols View* (shown in SST mode) shows symbols from the PHY lanes. Identically to *Wave Form View* you can scroll the *Symbols View* by clicking it, holding and dragging or by using the arrow keys.

	0:04	19.948.	405.701	049.948	409.55	0:049	.94	3.41	.3.232	. 0	:049.94	8.417.2	3(	0:049.9	48.421.	006(049.	948.42
AUX																	
Link										SST							
Lines	FRAME	4 LINE (	5760) 11	24										FRAM	E 5 LINE	0	
MSA/SDP																_	
Symbols		FE			Pixels					В	s		VBID	MVID	MAUD	DUI	YMY
Lane O	00	F7	00	00	00	00	(	0	BC	7C	7C	BC	01	77	91	00	00
Lane 1	00	F7	00	00	00	00	(	0	BC	7C	7C	BC	01	77	91	00	00
Lane 2	00	F7	00	00	00	00	(	0	BC	7C	7C	BC	01	77	91	00	00
Lane 3	00	F7	00	00	00	00	(	0	BC	7C	7C	BC	01	77	91	00	00
					1011100001	1101001001		10011				0011111010		10011100100			
Dhu Iana 0	1/31	3A8/F7	0A5/05	169/A9	21D/FD	24B/2B		/62	283/BC	33C/7C	0C3/7C	17C/BC	361/1E	09C/1C	0AB/04	25B/3B	2D2/82
Phy Lane 0	7.1-	K23.7+	D5.0+	D9.5-	D29.7-	D11.1-	D2	.3-	K28.5+	K28.3-	K28.3+	K28.5-	D30.0+	D28.0+	D4.0-	D27.1-	D2.4+
	00		00	00	00	00	(	0					01	77	91	00	00
			1010011011			1101001001			00011111010					00011101011		10010011001	
Phy Lane 1	1/31	057/F7	365/05	169/A9	1E2/FD	24B/2B		/62	17C/BC	0C3/7C	33C/7C	283/BC	09E/1E	35C/1C	354/04	264/3B	12D/82
rny bane r	7.1-	K23.7-	D5.0-	D9.5-	D29.7+	D11.1-	D2	.3+	K28.5-	K28.3+	K28.3-	K28.5+	D30.0-	D28.0-	D4.0+	D27.1+	D2.4-
	0.0		00	00	00	00	(	0					01	77	91	00	00
			1010011011		0100011110	1101001001	01001	01100	00011111010	1100001100	0011110011	1100000101	011110010			0010011001	10110100 12D/82
Phy Lane 2	1/31	057/F7 K23.7-	365/05 D5.0-	169/A9	1E2/FD D29.7+	24B/2B		/62	17C/BC	0C3/7C K28.3+	33C/7C K28.3-	283/BC	09E/1E D30.0-	35C/1C D28.0-	354/04	264/3B	
	7.1-	K23.7-	D5.0-	D9.5-	D29.7+	D11.1-	D2	.3+	K28.5-	K28.3+	K28.3-	K28.5+		D28.0-	D4.0+	D27.1+	D2.4-
			00	00		1101001001		0	11100000101				01	//	91	00	
	1/31	3A8/F7	0A5/05	169/A9	21D/FD	24B/2B		/ 62	283/BC	33C/7C	0C3/7C	17C/BC	361/1E	09C/1C	0AB/04	25B/3B	2D2/8
Phy Lane 3	7.1-	K23.7+	D5.0+	D9.5-	D29.7-	D11.1-		.3-	K28.5+	K28.3-	K28.3+	K28.5-	D30.0+	D28.0+	D4.0-	D27.1-	D2.4+
	00	R23.71	00	00	00	00		0	R20.51	R20.5-	R20.31	R20.3-	01	77	91	00	00

AUX:	Events of the AUX channel.
Link:	Link state (TPS1, TPS2, TPS3, TPS4, SST, MST etc.)
Lines:	Frame and line number
MSA/SDP:	Location of MSA and SDP events
Symbols:	Control and special symbols
Lanes (0-3):	Decoded data and control symbols
PHY Lanes (0-3):	Binary bit stream, 10b/8b scrambled symbols, symbol code and descrambled values

### **Link Symbols**

	1110010	001010111	1010010100												15 202 20 200 2	010010110.
	1/31	3A8/F7	0A5/05	169/A9	21D/FD	24B/2B	32D/62		/BC 33C/7C	0C3/7C	17C/BC	361/3	1E 09C/1C	0AB/04	25B/3B	2D2/82
Phy Lane 0	7.1-	K23.7+	D5.0+	D9.5-	D29.7-	D11.1-	D2.3-	K28	.5+ K28.3-	K28.3+	K28.5-	D30.4	0+ D28.0+	D4.0-	D27.1-	D2.4+
	00		00	00	00	00	00		1.0h make 7	0.000	(101000	01.1	77	91	00	00
	1110011	110101000	1010011011	1001011010	0100011110	1101001001	01001011000		10b symbol				100001110101	10010101011	0010011001	101101001
	1/31	057/87	365/05	169/A9	1E2/FD	24B/2B	0D2/62	170	8b symbol	: 0xBC			E 35C/1C	354/04	264/3B	12D/82
hy Lane 1	7.1-	K23.7-	D5.0-	D9.5-	D29.7+	D11.1-			Symbol cod				- D28.0-	D4.0+	D27.1+	D2.4-
	00		00	00	00	00	00		Descramble	index :	53874 0	KD272	77	91	00	00
	1110011	110101000	1010011011	1001011010	0100011110	1101001001	01001011000	00111					100001110101	10010101011	0010011001	1011010010
		057/F7	365/05	169/A9		24B/2B		170	Start :	0:049.9	48.413.8	82	E 35C/1C	354/04	264/3B	12D/82
hy Lane 2	7.1-	K23.7-	D5.0-	D9.5-	D29.7+	D11.1-	D2.3+	K28	End :	0:049.9	48.415.1	17	- D28.0-	D4.0+	D27.1+	D2.4-
	00		00	00	00	00	00		Duration :	0:000.0	00.001.2	35	77	91	00	00
	1110010	001010111	1010010100	1001011010	1011100001	1101001001	10110100111	11000	Start :	404 55	0 750 bi	ts	011001110010	01101010100	1101101001	010010110;
the Frence O	1/31	3A8/F7	0A5/05	169/A9	21D/FD	24B/2B	32D/62	283	End :	404 59	0 759 bi	5	LE 09C/1C	0AB/04	25B/3B	2D2/82
Phy Lane 3	7.1-	K23.7+	D5.0+		D29.7-	D11.1-		K28			10 bi		+ D28.0+	D4.0-	D27.1-	D2.4+
	00		00	00	00	00	00					V8.	77	91	00	00

The lower part of the *Symbol View* (shown in SST mode) describes the distribution of link symbols in the physical link lanes. You can see the individual bits above the symbol blocks. When you mouse hover over a symbol, a popup shows details of the selected symbol. Details include:

10b symbol:	Link symbol as sent (in this case 8b/10b link coding)
8b symbol:	Link symbol after conversion to 8 bits
Symbol code:	Link symbol K or D code
Descrambled:	Link symbol value after de-scrambling
Start:	Start of the item from start of the captured data
End:	End of the item from start of the captured data
Duration:	Length of the symbols

For clarity, the position of control symbols and and payload of link events is marked with a gray bar on top of the corresponding link symbols. Shown in SST mode.

0101010101001
A0/AA0
D10.0+
00

Each individual block contains the following information

First row:	10b/8b link symbol in HEX format
Second row:	Link symbol K or D code. K symbols are highlighted with red color.
Third row:	Descrambled value if available

### **Scrambling**

You can see the result of scrambling in *Symbols View (shown in SST mode)*. As you can see in the image below, all blocks have value of 00. However, the first row of each block reads a different 10b/8b link symbols.

	01001000	1101001101	0001011100	0111101010	1011001010	0101001010	1010110101
	)4B/EB	2CB/8B	0E8/77	15E/BE	14D/AD	14A/BF	2B5/5F
Phy Lane 0	)11.7+	D11.4-	D23.3+	D30.5-	D13.5-	D31.5+	D31.2-
	00	00	00	00	00	00	00
	01001000	1101001101	0001011100	0111101010	1011001010	0101001010	1010110101
	)4B/EB	2CB/8B	0E8/77	15E/BE	14D/AD	14A/BF	2B5/5F
Phy Lane 1	)11.7+	D11.4-	D23.3+	D30.5-	D13.5-	D31.5+	D31.2-
	00	00	00	00	00	00	00
	01001000	1101001101	0001011100	0111101010	1011001010	0101001010	1010110101
	)4B/EB	2CB/8B	0E8/77	15E/BE	14D/AD	14A/BF	2B5/5F
Phy Lane 2	)11.7+	D11.4-	D23.3+	D30.5-	D13.5-	D31.5+	D31.2-
	00	00	00	00	00	00	00
	01001110	1101000010	1110100011	1000011010	1011001010	1010111010	0101000101
	.CB/EB	10B/8B	317/77	161/BE	14D/AD	175/BF	28A/5F
Phy Lane 3	011.7-	D11.4+	D23.3-	D30.5+	D13.5-	D31.5-	D31.2+
	00	00	00	00	00	00	00

### **Forward Error Correction (FEC)**

FEC parity codes are highlighted in *Symbols View* with a light green color. CD\_ADJ symbols are highlighted with light red color. Image for SST mode.

	В9				В2		
	B1	3C			6A		
	94	42		AO	2A		
	94	42		AO	2A		
01	1001101010	1110001100	1001011101	1001001101	0100111010	1100010001	10
D	159/B9	0C7/67	2E9/89	2C9/90	172/B2	223/E3	2
-	D25.5-	D7.3-	D9.4-	D16.4+	D18.5-	D3.7+	
10	1000111010	0011101001	1100010010	0110110010	0101011100	1110010011	01
C	171/B1	25C/3C	123/83	136/90	0EA/6A	327/68	2
+	D17.5-	D28.1-	D3.4+	D16.4-	D10.3-	D8.3-	
10	0010110010	1011010101	0011001110	0110001010	0101011001	1010011011	01
C	134/94	2AD/42	1CC/F8	146/A0	26A/2A	365/05	2
+	D20.4+	D2.2-	D24.7+	D0.5+	D10.1-	D5.0-	
10	0010110010	1011010101	0011001110	0110001010	0101011001	1010011011	01
C	134/94	2AD/42	1CC/F8	146/A0	26A/2A	365/05	2
÷	D20.4+	D2.2-	D24.7+	D0.5+	D10.1-	D5.0-	

#### **SDP**

SDPs are highlighted with turquoise color. You can see the start of the SDP event marked as SS and the end of the SDP event marked as SE. Image for SST mode.

		SST													
									BS-IDI	LE 1 LINE	_3				
							SDP	01_7							
	SS													SE	
	5C	00	60	00	01	2C	00	В4	00	80	00	00	7F	FD	
	5C	01	07	00	01	2C	00	В4	00	80	00	00	7F	FD	
	5C	47	D5	00	01	2C	00	В4	00	80	00	00	7F	FD	
	5C	18	31	00	01	2C	00	В4	00	80	00	00	7F	FD	
.0	1100001010	1100011100	000111000101101010100100000000000000000												
	143/5C	0E3/63	2DA/9A	29A/5A	19C/DC	1D2/E2	2E2/9D	231/F1	29B/5B	1A3/C3	34A/1F	165/A5	15A/BA	3A2/FD	
	K28.2+	D3.3-	D26.4-	D26.2-	D28.6-	D2.7+	D29.4+	D17.7+	D27.2-	D3.6-	D31.0+	D5.5-	D26.5-	K29.7+	
		00	60	00	01	2C	00	В4	00	80	00	00	7 F		
. 0														01000101110	
	143/5C	32D/62	1E2/FD	29A/5A	19C/DC	1D2/E2	2E2/9D	231/F1	29B/5B	1A3/C3	34A/1F	165/A5	15A/BA	3A2/FD	
	K28.2+	D2.3-	D29.7+	D26.2-	D28.6-	D2.7+	D29.4+	D17.7+	D27.2-	D3.6-	D31.0+	D5.5-	D26.5-	K29.7+	
		01	07	00	01	2C	00	В4	00	80	00	00	7F		
. 0					0011100110								0101101010	10111010001	
	143/5C	26B/24	245/2F	29A/5A	19C/DC	22D/E2	11D/9D	3B1/F1	2A4/5B	1A3/C3	0B5/1F	165/A5	15A/BA	05D/FD	
	K28.2+	D4.1-	D15.1+	D26.2-	D28.6-	D2.7-	D29.4-	D17.7-	D27.2+	D3.6-	D31.0-	D5.5-	D26.5-	K29.7-	
		47	D5	00	01	2C	00	В4	00	80	00	00	7 F		
. 0	0011110101						1011100010							10111010001	
	2BC/5C	0E4/7B	18B/CB	29A/5A	19C/DC	22D/E2	11D/9D	3B1/F1	2A4/5B	1A3/C3	0B5/1F	165/A5	15A/BA	05D/FD	
	K28.2-	D27.3+	D11.6-	D26.2-	D28.6-	D2.7-	D29.4-	D17.7-	D27.2+	D3.6-	D31.0-	D5.5-	D26.5-	K29.7-	
		18	31	00	01	2C	00	В4	00	80	00	00	7F		

#### **Pixel data**

Grey area is fill symbols (scrambled 00). Light yellow area is actual pixels (surrounded by fill end symbol and fill start symbol). K30.7 is fill start and K23.7 is fill end. Image for SST mode.

	FE					Pixels					FS	
00	F7	00	00	00	00	00	00	00	00	00	FE	00
00	F7	00	00	00	00	00	00	00	00	00	FE	00
00	F7	00	00	00	00	00	00	00	00	00	FE	00
00	F7	00	00	00	00	00	00	00	00	00	FE	00
00101011	011000101011	11100010001	0011101001	0110100101	1001011001	1100011010	1110001100	0110110100	0111001110	1100010101	1000010111	01000110100
36A/0	DA 3A8/F7	223/E3	25C/3C	296/56	269/29	163/A3	0C7/67	0B6/10	1CE/EE	2A3/43	3A1/FE	162/BD
D10.0	)- K23.7+	D3.7+	D28.1-	D22.2-	D9.1-	D3.5-	D7.3-	D16.0-	D14.7-	D3.2-	K30.7+	D29.5+
00		00	00	00	00	00	00	00	00	00		00
00101010	100111010100	01100011110	0011101001	0110100101	1001011001	1100011010	0001110011	1001001011	0111001000	1100010101	0111101000	10111010100
0AA/0	DA 057/F7	1E3/E3	25C/3C	296/56	269/29	163/A3	338/67	349/10	04E/EE	2A3/43	05E/FE	15D/BD
D10.0	)+ K23.7-	D3.7-	D28.1-	D22.2-	D9.1-	D3.5-	D7.3+	D16.0+	D14.7+	D3.2-	K30.7-	D29.5-
00		00	00	00	00	00	00	00	00	00		00
00101010	100111010100	01100011110	0011101001	0110100101	1001011001	1100011010	0001110011	1001001011	0111001000	1100010101	0111101000	10111010100
OAA/0	A 057/F7	1E3/E3	25C/3C	296/56	269/29	163/A3	338/67	349/10	04E/EE	2A3/43	05E/FE	15D/BD
D10.0	)+ K23.7-	D3.7-	D28.1-	D22.2-	D9.1-	D3.5-	D7.3+	D16.0+	D14.7+	D3.2-	K30.7-	D29.5-
00		00	00	00	00	00	00	00	00	00		00
00101011	011000101011	1 1 1 0 0 0 1 0 0 0 1	0011101001	0110100101	1001011001	1100011010	1110001100	0110110100	0111001110	1100010101	1000010111	01000110100
36A/0	DA 3A8/F7	223/E3	25C/3C	296/56	269/29	163/A3	0C7/67	0B6/10	1CE/EE	2A3/43	3A1/FE	162/BD
D10.0	)- K23.7+	D3.7+	D28.1-	D22.2-	D9.1-	D3.5-	D7.3-	D16.0-	D14.7-	D3.2-	K30.7+	D29.5+
00		00	00	00	00	00	00	00	00	00		00

#### **MSA**

MSA symbols are highlighted in purple color. Image for SST mode.

							SST						
	FRAME	4 LINE 0											
							MSA						
	SS	SS										SE	
00	5C	5C	00	17	77	08	98	04	65	00	2C	FD	00
00	5C	5C	00	17	77	00	C0	00	29	00	05	FD	00
00	5C	5C	00	17	77	07	80	04	38	00	00	FD	00
00	5C	5C	00	17	77	00	80	00	20	00	00	FD	00
110001010	0011110101	1100001010	1010110001	0011100110	1110100100	0110110110	1000111010	0010111001	0101010110	0011100101	1001101001	0100010111	01101001101
147/A7	2BC/5C	143/5C	235/FF	19C/DC	097/17	1B6/D0	171/B1	274/34	1AA/CA	29C/5C	259/39	3A2/FD	196/D6
D7.5-	K28.2-	K28.2+	D31.7-	D28.6-	D23.0-	D16.6-	D17.5-	D20.1-	D10.6-	D28.2-	D25.1-	K29.7+	D22.6-
00			00	17	77	08	98	04	65	00	2C		00
	1100001010			0011100110	0001011011	0011000110	1001011110	1001001001	0110011101	0011100101			01101001101
178/A7	143/5C	2BC/5C	1CA/FF	19C/DC	368/17	18C/D8	1E9/E9	249/30	2E6/86	29C/5C	349/10	3A2/FD	196/D6
D7.5+	K28.2+	K28.2-	D31.7+	D28.6-	D23.0+	D24.6+	D9.7-	D16.1+	D6.4-	D28.2-	D16.0+	K29.7+	D22.6-
00			00	17	77	00	C0	00	29	00	05		00
	1100001010		0101001110	0011100110	0001011011	0101000110	1001011010	0010111001	1110100010	0011100101		0100010111	01101001101
178/A7	143/5C	2BC/5C	1CA/FF	19C/DC	368/17	18A/DF	169/A9	274/34	117/97	29C/5C	355/15	3A2/FD	196/D6
D7.5+	K28.2+	K28.2-	D31.7+	D28.6-	D23.0+	D31.6+	D9.5-	D20.1-	D23.4-	D28.2-	D21.0-	K29.7+	D22.6-
00			00	17	77	07	80	04	38	00	00		00
	1100001010			0011100110	0001011011	0011000110	1001011010	0110111001	1010001101	0011100101			01101001101
178/A7	143/5C	2BC/5C	1CA/FF	19C/DC	368/17	18C/D8	169/A9	276/30	2C5/8F	29C/5C	095/15	05D/FD	196/D6
D7.5+	K28.2+	K28.2-	D31.7+	D28.6-	D23.0+	D24.6+	D9.5-	D16.1-	D15.4+	D28.2-	D21.0+	K29.7-	D22.6-
00			00	17	77	00	80	00	20	00	00		00

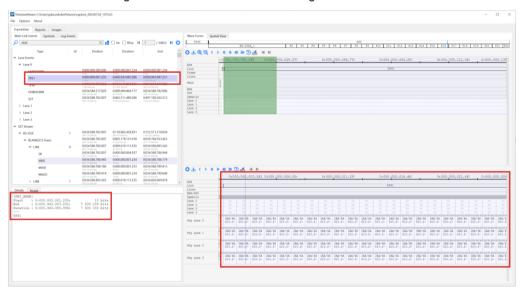
#### VBID

The *Event Details* will show information of what the line will contain. In the image below you can see that the line is vertical blanking without pixel data. Image for SST mode.

	jes										
in Link Events Symbols	Log Events				Wave Forms Sp TPS4	atial View		887			
vbid		×	🛛 🛃 📋 Aa 📋 RExp	H 1 / 34953 N 🔇	1134	8d-ID18_1 F2 F3	F4 F5 F6		F10 F11 F12 F13 F14	F15 F16 F17 F18 F1	9 F20 F21
Туре	Id	Position	Duration	End	<b>○</b> ±€€ <	> « » « » 🕄 🛃 H H					
ane Events						0:034.588.738.711	0:034	588.787.73	0:034.588.815.89	0:034.588.844.00	034.588.8
ST Stream					AUX Link	UNDOGR				TRE	
✓ BS-IDLE	1	0:034.588.782.007 280 170 360 Ses	0:118.982.428.831	0:153.571.210.838	Frame	ONCOMEN				BS-IDLE_1	
<ul> <li>BLANK(S12 lines)</li> </ul>		0:034.588.782.007	0:005.178.151.418	0:039.766.933.425	Lines	0		_		LINE_0	
✓ LINE	0	0:034.588.782.007	0:000.010.113.535	0:034.598.895.542	VBID	3 4					
SR		0:034.588.782.007	0:000.000.004.937	0:034.588.786.944	MSA SDP			_			
VBID		0:034.588.786.945	0:000.000.001.234	0:034.588.788.179	Symbols Lane 0		52				
MVID		0:034.588.788.180	0:000.000.001.233	0.034.588.789.413	Lane 1						
MAUD		0:034.588.789.414	0.000.000.001.234	0:034.588.790.648	Lane 2 Lane 3						
> LINE	1	280 170 420 bits 0:034.598.895.543	0.000.010.113.535	280 170 429 km 0:034.609.009.078							
> UNE	2	0:034.609.009.079	0:000.010.113.535	0.034.619.122.614							
	2	0:034.619.122.615	0.000.010.113.535	280 416 119 bits 0:034.629.236.150							
> LINE		0:034.629.236.151	0:000.010.113.535	200-400-000 http: 0:034.639.349.686							
> UNE	4	0.034.639.349.687	0:000.010.113.535	0.034.649.463.222							
> LINE	5	0:034.639.549.667 200 579 960 http: 0:034.649.463.223	0:000.010.113.535 0:000.010.113.535	0:034.649.463.222							
> UNE	6	280-661 880 bits		280 743 799 bits							
> LINE	7	0:034.659.576.759 280 742 800 bits	0:000.010.113.535	0:034.669.690.294 200.620 719 bits							
> LINE	8	0:034.669.690.295 280-825 720 Million	0:000.010.113.535 81 929 bits	0:034.679.803.830 280 907 639 Min	$0 \pm < > <$	» « » 🥄 🛃 н н	_				
> LINE	9	0:034.679.803.831 280 907 640 bits	0:000.010.113.535	0:034.689.917.366 200 MD 539 Mm		0:034.588.781.113	0:034	588.788.474	0:034.588.792.295	0:034.588.796.10	034.588.1
> LINE	10	0:034.689.917.367	0:000.010.113.535	0:034.700.030.902	AUX			-			•
alls Image					Link Lines				88T BS-IDLE 1 LINE	0	
Y SYMBOL]					MSA/SDP Symbols	18	VBID	NVID NAUD		DOMEY	
rt : 0:034.588.78 : 0:034.588.78		180 170 400 bits			Lane 0	00 10 70 70 1	C 19	00 00	00 00 00	00 00 00	0.0
		10 170 409 bits			Lane 1 Lane 2	00 10 70 70 1	C 19 C 19	00 00	00 00 00	00 00 00	00
					Lane 3	00 10 70 70 10	c 19	00 00	00 00 00	00 00 00	00
ation : 0:000.000.00					Phy Lane 0	234/F4 08C/1C 33C/7C 0C3/7C 08C D20.7+ X29.0- X28.3- K28.3+ K28 00	/1 1E6/E6 .0 D6.7- 19	068/17 186/00 023.0+ D0.6+ 00 00	374/14 172/B2 238/E7 D20.0- D18.5- D7.7+ 00 00 00	0AD/02 12D/82 0F2/72 D2.0- D2.4- D18.3- 00 00 00	0CE/6E 2 D14.3-
ation : 0:000.000.00 ticalBlanking: TRUE erlace: FALSE ideoStream: TRUE						234/r4 0sc/1c 33c/7c 0c3/7c 0sc	/1 1E6/E6	68/17 186/00	374/14 172/52 238/87	0AD/02 12D/82 0F2/72 D2.0- D2.4- D18.3-	0CE/6E 3
ation : 0:000.000.00 ticalBlanking: TRUE erlace: FALSE					Phy Lane 1	D20.7+ H28.0- H28.3- H28.3+ H28	19	00 00	00 00 00	00 00 00	00
ation : 0:000.000.00 ticalBlanking: TRUE erlace: FALSE ideoStream: TRUE ioMute: TRUE p SYNC DETECT: FALSE					Phy Lane 1 Phy Lane 2	D20.7+ H28.0- H28.3- H28.3+ H28	19 /1 1E6/E6 .0 D6.7- 19	00 00 668/17 186/C0 23.0+ D0.6+ 00 00		0AD/02 12D/82 0F2/72 D2.0- D2.4- D18.3- 00 00 00	0CE/6E 2 D14.3- 00

### **TPS Events**

The image below shows how the events are shown for each lane in *Event Selector*, *Symbol View* and *Event details*. The image below shows a TPS1 event. Image for SST mode.

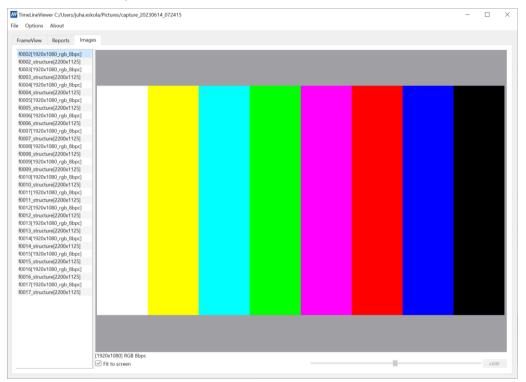


The image below illustrates the transition from TPS1 to TPS4. Image for SST mode.

