



User Manual UCD Console SW Version 3.6

/// UNIGRAF

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Edition

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1. ABOUT THIS MANUAL

Purpose

This guide is a User Manual of UCD-4XX test devices, that 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 the UCD-4XX units.
- Provide instructions for the user on how to use UCD Console SW.

Product and Software Version

This manual explains features found in UCD Console SW 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.



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



Product Description

USB-Connected Test Equipment

UCD-4XX devices are high speed, USB 3.0 connected video interface test units. UCD-4XX units include the following models:

- UCD-400 DisplayPort 1.4a Analyzer and Generator
- UCD-411 DisplayPort 1.4a Generator
- UCD-412 HDMI 2.1 Generator
- UCD-422 HDMI 2.1 Analyzer and Generator
 - UCD-424 USB-C DisplayPort Alt mode Analyzer and Generator

UCD Console SW is a common graphical user interface (GUI) for Unigraf's UCD test devices. The outlook and details of UCD Console SW will vary depending on the capabilities of the connected unit and will reflect the features enabled.

UCD-4XX units feature 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.

Stand-Alone Test Equipment

In stand-alone UCD models the test equipment is built inside a PC and the control interface is a PCI bus instead of a USB connection. Please find below a list of available units:

- UCD-451 Stand-alone DisplayPort 1.4a Generator
- UCD-452 Stand-alone HDMI 2.1 Generator

UCD-400 and UCD-411

Product Features

- UCD-400: Reference Sink and Source for verifying DP connected devices.
- UCD-411: Reference Source for verifying DP connected sinks.
- DisplayPort 1.4a compliant with HBR3 support
- High resolution video up to 8K 30 Hz, 4K / UHD 120 Hz uncompressed and audio.
- Supports MST (4 streams), Adaptive-Sync, Forward Error Correction (FEC), Display Stream Compression (DSC) and Link Training Tunable PHY Repeater (LTTPR)
- Compatible with HDCP versions 1.3 and 2.3
- 2 GB on-board high-speed video frame buffer
- High speed USB 3.0 host PC interface

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

Functional Description

UCD-400 units consist of a multimedia signal input stage with on-board frame buffer, an internal pattern generator, a control stage, 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.



Delivery Content

Product shipment contains:

- The UCD-400 or UCD-411 unit
- AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
- USB 3.0 compliant cable for host PC connection
- Micro-USB type B compatible cable for FW programming
- USB-C to DP Bi-directional Cable for testing USB-C sinks or sources

USB Type-C Interface

UCD-400 and UCD-411 delivery package includes a "C to DP Bi-directional Cable" to enable testing of Sink or Source devices with USB-C interface.

Connections

The image below indicates the connections in **UCD-400** unit and their description.



UCD-412 and UCD-422

Product Features

- UCD-422: Reference Sink and Source for verifying HDMI connected devices.
- UCD-412: Reference Source for verifying HDMI connected sinks.
- HDMI 2.1 compatible. Supports FRL and TMDS signaling.
- Supports HDMI video and audio up to 10K@30 Hz, 8K@60 Hz (YCbCr 4:2:0), 4K@120 Hz (YCbCr 4:2:0)
- Supports Display Stream Compression (DSC), and Enhanced Audio Return Channel (eARC)
- Compatible with HDCP versions 1.4 and 2.3
- 2 GB on-board high-speed video frame buffer
- High speed USB 3.0 host PC interface

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

Functional Description

UCD-422 units consist of a multimedia signal input stage with on-board frame buffer, an internal pattern generator, a control stage, 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.

Please find below logical diagram of UCD-422 unit



Delivery Content

- Product shipment contains:
- The UCD-422 or UCD-412 unit
- AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
- USB 3.0 compliant cable for host PC connection
- HDMI 2.1 grade HDMI cable
- Micro-USB type B compatible cable needed for FW programming.
- Ethernet cable needed for FW programming.

Connections

The image below indicates the connections in **UCD-422** unit and their description.



UCD-424

Product Features

- Reference Sink and Source for verifying DisplayPort[™] Alt Mode over USB-C
- USB-C v1.3 input and output with Power Delivery 3.0
- DisplayPort 1.4a compliant with HBR3 support
- High resolution video up to 8K 30 Hz, 4K / UHD 120 Hz uncompressed and audio
- Supports MST (4 streams), Adaptive-Sync, Forward Error Correction (FEC), Display Stream Compression (DSC), and Link-Training Tunable PHY Repeater (LTTPR)
- Compatible with HDCP versions 1.3 and 2.3
- 2 GB on-board high-speed video buffer
- High speed USB 3.0 host PC interface

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

Functional Description

UCD-424 units consist of a multimedia signal input stage with on-board frame buffer, an internal pattern generator, a control stage, 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.

USB Data bypass can be enabled between the USB-C connector attached to the DUT to an external device connected to the vacant USB-C connector.

The Interface & Control stages are receiving instructions from the host PC to configure and control the functionality of the unit.



Delivery Content

Product shipment contains:

- The UCD-424 unit
- AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
- USB 3.0 compliant cable for host PC connection
- USB-C to USB-C USB 3.2 Gen2 e-marked cable
- USB-C to DP Bi-directional Cable for testing DP sinks or sources.

Connections

The image below indicates the connections in **UCD-424** unit and their description.



UCD-451

UCD-451 is a stand-alone DisplayPort interface test unit with full featured Generator functionality. UCD-451 contains a built-in PC, a DisplayPort reference source, and software for configuring the test interface and running tests.