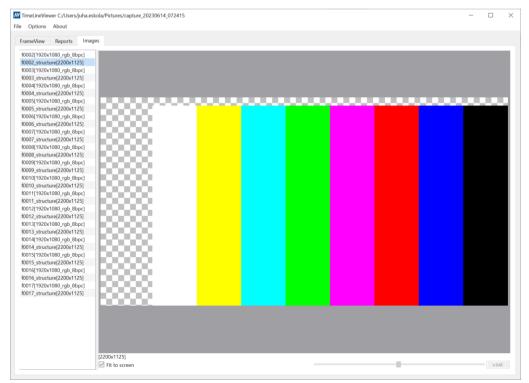
		0	:000.85	4.696.3	25		0:00	.854.7	01.43:	(	.000.8	54.705.	841	0:00	0.854	10.25(	5( 0:000.854.714	
AUX																		
Link			TPS1													TPS4		
Lines																		
MSA/SDP																		
Symbols																		
Lane 0										1C	BC	BC	1C	00	00	00	00	00
Lane 1										1C	BC	BC	1C	00	00	00	00	00
Lane 2										1C	BC	BC	1C	00	00	00	00	00
Lane 3										1C	BC	BC	1C	00	00	00	00	00
Phy Lane 0	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	01010101010 2AA/4A D10.2-	0101010101 2AA/4A D10.2-	0BC/1C K28.0-	17C/BC K28.5-	283/BC K28.5+	0BC/1C K28.0-	235/FF D31.7- 00	097/17 D23.0- 00	1B9/C0 D0.6- 00	0B4/14 D20.0+ 00	172/B2 D18.5- 00
Phy Lane 1	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	0BC/1C K28.0-	17C/BC K28.5-	283/BC K28.5+	0BC/1C K28.0-	235/FF D31.7- 00	097/17 D23.0- 00	1B9/C0 D0.6- 00	0B4/14 D20.0+ 00	172/B2 D18.5- 00
Phy Lane 2	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	0101010101 2AA/4A D10.2-	2AA/4A D10.2-	0BC/1C K28.0-	17C/BC K28.5-	283/BC K28.5+	0BC/1C K28.0-		097/17 D23.0- 00	1001110110 1B9/C0 D0.6- 00	0B4/14 D20.0+ 00	172/B2 D18.5- 00
Phy Lane 3	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	0101010101 2AA/4A D10.2-	2AA/4A D10.2-	0101010101 2AA/4A D10.2-	01010101010 2AA/4A D10.2-	0101010101 2AA/4A D10.2-	0BC/1C K28.0-	17C/BC K28.5-	283/BC K28.5+	0BC/1C K28.0-	235/FF D31.7- 00	097/17 D23.0- 00	1001110110 1B9/C0 D0.6- 00	0B4/14 D20.0+ 00	0010011101 172/B2 D18.5- 00

# **Images Tab**

Video frames decoded from Main Link Data Capture can be previewed in Images tab. Frames are listed on the left-hand side of the window. Each frame has two lines. The first line shows the frame with its active area only.

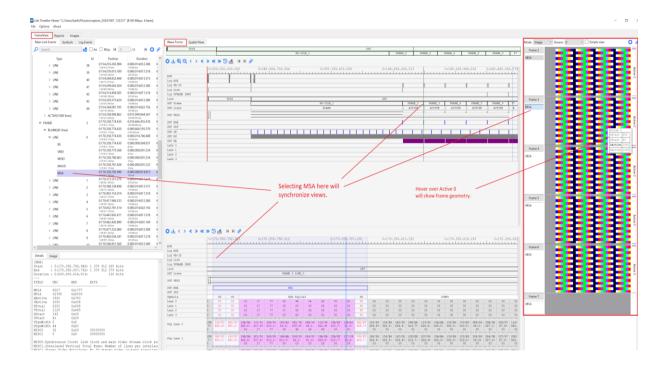


The second line is a structure frame, which shows total and active area.



# Frame Image View

Frame Image View can be used to select *Frames* and *MSA* events in related views. As shown below selecting the MSA event in *Frame Image View* also selects it in Event Selector View and synchronizes the other views. Hovering over the Active0 area will show the frame geometry details, Stream combo box allows selection of streams for MST. Simple view checkbox presents a simplified view (does not work at present).



# 7. EVENT TIMELINE VIEWER

Event Timeline Viewer is an application for inspecting data captured in capture and event log tabs.

Event Timeline Viewer consists of four areas.

- 1. Frame View
- 2. Event View
- 3. Event Log
- 4. Details / Image

		55	AME_1 FR	AME_2 FRJ	RAME_3 FRAME_4 FRAME_5 FRAME_6 FRAME_7 FRAME_8 FRAME_9 FRAME_10														
Frames HDMI HPD	2 <	2 ·	• M • FRAME_1	FRAME_2	FRAME_3     FRAME_4     FRAME_5     FRAME_6     FRAME_7     FRAME_8     FRAME_9     FRAME_10														
Search		4	Aa RExp 4	0 /0 🕅	Details Image														
Туре	ID	Start	Duration	End	[Log Packet] Start : 0:000.125.559.001; 0 bits														
og HDMI		0:000.125.556.000	0:000.000.001.000	0:000.125.557.000	End <th:0:000.125.560.001 <="" th="">         0 bits           Duration:0:000.000.001.000/         1 bits</th:0:000.125.560.001>														
og HDMI	3	0:000.125.558.000	0:000.000.001.000	0:000.125.559.000	57:000         Duration : 0:000.0001.000;         1 bits														
og HDMI		0:000.125.559.001	0:000.000.001.000	0:000.125.560.001															
RAME	7	0:000.126.164.000	0:000.016.000.000	0:000.142.164.000	Audio Stream Encoding Standard = Refer to Stream Header Audio Stream Transport Standard = Refer to Stream Header														
.og HDMI		0:000.142.223.000	0:000.000.001.000	0:000.142.224.000	Sample Size = Refer to Stream header Sampling Frequency = Refer to Stream Header														
.og HDMI		0:000.142.225.000	0:000.000.001.000	0:000.142.226.000	Audio Coding Extension Type = Refer to Audio Coding Type (CT) Audio Stream Encoding Standard = Refer to Audio Coding Type (CT)														
.og HDMI		0:000.142.226.001	0:000.000.001.000	0:000.142.227.001	Audio Stream Transport Standard = Refer to Audio Coding Type (CT) Level Shift Value = 0dB														
RAME	8	0:000.142.831.000	0:000.016.000.000	0:000.158.831.000	Down-mix Inhibit Flag = Permitted or no information about any assertion of this LFE Playback Level Information = Unknown or refer to other information														
.og HDMI		0:000.158.889.000	0:000.000.001.000	0:000.158.890.000	Transformed HDMI Data:														
.og HDMI		0:000.158.891.000	0:000.000.001.000	0:000.158.892.000	84 01 0A 70 01 00 00 00 00 00 00 00 00 00 00 00 00														
.og HDMI		0:000.158.892.001	0:000.000.001.000	0:000.158.893.001	00 00 00														
RAME	9	0:000.159.497.000	0:000.016.000.000	0:000.175.497.000	4														
.og HDMI		0:000.175.556.000	0:000.000.001.000	0:000.175.557.000	- ·														
		0:000.175.557.001	0:000.000.001.000	0:000.175.558.001															
.og HDMI				0:000.175.559.002															
Log HDMI		0:000.175.558.002	0:000.000.001.000	0:000.175.559.002															

#### **Frame View**

UCD Timeline Viewer [duration: 203 906 000 bits	s ]										-	- 🗆	$\times$
		FRAME_1	FRAME_2	FRAME_3	FRAME_4	FRAME_5	FRAME_6	FRAME_7	FRAME_8	FRAME_9		FRAME_10	

The uppermost panel shwos the captured frames. The selected frame is highlighted in purple. You can select a frame by double-clickin it. The area highlighted in green indicates the area shown in the Events view. Please, note that you cannot zoom in or out in the frame view.

#### **Event View**

	FRAME_1		RAME_2	FRAME_3	FRAME_4	FRAME_5	FRAME_6	FRAME_7	FRAME_8	FRAME_9	FRAME_10
<b>○</b> ± € Q	< > « » « » 🕄 🚣	M 1									
Frames	FRAME_2							FRAME_4			
HDMI											
HPD											

The view below shows all frames and events selected in the capture tab. The are highlighted in green in frame view indicates the are shown in events view.

#### <u>Tools</u>

Tool		Function
O Gear Icon		Hide / add events on the timeline
🛃 Save Icon		Save, load, remove, import, export and remove presets
🗨 🭳 Magnifying Glass Icons		Zoom in/out on the timeline
< > < » < Arrow Icons		Move on the timeline. More arrows moves the timeline more. You can also move by clicking and dragging on the timeline.
S Move to a time point		Move to a certain time point on the timeline by double clickin on the timeline. The selected event is highlighted in the event log. By right clicking on the timeline and right clicking again you can measure distance between two time points.
Erase all rulers		Erase all measurements made.
Zoomina	on	the

Zooming	on	the	timeline
О́+ ⊕́ ⊖́ < > « » « » Э́н м			
Frames TRADE_4 RENI HPO			
REMI			
EPD			

Went the timeline is zoomed out, you can see events as grey lines. When you zoom in you can see the event block. You can zoom in either with the magnifying glass icons or by scrolling with your mouse.

<b>○</b> ±€Q <	> « » « » 🕑	🚣 I4 DI				
Frames						
HDMI		Log HDMI		Log HDMI	Log HDMI	
HPD						

When you double click on event or frame, the correseponding event or frame is selected in the event log and highlighted in purple.

			RAME 1 FR	AND 2 I FR	E 3    FRAME 4    FRAME 5    FRAME 6    FRAME 7    FRAME 8    FRAME 9    FRAME 10
1		> <b>« » « »</b>			
ranes	· ·	/ . / . //			
HOMI					Log MINEI Log HIMEI
HPD					
Search		2	🗌 Aa 🗌 RExp. 🕅	0 /0 №	
Type	ID	Start	Duration	End	(Log Packet) Start : 0:000.092.225.000; 0 bits
RAME	3	0.000.059.498.000	0.000.016.000.000	0:000.075.498.000	End : 0:000.092.226.000; 0 bits
	3				Duration : 0:000.001.000; 1 bits
og HDMI		0.000.075.556.000	0.000.000.001.000	0:000.075.557.000	Packet code: 0x82
.og HDMI		0.000.075.558.000	0.000.000.001.000	0:000.075.559.000	Packet Header:
Log HDMI		0:000.075.559.001	0.000.000.001.000	0:000.075.560.001	Packet Length: 13 Checksum: 57
FRAME	4	0.000.076.164.000	0.000.016.000.000	0:000.092.164.000	Version: 2 Packet Data:
					Scan Info(0:1) 0 (No Data)
Log HDMI		0.000.092.223.000	0.000.000.001.000	0:000.092.224.000	Bar Data(2:3) 0 (Not present) Format Info(4) 0 (Not present)
Log HDMI		0:000.092.225.000	0.000.000.001.000	0:000.092.226.000	Color Space(5:7) 0(RGB)
Log HDMI		0:000.092.226.001	0.000.000.001.000	0:000.092.227.001	AFD Aspect(8:11) 8((ATSC: Same as Picture Aspect Ratio) (DVB: As the coded frame)) Coded frame AR(12:13) 0(No Data)
FRAME	5	0:000.092.831.000	0.000.016.000.000	0:000.108.831.000	Colorimetry(14:15) 0 (No Data) Non-U Scaling(16:17) 0 (No Known non-uniform scaling)
Log HDMI		0.000.108.889.000	0.000.000.001.000	0:000.108.890.000	RGB Quant(18:19) 0(Default (depends on video format))
					E-Colorimetry (20:22) 0 (No data) ITC Content (23) 0 (No Data)
Log HDMI		0:000.108.891.000	0.000.000.001.000	0:000.108.892.000	VIC(24:31) 16 Pixel repets(32:35) 0(No repeats)
Log HDMI		0.000.108.892.001	0.000.000.001.000	0:000.108.893.001	ITC Type (36:37) 0 (Graphics)
	6	0.000.109.497.000	0.000.016.000.000	0:000.125.497.000	YCC Quant (38:39) 0 (Limited range) ETB (40:55) 0
FRAME		0.000.125.556.000	0.000.000.001.000	0:000.125.557.000	SBB (56:71) 0 ELB (72:87) 0
FRAME					SR8(81103) 0
og HDMI		0.000 407 770 000	0.000.000.004.000		
FRAME Log HDMI Log HDMI		0:000.125.558.000	0.000.000.001.000	0:000.125.559.000	Transformed HDMI Data:

### **Event Log**

Type	ID	Start	Duration	End	Info	i.
FRAME	3	0:000.059.498.000	0:000.016.000.000	0:000.075.498.000		
Log HDMI		0:000.075.556.000	0:000.000.001.000	0:000.075.557.000	0x03 HDMI GCP	
Log HDMI		0:000.075.558.000	0:000.000.001.000	0:000.075.559.000	0x82 HDMI AVI [INFOFRAME]	
Log HDMI		0:000.075.559.001	0:000.000.001.000	0:000.075.560.001	0x84 HDMI Audio [INFOFRAME]	
FRAME	4	0:000.076.164.000	0:000.016.000.000	0:000.092.164.000		
Log HDMI		0:000.092.223.000	0:000.000.001.000	0:000.092.224.000	0x03 HDMI GCP	
Log HDMI		0:000.092.225.000	0:000.000.001.000	0:000.092.226.000	0x82 HDMI AVI [INFOFRAME]	
Log HDMI		0:000.092.226.001	0:000.000.001.000	0:000.092.227.001	0x84 HDMI Audio [INFOFRAME]	
FRAME	5	0:000.092.831.000	0:000.016.000.000	0:000.108.831.000		
Log HDMI		0:000.108.889.000	0:000.000.001.000	0:000.108.890.000	0x03 HDMI GCP	
Log HDMI		0:000.108.891.000	0:000.000.001.000	0:000.108.892.000	0x82 HDMI AVI [INFOFRAME]	
Log HDMI		0:000.108.892.001	0:000.000.001.000	0:000.108.893.001	0x84 HDMI Audio [INFOFRAME]	
FRAME	6	0:000.109.497.000	0:000.016.000.000	0:000.125.497.000		
Log HDMI		0:000.125.556.000	0:000.000.001.000	0:000.125.557.000	0x03 HDMI GCP	
Log HDMI		0:000.125.558.000	0:000.000.001.000	0:000.125.559.000	0x82 HDMI AVI [INFOFRAME]	
Log HDMI		0:000.125.559.001	0:000.000.001.000	0:000.125.560.001	0x84 HDMI Audio [INFOFRAME]	
FRAME	7	0:000.126.164.000	0:000.016.000.000	0:000.142.164.000		

Event log shows all captured events and frames. The following info is presented in the table:

Туре	Function
ID	Number of captured frame
Start	Start of the event
Duration	Duration of the event
End	End of the event
Info	Additional information about the event.

### Event Log Tools

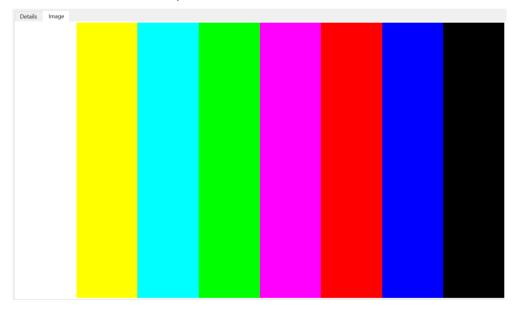
P Search Search	Search events from the event log. Search results are highlighted in purple.			
Apply search filters	Apply filters.			
Aa RExp Search filters	Aa filter: Make search case sensitive RExp: Use regular expressions in search			
K 7 /12 Search results	Shows search results. Move from one search result to another by clicking the arrows.			
Configure	Selec which columns are shown in event log.			

UCD-5XX User Manual • UCD Console 3.5

### **Details / Image**

Details Image		
[Log Packet]		^
Start : 0:000.092.225.000;	0 bits	~
End : 0:000.092.226.000;	0 bits	
Duration : 0:000.000.001.000;	1 bits	
Packet code: 0x82		
Packet Header:		
Packet Length:	13	
Checksum:	57	
Version:	2	
Packet Data:		
Scan Info(0:1)	0(No Data)	
Bar Data(2:3)	0 (Not present)	
Format Info(4)	0 (Not present)	
Color Space(5:7)	0 (RGB)	
AFD Aspect (8:11)	8((ATSC: Same as Picture Aspect Ratio) (DVB: As the coded frame))	
Coded frame AR(12:13)	0(No Data)	
Colorimetry (14:15)	0(No Data)	
Non-U Scaling(16:17)	0 (No Known non-uniform scaling)	
RGB Quant (18:19)	0(Default (depends on video format))	
E-Colorimetry (20:22)	0(No data)	
ITC Content (23)	0(No Data)	
VIC(24:31)	16	
Pixel repets (32:35)	0(No repeats)	
ITC Type (36:37)	0(Graphics)	
YCC Quant (38:39)	0(Limited range)	
ETB(40:55)	0	
SBB (56:71)	0	
ELB(72:87)	0	
SRB (88:103)	0	
Transformed HDMI Data:		
82 02 0D 57 00 08 00 10 00 00 00 00		
00 00 00 00 00 00 00 00 00 00 00 00	00 00 038	~
00 00 00		*

Details tab shows details of the selected event. When the selected event is a frame, the image tab shows the captured frame.



# 8. EVENT LOG

Event Log dialog is divided into two panels: the left panel lists all transactions, and the right panel shows the parsed transaction data for the line selected in the list on the left.

ninal Memory Layout	Event Log DP F	XX							
Start Stop					Load	Save	Report	Open Timelin	ne Vie
DP RX	Filter:				Apply				
✓ HPD	Search:			< 0 /0	> Search	•			
ZAUX	Source	Туре	Start	Info		^			
SDP									
VB-ID									
MSA									
Link Pattern									
AUX_BW									
VFRAME INFO									
Select all									
TX									
] HPD ] AUX									
Select all									
ielect all									
						~			

Role	Logged Events
DP Sink DP Alt Mode Sink	HPD, AUX, SDP, VB-ID, MSA, Link Pattern, AUX_BW
DP Source DP Alt Mode Source	HPD, AUX
DP Alt Mode Sink DP Alt Mode Source	PD, LSE

Start:	Starts event logging and stop it by clicking Stop.
Save:	Save transactions as Event Log data as binary or as CSV
Load:	Load saved Event Log data
Report:	Store event logs as reports in HTML format to be shared and viewed with any web browser.
Open Timeline Viewer	Open Event Timeline Viewer to inspect the captured data. Refer to chapter seven of this manual for detailed instructions.
AutoScroll:	When selected, the transaction list is automatically scrolled vertically, and the latest transaction is shown as the last item of the list. When not selected, the items shown before clicking Start will be shown.
Events:	Number of events detected
Colors:	Open configure colors dialog
Clear:	Click to clear transaction list. When <i>Clear on Start</i> is selected, the list is cleared when clicking Start.

# **Selecting Logged Events**

#### HPD

Status and status changes of Hot Plug Detect (HPD) signal, power detection status and cable connection status. HPD Trace, HPD De-assert to HPD Assert interval.

### AUX

Log DP AUX Channel transactions and Sideband Messaging.

#### **SDP**

Log DP Secondary-data Packets. Click the button to open the *Event Filter Dialog*. The dialog enables the filtering of SDP packets. In the dialog, the reference to Packet Type Value is indicated in square brackets "[]".

DP RX SDP filterin	a:							
Enable logging of following packets [IDs in hex]:								
	amp [1] 🗌 Aud							
Extension [4]	Aud	lio_CopyManagem	ent [5]					
ISRC [6]	VSC	[7]						
Camera Generio								
🗹 CG0 [8]	🗹 CG1 [9]	🗹 CG2 [A]	🗹 CG3 [B]					
CG4 [C]	CG5 [D]	🗹 CG6 [E]	CG7 [F]					
InfoFrames								
VS [80 + 1]		/1 [80 + 2]						
SPD [80 + 3]	A 1	udio [80 + 4]						
MPEG Source	:e [80 + 5] 🗌 N	TSC VBI [80 + 6]						
🗹 DRM [80 + 7	מ							
Select all								
Enter packet type	as nex value sepa	arated by comma:						
0x0, 0xF								

#### **VB-ID**

Log Vertical Blanking ID packets sent in DP stream. Click the button to open the *Event Filter Dialog*. The dialog enables definition of which events will be logged.

Event Filter Dialo	g			2
VBID filtering				
	Disab	led On se	et On cle	ear On any
VBLANK	0	0	0	۲
FIELD_ID	0	0	0	۲
INTERLACE	0	0	$\circ$	۲
NO_VIDEO	0	0	0	۲
NO_AUDIO	0	0	$\odot$	۲
HDCP_SYNC	0	0	$^{\circ}$	۲
COMPRESSED	0	0	0	۲
RESERVED	۲	0	$\odot$	0
On MVID change				
On MAUD change	•			
🔘 Log all		Log	on change	2
		Oł	(	Cancel

#### **MSA**

Log Main Stream Attributes sent in DP stream. Click the .... button to open the *Event Filter Dialog*. The dialog enables logging of all MSA packets and the changes on the selected parameter.

💯 Event Filter Dialog								
MSA filtering								
Enable logging 1	45A packet on ch	ange in:						
MVID	VID	HTOTAL						
HSTART	VSTART	MSP	HSW					
VSP	VSW	и нитрин	VHEIGHT					
MISCO	MISC1							
🔵 Log all		Log on ch	ange					
		ОК	Cancel					

#### **VFRAME INFO**

Dimensions of the catured frame measured by the Sink

#### PD

Log USB-C PD communication messages

#### LSE

Low Speed Electrical logger captures the Voltage and Current on the low speed lanes of the USB-C connector including CC, VBUS, VCONN, and SBU.

Event Filter Dialog			×
USB-C LSE thresholds:			
VBUS threshold	20		
IVBUS threshold	50	≑ mA	
VCC threshold	50		
VSBU threshold	20		
IVCONN threshold	50	🗢 mA	
		ОК	Cancel

Event Filter Dialog sets the threshold values for capturing the changes. Parsed transaction data shows the captured data with indication of the changed values.

#### AUX\_BW

Log AUX\_Bitwise transactions as a series of Manchester II codes.

#### **Link Pattern**

Click the .... button to open the Event Filter Dialog.

Log link patterns. Event filter dialog sets the type of link patterns that will be captured.

Custom Pattern (80 bit) is a sequence that either splits into 10 bytes or 8b/10b encoded symbols. For 10b symbols, either K/D odes or hex values must be provided. For bytes, hex values must be provided.

Event Filter Dialog	×	W Event Filter Dialog	
DP RX Link Pattern filtering:		DP RX Link Pattern filtering:	
	Start End		Start End
TPS1		TPS1	
TPS2		TPS2	
TPS3		TPS3	
TPS4		TPS4	
Idle pattern		Idle pattern	
Active video		Active video	
ML_PHY_SLEEP		ML_PHY_SLEEP	
ML_PHY_STANDBY		ML_PHY_STANDBY	
Custom pattern (80 bit)		Custom pattern (80 bit)	
CP2520.1		CP2520.1	
CP2520.2		CP2520.2	
PRBS7		PRBS7	
PRBS31		PRBS31	
🗆 Log all		🗌 Log all	
Custom Pattern (80 bit)		Custom Pattern (80 bit)	
Type: Bytes (8bit, her	c) ~	Type: Bytes (8t	vit, hex) 🗸 🗸
		Bytes (8b	
0 0 0 0 ff ff	ff ff ff		(10bit, hex)
		K/D code	es (8bit/10bit enc.)
	OK Cancel		OK Cancel

## **Event Transaction List**

Transaction data in Transaction List is ordered in columns. Each column provides additional Information.

You can search events by typing its name in the Search bar and pressing enter or selecting the *Search* button. Pressing F3 (Ctrl+G on macos) takes you to the next found and Shift+F3 (Shift+Ctrl+G on macOS) takes you to the previous found.

erminal N	Memory Layout	Event Log	DP RX											
Start	Stop									Load	Sa	ve	Report	Open Timeline View
DP RX		Filter:							_	Apply	•	Devid		= 00 = 00
HPD		Search:	/B-ID			<	548	/ 556	>	Search	*	Data	length	= 00 = 3 g_Flag = 0[bit 0
AUX		u	Туре	Start			Info				^	Field	IID_Flag clace Flag	g_riag = 0[bit 0 = 0[bit 1 = 0[bit 2
SDP		1235	VB-ID	00.00:04.488.04	VB-ID = 0x00;							NoVid	ieoStream_F	
VB-ID		1236	VB-ID	00.00:04.504.02	VB-ID = 0x01;								SYNC DETEC	T = 0[bit 5 m Flag = 0[bit 6
MSA 🗹		1237	VFRAME INFO	00.00:04.504.02	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	GTH: 2						Rese: Mvid	rved	= 0[bit 7 = 0x00
🗹 Link Pat	ttern	1238	SDP	00.00:04.504.02	0x84 DP Audio [INFOFRAME]							Maud		= 0x00
AUX_BV	N	1239	VB-ID	00.00:04.504.70	VB-ID = 0x00;									
VFRAM		1240	VB-ID	00.00:04.520.69	VB-ID = 0x01;									
✓ Select a	lect all	1241	VFRAME INFO	00.00:04.520.69	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	IGTH: 2								
DP TX		1242	SDP	00.00:04.520.69	0x84 DP Audio [INFOFRAME]									
HPD		1243	VB-ID	00.00:04.521.37	VB-ID = 0x00;									
☑ AUX ☑ Select a		1244	VB-ID	00.00:04.537.35	VB-ID = 0x01;									
_		1245	VFRAME INFO	00.00:04.537.35	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	IGTH: 2								
✓ Select all		1246	SDP	00.00:04.537.35	0x84 DP Audio [INFOFRAME]									
		1247	VB-ID	00.00:04.538.03	VB-ID = 0x00;									
		1248	VB-ID	00.00:04.554.02	VB-ID = 0x01;									
		1249	VFRAME INFO	00.00:04.554.02	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	IGTH: 2								
		1250	SDP	00.00:04.554.02	0x84 DP Audio [INFOFRAME]									
		1251	VB-ID	00.00:04.554.70	<ul> <li>Time from start of logging</li> </ul>									
		1252	VB-ID	00.00:04.570.69	Time from device reboot									
		1253	VFRAME INFO	00.00:04.570.69	Time from previous event	GTH: 2								
		1254	SDP	00.00:04.570.69	<ul> <li>Show as microseconds</li> <li>Show as hours.min:s.ms.us.ns</li> </ul>									
		4000	VR.ID	00 00-04 571 37							>			
AutoScroll	Clear	Clear on S	tart Colors	Events (filtered	Configure colors	/ 1271								

Source:	The communication port: DP RX to DP TX
Туре	The logged item: HPD, AUX, SDP, VB-ID, MSA, Link Pattern, AUX_BW, VFRAME INFO
Start:	Each line is identified by its timestamp, marking the instant when an event or error was detected, or when a data transaction got started. The timestamp can be displayed as a time delay from the start of the acquisition (absolute) or from the previous line (relative).
	The timestamp can be displayed in milliseconds or in minutes, seconds, and microseconds.
Info	This column provides a short description of the message content

When hovering the mouse over the transaction list, a mouse-over window will open. It provides a brief list of the content in the transaction under the mouse.

# **Customizing Transaction List**

User Can change what data is shown in the transaction list by adding and removing columns or limiting the transaction types in the list. Users can also color highlight various types of transactions for better readability.

Right-click on the list to open the menu.

00:00:00 7	90.435.000 VR-ID - 0x00+
00:00:(	Time from start of logging Time from device reboot
00:00:(	Time from previous event
00:00:(	Show as microseconds
00:00:(	Show as hours:mins:secs.msecs.mcsecs.nsecs
00:00:(	Configure colors
00:00:(	Configure columns

#### **Configure Start**

The time indicated in column *Start* can be either:

- Time from start of logging.
- Time from previous reboot.
- Time from previous event.

The time can be expressed either:

- In microseconds (1/1 000 000 Second).
- Hours : minutes : seconds . milliseconds . microseconds . nanoseconds.

### **Configure Colors**

*Configure colors* dialog allows the user to highlight various types of transactions in the list by changing character color and background color of the transaction line.

Configure colo	rs	1	×
Add	Config Remove	▲ ▼ Clo	
Rule(appl	ied in order shown)	Format	Applies to
1 Normal line On	Packet	AaBbCcYyZz	
			Apply

Add: Add a new color highlight rule

Config:	Modify the selected rule
Remove:	Delete the selected rule
Clone:	Duplicate the selected rule
▲ ♥:	Change the order where rules are applied. The rules are applied from the bottom to the top of the list.

UCD-5XX User Manual • UCD Console 3.5

#### **Adding Rules**

The color highlight rules are set by transaction type. The content of *Add rules* dialog is dependent on the type of item selected.

💯 Configure search X	Configure search	X Configure search
Type:     Normal Ine       Event:     Internatione       Back:     1       TSDP     HPD       Property     Start       Color=#fffff       textColor=#f000000       font=MS Shell Dig 2:8	Type:     AUX       Event:     On Write       Address in range     Start address: 0x       0     End address       0     End address	Y Type: SDP     SubType: Extension     Ary     Event: Audo Streatoro     Badk: Text Audo Streatoro     SubType = Extension     SubType = Extension     SubType = Extension     Sype = Sope Audo Copy Management     Audo Copy Management     SubType = Extension     Stream Configuration     Conresgener: 0     Font=MSShell Dig 2:8
Apply	Apply	Apply

### **Configure Columns**

In the dialog there are two columns: *Available* and *Active*. An item from the Available list can be included in the Active column by selecting it and clicking on the right arrow [>] in the middle of the two columns.

	Available	^			Active
l	HPD:hpd (60)			1	Source (60)
2	HPD:pwd (60)		>	2	Туре (60)
3	HPD:cd (60)		<	3	Start (146)
ŧ	HPD:+5V (60)			4	Info (458)
5	AUX:address (60)				
5	AUX:length (60)				

The order of Active items can be changed by selecting an item and moving its position in the list with up  $\blacktriangle$  and down  $\blacktriangledown$  arrows.

### **Type Filter**

Type filter dialog lists the types of transactions found in the list and allows the user to select which transaction lines are currently shown.

Case Sensitive	
Columns:	
Source	
🗹 Туре	
🗹 Start	
🗹 Info	
fypes:	
Types DP RX DP RX AUX Sideband DP TX HPD Sideband	
Select all	Apply

#### **Quick Filter**

By entering a DPCD address in the Quick Filter field on top of the transaction line, the user can limit the list to show only the reads or writes to this DPCD address.

# **Event Details**

### HPD

HPD transactions include the following statuses:

HPD Level:	Status of HPD signal: HIGH (Asserted), LOW (De-asserted)
Power Level: (in DP RX)	Status of source device detection: High (DP Tx detected), LOW (DP Tx not detected)
Cable Detect Level: (in DP RX):	Status of cable detection HIGH (Cable connection detected) LOW (Cable connection not detected)

```
Device ID = 01 [DP RX]

HPD Level = HIGH

Power Level = LOW (DP Tx is connected to Rx and has power applied to AUX pull-up resist

Cable Detect Level = HIGH
```

#### **HPD Trace**

HPD De-assert to HPD Assert interval.

```
Interval: 501.525 ms [HPD Assert]
```

### AUX

Transaction list includes the following DP AUX Channel transactions. The parsed transactions panel provides details for each transaction.

RD:	Native AUX Request Transaction for read
WR:	Native AUX Request Transaction for write
I2C RD:	I2C-over-AUX Request Transaction for read
I2C WR:	I2C-over-AUX Request Transaction for write
AUX_ACK:	AUX Reply Transaction (Request accepted)
AUX_NACK:	AUX Reply Transaction (Request not accepted)
AUX_DEFER:	AUX Reply Transaction (Delayed, new request needed)
Sideband REQ:	Sideband down request message (DOWN_REQ_MSG)
Sideband REP:	Sideband down reply message (DOWN_REP_MSG)
HDCP Trace 1.X or HDCP Trace 2.3:	HDCP Transmitter and HDCP Receiver communicate DPCD values over AUX Channel. Transactions are listed as DPCD Address Range Traces where HDCP Port name is indicated.

### Native AUX Transaction Example

Direction	= Source to Sink	ſ
Native AUX Request		
Length	= 6	
Address	= 0x00200	
Address	= 0x00200	
Link/Sink Device Sta		
	tus	
SINK_COUNT [RO]		
0x00200		
Link/Sink Device Sta	<b>t</b> 110	
DEVICE SERVICE IRQ V		
DEVICE_SERVICE_IRQ_V	ECIOR	
0x00201		
Link/Sink Device Sta	tue	
LANEO 1 STATUS [RO]	cus	
x00202		
1400202		
Link/Sink Device Sta	tus	
ANE2 3 STATUS [RO]		
x00203		
1400200		
Link/Sink Device Sta	tus	
LANE ALIGN STATUS UP		
0x00204		
Link/Sink Device Sta	tus	
SINK STATUS [RO]		
0x00205		

Direction Native AUX Reply I2C-over-AUX Reply	=		Source	
Link/Sink Device Status SINK_COUNT [RO] 0x00200 := 0x01 SINK_COUNT = 1 CP_READY = 0				
Link/Sink Device Status DEVICE_SERVICE_IRQ_VECTOR 0x00201 := 0x10 REMOTE_CONTROL_COMMAND_PENDING = 0 AUTOMATED_TEST_REQUEST = 0 CP_IRQ = 0 MCCS_IRQ = 0 DOWN_REP_MSG_RDY = 1 UP_REQ_MSG_RDY = 0 SINK_SPECIFIC_IRQ = 0				
Link/Sink Device Stat LANE0_1_STATUS [R0] 0x00202 := 0x77 LANE0_CR_DONE = 1 LANE0_CHANNEL_EQ_I LANE0_SYMBOL_LOCKE LANE1_CR_DONE = 1 LANE1_CHANNEL_EQ_I LANE1_SYMBOL_LOCKE	DONE 2D = DONE	= 1 2 = 1		

Link/Sink Device Status

### Sideband Message Example

Sideband message header		Sideband message header	
Link_Count_Total	1	Link_Count_Total	1
Link_Count_Remaining	0	Link_Count_Remaining	0
Broadcast_Message	0	Broadcast Message	0
Path_Message	1	Path Message	1
MSG_Body_Length	3	MSG Body Length	7
Start_Of_MT	1	Start Of MT	1
End_Of_MT	1	End Of MT	1
Message_Sequence_No	0	Message_Sequence_No	0
Sideband message validity check		Sideband message validity check	
MSG_Header_CRC	7 [Good]	MSG Header CRC	0[Good]
MSG Body_CRC	95 [Good]	MSG Body CRC	20 [Good]
Header Reserved (Zero) fields	[Good]	Header Reserved (Zero) fields	[Good]
Message Transaction decode		Message Transaction decode	
Request Identifier	0x10[ENUM PATH	Reply Type	ACK
Port Number	8	Request Identifier	0x10[ENUM PATH
-		Port Number	8
		Full Payload Bandwidth Number Available	7737
		Payload Bandwidth Number	7737

### HDCP Trace Example

$E(kpub)_k(m) - DPCD$ Address range trace								
0x69220 - 0x6929F No extended trace decoding available.								
Block dump:								
CD C7 90 67 D8 D9 9A BD 43 56 64 18 52 A5 73 BB								
41 56 E1 FD 82 F8 3A 24 9A BB 0C FD 42 98 3B 17								
D8 E6 07 14 D6 E9 CA 25 19 10 3D 26 38 F6 15 B7								
5E 4F BE 8B 25 B3 CC 62 0E 1D 00 21 41 E2 DD 09								
50 A2 26 E5 8F 9D A0 2F F2 18 AA 98 48 C6 6D 49								
AB D8 92 7E B3 A7 F2 CC 85 55 F7 51 53 31 41 FC								
68 C2 6D BF 06 5A 8B D7 B9 17 87 53 8E 16 DE 74								
00 E3 96 1C 4E A8 81 30 BA 68 B8 3D D6 EE C9 F7								

#### **SDP**

#### DP Secondary-data Packets.

SDP ID: SDP Type: SDP Length: SDP Version:	0x84 0x01B (27)	
	0xl Channel Count 2 0x0 Refer to Stream Header	
Data Byte 2: SS[1-0]: SF[4-2]:		r to Stream Header r to Stream Header
Data Byte 3: CXT[4-0]:	0x00 Refer to CT (Data Byte 1)	
		2 3 4 5 6 FR
LSV[6-3]:	0x0 LFE Playback Level Unkn 0x0 Level Shift Value 0dB 0x0 Down-mix Inhibit Flag Perm	
Body: 01 00 00	48 (PB: 00 84 D7 D1) 00 00 00 00 00 00 00 00 00 00 00 00 00	

#### **VB-ID**

Vertical Blanking ID packets sent in DP stream.

```
Device ID = 00

Stream ID = 00

Data length = 3

VerticalBlanking_Flag = 1[bit 0]

FieldID_Flag = 0[bit 1]

Interlace_Flag = 0[bit 3]

NoVideoStream_Flag = 0[bit 4]

HDCP SYNC DETECT = 0[bit 5]

CompressedStream_Flag = 0[bit 6]

Reserved = 0[bit 7]

Mvid = 0x33

Maud = 0x00
```

#### **MSA**

Main Stream Attributes sent in DP stream.

```
Device ID = 01

Stream ID = 03

Data length = 28

Mvid = 0x2333

Nvid = 0x8000

H-Total = 2200

V-Total = 1125

H-Active = 1920

V-Active = 1080

H-Sync Width = 44

V-Sync Width = 5

H-Sync Start = 192

V-Sync Start = 192

V-Sync Start = 41

MISC0 = 0x20

MISC0.Clock = Asynchronous

MISC1 = 0x00

MISC1.Interlaced Vertical Total Even: Number of lines per interlaced frame (consist

MISC1.Interlaced Vertical Total Even: No 3D stereo video in-band signaling
```

### **VFRAME INFO**

Measured dimensions of the captured video frame

Stream ID	= 0
VFRECORD 1	
VFA TYPE	VIDEO DP MEAS
VFA LENGTH	2
Vtotal	1125
Hactive	1920
Vactive	1080

### PD

USB-C PD communication messages

Header	0x21A1 Data Message
Extended (15)	0
Data Objs(1412)	2
Message ID(119)	0
Port Power Role(8)	Source(0x1)
Spec Rev (76)	v3.0(0x2)
Port Data Role(5)	DFP(0x1)
Message Type(40)	Source_Capabilities(0x01)
Fixed PDO - Source	0x2A01912C
Fixed supply(3130)	0x0
Dual-Role Power(29)	True (0x1)
USB Suspend Supported(28)	False(0x0)
Unconstrained Power(27)	True(0x1)
USB Comm Capable(26)	False(0x0)
Dual-Role Data(25)	True (0x1)
Unchunked Ext Messages Sup(24)	False(0x0)
EPR Mode Capable(23)	False(0x0)
Reserved (22)	0x0
Peak Current(2120)	Peak current equals Ioc(0x0)
Voltage (1910)	5000mV(0x064)
Maximum Current(90)	3000mA(0x12C)
Fixed PDO - Source	0x2A02D12C
Fixed supply(3130)	0x0
Dual-Role Power(29)	True (0x1)
USB Suspend Supported(28)	False(0x0)
Unconstrained Power(27)	True (0x1)
USB Comm Capable(26)	False(0x0)
Dual-Role Data(25)	True (0x1)
Unchunked Ext Messages Sup(24)	False(0x0)
EPR Mode Capable(23)	False(0x0)
Reserved(22)	0x0
Peak Current(2120)	Peak current equals Ioc(0x0)
Voltage(1910)	9000mV(0x0B4)
Maximum Current(90)	3000mA(0x12C)
CRC	0x18F3953D
End of packet	

### LSE

Status of USB-C Low Speed Electrical signals

= 01 = 40 [bytes]
= 40 [bytes]
= 40
= 02:53:20.750.932.000
= 5420 mV [updated]
= 88 mA
= 5337 mV [updated]
= 1680 mV [updated]
= 234 mV
= 2865 mV
= 5337 mA [updated]

### **Link Pattern**

Status of link pattern detected in which lane.

```
Device ID = 01
Lane 0 []
Lane 1 []
Lane 2 []
Lane 3 [TPS1; Detected; ]
```

#### AUX\_BW

Status of captured binary Manchester II codes. The duration of the preamble and postamble will be presented.



The *EDID/DisplayID Editor* main window is divided into three views. The bottom area additionally has command buttons. The top left tree view selection determines the blocks to be edited. The top right view shows data for the currently selected item in the top left view. These values may be edited when the *Editor Mode* checkbox is checked, The bottom right hex view shows data as hex values. The hex values of the currently selected item in the top left view are highlighted. Values can be edited when the *HEX Edit Mode* checkbox is checked.

	: <u>W</u> indow <u>H</u> elp									
x	Event Log Terminal Me	mory Layout								
k	HDCP Video Audio	Link Analyzer Capture	DPCD	SDP I	DSC FEC Source DUT	Testing Cable Info EDID/DisplayID				
-										
DIC	DisplayID									
Add	d Item 💌 Remove Item Filter				Read m	ode:      I2C Read      SBM Read      Virtual Sink #1      Show	Read Only 🗹 Recurse			
Nan	ne		^ Ec	ditor Te:	t EDID					
	VESA				Name	Value	^			
	> Vendor & Product ID				Name		10			
	EDID Structure Version and Re		0	Header		0x00FFFFFFFFFF00				
	> Basic Display Parameters / Fea Color Characteristics	itures	1	Extension	Block Count N	2				
	> Established Timings I		2	2 Checksum		0x1C				
	> Established Timings II		2		acturer Name	UFG				
Manufacturer's Timings     Standard Timings: Identification     Preferred Timing Block			3	Vendor & Pro						
			4	Vendor & Pro		0x4036				
> 18 byte descriptor 2			5	ID Serial N Vendor & Pro		3900643				
	> 18 byte descriptor 3		6	Туре		Week & Year of Manufactured				
	18 byte descriptor 4 CTA				duct ID->Week & Year of Manufacture ( Manufactured	ar. 8				
	Info		7	Vendor & Pro	duct ID->Week & Year of Manufacture (	<sub>27.6</sub> 52				
	> Data block collection		× -	Year of M	anufacture	2014	×			
	Detailed Timinas		~	0	0 01 02 03 04 05 06	07 08 09 0A 0B 0C 0D 0E 0F	^			
Fe	atures CTA v3			00000 🧕	0ffffffffffff	0054c73640e3843b00				
	Name	Value	^ 0			78 3a 5f b1 a2 57 4f a2 28				
1	Max Resolution	15360 x 8640	0			4f810081c08180a9c0				
2	16K Max Frame Rate	60 Hz				d0 00 a0 £0 70 3e 80 30 20				
3	10K Max Frame Rate	60 Hz				1a 56 5e 00 a0 a0 a0 29 50				
						00001a00000£40038				
4	8K Max Frame Rate	60 Hz				20 20 20 20 20 00 00 00 fc 30 20 44 50 31 0a 20 02 1c				
5	4K Max Frame Rate	60 Hz				00 29 0f 7f 07 15 06 55 3d				
6	2K Max Frame Rate	60 Hz				00 00 00 00 00 00 00 00 00 00				
7	HDR Static	Disabled								
							~			
n	LIDB Domentie	Disabled				and a president contraction of the second seco				
	Main Features			Editor Mode	HEX Edit Mode		Apply			

Add Item:	Add a new EDID or DisplayID block. Available when in <i>Editor Mode</i> exclusivly.
Remove Item:	Delete the selected EDID or DisplayID block. Available when in <i>Editor Mode</i> exclusivly.
Filter:	Show only items having indicated the string in the field name
Read mode:	Select EDID data reading mode: I2C: local EDID read using I2C protocol SBM (MST mode only): virtual channels read with SBM protocol
Show Read Only:	When selected, automatically created fields are also shown.
Recurse:	When selected, the whole logical tree of the selected item is parsed in the right hand side list.

Note:

The buttons at the bottom of the dialog differ based on role: Analyser (*Read fromTE* and *Write to TE*) or Generator (*Download from Sink* and *Upload to Sink*).

Read from TE (Analyzer):	Read device local EDID/DisplayID blocks into editor.					
Write to TE (Analyzer):	Write editor data to device local EDID/DisplayID blocks.					
Download from Sink (Generator):	Read EDID/DisplayID blocks from connected sink device into editor.					
Upload to Sink (Generator):	Write editor EDID/DisplayID blocks to connected sink device See note below.					
Editor Mode:	Enable editing EDID/DispslayID content in top right view. For example, for testing purposes, it's possible to load invalid EDID/DisplayID data and write it to TE without modifications. Once <i>Editor Mode</i> is enabled, the validator corrects errors such as invalid checksums. Top right view name-value pairs can be edited.					
HEX Edit Mode:	Enable editing EDID/DisplayID content in bottom right HEX view. When enabled, HEX values may be edited. Click <i>Apply</i> to validate changes and update other views.					
Save As:	Save the current editor data to disk in various formats: binary, hex, ecd or txt.					
Load:	Load EDID/DisplayID data from disk. Same formats as above available.					

The *Main Features* view *Features* tab view gives an overview of items of common interest. For example, whether the sink is capable of HDR, or Dolby Vision, etc.

		Name	Value			
	Max Res	olution	10240 x 4320			
	10K Max	k Frame Rate	60 Hz			
	8K Max	Frame Rate	60 Hz			
	4K Max Frame Rate		145 Hz			
	2K Max Frame Rate		145 Hz			
	HDR Static		Disabled			
	HDR Dynamic		Disabled			
	HDR10+		Disabled			
	Dolby Vision		Disabled			
)	SBTM		Disabled			

The *Main Features* view *CTA vx* tab (avalable only in EDID tab not DisplayID tab) allows enabling/disabling features. You enable/disable a feature by double clicking the Value field with *Editor Mode* enabled. When enabling, new highlighted hex values will be added and highlighted in the lower right Hex view. New node data will also appear under the CTA node in the top right tree view.

F	eatures	CTA v3		
		Nai	ne	Value
1	HDR Stati			Enabled
2	HDR Dyn Data block o			Disabled
3	HDR10+ Data block c	ollection		Disabled
4	Dolby Vis Data block o			Disabled
5	SBTM Data block o	ollection		Disabled

# **EDID Editor Features**

A practically unlimited number of extension blocks may exist in a single collection. The number of blocks is limited by VESA Specifications and possibly by available system resources. Most EDID/DisplayID blocks contain a structure that is very similar to a tree structure. The Editor decodes each block into a tree view of the block. The tree view then contains all values within the data block. The contents can then be easily browsed. The Editor has a support for automatic variables, such as the block checksum. When the user changes a value in a block, the checksum will be updated. The automatic variables are read only. A log print will be made when an automatic variable is updated by the editor.

# **Editing Tips**

Editing is very straightforward. There are some special cases where the user needs to know how to accomplish certain types of tasks.

- Double-click the property field to edit.
- Red values in the HEX view indicate a changed value.
- Enter key will apply text edit values and combo box selections.
- In CTA-861 blocks, you can add and remove 18-byte descriptors and CEA data blocks by setting the values "18-byte Descriptors in this block" and "CEA Data block count".
- Enter hex values with prefixes "**0x**" or "**\$**". No prefix represents a decimal value.
- You can always enter values as hexadecimal or decimal, regardless of how the value is presented.
- Floating point values must be given with period "." as decimal separator, even if your localization setting defines decimal separator as comma (or other).
- Remember to click *Set* after changing a bit-value presented as a single checkbox if you want the new value applied.

Note: The Editor does not have an *Undo* function. Therefore, it is recommended that you back up unedited data to a file before editing.

# 10. PACKET EDITOR

#### Packet Editor enables creation and editing metadata packets.

Unigraf Packet Editor														-	(		×
Protocol Display Port V Type Audio V Ne	w	Sav	e As.		Lo	oad											
Add Item - Remove Item Filter	]									] Sho	ow rea	ad or	nly pr	ope	ties	Re	ecurse
Name	1			N	lame								Value				^
✓ Audio InfoFrame	0	Audio Cl	nann	el Cou	unt				2 ch	anne	els						
Packet Header ✓ Packet Data	1	Audion [	Codi	ng Ty	pe/S	Stream	m En	coding	Refe	er to	Stream	m He	eader				
Channel allocation (0 - 49)	2	Sample S	ize						Refe	er to	Strea	m He	eader				
	3	Samplin	g Free	quenc	y				Refe	er to	Strea	m He	eader				
		1 Туре							Cha	nnel	alloc	atior	n (0 -	49)			
	:	CA Channel alk	cation	(0 - 49	IJ				0								~
	Γ		00	01	02	03	04	05 06	07	08	09	AO	0B	oc	00 0	E 0	F
		000000	00	84	1b	48	01(	00 00	00	00	00	00	00	00	00 0	0 0	0
		000010	00	00	00	00	00	00 00	00	00	00	00	00	00	00 0	0 0	0
		000020	00	00	00	00											
		lueven															
	JL	HEX Edit	Mod	le									Ар	ply			

The types of supported packets are:

- Audio InfoFrame (Audio)
- AVI InfoFrame (AVI)
- Custom InfoFrame (Custom) (HDMI)
- Custom Packet (custom) (DP)
- DR&M InfoFrame (DR&M) (HDMI)
- DR&M Packet (DR&M) (DP)
- EMP-VRR (EMP-VRR)
- GCP InfoFrame (GCP)
- SPD InfoFrame (SPD)
- Vendor-Specific InfoFrame (VS) (HDMI)\*
- Vendor-Specific SDP (VS) (DP)\*

\*) Please select from available VS packet types in field "4: Type" in the packet editor.

# 11. PATTERN EDITOR

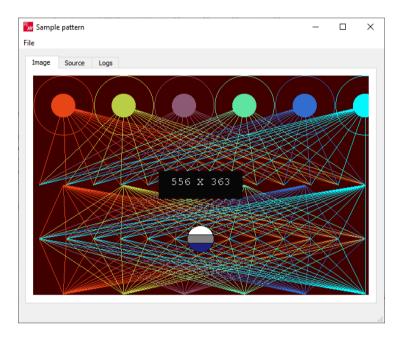
Pattern Editor is a tool for editing and debugging Unigraf Custom VTP Pattern scripts.

Please refer to APPENDIX F: VTP PATTERN LANGUAGE later in this document for description of the VTP Pattern Language syntax.

Pattern Editor consists of three tabs:

### Image Tab

Monitoring the rendering of the VTP pattern script.



### **Source Tab**

Tool for editing VTP Pattern Language script. Click Apply to render the code in the resolution of the preview image in *Image* tab.