UCD-451 is designed to specially facilitate Dolby Vision[™] testing in DisplayPort interface.

Product Features

- DisplayPort 1.4a compliant with HBR3 support
- 8K Dolby Vision™ Test Tool
- High resolution video up to 8K 30 Hz, 4K / UHD 120 Hz uncompressed and audio.
- Supports MST (4 streams), Adaptive-Sync, Forward Error Correction (FEC), Display Stream Compression (DSC) and Link Training Tunable PHY Repeater (LTTPR)
- Compatible with HDCP versions 1.3 and 2.3
- Extended video memory up to 32 GBytes
- Embedded Windows PC

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

Functional Description

Part of the DDR memory in the PC motherboard is locked and reserved for storing the playback content. During playback, content is first loaded from hard disk (HDD) to the RAM memory of the PC (DDR). Video frames are then sequentially transferred from PC RAM to pattern generator's internal playback memory via PCIe bus. Pattern Generator firmware triggers a PCIe transfer to request content when needed.

Please find below logical diagram of UCD-451 unit.



UCD-452

UCD-452 is a stand-alone HDMI interface test unit with full featured Generator functionality. UCD-452 contains a built-in PC, a HDMI reference source, and software for configuring the test interface and running tests.

UCD-452 is designed to specially facilitate Dolby Vision™ testing in HDMI interface.

Product Features

- HDMI 2.1 compatible Test Equipment. Supports FRL and TMDS signaling.
- 8K Dolby Vision™ Test Tool
- Supports HDMI video and audio up to 10K@30 Hz, 8K@60 Hz (YCbCr 4:2:0), 4K@120 Hz (YCbCr 4:2:0)
- Supports Display Stream Compression (DSC), and Enhanced Audio Return Channel (eARC)
- Compatible with HDCP versions 1.4 and 2.3
- Extended video memory up to 32 GBytes
- Embedded Windows PC

Note: Due to HW limitations, only 2 GBytes of video memory can be used with uncompressed deep color video at 3840x2160 p144 video timing. This allows for playing sequences containing up to 40 frames.

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

Functional Description

Part of the DDR memory in the PC motherboard is locked and reserved for storing the playback content. During playback, content is first loaded from hard disk (HDD) to the RAM memory of the PC (DDR). Video frames are then sequentially transferred from PC RAM to pattern generator's internal playback memory via PCIe bus. Pattern Generator firmware triggers a PCIe transfer to request content when needed.

HDMI Tx HDMI Pattern Generator Control & Interface

Please find below a logical diagram of UCD-452 unit.

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.

3. INSTALLATION

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 and macOS.

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

Drivers (installed during set up) UCD Console SW (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, also the firmware of the unit 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**.

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 you 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 - '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.

Updating from Earlier FW Versions

UCD Firmware versions prior to 1.8.52 (see Help > About on Consol) do not support the procedure described here. Follow the instructions in *Appendix G Firmware Recovery Procedure with Quartus Prime* in this manual.

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-4XX 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.

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 PD of version 0.0.17 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-4XX 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*.

	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/N.3.5.192.0 UX 2.6.1 UN update needed. Existing 2.6.1] UN 1.3.4 [No update needed. Existing 1.3.4] PDRX 1.4.6 [Existing 1.4.5] [No DTX 1.4.6 [Existing 1.4.5]	.0.0]
	< Bac	ck <u>N</u> ext > Cancel

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

UCD Config	×
UCD Config Review the update operations to perform.	
Operations selected:	
Update device firmware:	
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.	
< <u>B</u> ack 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.

The update proceedure may take several minutes.

Recovering Failures in FW Update Procedure

If FW Update procedure fails (e.g., when updating from an earlier FW that does not support the procedure described here) refer to Appendix G of this manual for instructions in *Firmware Recovery Procedure with Quartus Prime*.

Once FW Recovery procedure has been done and a FW version supporting UCD Firmware Configuration tool has been installed, all future updates can be done using this tool.

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.

UCD Config	×
UCD Modules Modules that should be updated are checked	///
Selected device: UCD-400 [2252C553]	
 UX 2.4.0 [No update needed. Existing 2.6.1] UF 1.3.4 [No update needed. Existing 1.3.4] MFMN4XX F.3.0.45.0/N.1.10.92.0 [No update needed. Existing F.3.5.11/N. 	3.6.71]
	_
< Back Next >	Cancel

License Manager

Licensing

The features of UCD Console SW 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 **UCD License Manager**. The License Manager can be found in the **Tools** menu of UCD Console SW.

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 in a sticker attached to the bottom of the device.

The Rescan... button will re-scan the system for installed hardware.

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.

Adding New License Keys

nter new license for device with seed number:	Kia.	
		Install
ind: DP	Found 17 occurrence(s)	
istalled licenses:		
Name 7 DP 2.1 AUX Controller for testing Source DUT	Key	
B DP 2.1 DisplayID / EDID CTS for testing Branch DUT		
9 DP 2.1 DisplayID / EDID CTS for testing Sink DUT	tertine contraction and the second	
10 DP 2.1 DisplayID / EDID CTS for testing Source DUT	provide the second s	
11 DSC Decoder for testing Source DUT on DP	the second s	
13 DSC Encoder for testing Sink DUT on DP	1000	
15 HDCP 2.3 CTS for testing Repeater DUT on DP	the second s	
16 HDCP 2.3 CTS for testing Sink DUT on DP	Read and a second s	
17 HDCP 2.3 CTS for testing Source DUT on DP		
20 HDR 10+ Display Device and SSTM for testing Sink DUT	Sector - L. Sector - D. Sector	
22 HDR 10+ Distribution Device for testing Source DUT on DP	The second	

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 caret 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.