Sample pattern e						_	
Image Source	Logs						
xml version="1.0</td <td>"encoding="</td> <td>ISO-8859-1"?&gt;<vf< td=""><td>attern Protected="</td><td>true"&gt;<description></description></td><td>&gt;Sample p</td><td>attern<!--</td--><td>٨</td></td></vf<></td>	"encoding="	ISO-8859-1"?> <vf< td=""><td>attern Protected="</td><td>true"&gt;<description></description></td><td>&gt;Sample p</td><td>attern<!--</td--><td>٨</td></td></vf<>	attern Protected="	true"> <description></description>	>Sample p	attern </td <td>٨</td>	٨
Description> <script< td=""><td>&gt;</td><td></td><td></td><td></td><td></td><td></td><td></td></script<>	>						
ABSOLUTE							
COLORRGB 256 0 0							
BOX 0 0 MAXX MAXY	r i i i i i i i i i i i i i i i i i i i						
SET H VS/2							
SET H2 VS/4*3 REPEAT X 50 MAXX	100						
SET C 1023*X/MAXX							
; Note: oversaturate							
COLORRGB 1023-C							
CIRCLE X 49 49	5.00						
FCIRCLE X 49 20							
REPEAT A 10 MAXX	45						
LINE X 50 A H							
LINE X H A H2							
LINE X VS A H2							
END							
END							
SET Z 100/3+5*2							
COLORRGB 30 30 3							
BOX MAXX*6/16 MA		(X*10/16 MAXY*9/	16				
COLORRGB 1023 10							
TEXTPOS MAXX/2 M ALIGN C	AXY/2						U
ALIGNIC							~
			Apply				

## Logs Tab

Log of the pattern code parsing indicating the values assigned to logical variables and the actual parameter values used for render instructions.

Sample pattern	-	>
:		
Image Source Logs		
		$\sim$
RGB 16384 0 0		
BOX 0 0 556 363		
h <- vs/2 = 181		
h2 <- vs/4*3 = 270		
c <- 1023*x/maxx = 92		
RGB 59584 17664 5888		
CIRCLE 50 49 49		
CIRCLE 50 49 20		
LINE 50 50 10 181		
LINE 50 181 10 270		
LINE 50 362 10 270		
LINE 50 50 55 181		
LINE 50 181 55 270		
LINE 50 362 55 270		
LINE 50 50 100 181		
LINE 50 181 100 270		
LINE 50 362 100 270		
LINE 50 50 145 181		
LINE 50 181 145 270		
LINE 50 362 145 270		
LINE 50 50 190 181		
LINE 50 181 190 270		
LINE 50 362 190 270		
LINE 50 50 235 181		
LINE 50 181 235 270		
LINE 50 362 235 270		
		$\mathbf{v}$

## Saving and Recalling the Script

In File pull-down menu the user can save his work.

Open:	Open a VTP language script from PC
Save Script:	Save the script currently in Source tab to PC
Save Image:	Save a rendered pattern in PNG, BMP, JPG or PPM format
Select Save Resolution:	Select from six common resolutions the size in which the pattern script will be rendered when saved.

# 12. IMAGE CONVERTER

Image Converter is a tool for converting images from one color format to another. This kind of conversion is typically needed when creating YCbCr test images from RGB bitmaps. Open the image converter from UCD Console's menu **Tools > Image Converter**.

Course impress	About Destination ima		
Source images	Colorspace: Colorimetry: Sampling: Bit depth:	YCbCr           TTU-R 8T.601           4:4:4           8           3           Change resolution           640x480	> > > >

Click **Upload files** to load the Source image.

IICL Converter			3 <u></u>		×
	About				
Source images		Destination image	es		
Test image	and the second	Colorspace:	YCbCr		~
	mark all and the	Colorimetry:	ITU-R BT.601		~
	and the second	Sampling:	4:4:4		~
	the state of the second second	Bit depth:	8		~
	A STATE OF A	Align to MSB	Change resoluti	ion	
		Resolution:	640x480		
Upload files					
human and h				Conver	All 🔻

Colorspace	YCbCr, RGB
Colorimetry	ITU-R BT.601, ITU-R BT.709, ITU-R BT2020
Sampling	4:4:4, 4:2:2, 4:2:0
Bit depth	8, 10, 12, 16
Align to MSB	Store binary data aligned to the Most Significant Bit (MSB). When this is left unchecked the binary data is aligned to the Least Significant Bit (LSB).
Change resolution	Select a resolution for the destination image from the pre-defined list
Covert All	Convert all uploaded images to destination format and save them in the same folder as the source images.
Covert All and save to the custom folder	Convert all uploaded images to destination format and save to the selected folder.

File name for the destination image is of form:

Test image[1920x1080\_yuv444\_8bpc\_BT601\_Packed\_YCbCr\_LSB]

# APPENDIX A: PRODUCT SPECIFICATION

# UCD-500

Input	DisplayPort: DP 2.0/2.1 capable (DP In) (10 Gbps link rate maximum) USB-C: PD 3.0 compliant (USB-C In) (20 Gbps link rate maximum)
Output	DisplayPort: DP 2.1 compliant (DP Out) (10 Gbps link rate maximum) USB-C: PD 3.0 compliant (USB-C Out) (20 Gbps link rate maximum)
Max video mode	7680 × 4320 p60 input and output. 15360 × 8640 p60 input and output with DSC.
Audio	Source and receive LPCM, 2 – 8 channels, 44.1 to 192 kHz. Source compressed formats using TSI
Content Protection	HDCP 2.3 supported
DSC Capability	DSC sink, with off-line decompression DSC source using pre-compressed content
Additional features	Playback function
Computer interface	USB 3.0
Operating System	Debian 11.0 or higher. Ubuntu 20.04.4 LTS or higher. MacOS Big Sur 11.7.10 or higher. Windows 10 10.0.19045 or higher.
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +24 Vdc output)
Environmental	Operating temperature: 15 to 35 deg C Storage temperature: 0 to 50 deg C Humidity 30% to 70% RH, non-condensing
Mechanical Size	331 mm x 197 mm x 66 mm
Weight	1.9kg

# UCD-500 Gen2

Input	DisplayPort: DP 2.1 compliant (DP In) (20 Gbps link rate) USB-C: PD 3.0 compliant (USB-C In) (20 Gbps link rate)
Output	DisplayPort: DP 2.1 compliant (DP Out) (20 Gbps link rate) USB-C: PD 3.0 compliant (USB-C Out) (20 Gbps link rate)
Max video mode	7680 × 4320 p60 input and output. 15360 × 8640 p60 input and output with DSC
Audio	Source and receive LPCM, 2 – 8 channels, 44.1 to 192 kHz. Source compressed formats using TSI
Content Protection	HDCP 2.3 supported
DSC Capability	DSC sink, with off-line decompression DSC source using pre-compressed content
Additional features	Playback function
Computer interface	USB 3.0
Operating System	Debian 11.0 or higher. Ubuntu 20.04.4 LTS or higher. MacOS Big Sur 11.7.10 or higher. Windows 10 10.0.19045 or higher.
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +24 Vdc output)
Environmental	Operating temperature: 15 to 35 deg C Storage temperature: 0 to 50 deg C Humidity 30% to 70% RH, non-condensing
Mechanical Size	331 mm x 197 mm x 66 mm

Weight

1.9kg

# APPENDIX B: PRODUCT FEATURES

Input / Output Role	UCD-5XX Default	DSC Decoder	DP 1,4a Link Analyzer	Panel Replay	eDP Support	DP 1.4a LL CTS	DP 1.4a DSC CTS	DisplayID / EDID CTS	Adaptive-Sync CTS	HDCP 2.3 CTS Source DUT	HDCP 2.3 CTS Sink, Source & Repeater DUT	TSI Basic
DP Reference Sink (UCD-400 and UCD-424)												
Video status, preview and saving	•											
Buffered capture	•											
Audio monitoring, graphical preview and saving	•											
Link status	•											
Link control	•											
HPD status and control	•											
Fast Link Training (Link Training without AUX Transaction)	•											
MST Feature (up to 4 streams)	•											
FEC Feature	•											
DSC Decoder, DSC Control		•					•					
Adaptive-Sync Feature**	•											
DPCD editor	•											
Monitor InfoFrame Status (SDP)	•											
EDID read and write	•											
EDID / DisplayID Editor	•											
HDCP 1.3 status and control*	•											
HDCP 2.3 status and control	•											
Event Log, AUX Analyzer	•											
Source DUT Testing (Link and CRC test)	•											
Main Link Analyzer			•									
eDP Reference Sink												
eDP Link Training & Link Rate Support					•							
Alternate Scrambler Seed Reset (ASSR)	•											
Ability to Ignore Certain MSA Data Fields	•											
OUI Support	•											
GUID Register Support	•											
Source Device Detection by way of the AUX_CH	•											
Panel Replay, PSR, ALPM												
Panel Replay				•								
PSR1					•							
PSR2					•							
Early Transport				•	•							
Selective Update				•	•							
AUX-less ALPM				•	•							

AUX-wake ALPM			•							
DP 1.4 / 2.1 Link Layer CTS for testing Source DUT										
DP 1.4a LL, Audio, FEC CTS				•						
DP 1.4a DSC CTS for testing Source DUT					•					
DisplayID / EDID CTS for testing Source DUT						•				
Adaptive-Sync CTS for testing Source DUT							•			
HDCP 2.3 CTS for testing DP Source DUT								•	•	
HDCP 2.3 CTS for testing DP Repeater DUT									•	

\* HDCP 1.3 is currently not supported. It will be supported in later 3.X release package.

\*\* Adaptive-Sync feature is currently limited to Stream 0. Adaptive-Sync CTS is currently limited to 8b/10b link coding and SST.

Input / Output Role	UCD-5XX Default	DSC Encoder	LTTPR	Panel Replay	eDP Support	DP 1.4a LL CTS	DP 1.4a DSC CTS	DisplayID / EDID CTS	Adaptive-Sync CTS	HDCP 2.3 CTS Sink DUT	HDCP 2.3 CTS Sink, Source and Repeater DUT	TSI Basic
DP Reference Source												
Video pattern generator (fixed patterns and timings)	•											
Custom video patterns and timings	•											
Audio generator	•											
Playback	•											
Link status	•											
Link control	•											
HPD status	•											
EDID read and write	•											
EDID / DisplayID Editor	•											
Fast Link Training (Link Training without AUX Transaction)	•											
MST Feature (up to 2 streams)	•											
MST Feature (up to 4 streams)	•											
FEC Feature	•											
DSC Encoder		•					•					
Adaptive-Sync Feature	•											
DPCD editor	•											
LTTPR Feature			•									
HDCP 1.3 status and control*	•											
HDCP 2.3 status and control	•											
Event Log, AUX Analyzer	•											
eDP Reference Source												
eDP Link Training & Link Rate Support					•							
Alternate Scrambler Seed Reset (ASSR)	•											
OUI Support	•											
GUID Register Support	•											
Live Frame Mode	•											
Panel Replay, PSR, ALPM												
Panel Replay				•								
PSR1					•							
PSR2					•							
Early Transport				•	•							
Selective Update				•	•							
AUX-less ALPM				•	•							
AUX-wake ALPM					•							
DP 1.4 / 2.1 Link Layer CTS for testing Sink DUT												
DP 1.4a LL, Audio and FEC CTS for testing Sink DUT **						•						
DP 1.4a DSC CTS for testing Sink DUT**							•					

DisplayID / EDID CTS for testing Sink DUT**				•				
Adaptive-Sync CTS for testing Sink DUT**					•			
HDCP 2.3 CTS for testing DP Sink DUT**						•	•	
HDCP 2.3 CTS for testing DP Repeater DUT**							•	

\* HDCP 1.3 is currently not supported. It will be supported in later 3.X release package.

\*\* Adaptive-Sync feature is currently limited to Stream 0. Adaptive-Sync CTS is currently limited to 8b/10b link coding and SST.

# **UCD-5XX Product Options**

Hardware Test Tool	P/N
UCD-500 Gen2	066710
UCD-500 Upgrade to UCD-500 Gen2	066705
HDCP 2.3 CTS Testing	
HDCP 2.3 CTS for testing Source DUT on DP	MT6634
HDCP 2.3 CTS for testing Sink DUT on DP	MT6636
HDCP 2.3 CTS for testing Repeater DUT on DP	MT6638
DP 2.1 CTS Testing	
DP 2.1 LL CTS for testing Source DUT	MT6662
DP 2.1 LL CTS for testing Sink DUT	MT6660
DP 2.1 DSC CTS for testing Source DUT	MT6656
DP 2.1 DSC CTS for testing Sink DUT	MT6657
DP 1.4a CTS Testing	
DP 1.4a LL CTS for testing Source DUT	MT6637
DP 1.4a LL CTS for testing Sink DUT	MT6635
DP 1.4a DSC CTS for testing Source DUT	MT6642
DP 1.4a DSC CTS for testing Sink DUT	MT6643
DisplayID / EDID CTS testing	
DP 2.1 DisplayID / EDID CTS for testing Source DUT	MT6646
DP 2.1 DisplayID / EDID CTS for testing Sink DUT	MT6647
Adaptive Sync CTS Testing	
DP 2.1 Adaptive-Sync CTS for testing Source DUT	MT6648
DP 2.1 Adaptive-Sync CTS for testing Sink DUT	MT6649
LTTPR CTS Testing	
DP 2.1 LTTPR CTS for testing Source DUT	MT6680
DP 2.1 LTTPR CTS for testing Sink DUT	MT6679
DP 2.1 LTTPR CTS for testing LTTPR Device	MT6682
Link Analyzer	
DP 2.1 Link Analyzer	MT6682
Panel Replay and eDP support	
DP 2.1 Panel Replay support for testing Sink & Source DUT	MT6683
eDP support for testing Sink & Source DUT	MT6684

# **APPENDIX C: PREDEFINED TIMINGS**

Description*	HA	VA	HT	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock
CVT 640 × 480 @ 60 Hz	640	480	800	525	144	35	96	2	60	(MHz) 25,20
CTA 640 × 480 @ 60 Hz (VIC 1)	640	480	800	525	144	35	96	2	60	25,20
CTA 720 × 480 @ 60 Hz (VIC 2)	720	480	858	525	122	36	62	6	60	27,03
CTA 720 × 480 @ 60 Hz (VIC 2)	720	480	858	525	122	36	62	6	60	27,00
CTA 720 × 576 @ 50 Hz (VIC 3)	720	576	864	625	132	44	64	5	50	27,00
CTA 720 × 576 @ 50 Hz (VIC 17)	720	576	864	625	132	44	64	5	50	27,00
CTA 720 × 576 @ 30 Hz (VIC 10)	720	576	864	625	132	44	64	5	100	54,00
CTA 720 × 576 @ 100 Hz (VIC 42)	720	576	864	625	132	44	64	5	100	54,00
CTA 720 × 370 @ 100 Hz (VIC 43)	720	480	858	525	122	36	62	6	120	54,00
	720	480	858	525	122	36	62	-	120	
CTA 720 × 480 @ 120 Hz (VIC 48)						44		6		54,05
CTA 720 × 576 @ 200 Hz (VIC 52)	720	576	864	625	132		64	5 5	200	108,00
CTA 720 × 576 @ 200 Hz (VIC 53)	720	576	864	625	132	44	64		200	108,00
CTA 720 × 480 @ 240 Hz (VIC 56)	720	480	858	525	122	36	62	6	240	108,00
CTA 720 × 480 @ 240 Hz (VIC 57)	720	480	858	525	122	36	62	6	240	108,00
DMT 800 × 600 @ 60 Hz (ID 9)	800	600	1056	628	216	27	128	4	60	39,79
DMT 848 × 480 @ 60 Hz (ID 14)	848	480	1088	517	224	31	112	8	60	33,75
DMT 1024 × 768 @ 60 Hz (ID 16)	1024	768	1344	806	296	35	136	6	60	65,00
CTA 1280 × 720 @ 50 Hz (VIC 19)	1280	720	1980	750	260	25	40	5	50	74,25
CTA 1280 × 720 @ 100 Hz (VIC 41)	1280	720	1980	750	260	25	40	5	100	148,50
CTA 1280 × 720 @ 24 Hz (VIC 60)	1280	720	3300	750	260	25	40	5	24	59,40
CTA 1280 × 720 @ 25 Hz (VIC 61)	1280	720	3960	750	260	25	40	5	25	74,25
CTA 1280 × 720 @ 30 Hz (VIC 62)	1280	720	3300	750	260	25	40	5	30	74,25
CTA 1280 × 720 @ 24 Hz (VIC 65)	1280	720	3300	750	260	25	40	5	24	59,40
CTA 1280 × 720 @ 25 Hz (VIC 66)	1280	720	3960	750	260	25	40	5	25	74,25
CTA 1280 × 720 @ 30 Hz (VIC 67)	1280	720	3300	750	260	25	40	5	30	74,25
CTA 1280 × 720 @ 50 Hz (VIC 68)	1280	720	1980	750	260	25	40	5	50	74,25
CTA 1280 × 720 @ 60 Hz (VIC 69)	1280	720	1650	750	260	25	40	5	60	74,25
CTA 1280 × 720 @ 100 Hz (VIC 70)	1280	720	1980	750	260	25	40	5	100	148,50
CTA 1280 × 720 @ 120 Hz (VIC 71)	1280	720	1650	750	260	25	40	5	120	148,50
CTA 1280 × 720 @ 48 Hz (VIC 108)	1280	720	2500	750	260	25	40	5	48	90,00
CTA 1280 × 720 @ 48 Hz (VIC 109)	1280	720	2500	750	260	25	40	5	48	90,00
CTA 1280 × 720 @ 60 Hz (VIC 4)	1280	720	1650	750	260	25	40	5	60	74,25
CTA 1280 × 720 @ 120 Hz (VIC 47)	1280	720	1650	750	260	25	40	5	120	148,50
CVT 1280 × 768 @ 60 Hz [RB1]	1280	768	1440	790	112	19	32	7	60	68,26
DMT 1280 × 768 @ 60 Hz (ID 23)	1280	768	1664	798	320	27	128	7	60	79,67
DMT 1280 × 800 @ 60 Hz (ID 27)	1280	800	1440	823	112	20	32	6	60	71,11
DMT 1280 × 800 @ 60 Hz (ID 28)	1280	800	1680	831	328	28	128	6	60	83,76
DMT 1280 × 960 @ 60 Hz (ID 32)	1280	960	1800	1000	424	39	112	3	60	108,00
DMT 1280 × 1024 @ 60 Hz (ID 35)	1280	1024	1688	1066	360	41	112	3	60	107,96
DMT 1360 × 768 @ 60 Hz (ID 39)	1360	768	1792	795	368	24	112	6	60	85,48
DMT 1400 × 1050 @ 60 Hz (ID 41)	1400	1050	1560	1080	112	27	32	4	60	101,09
DMT 1400 × 1050 @ 60 Hz (ID 42)	1400	1050	1864	1089	376	36	144	4	60	121,79

\*) CVT: Coordinated Video Timings (CVT v2.0) DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

Description*	HA	VA	HT	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (MHz)
CTA 1440 × 240 @ 60 Hz (VIC 8)	1440	240	1716	263	238	18	124	3	60	
CTA 1440 × 240 @ 60 Hz (VIC 9)	1440	240	1716	263	238	18	124	3	60	27,00 27,00
CTA 1440 × 480 @ 60 Hz (VIC 3)	1440	480	1716	525	230	36	124	6	60	54,00
CTA 1440 × 480 @ 60 Hz (VIC 14)	1440	480	1716	525	244	36	124	6	60	54,00
CTA 1440 × 576 @ 50 Hz (VIC 22)	1440	576	1728	625	264	22	124	3	50	54,00
CTA 1440 × 288 @ 50 Hz (VIC 23)	1440	288	1728	314	264	22	126	3	50	27,00
CTA 1440 × 288 @ 50 Hz (VIC 24)	1440	288	1728	314	264	22	126	3	50	27,00
CTA 1440 × 576 @ 50 Hz (VIC 29)	1440	576	1728	625	264	44	128	5	50	54,00
CTA 1440 × 576 @ 50 Hz (VIC 30)	1440	576	1728	625	264	44	128	5	50	54,00
CVT 1600 × 1200 @ 60 Hz [RB1]	1600	1200	1760	1235	112	32	32	4	60	130,42
DMT 1600 × 1200 @ 60 Hz (ID 51)	1600	1200	2160	1250	496	49	192	3	60	162,00
CTA 1680 × 720 @ 24 Hz (VIC 79)	1680	720	3300	750	260	25	40	5	24	59,40
CTA 1680 × 720 @ 25 Hz (VIC 80)	1680	720	3168	750	260	25	40	5	25	59,40
CTA 1680 × 720 @ 20 Hz (VIC 80)	1680	720	2640	750	260	25	40	5	30	59,40
CTA 1680 × 720 @ 50 Hz (VIC 82)	1680	720	2200	750	260	25	40	5	50	82,50
CTA 1680 × 720 @ 100 Hz (VIC 84)	1680	720	2000	825	260	100	40	5	100	165,00
CTA 1680 × 720 @ 48 Hz (VIC 110)	1680	720	2750	750	260	25	40	5	48	99,00
CTA 1680 × 720 @ 60 Hz (VIC 83)	1680	720	2200	750	260	25	40	5	60	99,00
CTA 1680 × 720 @ 120 Hz (VIC 85)	1680	720	2000	825	260	100	40	5	120	198,00
DMT 1680 × 1050 @ 60 Hz (ID 57)	1680	1050	1840	1080	112	27	32	6	60	119,23
DMT 1680 × 1050 @ 60 Hz (ID 58)	1680	1050	2240	1089	456	36	176	6	60	146,36
DMT 1792 × 1344 @ 60 Hz (ID 62)	1792	1344	2448	1394	528	49	200	3	60	204,75
DMT 1856 × 1392 @ 60 Hz (ID 65)	1856	1392	2528	1439	576	46	224	3	60	218,27
CTA 1920 × 1080 @ 50 Hz (VIC 31)	1920	1080	2640	1125	192	41	44	5	50	148,50
CTA 1920 × 1080 @ 24 Hz (VIC 32)	1920	1080	2750	1125	192	41	44	5	24	74,25
CTA 1920 × 1080 @ 25 Hz (VIC 33)	1920	1080	2640	1125	192	41	44	5	25	74,25
CTA 1920 × 1080 @ 100 Hz (VIC 64)	1920	1080	2640	1125	192	41	44	5	100	297,00
CTA 1920 × 1080 @ 24 Hz (VIC 72)	1920	1080	2750	1125	192	41	44	5	24	74,25
CTA 1920 × 1080 @ 25 Hz (VIC 73)	1920	1080	2640	1125	192	41	44	5	25	74,25
CTA 1920 × 1080 @ 30 Hz (VIC 74)	1920	1080	2200	1125	192	41	44	5	30	74,25
CTA 1920 × 1080 @ 50 Hz (VIC 75)	1920	1080	2640	1125	192	41	44	5	50	148,50
CTA 1920 × 1080 @ 60 Hz (VIC 76)	1920	1080	2200	1125	192	41	44	5	60	148,50
CTA 1920 × 1080 @ 100 Hz (VIC 77)	1920	1080	2640	1125	192	41	44	5	100	297,00
CTA 1920 × 1080 @ 120 Hz (VIC 78)	1920	1080	2200	1125	192	41	44	5	120	297,00
CVT 1920 × 1080 @ 30 Hz [RB1]	1920	1080	2080	1096	112	13	32	5	30	68,39
CVT 1920 × 1080 @ 30 Hz [RB2]	1920	1080	2000	1096	72	14	32	8	30	65,76
CVT 1920 × 1080 @ 144 Hz [RB3]	1920	1080	2080	1157	152	14	32	8	144	346,66
CVT 1920 × 1080 @ 200 Hz [RB3]	1920	1080	2080	1190	152	14	32	8	200	495,21
CTA 1920 × 1080 @ 30 Hz (VIC 34)	1920	1080	2200	1125	192	41	44	5	30	74,25
CVT 1920 × 1080 @ 60 Hz [RB1]	1920	1080	2080	1111	112	28	32	5	60	138,65
CVT 1920 × 1080 @ 60 Hz	1920	1080	2000	1111	72	14	32	8	60	133,32
DMT 1920 × 1080 @ 60 Hz (ID 82)	1920	1080	2200	1125	192	41	44	5	60	148,50
CTA 1920 × 1080 @ 60 Hz (VIC 16)	1920	1080	2200	1125	192	41	44	5	60	148,50
CVT 1920 × 1080 @ 120 Hz [RB1]	1920	1080	2080	1144	112	61	32	5	120	285,54
CVT 1920 × 1080 @ 120 Hz [RB2]	1920	1080	2000	1144	72	14	32	8	120	274,56
CTA 1920 × 1080 @ 120 Hz (VIC 63)	1920	1080	2200	1125	192	41	44	5	120	297,00

\*) CVT: Coordinated Video Timings (CVT v2.0)

DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

Description*	НА	VA	НТ	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock
	100									(MHz)
CTA 1920 × 1080 @ 48 Hz (VIC 111)	1920	1080	2750	1125	192	41	44	5	48	148,50
CTA 1920 × 1080 @ 48 Hz (VIC 112)	1920	1080	2750	1125	192	41	44	5	48	148,50
DMT 1920 × 1200 @ 60 Hz (ID 69)	1920	1200	2592	1245	536	42	200	6	60	193,62
DMT 1920 × 1440 @ 60 Hz (ID 73)	1920	1440	2600	1500	552	59	208	3	60	234,00
CVT 2048 × 1536 @ 60 Hz [RB1]	2048	1536	2208	1580	112	41	32	4	60	209,32
CTA 2560 × 1080 @ 24 Hz (VIC 86)	2560	1080	3750	1100	192	16	44	5	24	99,00
CTA 2560 × 1080 @ 25 Hz (VIC 87)	2560	1080	3200	1125	192	41	44	5	25	90,00
CTA 2560 × 1080 @ 30 Hz (VIC 88)	2560	1080	3520	1125	192	41	44	5	30	118,80
CTA 2560 × 1080 @ 50 Hz (VIC 89)	2560	1080	3300	1125	192	41	44	5	50	185,63
CTA 2560 × 1080 @ 100 Hz (VIC 91)	2560	1080	2970	1250	192	166	44	5	100	371,25
CVT 2560 × 1440 @ 60 Hz [RB2]	2560	1440	2640	1481	72	14	32	8	60	234,59
CVT 2560 × 1440 @ 60 Hz [RB1]	2560	1440	2720	1481	112	38	32	5	60	241,70
CVT 2560 × 1440 @ 144 Hz [RB3]	2560	1440	2720	1543	152	14	32	8	144	604,57
CVT 2560 × 1440 @ 200 Hz [RB3]	2560	1440	2720	1586	152	14	32	8	200	863,09
CTA 2560 × 1080 @ 48 Hz (VIC 113)	2560	1080	3750	1100	192	16	44	5	48	198,00
CVT 2560 × 1080 @ 60 Hz	2560	1080	3424	1120	704	37	272	10	60	230,09
CVT 2560 × 1080 @ 60 Hz [RB1]	2560	1080	2720	1111	112	28	32	10	60	181,32
CVT 2560 × 1080 @ 144 Hz [RB3]	2560	1080	2720	1157	152	14	32	8	144	453,33
CVT 2560 × 1080 @ 200 Hz [RB3]	2560	1080	2720	1190	152	14	32	8	200	647,59
CTA 2560 × 1080 @ 60 Hz (VIC 90)	2560	1080	3000	1100	192	16	44	5	60	198,00
CTA 2560 × 1080 @ 120 Hz (VIC 92)	2560	1080	3300	1250	192	16	44	5	120	495,00
DMT 2560 × 1600 @ 60 Hz (ID 77)	2560	1600	3504	1658	752	55	280	6	60	348,58
DMT 2560 × 1600 @ 60 Hz (ID 76)	2560	1600	2720	1646	112	43	32	6	60	268,63
CTA 2880 × 240 @ 60 Hz (VIC 12)	2880	240	3432	263	476	18	248	3	60	54,00
CTA 2880 × 240 @ 60 Hz (VIC 13)	2880	240	3432	263	476	18	248	3	60	54,00
CTA 2880 × 288 @ 50 Hz (VIC 27)	2880	288	3456	314	528	22	252	3	50	54,00
CTA 2880 × 288 @ 50 Hz (VIC 28)	2880	288	3456	314	528	22	252	3	50	54,00
CTA 2880 × 480 @ 60 Hz (VIC 35)	2880	480	3432	525	488	36	248	6	60	108,00
CTA 2880 × 480 @ 60 Hz (VIC 36)	2880	480	3432	525	488	36	248	6	60	108,00
CTA 2880 × 576 @ 50 Hz (VIC 37)	2880	576	3456	625	528	44	256	5	50	108,00
CTA 2880 × 576 @ 50 Hz (VIC 38)	2880	576	3456	625	528	44	256	5	50	108,00
2880 × 1440 @ 60 Hz	2880	1440	2976	1456	48	8	8	1	60	259,98
CVT 3840 × 2160 @ 30 Hz [RB1]	3840	2160	4000	2191	112	28	32	5	30	262,92
CVT 3840 × 2160 @ 30 Hz [RB2]	3840	2160	3920	2191	72	14	32	8	30	257,66
CVT 3840 × 2160 @ 144 Hz [RB3]	3840	2160	4000	2314	152	14	32	8	144	1333,33
CVT 3840 × 2160 @ 60 Hz [RB1]	3840	2160	4000	2222	112	59	32	5	60	533,28
CVT 3840 × 2160 @ 60 Hz [RB2]	3840	2160	3920	2222	72	14	32	8	60	522,61
CVT 3840 × 2160 @ 60 Hz [RB3]	3840	2160	4000	2222	152	14	32	8	60	533,47
CTA 3840 × 2160 @ 60 Hz (VIC 97)	3840	2160	4400	2250	384	82	88	10	60	594,00
CTA 3840 × 2160 @ 24 Hz (VIC 93)	3840	2160	5500	2250	384	82	88	10	24	297,00
CTA 3840 × 2160 @ 25 Hz (VIC 94)	3840	2160	5280	2250	384	82	88	10	25	297,00
CTA 3840 × 2160 @ 30 Hz (VIC 95)	3840	2160	4400	2250	384	82	88	10	30	297,00
CTA 3840 × 2160 @ 50 Hz (VIC 96)	3840	2160	5280	2250	384	82	88	10	50	594,00
CTA 3840 × 2160 @ 24 Hz (VIC 103)	3840	2160	5500	2250	384	82	88	10	24	297,00
CTA 3840 × 2160 @ 25 Hz (VIC 104)	3840	2160	5280	2250	384	82	88	10	25	297,00
CTA 3840 × 2160 @ 30 Hz (VIC 105)	3840	2160	4400	2250	384	82	88	10	30	297,00

\*) CVT: Coordinated Video Timings (CVT v2.0)

DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

Description*	HA	VA	нт	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (MHz)
CTA 3840 × 2160 @ 50 Hz (VIC 106)	3840	2160	5280	2250	384	82	88	10	50	594,00
CTA 3840 × 2160 @ 60 Hz (VIC 107)	3840	2160	4400	2250	384	82	88	10	60	594,00
CTA 3840 × 2160 @ 48 Hz (VIC 114)	3840	2160	5500	2250	384	82	88	10	48	594,00
CTA 3840 × 2160 @ 48 Hz (VIC 116)	3840	2160	5500	2250	384	82	88	10	48	594,00
CTA 3840 × 2160 @ 100 Hz (VIC 117)	3840	2160	5280	2250	384	82	88	10	100	1188,00
CTA 3840 × 2160 @ 100 Hz (VIC 119)	3840	2160	5280	2250	384	82	88	10	100	1188,00
CTA 3840 × 2160 @ 120 Hz (VIC 120)	3840	2160	4400	2250	384	82	88	10	120	1188,00
CVT 4096 × 2160 @ 60 Hz [RB2]	4096	2160	4176	2222	72	14	32	8	60	556,74
CVT 4096 × 2160 @ 60 Hz [RB1]	4096	2160	4256	2222	112	59	32	10	60	567,41
CVT 4096 × 2160 @ 60 Hz [RB3]	4096	2160	4256	2222	152	14	32	8	60	567,61
CVT 4096 × 2160 @ 144 Hz [RB3]	4096	2160	4256	2314	152	14	32	8	144	1418,66
CTA 4096 × 2160 @ 60 Hz (VIC 102)	4096	2160	4400	2250	216	82	88	10	60	594,00
CTA 4096 × 2160 @ 120 Hz (VIC 219)	4096	2160	4400	2250	216	82	88	10	120	1188,00
CTA 4096 × 2160 @ 100 Hz (VIC 218)	4096	2160	5280	2250	384	82	88	10	100	1188,00
CTA 4096 × 2160 @ 50 Hz (VIC 101)	4096	2160	5280	2250	216	82	88	10	50	594,00
CTA 4096 × 2160 @ 48 Hz (VIC 115)	4096	2160	5500	2250	384	82	88	10	48	594,00
CTA 4096 × 2160 @ 24 Hz (VIC 98)	4096	2160	5500	2250	384	82	88	10	24	297,00
CTA 4096 × 2160 @ 25 Hz (VIC 99)	4096	2160	5280	2250	216	82	88	10	25	297,00
CTA 4096 × 2160 @ 30 Hz (VIC 100)	4096	2160	4400	2250	216	82	88	10	30	297,00
CVT 3840 × 2160 @ 120 Hz [RB1]	3840	2160	4000	2287	112	124	32	5	120	1097,76
CVT 3840 × 2160 @ 120 Hz [RB2]	3840	2160	3920	2287	72	14	32	8	120	1075,80
CTA 3840 × 2160 @ 120 Hz (VIC 118)	3840	2160	4400	2250	384	82	88	10	120	1188,00
CVT 5120 × 2160 @ 30 Hz [RB1]	5120	2160	5280	2191	112	28	32	10	30	347,05
CVT 5120 × 2160 @ 30 Hz [RB2]	5120	2160	5200	2191	72	14	32	8	30	341,80
CTA 5120 × 2160 @ 30 Hz (VIC 123)	5120	2160	6000	2200	216	32	88	10	30	396,00
CVT 5120 × 2160 @ 60 Hz [RB1]	5120	2160	5280	2222	112	59	32	10	60	703,93
CVT 5120 × 2160 @ 60 Hz [RB2]	5120	2160	5200	2222	72	14	32	6	60	693,26
CTA 5120 × 2160 @ 60 Hz (VIC 126)	5120	2160	5500	2250	216	82	88	10	60	742,50
CVT 5120 × 2160 @ 120 Hz [RB1]	5120	2160	5280	2287	112	124	32	10	120	1449,04
CVT 5120 × 2160 @ 120 Hz [RB3]	5120	2160	5280	2287	152	14	32	8	120	1449,55
CVT 5120 × 2160 @ 120 Hz [RB2]	5120	2160	5200	2287	72	14	32	8	120	1427,09
CTA 5120 × 2160 @ 120 Hz (VIC 193)	5120	2160	5500	2250	216	82	88	10	120	1485,00
5120 × 2880 @ 60 Hz	5120	2880	5280	2962	112	79	32	5	60	938,36
5120 × 2880 @ 60 Hz	5120	2880	5200	2962	72	14	32	8	60	924,14
5120 × 2880 @ 60 Hz	5120	2880	5280	2962	152	14	32	8	60	938,69
CTA 5120 × 2160 @ 48 Hz (VIC 124)	5120	2160	6250	2475	384	307	88	10	48	742,50
CTA 5120 × 2160 @ 50 Hz (VIC 125)	5120	2160	6600	2250	384	82	88	10	50	742,50
CTA 5120 × 2160 @ 100 Hz (VIC 127)	5120	2160	6600	2250	384	82	88	10	100	1485,00
CTA 5120 × 2160 @ 25 Hz (VIC 122)	5120	2160	7200	2200	384	32	88	10	25	396,00
CTA 5120 × 2160 @ 24 Hz (VIC 121)	5120	2160	7500	2200	384	32	88	10	24	396,00
CVT 7680 × 4320 @ 30 Hz [RB1]	7680	4320	7760	4381	72	14	32	8	30	1019,90
CVT 7680 × 4320 @ 30 Hz [RB1]	7680	4320	7840	4381	112	58	32	5	30	1030,41
CVT 7680 × 4320 @ 60 Hz [RB1]	7680	4320	7760	4443	72	14	32	8	60	2068,66
CVT 7680 × 4320 @ 100 Hz [RB1]	7680	4320	7760	4529	72	14	32	8	100	3514,50
CVT 7680 × 4320 @ 60 Hz	7680	4320	7840	4443	112	120	32	5	60	2089,99
CVT 7680 × 4320 @ 100 Hz [RB1]	7680	4320	7840	4529	112	206	32	5	100	3550,74

\*) CVT: Coordinated Video Timings (CVT v2.0)

DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

Description*	НА	VA	нт	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (MHz)
CTA 7680 × 4320 @ 120 Hz (VIC 201)	7680	4320	8800	4500	768	164	176	20	120	4752,00
CTA 7680 × 4320 @ 120 Hz (VIC 209)	7680	4320	8800	4500	768	164	176	20	120	4752,00
CTA 7680 × 4320 @ 30 Hz (VIC 204)	7680	4320	9000	4400	768	64	176	20	30	1188,00
CTA 7680 × 4320 @ 30 Hz (VIC 196)	7680	4320	9000	4400	768	64	176	20	30	1188,00
CTA 7680 × 4320 @ 60 Hz (VIC 207)	7680	4320	9000	4400	768	64	176	20	60	2376,00
CTA 7680 × 4320 @ 60 Hz (VIC 199)	7680	4320	9000	4400	768	64	176	20	60	2376,00
CTA 7680 × 4320 @ 100 Hz (VIC 208)	7680	4320	10560	4500	768	164	176	20	100	4752,00
CTA 7680 × 4320 @ 100 Hz (VIC 200)	7680	4320	10560	4500	768	164	176	20	100	4752,00
CTA 7680 × 4320 @ 25 Hz (VIC 203)	7680	4320	10800	4400	768	64	176	20	25	1188,00
CTA 7680 × 4320 @ 25 Hz (VIC 195)	7680	4320	10800	4400	768	64	176	20	25	1188,00
CTA 7680 × 4320 @ 50 Hz (VIC 198)	7680	4320	10800	4400	768	64	176	20	50	2376,00
CTA 7680 × 4320 @ 50 Hz (VIC 206)	7680	4320	10800	4400	768	64	176	20	50	2376,00
CTA 7680 × 4320 @ 24 Hz (VIC 194)	7680	4320	11000	4500	768	164	176	20	24	1188,00
CTA 7680 × 4320 @ 48 Hz (VIC 197)	7680	4320	11000	4500	768	164	176	20	48	2376,00
CTA 7680 × 4320 @ 24 Hz (VIC 202)	7680	4320	11000	4500	768	164	176	20	24	1188,00
CTA 7680 × 4320 @ 48 Hz (VIC 205)	7680	4320	11000	4500	768	164	176	20	48	2376,00
CTA 10240 × 4320 @ 24 Hz (VIC 210)	10240	4320	12500	4950	768	614	176	20	24	1485,00
CTA 10240 × 4320 @ 25 Hz (VIC 211)	10240	4320	13500	4400	768	64	176	20	25	1485,00
CTA 10240 × 4320 @ 30 Hz (VIC 212)	10240	4320	11000	4500	472	164	176	20	30	1485,00
CTA 10240 × 4320 @ 48 Hz (VIC 213)	10240	4320	12500	4950	768	614	176	20	48	2970,00
CTA 10240 × 4320 @ 50 Hz (VIC 214)	10240	4320	13500	4400	768	64	176	20	50	2970,00
CTA 10240 × 4320 @ 60 Hz (VIC 215)	10240	4320	11000	4500	472	164	176	20	60	2970,00
CTA 10240 × 4320 @ 100 Hz (VIC 216)	10240	4320	13200	4500	768	164	176	20	100	5940,00
CTA 10240 × 4320 @ 120 Hz (VIC 217)	10240	4320	11000	4500	472	164	176	20	120	5940,00
CTA 15360 x 8640 @ 30Hz [RB1]	15360	8640	15520	8761	112	118	32	5	30	4079,00
CTA 15360 x 8640 @ 30Hz [RB2]	15360	8640	15440	8761	72	14	32	8	30	4058,10
CTA 15360 x 8640 @ 30Hz [RB3]	15360	8640	15520	8761	152	14	32	8	30	4080,55

\*) CVT: Coordinated Video Timings (CVT v2.0)

DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

# APPENDIX D: PREDEFINED PATTERNS

Fixed Patterns	5	
Selection	Pattern	Description
Disabled	×	The links are activated but no video data transferred
Color Bar		100% intensity color bars of all primaries and mixed combinations.
Chessboard	***	8 by 8 chessboard with black (0%) and 100% intensity white
Solid Color		Solid color. User selected RGB values
Solid White		100% white
Solid Red		100% red
Solid Green		100% green
Solid Blue		100% blue
		Vertical stripes of black (0%) and white (100%).
White V-Strips		Parameters set the widths of the black and white stripes in pixels respectively. Default black / white = 20 / 20 pixels. Parameter range 1 to 1000.
RGB Wide Strips		16 pixels high horizontal red, green, blue, and white stripes. Intensity is increased from 0 to 100% with steps defined by the given parameter (Color Step = cs) and selected color. (step = cs*color_depth/256). "n" range 0 to 5000 (default 100).
Color Ramp		Color Ramp test pattern defined by VESA DisplayPort Link Layer Compliance Test Specification.
Color Square		Color Square test pattern defined by VESA DisplayPort Link Layer Compliance Test Specification. Color mode can be selected between RGB, YCbCr 4:4:4, 4:2:2, 4:2:0 (ITU Rec 601 / 709)
Motion Pattern		Horizontally moving color bar pattern. The pattern is shifted to left one pixel in each frame in a sequence. The length of the sequence is defined with parameter. Range 0 to 34 (default is 20)
Square Window		100% intensity white square horizontally and vertically centered. Height and width defined by parameter as the percentage of height and width of the frame (default 30).

## **Extended Patterns**

Selection	Icon	Description
Select Image	O	Custom image uploaded by the user. Click on Select to browse.
Select DSC Image	OSC O	Custom DSC compressed image file uploaded by the user. Click on Select to browse.
Unigraf PM5544	<b>e</b>	Vpattern vector pattern based on PM5544
Color Web		Vpattern vector pattern.
Chinese Town Full HD		JPG Bitmap image (1920 x 1080 px)
UG-2111 HLG Narrow		Software generated pattern. HLG Narrow dynamic range.
UG-2111 PQ Narrow		Software generated pattern. PQ Narrow dynamic range.
UG-2111 PQ Full		Software generated pattern. PQ Full dynamic range.
Multi		Vpattern vector pattern. Multi-purpose pattern w square grid, cross-grids, 1x1 crosshatches, circles, and color bars
SMPTE RP-133		Vpattern vector pattern based on SMTPE RP-133
SMPTE 303M		Vpattern vector pattern. SMPTE 303M; Full Range; RGB values before gamma correction based on D65 and PAL primaries
Blue		Vpattern vector pattern. 100% Blue
CirclesW	88	Vpattern vector pattern. Concentric circles
Complex	-	Vpattern vector pattern. Complex Pattern w 64 steps
Green		Vpattern vector pattern. 100% Green
Hor1W-Even		Vpattern vector pattern. Horizontal 1 px wide White bars in even rows
Hor1W-Odd		Vpattern vector pattern. Horizontal 1 px wide White bars in odd rows
Hor4W		Vpattern vector pattern. Horizontal 4 px high White bars
Hor10W		Vpattern vector pattern. Horizontal 10 px high White bars
Hor-10xB		Vpattern vector pattern. 10 pcs horizontal Blue bars
Hor-10G		Vpattern vector pattern. 10 pcs horizontal Green bars

## **Extended Patterns (cont.)**

Selection	Icon	Description
Hor-10xR		Vpattern vector pattern. 10 pcs horizontal Red bars
Hor-10xW		Vpattern vector pattern. 10 pcs horizontal White bars
HorRainbow-1024		Vpattern vector pattern. Horizontal Rainbow Ramps 1024 steps
HorRGBW-1024		Vpattern vector pattern. Horizontal RGBW Ramps 1024 steps
HorScale9		Vpattern vector pattern. Nine Horizontal Color Ramps
HorScaleW-64		Vpattern vector pattern. Horizontal White ramp 64 steps
HorScaleW-128		Vpattern vector pattern. Horizontal White ramp 128 steps
HorScaleW-X2		Vpattern vector pattern. Horizontal White ramp w edges 128 steps
InnerBox-BKtoB		Vpattern vector pattern. InnerBox pattern from Black to Blue
InnerBox-BKtoG	×	Vpattern vector pattern. InnerBox pattern from Black to Green
InnerBox-BKtoR		Vpattern vector pattern. InnerBox pattern from Black to Red
InnerBox-BKtoW	×	Vpattern vector pattern. InnerBox pattern from Black to White
InnerBoxMIX		Vpattern vector pattern. InnerBox pattern mixed hues.
InnerBox-RtoB		Vpattern vector pattern. InnerBox pattern from Red to Blue
Red		Vpattern vector pattern. 100% Red
Ver1W-Even		Vpattern vector pattern. Vertical 1 px wide White bars in even columns
Ver1W-Odd		Vpattern vector pattern. Vertical 1 px wide White bars in odd columns
Ver4W		Vpattern vector pattern. Vertical 4 px wide White bars
Ver10W		Vpattern vector pattern. Vertical 10 px wide White bars
Ver-10xG		Vpattern vector pattern. 10 pcs Vertical Blue bars
Ver-10xR		Vpattern vector pattern. 10 pcs Vertical Blue bars
Ver-10xB		Vpattern vector pattern. 10 pcs Vertical Blue bars
Ver-10xW		Vpattern vector pattern. 10 pcs Vertical Blue bars

## **Extended Patterns (cont.)**

Selection	Icon	Description
VerBars75%		Vpattern vector pattern. Vertical 75% intensity Color bars
VerBars100%		Vpattern vector pattern. Vertical 100% intensity Color bars
VerRGBW-1024		Vpattern vector pattern. Vertical RGBW Ramps 1024 steps
X-HatchBK-C		Vpattern vector pattern. Black 16 x12 Grid w Circle on White background
X-HatchW		Vpattern vector pattern. White 16 x12 Grid on Black background
X-HatchW-C		Vpattern vector pattern. White 16 x12 Grid w Circle on Black background
X-HatchW-CC		Vpattern vector pattern. White 16 x12 Grid w Ellipses, Circle and 100% color bars
Gray Box 10		Vpattern vector pattern. China 5.6 White Window 10%
Gray Box 20		Vpattern vector pattern. China 5.6 White Window 20%
Gray Box 30		Vpattern vector pattern. China 5.6 White Window 30%
Gray Box 40		Vpattern vector pattern. China 5.6 White Window 40%
Gray Box 50		Vpattern vector pattern. China 5.6 White Window 50%
Gray Box 60		Vpattern vector pattern. China 5.6 White Window 60%
Gray Box 70		Vpattern vector pattern. China 5.6 White Window 70%
Gray Box 80		Vpattern vector pattern. China 5.6 White Window 80%
Gray Box 90		Vpattern vector pattern. China 5.6 White Window 90%
Gray Box 100		Vpattern vector pattern. China 5.6 White Window 100%
8 Level Gray		Vpattern vector pattern. China 5.5 Ultimate 8 Level Grayscale

<b>Extended Patterns</b>	(cont.)
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Selection	lcon	Description
Black'n'White Window HDTV	•••	Vpattern vector pattern. China 5.8 Black and White Window(FOR HDTV)
Black'n'White Window SDTV		Vpattern vector pattern. China 5.8 Black and White Window(FOR SDTV)
Black Line HDTV		Vpattern vector pattern. China 5.10 Black Line HDTV
Black Line SDTV		Vpattern vector pattern. China 5.10 Black Line SDTV
Black Window		Vpattern vector pattern. China 5.7 Black Window
Check Board	**	Vpattern vector pattern. China 5.9 Check Board
Line'n'Window		Vpattern vector pattern. China 5.11 Line and Window
Narrow White Window		Vpattern vector pattern. China 5.19 Narrow White Window
Single Dot	·	Vpattern vector pattern. China Single Dot
White Line HDTV		Vpattern vector pattern. China 5.10 White Line for HDTV
White Line SDTV		Vpattern vector pattern. China 5.10 White Line for SDTV

More test patterns can be downloaded e.g. from www.icdm-sid.org/

# APPENDIX E: SINK, SOURCE AND REPEATER TESTS

Source DUT Testing		Default	DP 1.4a LL CTS*	DP 1.4a DSC CTS*	DP 2.1 LL CTS*	DP 2.1 DSC CTS	DP 2.1 DisplayID & EDID CTS*	DP 2.1 Adaptive-Sync CTS DUT*	DP 2.1 LTTPR CTS	HDCP 2.3 CTS*
Audio Test	Validate audio signal frequency and glitch-free audio reproduction	•								
CRC Video Tests	CRC based single frame reference video test, CRC based single frame stability test, CRC based sequence of frames reference video test, CRC based continuous sequence of frames reference video test	•								
DP 1.4a Link Layer CTS	4.2.1.1 – 4.2.1.5, 4.2.2.1 – 4.2.2.10, 4.3.1.1 – 4.3.1.13, 4.3.2.1 – 4.3.2.5, 4.3.3.1, 4.4.1.1 – 4.4.1.3, 4.4.2, 4.4.3, 4.4.4.2 – 4.4.4.6, 4.5.1.1 – 4.5.1.2		•							
DP 1.4a DSC CTS	4.6.1.1 – 4.6.1.9			•						
DP 2.1 Link Layer CTS	4.2.1.1 – 4.2.1.5, 4.2.2.1 – 4.2.2.2, 4.2.2.4 – 4.2.2.5, 4.2.2.7 – 4.2.2.8, 4.2.2.10 – 4.2.2.14, 4.3.1.1 – 4.3.1.24, 4.3.2.1 – 4.3.2.4, 4.3.3.1 – 4.3.3.2, 4.4.1.1-4.4.1.6, 4.4.2.1 – 4.4.2.2				•					
DP 2.1 DSC CTS	4.6.1.1 – 4.6.1.9					•				$\square$
DisplayID-EDID CTS***	4.7.1.1 – 4.7.1.4, 4.7.2.1 – 4.7.2.2, 4.7.3.1 – 4.7.3.3, 4.7.4.1, , 4.7.5.1, 4.7.6.1 - 4.7.6.4, 4.7.7.1 - 4.7.7.2						•			
Adaptive-Sync CTS****	4.8.1.1 – 4.8.1.2, 4.8.2.1 – 4.8.2.3							•		$\square$
DP 2.1 LTTPR CTS	4.9.1.1 – 4.9.1.22								•	
HDCP 2.3 CTS 1A Test Set	HDCP2.3 CTS 1A-01 – HDCP2.3 CTS 1A-12									
HDCP 2.3 CTS 1B Test Set	HDCP2.3 CTS 1B-01 – HDCP2.3 CTS 1B-10									
Link Config Tests	Link Training at All Supported Lane Counts and Link Rates	•								
Pixel Level Video Tests	Compare video frame sequence with a single reference	•								

\*) Separate licenses for testing Sink, Source, Branch DUT (LL CTS, DSC, DisplayID, Adaptive-Sync)

\*\*\*) Unigraf UCD-400 was used by VESA for TE correlation of the tests

\*\*\*\*) Adaptive-Sync CTS is currently limited to 8b/10b link coding and SST mode. Unigraf UCD-400 was used by VESA for TE correlation of the tests.

Sink DUT Testing		Default	DP 1.4a LL CTS*	DP 1.4a DSC CTS*	DP 2.1 LL CTS*	DP 2.1 DSC CTS	DP 2.1 DisplayID & EDID CTS*	DP 21 Adaptive-Sync CTS DUT*	DP 2.1 LTTPR CTS*	HDCP 2.3 CTS*
DP 1.4 Link Layer CTS	5.2.1.1 - 5.2.1.12, 5.2.2.1 - 5.2.2.9, 5.3.1.1 - 5.3.1.9, 5.3.2.1 - 5.3.2.2, 5.4.1.1 - 5.4.1.4, 5.4.2, 5.4.3.1 - 5.4.3.2, 5.4.4.1 - 5.4.4.6, 5.5.1.1 - 5.5.1.7		•							
DP 1.4 DSC CTS	5.6.1.1 - 5.6.1.26, 5.6.2.1 - 5.6.2.14			•						
DP 2.1 Link Layer CTS	5.2.1.8 - 5.2.1.12, 5.2.2.1 - 5.2.2.9, 5.3.1.1 - 5.3.1.15, 5.3.2.1 - 5.3.2.2, 5.4.1.1 - 5.4.1.8, 5.4.2.1 - 5.4.2.2, 5.4.3.1 - 5.4.3.4, 5.4.5.1 - 5.4.5.5, 5.5.1.1 - 5.5.1.7, 5.6.3.7				•					
DP 2.1 DSC CTS	5.6.1.1 – 5.6.1.26, 5.6.2.1 – 5.6.2.16, 5.6.3.1 – 5.6.3.6					•				
DisplayID-EDID CTS***	$\begin{array}{l} 5.7.1.1-5.7.1.2,\ 5.7.1.3.1-5.7.1.3.4,\ 5.7.1.4.1-\\ 5.7.1.4.9,\ 5.7.1.5-5.7.1.6,\ 5.7.2.1-5.7.2.2,\ 5.7.2.3.1\\ -5.7.2.3.5,\ 5.7.2.4.1-5.7.2.6.2,\ 5.7.2.5.1-\\ 5.7.2.5.2,\ 5.7.2.6.1-5.7.2.6.2,\ 5.7.2.7.1,\ 5.7.2.8,\\ 5.7.3.1-5.7.3.5,\ 5.7.4.1-5.7.4.3,\ 5.7.4.5,\ 5.7.5.1,\\ 5.7.6.1-5.7.6.5,\ 5.7.7.1-5.7.7.6,\ 5.7.8.1-5.7.8.6,\\ 5.7.9.1-5.7.9.3,\ 5.7.10.1-5.7.10.3,\ 5.7.11.1-\\ 5.7.11.5,\ 5.7.12.1-5.7.12.4,\ 5.7.14.1-5.7.14.7,\\ 5.7.15.1-5.7.15.9,\ 5.7.16.1-5.7.16.7,\ 5.7.17.1-\\ 5.7.17.5,\ 5.7.18.1,\ 5.7.29.1-5.7.20.6,\\ 5.7.20.1-5.7.20.3,\ 5.7.21.1-5.7.21.5,\ 5.7.22.1-\\ 5.7.22.7\end{array}$						•			
Adaptive-Sync CTS****	5.8.1.1 – 5.8.1.3							•		
DP 2.1 LTTPR CTS	5.9.1.1 – 5.9.1.15								•	
HDCP 2.3 CTS 2C Test Set	HDCP2.3 CTS 2C-01 – HDCP2.3 CTS 2C-05									

\*) Separate licenses for testing Sink, Source, Branch DUT (LL CTS, DSC, DisplayID, Adaptive-Sync)

\*\*\*) Unigraf UCD-400 was used by VESA for TE correlation of the tests

\*\*\*\*) Adaptive-Sync CTS is currently limited to 8b/10b link coding and SST mode. Unigraf UCD-400 was used by VESA for TE correlation of the tests.

LTTPR and DP Tunnel Device Testing		Default	DP 2.1 LTTPR CTS for testing LTTPR Device
DP 2.1 LTTPR CTS for testing LTTPR Device	7.1.1.1 – 7.1.1.9, 7.1.2.1 – 7.1.2.9, 7.1.3.1-7.1.3.8, 7.1.4.1-7.1.4.10, 7.1.5.1- 7.1.5.6, 7.1.6.1-7.1.6.7, 7.1.7.1-7.1.7.7, 7.1.8.1, 7.1.9.1, 7.1.10.1		•

Repeater DUT Testing		Default	HDCP 2.3 CTS*
HDCP 2.3 CTS 3A Test Set	HDCP2.3 CTS 3A-01 – HDCP2.3 CTS 3A-06		•
HDCP 2.3 CTS 3B Test Set	HDCP2.3 CTS 3B-01 – HDCP2.3 CTS 3B-07		•
HDCP 2.3 CTS 3C Test Set	HDCP2.3 CTS 3C-01 – HDCP2.3 CTS 3C-25		•

\*) Separate licenses for testing Sink, Source, Branch (LL CTS) and Repeater (HDCP) DUT

# **Compliance Tests**

Compliance test capability is a license enabled add-on to UCD Console. The tests are included in the GUI software, license codes enable the tests for use.

Please refer to Appendix B Licensing for details. The list of compliance tests that UCD Console supports, please refer to document DP CTS Tool Options for Unigraf UCD-500.pdf. It can be downloaded in Unigraf Document Center at <a href="https://www.unigraf.fi/documents/">https://www.unigraf.fi/documents/</a>. If you have any additional questions, please contact Unigraf or your local representative.

Compliance tests (CTS Tests) are part of tests included in **Source DUT Testing** tab of **DP RX** and **Sink DUT Testing** tab of **DP TX**.

The tests cases are divided into test categories as described in *Appendix E* of this document. Test categories are placed in sub-tabs. Test category tabs are enabled based on licenses present. Please refer to chapter 3 *License Manager* earlier in this document.

#### **Test Parameters**

Before running the tests, capabilities of the DUT have to be defined for the test engine. Each test category has its dedicated test parameter dialog. Click **Configure** in *Source DUT Testing* or *Sink DUT Testing* tab to open the parameter dialog.

For a detailed description of capabilities listed on the tab please refer to Chapter 3 Compliance Test Operation of document VESA DisplayPort Link Layer Compliance Test Specification.

P 2.1 LL CTS	
neral Audio DisplayID Adaptive-Sync	Video modes Debug options
Test Timeouts  Test Timeout (ms)  Long HPD pulse duration (ms)  Test Automation  TEST_LINK_TRAINING  TEST_EDID_READ  TEST_VIDEO_PATTERN	DUT Capabilities Max lanes supported 4 ~ Max Bitrate supported HBR3 (8.10 Gbps) ~ DP 2.1 Settings DP 2.1 Settings 10 Gbps 13.5 Gbps 20 Gbps LTTPR device count 0 Minimum Link Bandwidth Supported 1LRBR ~
TEST_AUDIO_PATTERN  VIDEO_OPERATOR_INPUT  DSC_VIS_VAL  Event indicating DUT ready Always ready   DSC DUT Capabilities  DSC Version  SC Maximum supported slice  DSC Supported  DSC supported  DSC block prediction enabled	<ul> <li>Voltage Swing level 3 (1.2V) supported</li> <li>Pre-Emphasis level 3 (9.5dB) supported</li> <li>Fixed timing DUT</li> <li>Spread Spectrum supported</li> <li>Video format change without LT supported</li> <li>E-DDC supported</li> <li>Audio Info Frame supported for 2 channel audio</li> <li>DUT is Type-C device</li> <li>FEC supported</li> <li>FEC supported</li> <li>FEC disable sequence supported</li> </ul>
	FLC disable sequence supported     Audio without Video supported     Max Link Bandwidth Policy supported     USB4 tunnel present     Use YCbCr 444 -> 422/420 3-tap filter



### DP 2.1 LL LTTPR CTS CR iteration delay

Debug options allows users to manually set the CR iteration delay. To access debug options to set the CR iteration delay, select a test from DP 2.1 LL LTTPR CTS test set and click **Configure**.

DP 2.1 LL LTTPR CTS	×
General Debug options	
Debug test options	
CR iteration delay (µs)	
Presets  OK Can	cel

Note:

Please make sure that the capability tables are completed before running the tests. The result of the test might be misleading if the DUT capabilities and the table do not match.

#### **DSC Test Content**

When running DSC Compliance Tests, Console needs to have access to DSC content used as test patterns. This content will be automatically created during test execution. Creation of the test content takes time and considerably slows down the execution of the test. To avoid this after the first test run, users are able to save the created DSC content by selecting the option *Keep auto-created DSC content files* described below.

Warning Please note, that the space needed for storing the full library **can be very large** (appr. 400 GBytes). Please make sure that the content will be stored in a medium that has the required space available.

#### **Options**

In Tools > Options menu you can define DSC Work folder and DSC test content directory.

DSC temp folder:	Folder for DSC Work files.
DSC test content folder:	Folder where DSC source bitmap files, related configuration files and DSC conversion tools are stored.
Keep auto-created DSC content files:	By default, the DSC compressed content is deleted after use. If selected, the content is not deleted

## **Running CTS Tests**

Source DUT Testing and Sink DUT Testing tabs include the tests enabled with the set of licenses present in UCD Console grouped in test set tabs. In tabs the tests are listed by the test name and reference number as in applicable compliance test specification. UCD-5XX firmware implements the test according to the test specification.

Test flow parameters like **Test timeout** and **Test cycle delay** can be defined in *Test Parameter* dialog launched by clicking **Configure**.

2 LTTPR config 3 LTTPR AUX n 4 LTTPR 8b10b 5 LTTPR 8b10b 6 LTTPR 8b10b 8 LTTPR 8b10b 10 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	TS DP 2.1 LL CTS configuration verifi- uration and status fi ad/write reply time transparent link train non-transparent link 2b non-transparent success transparent success transparent success transparent success to runn-transparent success to runnsparent success	ation eld verification budget verifica ing for lane c : training for link training for ul Link Trainin cessful Link Trainin	ation ount and li one count a or lane cou	and link ra	FEC	Sink DUT Testing		Pass 0 0	Fail 0 0	Skip 0 0	Runs 0 0	Last status	^
1 LTTPR global 2 LTTPR config 3 LTTPR AUX n 4 LTTPR 8b10b 5 LTTPR 8b10b 5 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10b 11 LTTPR 8b10 12 LTTPR 8b10	configuration verifie uration and status fi ad/write reply time transparent link trais non-transparent link 2b non-transparent successi non-transparent successi on or-transparent successi on on-transparent successi on non-transparent successi	ation eld verification budget verifica- ing for lane c training for la link training for la Link Trainin cessful Link Trainin	ation ount and li one count a or lane cou	and link ra				0	0 0	0 0	0 0	Last status	^
2 LTTPR config 3 LTTPR AUX n 4 LTTPR 8b10b 5 LTTPR 8b10b 6 LTTPR 8b10b 8 LTTPR 8b10b 10 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	uration and status fi ad/write reply time transparent link trai non-transparent linl 2b non-transparent linl 2b non-transparent successi non-transparent successi non-transparent successi transparent successi	eld verification budget verifica ing for lane c training for la link training for ful Link Trainin cessful Link Trainin ful Link Trainin	ation ount and li one count a or lane cou	and link ra				0	0 0	0 0	0 0	Last status	î
2 LTTPR config 3 LTTPR AUX n 4 LTTPR 8b10b 5 LTTPR 8b10b 6 LTTPR 8b10b 8 LTTPR 8b10b 10 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	uration and status fi ad/write reply time transparent link trai non-transparent linl 2b non-transparent linl 2b non-transparent successi non-transparent successi non-transparent successi transparent successi	eld verification budget verifica ing for lane c training for la link training for ful Link Trainin cessful Link Trainin ful Link Trainin	ation ount and li one count a or lane cou	and link ra				0	0	0	0		
3 LTTPR AUX n 4 LTTPR 8b10b 5 LTTPR 8b10b 6 LTTPR 128b1 7 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10b 11 LTTPR 8b10 12 LTTPR 8b10	ad/write reply time transparent link train non-transparent link 2b non-transparent link transparent success non-transparent success transparent success to non-transparent success to transparent success	budget verifica ning for lane c training for la link training fo ul Link Trainin cessful Link Trainin ful Link Trainin	ation ount and li one count a or lane cou	and link ra				-	-	-	-		
4 LTTPR 8b10b 5 LTTPR 8b10b 6 LTTPR 128b1. 7 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10b 11 LTTPR 8b10 11 LTTPR 8b10	transparent link trais non-transparent link 2b non-transparent transparent success non-transparent suc transparent success non-transparent success non-transparent success	ning for lane c training for la link training for ul Link Trainin cessful Link Tr ul Link Trainin	ount and li ine count i or lane cou	and link ra				0	0	0			
5 LTTPR 8b10b 6 LTTPR 128b1. 7 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	non-transparent lini 2b non-transparent transparent successi non-transparent suc transparent successi non-transparent successi non-transparent successi	training for la link training fo ul Link Trainin cessful Link Tr ul Link Trainin	ine count i or lane cou	and link ra				-			-		
6 LTTPR 128b1. 7 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	2b non-transparent transparent success non-transparent suc transparent success non-transparent success transparent success	link training fo ul Link Trainin cessful Link Tr ul Link Trainin	or lane cou					0	0	0	0		
7 LTTPR 8b10b 8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10b 11 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	transparent success non-transparent suc transparent success non-transparent su transparent succes	ul Link Trainin cessful Link Tr ul Link Trainin						0	0	0	0		
8 LTTPR 8b10b 9 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	non-transparent suc transparent success non-transparent su transparent succes	cessful Link Tr ul Link Trainin	y (Higner			Colora de la colora	D	0	0	0	0		
9 LTTPR 8b10b 10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	transparent success non-transparent su transparent succes	ul Link Trainin	aining (UC						0	0	0		
10 LTTPR 8b10 11 LTTPR 8b10 12 LTTPR 8b10	non-transparent su transparent succes						JUCK RECO	0	0	0	0		
11 LTTPR 8b10 12 LTTPR 8b10	transparent succes						(vend	0	0	0	0		
12 LTTPR 8b10							(very)	0	õ	ő	0		
							ion)	0	ő	ő	0		
						e, due to failure in EC		-	ő	ő	ő		
14 LTTPR 1286						e, due to failure in Cl			0	ŏ	0		
						Ith, due to no start of			ŏ	ŏ	ő		
													Y
ted Select	- Configure	Import	Expo	ort 🗌	Stop on	Failure Repeats:	1	Delay ti	me, sec 1	÷.	Save Report	Clear	All
	tted Select	ted Select <b>v</b> Configure	ted Select • Configure Import	tted Select V Configure Import Expo	tted Select • Configure Import Export 🗌	tted Select ▼ Configure Import Export  Stop on	ted Select • Configure Import Export Stop on Failure Repeats:	tted Select • Configure Import Export Stop on Failure Repeats 1 S	tted Select V Configure Import Export Stop on Failure Repeats: 1 3 Delay ti	ted Select • Configure Import Export Stop on Failure Repeats 1 S Delay time, see 1	tted Select • Configure Import Export Stop on Failure Repeats: 1 C Delay time, sec 1 C	ted Select • Configure Import Export Stop on Failure Repeats: 1 3 Delay time, sec 1 3 Save Report	tted Select • Configure Import Export Stop on Failure Repeats: 1 C Delay time, sec 1 Save Report Clear.

Select the tests for execution by clicking the corresponding row. For selecting multiple consecutive tests in the list hold down the Shift key of your keyboard while selecting the tests. For selecting multiple individual tests hold down the Ctrl key in your keyboard while selecting.

Run Selected	Click to start selected tests. By clicking Abort the sequence is stopped.
Select:	Includes the following options for creating templates for tests execution: Select All, Clear All, Invert All, Save, Import and Export
Configure	Clicking opens a dialog for defining the test parameters for that set. Please refer to <i>Test Parameters</i> below for description.
Import:	Load saved test parameter files (*.td or *.json).
Export:	Save test parameters for later use or for use in test automation. For saving parameters for later use in UCD Console, either format can be used. For saving parameters for TSI scripting, please use *.td files. For use with Python applications, please use *.json files.
Stop on Failure:	Stops execution of the selected tests if one of the tests fail
Repeats:	Repeat the selected test several times. When repeating a sequence of tests, all selected tests are performed in each repetition. E.g., when you repeat tests 1, 2 and 3 two times, the sequence is: 1, 2, 3, 1, 2, 3.
Delay time	Delay in seconds between individual tests.
Save Report:	Click to generate a report file in HTML format for sharing the results with other parties for <i>viewing</i> without UCD Console.
Clear All	Clear the test log and the results matrix

### **Saving Test Parameters**

Test parameters can be saved in various ways.

- Export parameters in Sink/Source DUT Testing tab to a \*.td file for later use in UCD Console or with TSI scripting or sharing.
- Export parameters in Sink/Source DUT Testing tab to a \*.json file for later use in UCD Console or with Python applications or sharing.
- Save parameters in *Configure* dialog as Presets to be later used in Console. Please find a description below.

#### **Presets**

In all *Configure* dialogs the selected parameters can be saved as Presets. Please click **Presets...** to save or recall a configuration. Click Save first to assign the configuration a name, and after that you can e.g. Export it to a file.



#### **Operator Feedback**

In some compliance tests operator action or feedback is required for items that the test itself cannot perform or confirm. In these cases test opens a pop-up dialog. In the dialog the operator is instructed about items to do or to be verified and buttons for providing the "Proceed" instruction or "Pass" and "Fail" feedback.

Clicking "Abort" stops execution of the test.

Test operator feedback	k required	×
i	Video Pattern Please, set-up the DUT to transmit the following video mode: • 1024x768 @ 60Hz (DMT 10h) When ready, press 'Proceed'.	
	Proceed Abort	
🕖 Test operator feedback req	uired	×
	eck information field values ase verify the following values are correct in EDID. • Manufacturer's name: UFG • Product code: 4036h • Serial number: 0172D3C6h • Week and year of manufacture: 52/2014 • Screen size: 61 x 35 cm	

If values are correct, click 'Pass'. If values are not correct, click 'Fail'.

Pass Fail Abort

# **Evaluating CTS Test Results**

The test procedure advancement can be monitored in the *Test Log* panel. It describes the steps of each individual test in the way defined in the corresponding VESA Compliance Test Specification. Please use the Status Log and Specification side by side when interpreting the results.

CD Console - UCD-500 [2150C475]: DisplayPort Source and Sink					— C	1
<u>Iools Window H</u> elp						
RX DP TX Event Log						
ink HDCP Video Audio EDID DPCD SDP FEC Source DUT Testing						
All tests Audio Test CRC Video Tests DP 1.4 LL CTS DP 2.1 LL CTS Link Config Tests Pixel Level Vi	ideo Tests					
Name	Pass	Fail	Skip	Runs	Last status	í
4.2.1.1 Source DUT Retry on No-Reply During AUX Read after HPD Plug Event (3200us)	1	0	0	1	Pass	
4.2.1.2 Source Retry on Invalid Reply During AUX Read after HPD Plug Event	1	0	0	1	Pass	
4.2.1.3 Source Device HPD Event Pulse Length Test	1	0	0	1	Pass	
4.2.1.4 Source Device IRQ_HPD Pulse Length Test	1	0	0	1	Pass	
4.2.1.5 Source Device Inactive HPD / Inactive AUX Test	1	0	0	1	Pass	
4.2.2.1 DPCD Receiver Capability and EDID Read upon HPD Plug Event	0	0	0	0		
4.2.2.2 DPCD Receiver Capability Read upon HPD Plug Event	0	0	0	0		
4.2.2.3 EDID Read	0	0	0	0		
4.2.2.4 EDID Read Failure #1: I2C-Over-AUX NACK	0	0	0	0		
4.2.2.5 EDID Read Failure #2: I2C-Over-AUX DEFER	0	0	0	0		
4.2.2.6 EDID Corruption Detection	0	0	0	0		
4.2.2.7 Branch Device Detection upon HPD Plug Event	0	0	0	0		
4.2.2.8 EDID Read on IRQ HPD Event after Branch Device Detection	0	0	0	0		
4.2.2.9 E-DDC Four Block EDID Read	0	0	0	0		
4.2.2.10 Link Status-Adjust Request AUX read interval during Link Training	0	0	0	0		
A 2 1 1 Successful IT at All Supported Lane Counts and Link Speeds	0	0	0	0		
Run Selected Select  Configure Import Export Stop on Failure Repeats: 1	Delay ti	me, sec 1	•	Save Rep	ort Clear	All
0002.062.444: AUX RD: 00202h: 3 00 00 00	Delay ti	me, sec 1	÷	Save Rep	ort Clear	All
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.652: AUX RD: 00206h: 2 11 11	Delay ti	me, sec 1	•	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00	Delay ti	me, sec 1	•	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.652: AUX RD: 00206h: 2 11 11 0002.062.99: AUX WR: 00108h: 4 01 01 01 01	Delay ti	me, sec 1	•	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.062.950: AUX RD: 00103h: 4 01 01 01 01 0002.063.9440: AUX RD: 00103h: 4 01 11 10 0002.063.446: AUX RD: 00102h: 2 11 11 0002.063.446: AUX RD: 00102h: 5 07 01 01 01 01	Delay ti	me, sec 1	Ŧ	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.652: AUX RD: 00206h: 2 11 11 0002.062.659: AUX RD: 00206h: 2 11 11 0002.063.446: AUX RD: 00202h: 3 11 11 80 0002.063.446: AUX RD: 00202h: 2 11 11 0002.063.444: AUX RD: 00202h: 3 07 01 01 010 0002.063.446: AUX RD: 00202h: 3 77 77 81	Delay ti	me, sec 1	•	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.063.241: AUX RD: 00206h: 2 11 11 0002.063.241: AUX RD: 00202h: 3 11 11 80 0002.063.444: AUX RD: 00202h: 2 11 11 0002.063.444: AUX RD: 00202h: 3 77 77 81 0002.063.444: AUX RD: 00202h: 3 77 77 81	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.652: AUX RD: 00206h: 2 11 11 0002.062.659: AUX RD: 00206h: 2 11 11 0002.063.446: AUX RD: 00202h: 3 11 11 80 0002.063.446: AUX RD: 00202h: 2 11 11 0002.063.444: AUX RD: 00202h: 3 07 01 01 010 0002.063.446: AUX RD: 00202h: 3 77 77 81	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.062.909: AUX WH: 00103h: 4 01 01 01 01 0002.063.446: AUX RD: 00202h: 3 11 11 80 0002.063.446: AUX RD: 00202h: 2 11 11 0002.063.446: AUX RD: 00102h: 5 07 01 01 01 01 0002.079.964: AUX RD: 00202h: 3 77 77 81 0002.083.745: Source DUT completes Link Training	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.444: AUX RD: 00202h: 2 11 11 0002.062.952: AUX RD: 00206h: 2 11 11 0002.063.241: AUX RD: 00202h: 3 11 11 80 0002.063.444: AUX RD: 00202h: 3 11 11 80 0002.063.744: AUX RD: 00202h: 3 11 11 0002.063.724: AUX WR: 00102h: 5 07 01 01 01 01 0002.078.544: AUX RD: 00202h: 2 11 11 0002.083.742: AUX RD: 00202h: 2 11 11 0002.083.742: AUX RD: 00202h: 2 11 11 0002.080.356: Source DUT completes Link Training 0002.080.356: Deassert HD 0002.080.708: Monitor AUX for transactions 0002.080.708: Monitor AUX for transactions	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.063.952: AUX RD: 00103h: 4 01 01 01 01 0002.063.946: AUX RD: 00202h: 3 11 11 80 0002.063.446: AUX RD: 00202h: 3 11 11 0002.063.446: AUX RD: 00102h: 5 07 01 01 01 01 0002.079.964: AUX RD: 00202h: 3 77 77 81 0002.080.396: Source DUT completes Link Training 0002.080.396: Source DUT completes Link Training 0002.080.752: DUT has 3 ms to finish AUX activity 0002.080.752: AUX RD: 00120h: 1 00	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 0020h: 3 00 00 00 0002.062.444: AUX RD: 0020h: 2 11 11 0002.062.952: AUX RD: 0020h: 2 11 11 0002.063.241: AUX RD: 0020h: 3 11 11 80 0002.063.444: AUX RD: 0020h: 3 11 11 80 0002.063.444: AUX RD: 0020h: 3 17 77 81 0002.063.174: AUX WR: 00102h: 5 07 01 01 01 01 0002.063.174: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.172: Built RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.172: Built RD: 0020h: 3 07 77 81 0002.063.172: DUT RD: Sm st of finish AUX activity 0002.063.121: AUX WR: 00102h: 1 00 0002.063.121: AUX WR: 00102h: 1 00	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.063.952: AUX RD: 00103h: 4 01 01 01 01 0002.063.946: AUX RD: 00202h: 3 11 11 80 0002.063.446: AUX RD: 00202h: 3 11 11 0002.063.446: AUX RD: 00102h: 5 07 01 01 01 01 0002.079.964: AUX RD: 00202h: 3 77 77 81 0002.080.396: Source DUT completes Link Training 0002.080.396: Source DUT completes Link Training 0002.080.752: DUT has 3 ms to finish AUX activity 0002.080.752: AUX RD: 00120h: 1 00	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 0020h: 3 00 00 00 0002.062.452: AUX RD: 0020h: 2 11 11 0002.062.909: AUX WR: 00103h: 4 01 01 01 01 0002.063.241: AUX RD: 0020h: 2 11 11 0002.063.444: AUX RD: 0020h: 2 11 11 0002.063.444: AUX WR: 00102h: 5 07 01 01 01 01 0002.063.441: AUX WR: 00102h: 5 07 01 01 01 01 0002.063.451: AUX RD: 00206h: 2 11 11 0002.080.396: Source DUT completes Link Training 0002.080.708: Monitor AUX for transactions 0002.080.708: Monitor AUX for transactions 0002.080.712: DUT has 3 ms to finish AUX activity 0002.080.741: End of protection interval 0003.080.651: Source DUT does not generate AUX transaction while HFD is low 0003.081.244: Test PASSED: "4.2.1.5 Source Device Inactive HED / Inactive AUX Test"	Delay ti	me, sec 1	÷	Save Rep	ort Clear	-
0002.062.444: AUX RD: 00202h: 3 00 00 00 0002.062.452: AUX RD: 00202h: 2 11 11 0002.062.905 AUX RD: 00103h: 4 01 01 01 01 0002.063.241: AUX RD: 00202h: 3 11 11 80 0002.063.241: AUX RD: 00202h: 3 11 11 0002.063.724: AUX RD: 00202h: 3 77 77 81 0002.080.374: D0206h: 2 11 11 0002.080.396: Source DUT completes Link Training 0002.080.704: Deassert HPD 0002.080.705: DUT has 3 ms to finish AUX activity 0002.080.741: End of protection interval 0002.080.741: Source DUT does not generate AUX transaction while HPD is low	Delay ti	me, sec 1	•	Save Rep	Clear	-
0002.062.444: AUX RD: 0020h: 3 00 00 00 0002.062.452: AUX RD: 0020h: 2 11 11 0002.062.909: AUX WR: 00103h: 4 01 01 01 01 0002.063.241: AUX RD: 0020h: 2 11 11 0002.063.444: AUX RD: 0020h: 2 11 11 0002.063.444: AUX WR: 00102h: 5 07 01 01 01 01 0002.063.441: AUX WR: 00102h: 5 07 01 01 01 01 0002.063.451: AUX RD: 00206h: 2 11 11 0002.080.396: Source DUT completes Link Training 0002.080.708: Monitor AUX for transactions 0002.080.708: Monitor AUX for transactions 0002.080.712: DUT has 3 ms to finish AUX activity 0002.080.741: End of protection interval 0003.080.651: Source DUT does not generate AUX transaction while HFD is low 0003.081.244: Test PASSED: "4.2.1.5 Source Device Inactive HED / Inactive AUX Test"	Delay ti	me, sec 1	•	Save Rep	ort Clear	-
0002.062.444: AUX RD: 0020h: 3 00 00 00 0002.062.452: AUX RD: 0020h: 2 11 11 0002.062.952: AUX RD: 0020h: 2 11 11 0002.063.241: AUX RD: 0020h: 3 11 11 80 0002.063.444: AUX RD: 0020h: 3 11 11 80 0002.063.724: AUX WN: 0010Ah: 5 07 01 01 01 01 0002.063.724: AUX WN: 0010Ah: 5 07 01 01 01 01 0002.063.174: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.080.446: Deassert HPD 0002.080.708: Monitor AUX for transactions 00022.080.708: Monitor AUX for transactions 0002.080.612: AUX WN: 0010Ah: 1 00 002.080.612: AUX WN: 0010Ah: 1 00 0003.081.655: Source DUT does not generate AUX transaction while HPD is low 0003.081.244: Test PASSED *** Tests Complete PASSED ***	Delay ti	me, sec 1	\$	Save Rep	Clear	
0002.062.444: ADX RD: 00202h: 3 00 00 00 0002.062.4552: AUX RD: 00202h: 2 11 11 0002.063.241: AUX RD: 00202h: 2 11 11 0002.063.241: AUX RD: 00202h: 3 11 11 80 0002.063.724: AUX RD: 00202h: 3 11 11 0002.063.724: AUX WR: 00102h: 5 07 10 10 10 1 0002.079.542: Source DUT completes Link Training 0002.080.171: AUX RD: 00202h: 2 11 11 0002.080.446: Desasert HED 0002.080.446: Desasert HED 0002.080.446: Desasert HED 0002.080.752: DUT has 3 ms to finish AUX activity 0002.080.652: Source DUT completes Link Training 0003.080.655: Source DUT does not generate AUX transaction while HED is low 0003.081.241: Test PASSED: *4.2.15 Source Device Inactive HED / Inactive AUX Test" *** Test Complete PASSED *** Tests execution finished.	Delay ti	me, sec 1		Save Rep	Clear	
0002.062.444: AUX RD: 0020h: 3 00 00 00 0002.062.452: AUX RD: 0020h: 2 11 11 0002.062.952: AUX RD: 0020h: 2 11 11 0002.063.241: AUX RD: 0020h: 3 11 11 80 0002.063.444: AUX RD: 0020h: 3 11 11 80 0002.063.724: AUX WN: 0010Ah: 5 07 01 01 01 01 0002.063.724: AUX WN: 0010Ah: 5 07 01 01 01 01 0002.063.174: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.063.171: AUX RD: 0020h: 2 11 11 0002.080.446: Deassert HPD 0002.080.708: Monitor AUX for transactions 00022.080.708: Monitor AUX for transactions 0002.080.612: AUX WN: 0010Ah: 1 00 002.080.612: AUX WN: 0010Ah: 1 00 0003.081.655: Source DUT does not generate AUX transaction while HPD is low 0003.081.244: Test PASSED *** Tests Complete PASSED ***	Delay ti	me, sec 1		Save Rep	ott Clear	