Click the Search inverted triangle at the upper right to view the *Find* edit control. Enter a search keyword: The license list is updated to show names that contain the keyword.

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 SW 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.

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 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>File Tools W</u> indow <u>H</u> elp		
Devices:	Roles:	
UCD-400 [1845C291]	DisplayPort Source and Sink	
		-
	Rescan Select Close	

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.

<i>)]]</i>	UCD C	onsole - l	JCD-400 [1924C312]: Display	Port Sour	ce and S	ink						-		×
<u>F</u> ile	Tool	s <u>H</u> elp														
(OP RX	DP TX	Event L	og												
	Link	HDCP	Video	Audio	EDID	DPCD	SDP	FEC	Source DUT Testi	ng						
	Auto				Decord		Samo		Caphira	0000	Eul Crean	Eit harizor	 ſ	Dicable	Draviaw	

Options

Options can be found in **Tools > Options**.

Options			2
Options	Debug		
Capturir	ng		
Image F	ile Format	PPM ~	
Audio F	ile Format	WAV ~	
Displays	HDCP compliance:	One or more displays are not HDCP compliant	
Folders			
Director	y to save images and au	dio	
C:/User	s/Tester/Pictures/Saved	Pictures	
DSC			
	np folder		
C:\Tem			
DSC test	t content folder		
C:/Prog	gramData/Unigraf/DSC_	content_library	
🗹 Keep	auto-created DSC cont	ent files	
DUT Test	ting Options		
🗌 Inclu	ude time info in Report le	ogs	
🗌 Do n	not show again test sequ	ence completed	
		OK Cancel	
		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

DSC

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

	<u>D3C</u>						
	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 the DSC compliance test	y created DSC compressed content will shorten the time needed for running s.					
	Please note, that the space needed for storing the full library can be very large (appr. 400 GBytes).						

DUT Testing Options

Configure DUT Testing reports.

Include time info in Report logs:	Include system date and time in the beginning of each event line in created reports.
Do not show again test sequence completed:	Include system date and time in the beginning of each event line in created reports.

Please make sure that the content will be stored in a medium that has the required space available.

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.





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

Analyzer functionality related controls and dialogs can be used by selecting DP RX or HDMI RX tabs.

Please note that in most UCD-4XX Series units, *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. 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.

Standard Tabs

Analyzer role features six standard tabs:

- Video preview and saving (Video)
- Audio monitoring and saving (Audio)
- EDID editor (EDID)
- HDCP status monitor and control (HDCP)
- Source DUT Testing tab
- Event Log

Interface Specific Tabs

Depending on the connected UCD device, additional interface specific tabs will be available.

UCD-400 and UCD-424: DP and USB-C DP Alt Mode Reference Sink

- Status information and control of the upstream link (Link)
- DPCD editor (DPCD)
- SDP sent by the Source device (SDP)
- Status and capabilities of the DSC feature (DSC)
- Forward Error Correction (FEC)

UCD-422: HDMI Reference Sink

- Status information and control of the upstream link (Link)
- Received InfoFrame packets (InfoFrame).

UCD-424: USB-C Reference Sink

USB-C Monitoring (PDC)

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.

Standard Tabs

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.

<u>T</u> ools <u>W</u> indow <u>H</u> elp				
RX Event Log Memory Layout Ter	minal			
ink HDCP Video Audio Link Ar	nalyzer Capture DPCD SE	DP DSC FEC Source DUT Testing E	DID/DisplayID Panel Replay AUX cor	ntroller
HDCP 2.x				
Status	Configuration			
General	HDCP Capable			
Active	Keys			
Authenticated	O Production			
Declared as HDCP capable	O Facsimile - "Test" - R1			
Keys loaded SST Mode: Type Unknown	O Facsimile - "Test" - R2			
	O None			
By stream				
Stream 0 Type N/A Stream 1 Type N/A				
Stream 2 Type N/A				
Stream 3 Type N/A				
PD Assert D4	eassert Pulse HPD 500 mse	c 🗘 Short Pulse 750 usec 🗘		
nline				
ICD Console - UCD-422 [2226C529]: HE Tools Window Help			_	
ICD Console - UCD-422 [2226C529]: HE Tools Window Help			_	
ICD Console - UCD-422 [2226C529]: HE Tools Window Help DMI RX Event Log Memory Lay Link HDCP Video Audio			_	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help DMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4	out Terminal Capture EDID InfoFran	HDCP 2.x	_	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help DMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status	Capture EDID InfoFrar	HDCP 2.x Status	Configuration	
JCD Console - UCD-422 [2226C529]; HC Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Status Active	out Terminal Capture EDID InfoFran Configuration ☑ HDCP Capable	HDCP 2.x Status General	HDCP Capable	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help DMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status	out Terminal Capture EDID InfoFran Configuration ✓ HDCP Capable Keys	HDCP 2.x Status General Active	✓ HDCP Capable Keys	
JCD Console - UCD-422 [2226C529]: HC Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Catus Active	Capture EDID InfoFrar Configuration HDCP Capable Keys	HDCP 2.x Status General Active	 ✓ HDCP Capable Keys ● Production 	
Link HDCP Video Audio HDCP 1.4 Status Active Authenticated Declared as HDCP capable	Capture EDID InfoFrar Configuration HDCP Capable Keys Production Facsimile - "Test"	HDCP 2.x Status General Active Authenticated Declared as HDCP capable	HDCP Capable Keys Production Facsimile - "Test" - R2	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable	Capture EDID InfoFrar Configuration HDCP Capable Keys	HDCP 2.x Status General Active	 ✓ HDCP Capable Keys ● Production 	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable	Capture EDID InfoFrar Configuration HDCP Capable Keys Production Facsimile - "Test"	HDCP 2.x Status General Active Authenticated Declared as HDCP capable	HDCP Capable Keys Production Facsimile - "Test" - R2	
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JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable Keys loaded Repeater Simulation Depth: 1 Device count: 2 KSV Value 1 Oxa 2 OxO	out Terminal Capture EDID InfoFrar Configuration ✓ HDCP Capable Keys ● Production ○ Facsimile - "Test" ○ None Status: OK + - ▲ ▼	HDCP 2.x Status General Active Authenticated Declared as HDCP capable	HDCP Capable Keys Production Facsimile - "Test" - R2	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable Keys loaded Repeater Simulation Depth: 1 Device count: 2 KSV Value 1 0xa	out Terminal Capture EDID InfoFrar Configuration ✓ HDCP Capable Keys ④ Production ○ Facsimile - "Test" ○ None Status: OK + - ▲ ▼	HDCP 2.x Status General Active Authenticated Declared as HDCP capable	HDCP Capable Keys Production Facsimile - "Test" - R2	
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JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable Keys loaded Perfection Depth: 1 © Device count: 2 © KSV Value 1 0xa 2 0x0 HPD	out Terminal Capture EDID InfoFran Configuration ✓ HDCP Capable Keys ● Production ○ Facsimile - "Test" ○ None Status: OK + - ▲ ▼ Freset ▼ Save Load	HDCP 2.x Status General Active Authenticated Declared as HDCP capable Keys loaded	HDCP Capable Keys Production Facsimile - "Test" - R2	
JCD Console - UCD-422 [2226C529]: HE Tools Window Help IDMI RX Event Log Memory Lay Link HDCP Video Audio HDCP 1.4 Status Authenticated Declared as HDCP capable Keys loaded Perfect count: 2 KSV Value 1 Oxa 2 OxO	out Terminal Capture EDID InfoFrar Configuration ✓ HDCP Capable Keys ● Production Facsimile - "Test" Status: OK + - ▲ ▼ Preset ▼ Save Load	HDCP 2.x Status General Active Authenticated Declared as HDCP capable Keys loaded	HDCP Capable Keys Production Facsimile - "Test" - R2	

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.
Declared as HDCP capable:	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 (DP).

Configuration

HDCP Capable: To inform source DUTs that TE (UCD device) is HPCD capable or not. Uncheck to disable.

Repeater Simulation

For HDMI the UCD device can simulate a HDCP repeater. Check the *Repeater Simulation* box to enable the rest of the controls.

Depth:	Depth of Repeater (maximum 4).
Device count:	The number of devices that act as repeaters (maximum 32).
KSV Value	KSV value assigned to each device.
Status	Shows HDCP authentication of repeater.

The Device count can be change via the spinbox or the +/- buttons.

Inverted triangles are used to navigate the KSV rows.

Use the Preset dropdown to Save, Load and Remove named (saved internally) sets.

Use the Import and Export options to load and save to files.

Press Apply to apply settings.

Keys

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

HDCP 1.3 / 1.4 and HDCP 2.3 Limitations

DisplayPort currently only supports HDCP 2.X.

HDMI currently does not support HDCP 2.3.

See ReleaseNotes.txt, Known issues (Limitations) in bundle to see limitations:

C:\Program Files\Unigraf\Unigraf UCD Tools\documents\ ReleaseNotes.txt on Windows.

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.

Stat Open Timeline Viewr Open storage folder E HPD Capture 1 © frames and save them in Disabled or format Buffer capacity: 242 frames Stream: 0 0 1 0 2 0 3 Image: Capture 1 0 0 0 1 0 2 0 3 Stream: 0 0 1 0 2 0 3 Image: Capture 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ink HDCP	Video	Audio Link Analyzer Capture DPCD SDP DSC FEC Source DUT Testing	EDID/DisplayID Panel Replay AUX control
B HPD Capture 1 frames and save them in Disabled format Buffer capacity: 242 frames B AUX Stream: 0 0 1 0 2 3 S SDP Image: Capacity: 242 frames MSA Image: Capacity: 242 frames Image: Link Pattern Image: Capacity: 242 frames <th>Start</th> <th></th> <th></th> <th>Open Timeline Viewer Open storage folder</th>	Start			Open Timeline Viewer Open storage folder
AUX Stream: 0 1 2 3 SDP Image: Stream: 0 1 2 3 VB-ID Image: Stream: Create scenarios Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream: Image: Stream: Image: MSA Image: Stream: Image: Stream: Image: Stream:<	Events		Buffered Capture Options	
SDP Image: Align to MSB VB-ID Image: Create scenarios MSA Image: Create scenarios Link Pattern Image: Create scenarios AUX_BW Image: Create scenarios AUX_BW Image: Create scenarios VFRAME INFO Image: Create scenarios Select all Audio:	HPD		Capture 1 🕞 frames and save them in Disabled 🗸 format	Buffer capacity: 242 frames
VB-ID Image: Create scenarios MSA Image: Create scenarios Link Pattern Image: Create scenarios AUX_EW Image: Create scenarios VFRAME INFO Image: Create scenarios Select all Audio:	Z AUX		Stream: • 0 • 1 • 2 • 3	
WA-ID Image: Seconario time 1000ms Image: Seconario time 1000ms MSA Image: Seconario time 1000ms Image: Seconario time 1000ms Image: AUX_BW Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconario time 1000ms Image: Seconariotitime 1000ms Image: Seconario time 1000	SDP	 	Align to MSB	
MSA (2) Link Pattern (3) AUX_BW VFRAME INFO Select all Audio:Enabled	VB-ID	63	Create scenarios	
Inite Pattern Inite AUX_BW Inite VFRAME INFO Inite Select all Audio:	MSA	(Ö)	Scenario time 1000ms 🗘	
AUX_BW VFRAME INFO Select all Audio: Enabled 	Link Pattern			
Image: VFRAME INFO Image: Select all Audio: Image: Delta Select all		-0-		
		0		
Status: Idle	Select all		Audio: Enabled	