At the completion of each test the result of the test is indicated in the matrix on the right hand side of the test panel. For each test the matrix lists the number of occurrences of each result and the number of tries performed.

## **Test Report**

Results of the test can be saved as a report in HTML format.

### **Viewing the CTS Test Report**

The report file can be viewed with any HTML browser. The report has built-in views for Report Summary, Test Summary, and individual tests.

	Unigraf Test Report	×	+							_		
	$\rightarrow$ C	D file:///	C:/Users/	man native	port.html				☆		${\times}$	
· · · · · · · · · · · · · · · · · · ·	Audio modes: Audio Mode 0: L-PCM, Audio Mode 0: L-PCM, Audio Mode 2: L-PCM, Audio Mode 2: L-PCM, Audio Mode 4: L-PCM, Audio Mode 4: Disable Audio Mode 7: Disable Audio Mode 7: Disable Device supports Fixed Device supports Fixed Device supports Fixed Device supports Fixed Adaptive-Sync range r 1920x1080p maximum 2560x1400p maximum 2560x1400p maximum	, 2 channels , 2 channels , 2 channels , 2 channels , 2 channels ed ad ad ad ad ad ad ad ad ad ad ad ad ad	16 bit @ 44 1 kH 16 bit @ 48 kHz 24 bit @ 48 kHz 24 bit @ 48 kHz fotal mode and Decrease c resh rate support 6: 120Hz 6: 120Hz	z (CD)	13.976 Hz							
-	<ul> <li>4096x2160p is not sup</li> <li>5120x2160p is not sup</li> <li>7680x4320p is not sup</li> </ul>	pported										
1	- 10240x4320p is not su	upported	4 2 1 1 800	rce DIF Detry	on No-Penly I	uting AIV P	and after HDD	Diug Frant	(3200) "			
1	Test Log 0000.000.002: sta 0000.000.963: Set 0000.001.083: Set 0000.001.295: Ena 0000.001.295: Ena	art test ' DCD_REV MAX_LINN Extended able TPS3 able TPS4	7 = 14 K_RATE = 1Eh, d Receiver Ca support support	MAX_LANE_COUN	JT = 4	-	ead after HPD	Plug Event	(3200us)"			
	Test Log 0000.000.902: Stat 0000.000.963: Set 0000.001.033: Set 0000.001.214: Set 0000.001.214: Set 0000.001.475: Ena 0000.001.475: Ref 0001.011.200: Wai 0001.045.042: Ref 0001.045.042: Ref 0001.045.090: Wai	art test ' DPCD_RET MAX_LINE Extended able TPS3 Mg HPD Pul Ference So AUX reque Ference So AUX reque Ference So AUX reque	7 = 14 <u>X</u> RATE = 1Eh, a support support lse (1000 ms) ink is set no arce DUT issu sst received ink does not irce DUT issu	MAX LANE COUN pabilities Fie t to respond t es an AUX requ send any reply es another AUX	NT = 4 eld Present = co any AUX request y to AUX request	1 Juest	ead after HFD	Flug Event	(3200us)"			
	Test Log 0000.000.902: Sta 0000.000.963: Set 0000.001.033: Set 0000.001.24: Set 0000.001.25: Ena 0000.001.47: Ena 0000.001.47: Ena 0001.010.97: Ref 0001.011.200: Wai 0001.045.042: Ref 0001.045.090: Wai 0001.045.080: Ref	Art test ' : DFCD_RE: : MAX_JINN : Extended ble TPS3 ble TPS3 ble TPS4 isfor PCD_RE: if or Soc AUX reque Ference Si th for Soc ther AUX Ference SI AUX RE: irce DUT ( irce DUT ( irce DUT (	7 = 14 K_RATE = 1Eh, I Receiver Ca support support lse (1000 ms) ink is set no rece DUT issu sat received ink does not request recei- ink is set to 00201h: 1 loes not disa	MAX LANE COUP pabilities Fie t to respond t es an AUX requ send any reply ived within 37 respond to AU 00 ble video befo g EDID	<pre>IT = 4 Id Present = Id Present = Id AUX request If to AUX request If to AUX request If a set a se</pre>	1 quest est prmally	ead after HFD	Flug Event	(3200us)"			

## **DUT Testing Options**

Please refer to Tools > Options earlier in this manual for control on including system date and time in the beginning of each event line in created reports.

# Audio Test Set

#### Validate audio signal frequency and glitch-free audio reproduction

Perform frequency check on the digital audio content and verify the content to be glitch-free. This test assumes that a pure sine-wave audio signal content is being transmitted to the test equipment.

The test will first capture a minimum of one second of audio content. The audio is then analyzed in two stages.

First, the power spectrum is calculated, and the highest peak must be within the defined window. Resolution of the peak frequency check is better than  $\pm 1$  Hz.

In the second stage, received audio is checked for random glitches, such as dropped or duplicated samples.

The test is considered passed if power of audio content spectrum has its maximum within the defined window, and the number of detected audio glitches does not exceed programmed limit.

📶 Validate audio signal frequency and glitch-free audio reproduction		
Name	Value	
Expected sampling rate of audio signal	44100	
Expected audible (sine) frequency as Hz	1000	
Allowed deviation from expected frequency as Hz	1	
Number of audio glitches allowed per test	0	
Tested audio save conditions	Save none	
Location where the captured audio is to be saved	C:/Users/Tester/Documents/Test Reports	
Presets  V OK Cancel		

#### Parameters in use

- Expected sampling rate of audio signal (default 44 100 s/sec)
- Expected audible (sine) frequency in Hz (default 1000 Hz)
- Allowed deviation from expected frequency in Hz (default 1 Hz)
- Number of audio glitches allowed per test (default 0)
- Tested audio save conditions (Save none / Save failed / Save all)

Click Location where the captured audio is to be saved to browse for the folder to store tests.

# **CRC Based Video Test Set**

Role:	Product:
DP Reference Sink (DP RX)	UCD-500 and Gen 2

### Configuration

			CRC (RGB/CrYCb) c	f Captured Reference Frames
10000		\$	0xB69E,0xB33E,0x	1AB3,
200		٢		
20		•		
1		٢		
1920				
1080		\$		
24		~		
0		•		
0		:	Number of centure	d safaransa famas
	Brow	se		
	0	•		
	Binary file	e ~		
	Align 1			
	200 20 1 1920 1080 24 0	200 20 1 1 1920 1080 24 0 0 8row 0	200 © 20 © 1 © 1920 © 1080 © 24 © 0 © 8rowse 0 ©	10000         •         0x869E.0x833E.0x           200         •         2           20         •         1           1         •         1           1080         •         1           24         •         1           0         •         1           0         •         1           0         •         1           0         •         1

Test timeout:	If enabled test will abort when the time has elapsed
Repeat until timeout:	Omit "Test length" parameter
Test length (# frames):	Number of captured frames to test
Errors allowed (# frames):	Number of failing frames allowed before test Fails
Repeat "Sequence Test" until timeout:	Repeat test sequence until the timeout set (length parameter below omitted)
"Sequence Test" length	Repeat count of the "Sequence Test"
Expected Video Format	Format of the signal expected
Expected Frame Rate:	Verify stability of the video signal. Verification disabled if Expected Frame Rate is set to "0"
Number of captured reference frames:	Number of frames stored as reference
Capture Reference Frames:	Capture reference frames for the test
Folder to save failed frames:	PC folder where failed frames are stored.
Max number of saved frames:	Maximum number of failed frames stored to PC
Format of saved frames:	Select saved image format (Binary file, PPM image, BMP image)
Align 12	12bpc values are be shifted to MSB of a 16bits container. If not checked, 12 LSB are used to store colour component values.
Presets:	Store and recall settings

#### **CRC Based Single Reference Frame Video Test**

The test compares captured frames to a captured reference. In Configure dialog, please select 1 to *CRC Capture length* and click *Capture Now.* 

TE compares the video mode (Frame Width, Height, BPP and optionally Frame rate) to provided parameters and after that captures frames and compares the CRC (check sum) of their three color components to the provided reference until the number of bad frame limit provided is detected or the provided total number of frames is reached.

The test is judged FAIL if video mode does not match, or the number of bad frames is exceeded.

The test optionally captures the failed frames as bitmap images and stores them into the hard disc.

#### Parameters in use

- Test Timeout (default 10 000 ms)
- Total number of frames (default 2 00 ms)
- Number of bad frames allowed (default 20)
- Reference width (default 1920)
- Reference height (default 1080)
- Reference BPP (default 24)
- Expected frame rate (mHz, 1/1000 Hz)
- Frame rate tolerance (mHz, 1/1000 Hz)
- Reference CRCs (R, G, B)

#### **CRC Based Single Frame Video Stability Test**

The test verifies that the captured video is stable.

TE captures a frame and sets the CRC of its color components as reference. After that TE captures frames and compares their CRC (check sum) to the reference until the number of bad frame limit provided is detected or the provided total number of frames is reached.

The test is judged FAIL if the number of bad frames is exceeded.

The test optionally captures the failed frames as bitmap images and stores them into the hard disc.

#### Parameters in use

- Test Timeout (default 100 00 ms)
- Total number of frames (default 200 ms)
- Number of bad frames allowed (default 20)

### **CRC Based Sequence of Reference Frames Test**

The verifies that a sequence of frames is captured in the right order.

TE compares the video mode (frame Width, Height, BPP and optionally Frame rate) to provided parameters. After that captures frames to find a frame with matching CRC (check sum) of their three color components to the first provided reference. After the first matching CRC is found it compares the CRC of the following frames until the Number of frames tested parameter is reached.

The test is judged FAIL if video mode does not match, the first frame in the list is not found or the CRC of the following frames do not match the provided list.

The test optionally captures the failed frames as bitmap images and stores them into the hard disc.

#### Parameters in use

- Test Timeout (default 10 000 ms)
- Number of frames to be tested (default 20)
- Reference width (default 1920)
- Reference height (default 1080)
- Reference BPP (default 24)
- Expected frame rate (mHz, 1/1000 Hz)
- Frame rate tolerance (mHz, 1/1000 Hz)
- Reference CRCs (R, G, B)

Note: Please note that in order for the TE to maintain the sequence, all CRCs in the reference frame list should be different.

#### **CRC Based Continuous Sequence of Reference Frames Test**

The test verifies that a sequence of frames is captured in the right order many times repeatedly.

TE compares the video mode (frame Width, Height, BPP and optionally Frame rate and Color format) to provided parameters. After that captures frames to find a frame with matching CRC (check sum) of their three color components to the first provided reference. After the first matching CRC is found it compares the CRC of the following frames until the Number of frames tested parameter is reached. After that it resets the list and starts from the first CRC. The list is repeated until timeout or until the provided number of repetitions is reached.

The test is judged FAIL if video mode does not match, the first frame in the list is not found or the CRC of the following frames do not match the provided list.

The test optionally captures the failed frames as bitmap images and stores them into the hard disc.

#### Parameters in use

- Test Timeout (default 10 000 ms)
- Number of frames to be tested (default 20)
- Number of iterations
- Reference width (default 1920)
- Reference height (default 1080)
- Reference BPP (default 24)
- Expected frame rate (mHz, 1/1000 Hz)
- Frame rate tolerance (mHz, 1/1000 Hz)
- Expected color format
- Reference CRCs (R, G, B)

# Note: Please note that in order for the TE to maintain the sequence, all CRCs in the reference frame list should be different.

# Link Config Tests

#### Link Training at All Supported Lane Counts and Link Rates

Test requests link training on all supported lane counts and link rates. Each link training must be successfully completed in order to pass the test.

In Configure, please define the parameters for the test.

📶 Link Test Set		×
Name	Value	
Test timeout, in milliseconds	5000	
Max lanes count supported by DUT	4	
Max lane rate supported by DUT	5.4 Gbps	
Long HPD pulse duration, in milliseconds	1000	
Link training start timeout, in milliseconds	5000	
Delay between test cycles, in milliseconds	3000	
Reserved	0	
Presets 🔻		OK Cancel

#### Parameters in use

- Test Timeout (default 5 000 ms)
- Max lane count supported by DUT (default 4)
- Max lane rate supported by DUT.
- Long HPD pulse duration (default 1 000 ms)
- Link training start timeout (default 5 000 ms)
- Delay between test cycles (default 3 000 ms)

# **Pixel Level Video Tests**

#### **Compare Video Frame Sequence with a Single Reference**

The test compares captured frames to the provided reference image on pixel level by buffering the indicated number of captured frames first in the local UCD device frame buffer and after that

Reference image settings		
Load image: 0	Browse im	age
Colorimetry: ITU-R BT 601 🛛 🔌 💽		
Image width (# pixek) Image height (# pixek) Image format	640 480 RGB	¢ • •
Bits per component (bpc)	8	~
Data format align:	MSB	~
Comparison configuration		
Frames count:	60	٥
Maximum number of failed frames allowed per test:	0	0
Maximum number of failed pixels allowed per frame:	0	٥
Tolerance between pixel values:	0	\$
Export properties		
	Browse	2
Folder to save failed images:	0	\$
	0	
Folder to save failed images: Maximum number of exported frames Export format	Binary file	~

downloads them to the PC for evaluation.

The test compares the captured frames to a provided reference image on pixel level.

- The color component values of each pixel in the captured frame is compared to the corresponding pixels in the reference image.
- If the difference is larger than the provided tolerance, the pixel is considered failed.
- If the number of failed pixels in a frame is larger than the provided tolerance, the frame is considered failed.
- If the number of failed frames in the test is larger than the provided tolerance, the test is considered failed.
- Failed frames can be stored for evaluation.

Load image:	Load the reference image
Image resolution:	Video resolution expected
Image format:	Image format expected
Bits per component:	Bits per component expected
Data format:	Video data format expected
Frames count:	Number of frames buffered for testing
Maximum number of failed frames allowed per test:	Number of failed frames allowed totally
Maximum number of failed frames allowed per test:	Number of failed pixels allowed per buffered frame
Tolerance between pixel values:	The allowed difference between a color component of pixel in the captured frame to the reference bitmap.
Folder to save failed images:	PC folder where failed frames are stored.
Maximum number of exported frames:	Maximum number of failed frames saved to PC
Export format:	Format of saved failed frames: Binary file, PPM image, BMP image

#### Presets:

Store and recall settings

#### Capturing Reference Image

Users can use the received video as reference. Make sure you are receiving video first.

1. In *Settings* dialog click the enable preview icon 🔯.

2. When the preview has been enabled click the *Capture reference* icon it to store a frame and use it as reference. Before accepting the frame, the stability of the video is verified with a CRC stability check. Captured CRC can also be verified by the user.

Pixel Level Video Test	5			$\times$
Reference image settir	ngs			
Load image:	af/UCD Console/cache/	DUT/s[1920x1080_rgb_8bpc_Packed_R0	GB_LSB].bin Browse ima	ige
Colorin	netry: ITU-R BT.601	🖉 💽 Crc: 0x1F83, 0xF0	CEB, 0x47CF	O 3
Image width (# pixels) Image height (# pixels Image format			1920 1080 RGB	¢ •
Bits per component (b	pc)		8	~
Data format align:			LSB	~
Comparison configura	tion			
Frames count:			60	٢
Maximum number of	failed frames allowed per test		0	\$
Maximum number of	failed pixels allowed per fram	e:	0	\$
Tolerance between pix	el values:		0	\$
Export properties				
Folder to save failed in	nages:		Browse	
Maximum number of			0	÷
Export format			Binary file	~
			Align to MSB	
Presets 👻			OK	Cancel

# APPENDIX F: VTP PATTERN LANGUAGE

### General

The Vpattern definition language (in the following simply "VTP") is a straightforward yet flexible way of describing test patterns for UCD Generators. This description provides an introduction and examples of the most usable instructions and parameters.

The VTP language uses text command syntax. Each row represents one drawing instruction. The coordinate system can be either absolute or scaled. In the absolute mode the actual pixel position is referred while in the scaled mode the coordinates refer to the "Drawing resolution" used while drawing. For both absolute and scaling coordinates the origin is the upper left hand corner of the screen.

#### Terminology

The following terms are used in this document:

*Coordinate system*: two numerical ranges of integer, positive numbers. E.g.  $\{0,799\},\{0,599\}$  or  $\{0,10000\},\{0,10000\}$ .

*Coordinates*: a tuple of integer, positive numbers used to address a position on an image, e.g. (100,250). The first number is the horizontal position, the second one the vertical position. The actual position is always related to the coordinate system currently in use.

*Drawing resolution*: the width and height of the space that can be used for drawing, expressed in pixels. E.g., 2560 by 1600.

*Drawing area*: a 2-dimensional area spanning all of the drawing resolution, expressed in the current coordinate system notation. E.g., if the drawing resolution is 800 x 600 pixels, the drawing area includes all points (x,y) where x = 0 to 799 and y = 0 to 599 in ABSOLUTE mode or x = 0 to 10000 and y = 0 to 10000 in SCALED mode.

#### **Notation**

The following notation is used in this document:

- A token is enclosed by characters '<' and '>'. For instance, <variable> represents a generic variable.
- Different legal choices for a command parameter are separated by character '|'. For instance, <variable> | <number> means that either variable or number can be used as parameters.
- Items that can be repeated 0, 1 or more times are preceded by '{' and followed by '}\*'. For instance {<number>}\* means zero, one or more occurrences of a number.

#### Syntax rules

The following general syntax rules apply to VTP language files:

- VTP is a text-based, interpreted language.
- Commands, variables, and constant names are not case-sensitive.
- All text at the right of a semicolon (';') is treated as comment.
- All strings are delimited by quotation marks ("a string"). Quote and backslash characters must be prefixed by the backslash symbols (" a quote \" and " a backslash \\").
- Filenames cannot contain pathnames.

# Commands

#### **Scaling commands**

All drawing commands using coordinates can refer either to absolute or scaled coordinates. The absolute coordinate system starts at 0 and its measurement unit is the pixel (vertically the line). It extends up to the maximum drawing resolution in use minus one, expressed in pixels too.

Conversely, the scaled coordinate system ranges from 0 to 10000, independently from the drawing resolution. Its measurement unit is thus a flexible, virtual pixel.

Absolute coordinates provide the fastest drawing speed, but they are resolution specific. Scaled coordinates are resolution independent while introducing a slight speed penalization.

For both systems, the origin (0,0) refers to the upper left hand corner of the screen.

#### ABSOLUTE

#### Syntax: ABSOLUTE

This command is normally used in the beginning of the VTP file. All drawing commands issued after ABSOLUTE will have absolute coordinate values, i.e., their coordinates will be interpreted as pixels and lines.

The allowed coordinate values are from 0 to the maximum drawing resolution minus one. For instance, for a drawing resolution of  $2560 \times 1600$  pixels, the allowed coordinate range (x,y) for x is 0 to 2559 and for y 0 to 1599.

Constants MAXX and MAXY can be used in place of the numeric values to achieve basic scaling capabilities.

#### **SCALED**

Syntax: SCALED

All drawing commands issued after the SCALED command will have their coordinates interpreted as within a range from 0 to 10000 (10001 possible coordinate values), regardless of the current drawing resolution. Positioning can be calculated as percentages. If you wanted to address a point at 50% of the drawing resolution, then you would use the number 5000. If you wanted 75% you would simply use 7500.

#### **Graphics Drawing Commands**

All of the following graphics drawing commands use the currently selected foreground color for shape perimeter and filling.

#### LINE

Syntax: LINE x1 y1 x2 y2

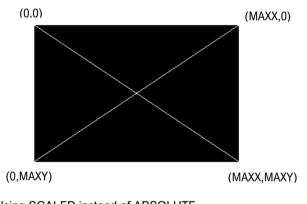
Draws a line from point (x1,y1) to point (x2,y2).

Example:

You can draw a white diagonal cross using either ABSOLUTE or SCALED coordinate mode and get the same result.

ABSOLUTE ; Set scaling mode to absolute. COLORDEPTH 8 ; 8 bits per color COLORRGB 255 255 255 ; white LINE 0 0 MAXX MAXY ; Draw a line from upper left to lower right corner. LINE 0 MAXY MAXX 0 ; Draw a line from lower left to upper right corner. Or if you want a fixed size for 640 x 480 resolution LINE 0 0 639 479 LINE 0 479 639 0

The pattern will look like this:



Using SCALED instead of ABSOLUTE.

SCALED COLORDEPTH 8 COLORRGB 255 255 255 LINE 0 0 10000 10000 LINE 0 10000 10000 0

#### <u>BOX</u>

Syntax: BOX x1 y1 x2 y2

Draws a filled rectangle with upper left corner (x1,y1) and lower right corner (x2,y2).

Example:

This code will create a full white screen with all resolutions.

SCALED COLORDEPTH 8 COLORRGB 255 255 255 BOX 0 0 10000 10000

#### DOT

Syntax: DOT x y

Draws a single dot at location (x,y).