<i>///</i> 0	CD Con	sole - UCD-	422 [2226C529]: HDIMI Source and Sink	
File	Tools	Window	Help	

<u>File Tools Window H</u> e	lp	
HDMI RX Event Log	Memory Layout Terminal HDMI TX	
Link HDCP Vide	o Audio Capture EDID InfoFrames Source DUT Testing CEC	
Start		Open Timeline Viewer Open storage folder
Events	Buffered Capture Options	
HPD	Capture 10 🗘 frames and save them in PPM 🗸 format	Buffer capacity: 242 frames
✓ Packets (③)	☐ Align to MSB	
✓ I2C ()	✓ Create scenarios	
CEC	Scenario time 1000ms	
✓ Select all	Audio: 🗹 Enabled	
Status: Capture stoppe	ed.	

Start / Stop	Start or stop capturing. Button label changes per action.
Capture N frames:	The number of video frames to capture.
Format:	Selection of the format of the saved video frame bitmaps. BIN, PPM, BMP, BIN + PPM, BIN + BMP.
Buffer capacity:	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).
Create scenarios	Define the length of the scenario.
Events:	Please refer to chapter <i>Event Log</i> for details of the captured events.
Audio:	Enable audio.
Status:	Status of the capture.
Open Timeline Viewer	Open Event Timeline Viewer to view the captured data. For detailed instructions refer to chapter seven of this manual.
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).

Video Tab

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



Disable / Enable Preview

Click the button to start or stop capturing video frames.

Current Stream (UCD-400, UCD-424)

Stream:
 0
 0
 1
 2
 3

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

Video Status

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

	09:19.30.975.164.000	(1427 x 915) RGB (0x00; 0x00; 0xFF) 0: 1920 x 1080 @ 59.995 Hz, RGB 8 bpc, Frame#12404.				
	MV 6007, NV 32768, H Live preview frame r	HT 2200, VT 1125, HA 1920, VA 1080, HS 192, VS 41, HSW 44, VSW 5. rate: 19.55 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.					
	Live preview f	at UCD test equipment are able to capture video at full frame rate. <i>Frame rate</i> indicates the rate of updating captured video on UCD Console preview te is limited e.g by the USB communication between UCD test equipment and the PC.				

Override Color Detection

The 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-	detected 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. Buffered mode can also be enabled in this dialog.

/// Record		?	×
Number of Frames to record 1 💼 🔲 Buffered Capacity of the buffer: 36 frames	OK	Can	cel

Buffered	When checked, all input frames are captured non-drop until the on-board frame buffer will be full.
	When not checked, only one input frame is buffered at a time. Frames will be skipped if the transfer of the data to the PC is slower than the input data rate.
Capacity of the buffer	Capacity of the on board frame buffer with the selected video and color mode.

Note: Please note that buffered mode cannot be used when Audio preview is enabled.

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. Double click or click **Open** to select a frame file for viewing. Please refer to Tools > Options where the location of this folder can be customized.

Full Screen

Full Screen

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

Double-click on the screen to exit full screen mode.

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.

nk	HDCP	Video	EDID D	PCD S	DP DS	C FEC	Source DUT Test	ting Capture	Audio	Link Analyzer				
	Auto		Record	Si	пар	Open	Full Screen	Fit Horizont	ally	Stream:	0 0 1 0	2 () 3	Disable Previ	ew
Video	UCD	_snap_12-2	22.54522 🔀	UCD_s	nap_12-22.	48977 🗵								
		۰.				•								
				۰.		_ /								
		۰.												
				۰.		_								
		۰.												
				۰.	_	_								
		۰.				•								
					_	_								
														Ļ
													>	
22.5	4.493.394.	000: 1920 x	1080 @ 59.99	15 Hz, RGE	8 8 bpc Fran	me#16300				(1	250 x 550)	RGB (0x00;	OxFF; Ox	00)

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 Red, Green and Blue components of the pixel on the cursor location in decimal values
- The HTML HEX color code of the pixel on cursor location
- In case of YCbCr color mode the intensity of the Y, Cb and Cr components of the pixel on the cursor location in decimal 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.

Previewing DSC Decompressed Stream (UCD-400, UCD-422, UCD-424)

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.

RX	DP TX	Event Lo	9															
ink	HDCP	Video	EDID	DPCD	SDP	DSC	FEC	Source DUT	Testing	Capture	Audio	Link A	nalyzer					
	Auto		Recor	d	Snap		Open	Full Sci	een [] Fit Horizo	ntally		Stream	n: 🖲 0	010	2 0 3	Disable	Previe
Vide	0																	
	0015 1939		6.475	5855 N.A.	47 4 8 - 3	100028	154.00	Sector Sector	1000	UN CHURCH	199662-2	1.5582						
	Charles I.				a fair				10 12 C									
	A. 14 3	di colosi						14 - A					A-12					
		SIL																
			A. Mark					in the same					100					
			a de la					C. A. S. Con										
				T	SC	' P	AW	Data										
							1.1.1	Data										
			Click	Snap b	utton to	o decor	mpress	and previe	w a fra	me.								
2													-					
09:4	17.49.91	2.077.000	3840	x 2160	8 29.99	9 Hz,	RGB 12	bpc, Frame	\$26193.									
		V 32768, w frame 1				3840,	VA 2160	, HS 112,	VS 28,	HSW 32,	/SW -5.							
PD																		
Click **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. A snapped DSC image can be saved as a DSC-file.

Auto Record Snap Open Full Screen Fit Horizontally Stream: O O 1 0 2 0 3 Disable f Video UCD_snap_12-55.31570
Video UCD_snap_12-55.31570
Log
rad.
Taking snanskop //MOTE: DC/ snanskops may take a ubila to decomposed)
Taking snapshot (NOTE: DSC snapshots may take a while to decompress!)
DSC Version = 1.2
pps identifier = 0x00 (0)
bis per component = 8
linebuf depth = 9
block_pred_enable = 0
block_pred_enable = 0 convert_rgb = 1
block_pred_enable = 0 convert_rgb = 1
block_pred_enable = 0 convert_rpb = 1 simple_422 = 0
block_pred_enable = 0 convert_typ = 1 simple_422 = 0 vby_enable = 0
block_pred_enable = 0 convert_rot = 1 simple_422 = 0 Vor_enable = 0
block_pred_enable = 0 convert_sop = 1 stmple_422 = 0 vbr_enable = 0 bts_pret_pixel = 0,60 (6)
block_pred_enable 0 convert_rgb 1 simple_422 0 blts_per_pixel 0 blts_per_pixel 240
blockpred_enable = 0 convert_rgb = 1 simple_422 = 0 vbr_enable = 0 bits_per_pixel = 0x60 (6)
block_pred_enable 0 convert_typ 1 simple_422 0 vbr_enable 0 blts_per_pixel > 0x60 (6) pix_bright 2160
block_pred_enable 0 convert_typ 1 simple_422 0 vby_enable 0 blsts_per_pixel 9x60 (6) pic.height 2160
block_pred_enable 0 convert_typ 1 simple_422 0 vby_enable 0 blsts_per_pixel 9x60 (6) pic.height 2160
block_pred_enable 0 convert_typ 1 simple_422 0 vby_enable 0 blsts_per_pixel 9x60 (6) pic.height 2160
block_pred_enable = 0 convert_sp = 1 simple_422 = 0 vbr_enable = 0 bltm_per_pixel = 0x60 (6) plc_height = 2160
block_pred_enable 0 convert_typ 1 simple_422 0 vbr_enable 0 blts_per_pixel > 0x60 (6) pix_bright 2160
block_pred_enable = 0 convert_tyD = 1 simple_422 = 0 vbr_enable = 0 bits_per_pixel = 0x60 (6) pic_height = 2160 D
block_pred_enable = 0 convert_ty0 = 1 simple_422 = 0 vbr_enable = 0 blts_per_pixel = 0x60 (6) plc_height = 2160

HDMI Link Analyzer Tab

Capture Data Events for analysis with *Link Timeline Viewer*. See chapter <u>Link Timeline Viewer</u> for details.

Link Analyzer buttons

202 UCD Console - UCD-422 [2226C529]; HDMI Source and Sink File Tools Window Help	_		\times
HDMI RX Event Log Memory Layout Terminal HDMI TX			
Link HDCP Video Audio Capture EDID InfoFrames Source DUT Testing CEC Link Analyzer			
Start Open Timeline Viewer	Open storage	e folder	
Events Capture Options: Main Link Capture Options:			
✓ HPD Amount: 1 ♀ ○ MB ● GB Encoding: Auto ✓ Lane count: Auto ✓		GPIO	
✓ Packets			
✓ I2C			
CEC			
Select all			
No configuration available			
Status: Idle			
- HPD			
Cable High Assert Deassert			
online			

Start	Start capturing main link data using Main Link Capture Options.
Open Timeline Viewer	Open Link Timeline Viewer. See Timeline Viewer.
Open storage folder	Open folder in the PC where capture data is stored. Folder is the video storage folder defined in <i>Tools > 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

The amount of data logged to buffer. Buffer size 2 GBytes maximum.

Trigger Point Options

Amount:

Data capture start can occur with or without defined trigger criteria.

Trigger criteria dropdown has four options: No active trigger, HDP assert, HDP deassert, I2C transaction, *CEC transaction, Main Link* video lock and *Packet data*.

Start			
Main Lin	k Capture Options:		
Amount:	1 🗘 🔿 MB 💿 G	iВ	
Trigger:	No active trigger 👘 🖂	Position:	Start \sim
	No active trigger		
	HPD assert		
	HPD deassert		
	I2C transaction		
	CEC transaction		
	Main Link video lock		
	Packet data		

When *I2C transaction* is selected, a drop down list box is enabled and visible with options: *Write*, *Read* and *Any*. Two spinboxs are enabled for *I2C Device Address* and *I2C Register Address*.