#### <u>FILL</u>

Syntax FILL x y

Initiates a flood fill (or seed fill) with foreground color starting from position (x,y).

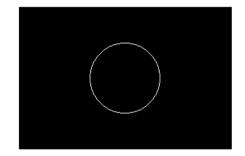
#### **CIRCLE**

Syntax: CIRCLE x y r

Draws a circle with center point at (x,y) and radius r. Please, note that when using SCALED coordinates radius r is expressed using reference to vertical maximum.

Example:

SCALED COLORDEPTH 8 COLORRGB 255 255 255 CIRCLE 5000 5000 2500 The pattern will look like this:

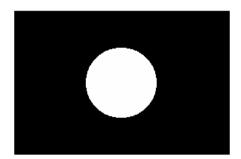


### **FCIRCLE**

Syntax: FCIRCLE x y r

Draws a circle with center point at (x,y) and radius r. Filled with foreground color. Please, note that when using SCALED coordinates radius r is expressed using reference to vertical maximum.

The pattern will look like this:



#### ELLIPSE

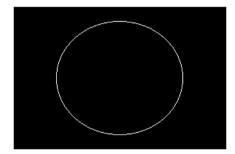
Syntax: ELLIPSE x y hr vr

Draws an ellipse with center point at (x,y), horizontal radius hr and vertical radius vr.

You can use ELLIPSE instead of CIRCLE for example for compensating the stretching in applications where the displayed pixel is not square.

Example:

SCALED COLORDEPTH 8 COLORRGB 255 255 255 ELLIPSE 5000 5000 3000 4000 The pattern will look like this:



#### **Text Drawing Commands**

All of the following commands use the currently selected foreground color for the "foreground" pixels of the font and the currently selected background color for "background" pixels.

#### **TEXTPOS**

Syntax: TEXTPOS x y

Sets the text drawing position to point (x,y).

#### <u>TEXT</u>

Syntax: TEXT <string> | <var> | <const> { <string> | <var> | <const> }\*

The command executes a CR and LF (carriage return and line feed) and then draws a text string <string>, a variable <var>, a constant <const> or a combination of them starting from the current text position.

<string> parameter is a quoted sequence of characters. If the string contains a quote character (") or a backslash character (\) then it must be preceded with a back slash character (\).

<var> is a parameter variable (A – Z, MAXX, MAXY) defined by SET command.

<const> one of the Timing Variables. Timing variables are defined by currently loaded timing parameters. Please refer to Chapter 3.

Example:

ABSOLUTE	
COLORDEPTH 8	
COLORRGB 255 255 255	
TEXTPOS 100 100	; Text starting point 100 pixels from left edge and ; 100 display lines down from top
TEXT "HRES=" HR " PIXELS"	; This will draw the text HRES then the value of variable HR ; and PIXELS
TEXT "Quote character \" and ba	ackslash \\"

### **Program Flow Commands**

### **REPEAT**

Syntax: REPEAT <variable> a b s

All commands after between REPEAT and END command are repeated the number of times defined by <variable>. <variable> is set to value a before starting the first iteration loop. At the end of each iteration, variable is incremented by s (variable = variable + s). The REPEAT is terminated when variable reaches or exceeds value b, and the execution continues from the command following the END command. For example:

SCALED COLORDEPTH 8 COLORRGB 255 255 255 REPEAT W 0 10000 200 LINE W 0 W 10000 END A maximum of 2 REPEAT loops can be nested (placed inside each other).

#### END

Syntax: END

This command follows a REPEAT command and defines a group of instructions to be repeated.

### **Color Commands**

#### **COLORDEPTH**

Syntax: COLORDEPTH n

The command is used in True Color Mode (COLORMODE 2), to define the number of bits used for each color component (R, G and B) of the data to be displayed. Possible values for parameter "n" are 6, 8, 10 and 12.

If COLORDEPTH command is not used, 10 bits per color is used.

Example: To display a bitmap that uses 8 bits for r, g and b (24-bit colors) you have to use COLORDEPTH 8.

Command	Nr of color bits	Range of values for R, G and B
COLORDEPTH 6	18	0 to 63
COLORDEPTH 8	24	0 to 255
COLORDEPTH 10	30	0 to 1023
COLORDEPTH 12	36	0 to 4095

COLORDEPTH can be used only once in a VTP file, and it has to be placed before all drawing instructions it is supposed to affect.

#### COLORRGB

Syntax: COLORRGB r g b

The command defines the foreground color used for the following drawing commands. The command is used in True Color Mode only.

The range of values for r, g and b depends on the bits per color used. If not changed with COLORDEPTH command, 10 bits per color is used. Please refer to COLORDEPTH command for range of values.

#### **Various Commands**

<u>SET</u>

Syntax: SET <variable> n

Assigns value n to programming variable called variable. n must be a positive number or zero.

## Variables

### **Timing Variables**

Timing Variable	Value name
HF	Drawing resolution horizontal size minus one
HP	Drawing resolution vertical size minus one
HR	Current timing horizontal frequency (MHz?)
НА	Current timing horizontal period (pixels)
HS	Current timing horizontal resolution (pixels)
HBP	Current timing horizontal active time (pixels)
HFP	Current timing horizontal sync length (pixels)
VF	Current timing horizontal back porch length (pixels)
VP	Current timing horizontal front porch length (pixels)
VR	Current timing vertical frequency (MHz?)
VA	Current timing vertical period (lines)
VS	Current timing vertical resolution (lines)
VBP	Current timing vertical active time (lines)
VFP	Current timing vertical sync length (lines)
PF	Current timing vertical back porch length (lines)
HLB	Current timing vertical front porch length (lines)
HRB	Pixel frequency (Mpps?)
VTB	Drawing resolution horizontal size minus one
VBB	Drawing resolution vertical size minus one

### **Expressions**

Any command numeric parameter can be replaced by an expression, according to the syntax below:

<term> ::= <variable> | <constant> | <number>

<expression> ::= <term> { '+' | '-' | '\*' | '/' | '%' } <term>

<parameter> ::= <term> | <expression>

Some example of legal parameter values:

### B MAXX 342 B + MAXX B / 2 B \* C

Expressions always have positive integers or zero value. When an expression is evaluated to a negative value, it is set automatically to zero. Number values are also always positive integers or zero.

### **Assignments**

A variable can be assigned a numerical value by using the SET command.

The second parameter of the SET command can be replaced by an expression thus allowing commands like those here below:

SET C B+MAXX SET K K+1 SET K A+B

### Default state at VTP execution startup

Coordinate system:	ABSOLUTE
Foreground color:	1023 1023 1023
Background color:	0 0 0
Image:	Output image is cleared (all black)
Variables:	All variables are initialized to zero
Color depth:	COLORDEPTH 10

# APPENDIX G: FIRMWARE RECOVERY

The chapter below describes a procedure for recovering Firmware of UCD-5XX unit in a case when e.g., the normal FW Update procedure failed because of a critical error.

Note

The firmware recovery procedure is only available for Windows operating system.

# **Downloading Tools**

The Recovery patch is programmed to UCD Device with a separate tool called Intel® Quartus® Prime Pro Edition Programmer and Tools. The tool can be downloaded from Intel® FPGA website:

https://www.intel.com/content/www/us/en/software-kit/746667/intel-quartus-prime-pro-edition-design-software-version-22-3-for-windows.html

1. On the download page, please select section "Additional Software". Please download the software under "Intel® Quartus® Prime Pro Edition Programmer and Tools".

2. Please download and install the tool using default option in the PC.

intel	PRODUCTS SUPPORT SOLUTIONS DEVELOPERS PARTNERS & @usincome	1
FPGA	re Dewiload Center	
	Intel® Quartus® Prime Pro Edition Design Software Version 22.3 for Windows Date Version 746667 9/24/2022 22.3 (Latest) x	
	The Intel <sup>®</sup> Quartus <sup>®</sup> Prime Pro Edition Design Software, Version 22.3 includes functional and security updates. Users should keep their software up-to-date and fullow the technical recommendations to help improve security. Additional lecturity updates are glarmed and will be provided as they become available. Users should promptly install the latest version upon refease.  Intel <sup>®</sup> Quartus <sup>®</sup> Prime Pro Edition Design Software, Version 22.3 is subject to removal available. Users should promptly install the latest version upon refease.  Intel <sup>®</sup> Quartus <sup>®</sup> Prime Pro Edition Design Software, version 22.3 is subject to removal available. Users should promptly install the latest version upon referse.  Intel <sup>®</sup> Quartus <sup>®</sup> Prime Pro Edition Design Software, version 22.3, subject to removal available to receive customer motifications by e-mail glarge subscribe to our customer motification mailing is.  If you are using floating license server for Intel FPGA software, you need to upgrade to the latest license daemon software (v11.18.2.0), Intel FPGA software, version 22.3, doesn't work with old version of daemon software (version 22.3, doesn't work with old version of daemon software (v11.18.2.0), Intel FPGA software, version 22.3, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work with old version of daemon software (version 22.4, doesn't work work work work work w	
	ptc-22.3.0.104-windows.exe       SHA1: b8adb559957633e99d3b147af7a509f173606b3b         ** Installation size: 0.39 GB	
	Intel® Quartus® Prime Pro Edition Programmer and Tools           Download         Size: 1.2 GB           QuartusProProgrammerSetup-22.3.0.104-windows.exe         SHA1: 46fa1732c9aac991e85bdebb3cdac94298c0954d           ** Installation size: 3.46 GB         SHA1: 46fa1732c9aac991e85bdebb3cdac94298c0954d	
	Ashling RiscFree IDE for Intel® FPGAs           Download         Size: 541.5 MB	

# Step 1

- 1. Connect the UCD device to the power supply and switch on power.
- Connect the UCD device with a USB cable to the PC through USB connector (Please refer to chapter Product Description > Connections earlier in this document)
- 3. Please locate the *UCD-5xx\_recovery.zip* file. By default the file is stored in C:\Program Files\Unigraf\Unigraf UCD Tools\recovery
- 4. Extract the content of the ZIP file in a folder in your PC, e.g., C:\Temp
- 5. Open Windows **Command Prompt** application
- 6. Change current directory to where the ZIP file was extracted (e.g. cd |Temp)
- Connect a micro-USB cable to JTAG connector in the UCD device (Please refer to chapter Product Description > Connections earlier in this document).
- 8. In the directory where the ZIP file was extrected (e.g. c:\Temp) please edit file recovery.bat
- On line three (3) parameter "QUARTUS\_DIR" is set to point to the folder where the Qartus Programmer was installed (by default C:\intelFPGA\_pro\22.3). If needed, please edit line three to match. Please save the file.

```
*recovery.bat - Notepad
<u>File Edit Format View H</u>elp
@ECHO OFF
SET OUARTUS_DIR=C:\intelFPGA_pro\22.3
SET QUARTUS_BINS=%QUARTUS_DIR%\qprogrammer\quartus\bin64
if EXIST %OUARTUS DIR%\ (
 FCHO -----
ECHO Programming s10_isp.sof to FPGA. Wait for ~1-2 minutes
 FCHO
 %QUARTUS_BINS%\jtagconfig.exe --setparam 1 JtagClock 6000000
 %QUARTUS_BINS%\quartus_pgm.exe -c 1 --mode=JTAG --operation="p;s10_isp.sof@1"
 ECHO -
 ECHO Please check if s10_isp.sof was programmed successfully, i.e. no errors on log above
 ECHO Please run FW update utility to complete recovery procedure
 ECHO
) else (
```

FCHO "%OLIARTIIS DIR% directory does not exist. Find Quartus programming tool location and cou

- In Windows Command Prompt application please make sure that current directory is still the same (e.g. C:\temp)
- 11. Launch batch recovery.bat
- 12. Please wait until the batch file has been completed (may take up to several minutes).

## Step 2

Perform FW update procedure as described in section **Installation > Firmware Update Procedure** earlier in this manual.

After Recovery procedure has been completed, you can delete the files stored in e.g., C:\Temp.

# APPENDIX H: PLAYLISTS AND SCENARIOS

UCD Console's Playback tab enables the user to execute playback macros called Playlists. Playlists define the video and audio content and the related metadata streamed in predefined sequences.

UCD Console - UCD-500 [2150C473]: DisplayPort Source and Sink Eile Iools <u>W</u> indow <u>H</u> elp		- 🗆 X
DP RX DP TX Event Log		
Link Pattern Generator Playback Audio Generator HDCP EDID DF	PCD FEC Sink DUT Testing	
Import	Selected Sequence	
Common HDR10+ Test	Source: Select Editor	
✓ Sample Content	Video	
<ul> <li>Basic Video &amp; Audio Example - DP.txt</li> </ul>	Source: -	
Flip-flop with Audio Flip-flop Silent	Amount: -	
Philips 1920x1080p + 1kHz	Horizontal Vertical Misc	
Philips 3840x2160p + 1kHz Y Frame Rate Example - DP.txt	Total - Total - Frame Rate, Hz: - Start - Start - Color Depth, BPP: -	
Spinners FHD 59fps	Active - Active - Color Encoding: -	
Spinners FHD 119fps	Sync Width - Sync Width -	
Spinners UHD 59fps Spinners UHD 119fps		
✓ HDR & Metadata Example - DP.txt	Audio	
	Source: -	
Run	Amount: -	
	Compressed: - Amount of channels: -	
	Sampling: - Bit depth: -	
	Packets	
	Source: -	
	Amount: -	
	Status: Idle	
HPD		
Asserted		
nline online		

#### **Playlist**

*Playlist* defines the UCD device and the output where the content is played. It lists the played Scenarios and their duration.

#### **Scenario**

*Scenario* is an operating structure that allows the user to determine a specific sequence of video frames, metadata packets and audio that are going to be played in the defined order.

Playlists and Scenarios are stored as human readable text files. The files can be edited using any text-editor software.

#### **Frame Memory**

When played, all content is first loaded to the frame memory buffer of the UCD device. This enables smooth transition between content items during execution of the Scenario.

The size of frame buffer memory sets a limit for content that can be played. In their default configuration UCD-5XX devices feature a 16 GBytes frame buffer memory. This frame buffer enables loading up to 320 pcs 4K video frames or 80 pcs 8K video frames. For information about models with larger frame buffer memory, please contact Unigraf.

#### Sample Content

UCD Console's Playback tab features a set of sample content. These examples can be used as a basis for creating custom test sequences. The sample content is stored as files by default in *C:\Program Files\Unigraf\Unigraf\Unigraf UCD Tools\Resources\playback\content*. It is advisable to create a copy of the installed original files and edit the copies.

Please find a description of the sample content later in this Appendix.

# **Playlists**

Playlist defines the UCD device and the output where the content is played. It lists the played video and audio sequences called Scenarios and their duration.

Playlists are stored as human readable text files. The files can be edited using any text-editor software. It is advisable to create a copy of the installed original files and edit the copies.

Note: Please note that Playlists and Scenarios are interface technology dependent. Metadata (or packets) are different between HDMI and DisplayPort

#### **Device section**

Section describes what device and what output connector to use.

Кеу	Description	Possible values
[Device]	Required. Start of the Device section.	
serialnumber	Required. Specifies serial number of the UCD device. The '*' wildcard can be used if only one UCD source device is connected to the PC.	'*' '1722C333'
connectortype	Required. Specifies output connector to be used. Playlist cannot contain scenarios for different connector types.	'HDMI Out' 'DisplayPort Out' 'USBC Out'
reset	N/A	'0' or '1' Default '0'

#### **Scenario section**

Section describes selected scenario and its playback parameters. Playlist runs scenarios in the order they are listed in the Playlist file.

Кеу	Description	Possible values
[Scenario]	Required. Start of a Scenario section. Playlist can have multiple Scenario sections.	
caption	Optional. Title of the Scenario. Any character string accepted.	'Scenario 1' 'SDR - HDR'
path	Required. Specifies path to scenario file.	Any path
period	Required. Duration of Scenario in msec. The duration is ignored if close-after-upload is set to '1'.	'60000' '5000'

# **Scenarios**

A Scenario is an operating structure that allows the user to determine a specific sequence of video frames, events and audio that are going to be played in a certain order. In addition, scenarios determine the environment for sequence to play.

Scenarios are stored as human readable text files. The files can be edited using any text-editor software. It is advisable to create a copy of the installed original files and edit the copies.

Note:

Please note that Playlists and Scenarios are interface technology dependent.

## Parameters

Scenario parameters are defined as a list of items. Please find below a description of Scenario items.

Scenario item	Description
video= :	Path and file name format of video frame files
audio= :	Path and file name of the audio file
packets= :	Path and file name format of metadata packet files
porder= :	Content Playing Order. Please see Content Playing Order below.
align12=1	Alignment of 12-bit binary pixel data. '1' aligned to LSB; '0' aligned to MSB.
audioswap= :	'1' for Little Endian audio samples
audiocompressed= :	'1' compressed audio; '0' uncompressed audio
audiosampling= :	Audio sampling rate. E.g., 44100
audiochannels= :	Nr. of audio channels
audiobits= :	Audio bits per sample (usually 16 or 24)
scrambler= :	'1' scrambling enabled; '0' scrambling disabled
colorspace= :	Video color space: RGB; YUV444; YUV422; YUV420
bitspercolor= :	Video color depth (bpc)
timing.hactive= :	Timing: Horizontal active
timing.vactive= :	Timing: Vertical active
timing.htotal= :	Timing: Horizontal total
timing.vtotal= :	Timing: Vertical total
timing.hstart= :	Timing: Horizontal start
timing.vstart= :	Timing: Vertical start
timing.hsync= :	Timing: Horizontal sync width
timing.vsync= :	Timing: Vertical sync width
timing.frate= :	
hdcp= :	HDCP version used
loadingRGB= :	The R, G and B color components of solid color pattern shown when content is being uploaded to the device before playback (e.g., 0,0,0)
linkRate:	Default link rate. HDMI: 0 = TMDS; 1 – 5 = FRL with 3, 6, 8, 10 and 12 Bbps link rate. DP: Link rate = Value × 0.27 Gbps. (E.g., 20 = 5.4 Gbps/lane (HBR2)).
linkRateMin= :	Minimum link rate used. If available link rate is lower, scenario will fail.
DSC timing parameters:	Parameters are different between DP and HDMI. Please see below.

### DSC Timing parameters for HDMI

dscFrameRate=	DSC Timing: Frame rate [fps] × 1000
dscHcactive=	DSC Timing: Horizontal active
dscHcblank=	DSC Timing: Horizontal blank
dscVtotal=	DSC Timing: Vertical total
dscVsync=	DSC Timing: Vertical sync
dscVstart=	DSC Timing: Vertical start
dscVactive=	DSC Timing: Vertical active

### DSC Timing parameters for DP

dscFrameRate=	DSC Timing: Frame rate [fps] × 1000
dscVtotal= DSC Timing: Vertical total	
dscVsync=	DSC Timing: Vertical sync
dscVstart=	DSC Timing: Vertical start
dscVactive=	DSC Timing: Vertical active
dscHtotal=	DSC Timing: Horizontal total
dscHsync=	DSC Timing: Horizontal sync
dscHstart= DSC Timing: Horizontal start	
dscHactive=	DSC Timing: Horizontal active

### **Content Playing Order**

Playing order is described in a textual format as a sequence of steps. Steps are separated with ';' symbol.

Each step describes:

- Index of played video frame or a range of video frames,
- How many times the frame(s) are played,
- Index of the packet or the set of packets that will be sent during the video frame(s),
- Color format used for the step.
- Optional frame rate when VRR/Adaptive-Sync is enabled.

#### Format structure

Each scenario step is described in following textual format:

pV:R:E:FvXX;

#### Parameters

Please see table below for description of used parameters.

Char	Description	Possible values	Examples
:	Required. Separator between general step parameters.	·.,	See any below
;	Required. Indication of step description end.	"." "	See any below
р	Not used with UCD-5XX	'p'	ʻp1:60:1:256;' ʻp0-59:60:1:256;'
V	Required. Index of a video frame. Index is zero based. Images are loaded from the indicated file path. Parameter can state either a single image or a range of images. The order in which images are called in scenario steps is optional. All specified parameters are applied to all frames in the scenario step.	'1' '0-59'	'1:60:16:256;' '0-59:60:16:256;'
R	Required. Repetitions of current step. E.g., stating '1' with 60 FPS frame rate means that current step will be played only for 1/60 of a second.	'30' '1'	'1:30:16:256;' '1:1:16:256;'
E	Optional. Index of metadata packet. Index is zero based. Packets are loaded from the indicated file path. Parameter can indicate either a single packet or a comma separated list of packets. Order of packets is optional.	'0' '4,1,29' none	'1:30:0:256;' '1:30:4,1,29:256;' '1:30::256;'
F	Required. Color format and color depth. PIs see chapter Color Format below.	'256' '513'	'1:30:0:256;' '1:30:0:513;'
vXX	Optional. Control of frame rate when VRR/Adaptive-Sync is enabled. In order to enable VRR/Adaptive-Sync, the corresponding event must be included in this step. The parameter is always in format of 'vXX', where 'XX' states frame rate. The parameter is provided after color format value, separated with 'v'.	'v60' 'v30'	'1:30:0:256v60;' '1:30:0:256v30;'

### Color Format

Color format is a two-byte value presented in decimal. The lower byte provides an index to used color space and the higher byte an index to the color depth. Please find the indexes in the table below.

Index	Color Depth (bits/color)	Color Space
0	6	RGB
1	8	YCbCr 4:4:4
2	10	YCbCr 4:2:2
3	12	YCbCr 4:2:0
4	16	-

The encoded parameter value is calculated using the following formula:

[Color Depth] × 256 + [Color Space],

where [Color Depth] and [Color Space] are indexes obtained from the table above.

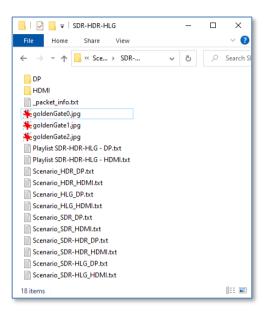
For example, parameter for YCbCr 4:4:4, 10 bits is  $(2 \times 256 + 1) = 513$ .

Pre-calculated values for available color formats:

	6 BPC	8 BPC	10 BPC	12 BPC	16 BPC
RGB	0	256	512	768	1024
YCbCr 4:4:4	N/A	257	513	769	1025
YCbCr 4:2:2	N/A	258	514	770	1026
YCbCr 4:2:0	N/A	259	515	771	1027

# Example

Please find below the description of Playlist SDR-HDR-HLG – DP.



### Playlist file (Playlist SDR-HDR-HLG - DP.txt)

( )	/
Playlist item and example content	Description
[Device]	Start of device section
Serialnumber = *	Only one UCD device present.
Connectortype = DisplayPort Out	DisplayPort output
[Scenario]	Start of Scenario 1
caption = SDR	Scenario title "SDR"
period = 10000	Duration 10 sec
path = Scenario_SDR_DP.txt	Scenario file: Scenario_SDR_DP.txt in current folder
[Scenario]	Start of Scenario 2
caption = HDR	Scenario title "HDR"
period = 10000	Duration 10 sec
path = Scenario_HDR_DP.txt	Scenario file: Scenario_HDR_DP.txt in current folder
[Scenario]	Start of Scenario 3
caption = HLG	Scenario title "HLG"
period = 10000	Duration 10 sec
path = Scenario_HLG_DP.txt	Scenario file: Scenario_HLG_DP.txt in current folder
[Scenario]	Start of Scenario 4
caption = SDR – HDR	Scenario title "SDR – HDR"
period = 10000	Duration 10 sec
path = Scenario_SDR-HDR_DP.txt	Scenario file: Scenario_SDR-HDR_DP.txt in current folder
[Scenario]	Start of Scenario 5
caption = SDR – HLG	Scenario title "SDR – HLG"
period = 10000	Duration 10 sec
path = Scenario_HDR_DP.txt	Scenario file: Scenario_SDR-HLG_DP.txt in current folder

### Scenario File (Scenario\_SDR-HDR-DP.txt)

Scenario item and example content	Description
video=goldenGate0.jpg	Video files in current folder, file name format goldenGate0.jpg (0)
audio= <audio not="" selected=""></audio>	Audio not selected
packets=DP\Infoframes_0000.bin	Packet files in folder DP file name format Infoframes_0000.bin (0)
porder=0:180:2:256;1:180:2,0:256;	180 frames of image index 0, Packet index 2, RGB 8 bpc 180 frames of image index 1, Packets index 2 and 0, RGB 8 bpc
align12=1	Pixel data is aligned to LSB
audioswap=0	-
audiocompressed=0	-
audiosampling=0	-
audiochannels=0	-
audiobits=0	-
scrambler=0	scrambling disabled
colorspace=RGB444	Video color space: RGB 4:4:4
bitspercolor=8	Video color depth: 8 (bpc)
timing.hactive=1920	Timing: Horizontal active
timing.vactive=1080	Timing: Vertical active
timing.htotal=2200	Timing: Horizontal total
timing.vtotal=1125	Timing: Vertical total
timing.hstart=192	Timing: Horizontal start
timing.vstart=41	Timing: Vertical start
timing.hsync=44	Timing: Horizontal sync width
timing.vsync=5	Timing: Vertical sync width
timing.frate=60000	Timing: Frame rate 60 fps
hdcp=none	HDCP not enabled
loadingRGB=52,127,150	Solid color pattern shown when content is being uploaded to the device before playback is R=52, G=127, B=150. (Sample:
linkRate=0	
linkRateMin=	
dscFrameRate=60	DSC Timing: Frame rate [fps] × 1000
dscHcactive=7840	DSC Timing: Horizontal active
dscHcblank=100	DSC Timing: Horizontal blank
dscVtotal=2250	DSC Timing: Vertical total
dscVsync=10	DSC Timing: Vertical sync
dscVstart=82	DSC Timing: Vertical start
dscVactive=2160	DSC Timing: Vertical active