Start
Main Link Capture Options:
Amount: 1 🗧 🔿 MB 💿 GB
Trigger: I2C transaction \checkmark Position: Start \checkmark
Write ~
I2C Device Address: 7f
I2C Register Address: Iff

When CEC transaction trigger is selected, available trigger options are shown below.

Select trigger options via checkboxes OVERDATA_ERROR, START_TIMING_ERROR and/or by filling in the CEC Template Data (hex) values.

Start		
Main Link Capture Options:		
Amount: 1 🖨 🔿 MB 🖲 G	В	
Trigger: CEC transaction \sim	Position: Start ~	
OVERDATA_ERROR	START_TIMING_ERROR	MSG_TIMING_ERROR
CEC Template Data (hex):		
1 2 3 4 5	6 7 8	
9 10 11 12 13	14 15 16	
	Reset	

When the *Main Link video lock* trigger is selected, available checkboxes are *GXB_LOCK_RISE*, *VID_LOCK_RISE*, and *VID_LOCK_FALL*.

Start			
Main Link Capture Options:			
Amount: 1 🗧 🔿 MB 💿 GB			
Trigger: Main Link video lock V Position: Start V			
GXB_LOCK_RISE			
VID_LOCK_FALL			

When *Packet data* is selected: Checkbox *BCH_ERROR*, when checked, will start capture when a *BCH_ERROR* error has occured (and only when one has occurred). Fill out *packet Template Data* (*hex*) to as needed to filter for events to start capture. Shown below is a trigger for *AVI Infoframes* in general.

Start				Open Timeline Viewer
-Main Link Capture Options:				
Amount: 200 🖨 🖲 MB	⊖ gb			
Trigger: Packet data	✓ Position: Start ✓			
BCH_ERROR				
Packet Template Data (hex):				
HBO HB1 HB2	PBO PB1 PB2 PB3	PB4 PB5 PB6 PB7	PB8 PB9 PB10 PB	11
82 02 0D				
PB12 PB13 PB14 PB15	PB16 PB17 PB18 PB19	PB20 PB21 PB22 PB23	PB24 PB25 PB26 PB	27
				Reset

Position

Triggered capture timepoints available are: Start, 25%, 50%, 75%, End.

Events

The following events can be selected:

<u>HPD</u>

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

Packets

HDMI infoframes. Click the ⁽²⁾ button to open the *Event Filter Dialog*.

Packet events without checkboxes can be added via the Enter packet type edit control (0x2 for audio sample for example).

/// Event Filter Dialog		\times
HDMI RX InfoFrames f	tlering:	
Enable logging of follo V S [81] SPD [83] MPEG Source [85] DRM [87] Select all		
Enter packet type as h	ex value separated by comma:	
0x0, 0x3, 0x4, 0x5, 0x6	, 0x7, 0x8, 0x9, 0xa, 0xb, 0xc, 0xd, 0xe, 0xf, 0x7f,	
	OK Canc	el

<u>12C</u>

Capture I2C communication.

<u>CEC</u>

Capture CEC communication.

DP Link Analyzer Tab

Capture Main-Link Data Events and AUX Transactions for analysis with Link Timeline Viewer. See chapter Link Timeline Viewer for details.

<u>Tools</u> <u>W</u> indow		18C248]: Dis	pibji ori bouri										- C
PRX Event Lo	g Men	nory Layout	Terminal	DP TX									
Link HDCP	Video	Audio	Link Analyze	r Capture	DPCD	SDP DS	SC FEC	Source DUT Testing	EDID/DisplayID	Panel Replay	AUX controller		
Start												Open Timeline Viewer	Open storage fol
Events Capture	e Options:	Main Li	ink Capture Op	tions:								(of each of the second of the	
HPD		Amoun	t: 512 🗘 🄇	MB 🔾 GE	B Encoding:	Auto	Lane cou	int: Auto 🗸					
AUX			Start of TPS					 Position: Start 	~				
SDP	0	Source	TPS1 ~ Po	sition: Initial	LT	~							
VB-ID	(2)												
MSA	0												
Link Patter													
AUX_BW													
VFRAME IN	NFO												
Select all													
Status: Idle													
HPD													

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 > 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 2 GBytes maximum.
Encoding:	Auto, 8b/10b or 128b/132b
Lane count:	Auto, 1, 2 or 4

Trigger Point Options

Trigger: Start of TPS1/TPS2/TPS3/TPS4 V Position: Sta	art 🗠
Source: TPS1 ~ Position: Initial LT ~ Sta	tart
25	5%
50	0%
75	5%
En	nd

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

In the dialog, first select the event block from the upper drop-down list and from the appearing submenus select the detailed trigger.

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 mask 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 value 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, AUX natve read	Set address in hex format

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.

HPD

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 ⁽²⁾ 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 "[]".

<i>III</i> Event Filter Dialog				×
DP RX SDP filtering:				
Enable logging of followi	ng packets	[IDs in hex]:		
Audio_TimeStamp [1]	Audio	_Stream [2]		
Extension [4]	Audio	_CopyManagem	ent [5]	
✓ ISRC [6]	VSC [7]		
Camera Generic				
🗹 CGO [8] 🛛 🗹 C	G1 [9]	🗹 CG2 [A]	🗹 CG3 [B]	
☑ CG4[C] ☑ C	G5 [D]	🗹 CG6 [E]	🗹 CG7 [F]	
Picture Parameter Set	[10] 🗹 V	SC_EXT_VESA [20]		
VSC_EXT_CTA [21]		daptive-Sync SDP	[22]	
InfoFrames				
VS [80 + 1]	_			
SPD [80 + 3]				
MPEG Source [80 + DRM [80 + 7]	5] [] NIS	C VBI [80 + 6]		
Select all				_
Enter packet type as hex v	value separ	ated by comma:		
0x0, 0xF				
			OK Cance	el

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.

Event Filter Dialog	>
VBID filtering	
	Disabled On set On clear On any
VBLANK	\circ \circ \circ
FIELD_ID	\circ \circ \circ
INTERLACE	\circ \circ \circ
NO_VIDEO	\circ \circ \circ
NO_AUDIO	\circ \circ \circ
HDCP_SYNC	0 0 0 0
COMPRESSED	\circ \circ \circ
RESERVED	\circ \circ \circ
On MVID change	
On MAUD change	
○ Log all	Log on change
	OK Cancel

MSA

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

Event Filter D	ialog		×
MSA filtering			
Enable logging	MSA packet on ch	ange in:	
MVID	NVID	HTOTAL	VTOTAL
HSTART	VSTART	HSP	HSW
VSP	VSW	HWIDTH	VHEIGHT
MISC0 Log all	MISC1	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.

💯 Event Filter Dialog				×
DP RX Link Pattern filtering:				
		Start	End	
TPS1			\checkmark	
TPS2			\square	
TPS3		\square	\checkmark	
TPS4		\checkmark	\checkmark	
Idle pattern		\square	\checkmark	
Active video		\checkmark	\checkmark	
ML_PHY_SLEEP		\checkmark	\checkmark	
ML_PHY_STANDBY		\checkmark	\square	
EIEOS pattern		\square		
Custom pattern (80 bit)				
CP2520.1		\checkmark	\checkmark	
CP2520.2		\checkmark	\square	
PRBS7		\checkmark	\square	
PRBS31		\checkmark	\checkmark	
Log all				
Custom Pattern (80 bit)				
Type:	Bytes (8bit, hex)			
0 0 0 0	0 0 0	0	0	
	OK	(Cancel	I

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.

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 span of the oscilloscope preview window is defined with Playback buffer found in Tools >
 Options dialog. The value is given in ksamples (1024 samples). The relation between the preview
 window span in milliseconds (msec) and the value given in *Playback buffer* depends on the
 sampling frequency. Please do not exceed the *Main buffer* set in the same dialog. Please refer
 to description of the *Video Audio and Misc Options* earlier in this document.

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

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.

UCD C		D-400 [21 w Help		DisplayPor	t Source	and Sink						-		×
DP RX	DP TX HDCP	Event L Video	og EDID	DPCD	SDP	DSC	FEC	Source DUT Testing	Capture	Audio	Link Analyzer			
Spectr	rum: 60 dE	3 ~	Record (m	ns) 5000			_	Refresh No audio p		~	Stream:	Disabl	e Preview]

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-4XX EDID. Since UCD-4XX is 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.

Audio Buffer Size

The amount of buffering used in the data transfer between the UCD-4XX unit and the PC in Audio buffer size in Tools > Options dialog, Main buffer. Increased buffer size will ensure a smooth audio output but will also increase the delay between the capture of the audio stream and its playback.

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.

Input audio mode

2 channels: 44100 Hz: 16 bits Frame #413 (lost frames 0)

This field (in the bottom of the dialog) indicates detected audio mode in the input stream and the number of audio packets captured.

EDID/DisplayID Tab

EDID/DisplayID Tab provides tools for accessing the EDID/DisplayID data of the UCD Sink 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 the *Hex Edit Mode*.
- Read and write to EDID/DisplayID memory for up to 4 virtual ports.

EDID/DisplayID Files

	DisplayID d Item Remove Item Filter	_		Read mode: 0 I2C F	Read 🔘 SBM Read Virtual Sink #1 🗸 🗌	Show Read Only	Recur	se
Nar	per a c		Editor	Text EDID	1 Million Co.			
VESA Vendor & Product ID			Name	Value				
	✓ Week & Year of Manufacture Week № Year of Manufacture		0 Hea		0x00FFFFFFFFFFF00			
	Week & Year of Manufactured EDID Structure Version and Revision Numbers			nsion Block Count N	2			
	> Basic Display Parameters / Feature Color Characteristics	ires	2 Cher	cksum	0x18			
	Color Characteristics > Established Timings I > Established Timings II			lanufacturer Name ar & Product ID	UFG			
				roduct Code ar & Product ID	0x4036			
Manufacturer's Timings Standard Timings Identification			5 ID S	erial Number	22415942			
Features CTA v3				er & Product ID				
	Name	Value		00 01 02 03 04 05 06	07 08 09 0A 0B 0C 0D 0E 0F			
1	Max Resolution	10240 x 4320	00000		0054c73640460a5601			
2	10K Max Frame Rate	60 Hz	00001		783a5fb1a2574fa228			
3	8K Max Frame Rate	60 Hz	00002		4f810081c08180a9c0 d000a0f0703e803020			
4	4K Max Frame Rate	145 Hz	00004		(1a)56)5e)00)a0)a0)a0)29)50			
5	2K Max Frame Rate	145 Hz	00005		0001a0000fd0038			
	HDR Static	Disabled	00006		20202020200000fc			
0	TIDA SIGUC	Disabled	00007		30204450310a200218			
_	▼ Main Features			Mode HEX Edit Mode	.00 /9 0F /F 0/ 15 06 55 30		Apply	
_								
Rea	d from TE Write to TE					Save As	Load	

Enable DisplayID		
Add Item V Remove Item Filter	Read mode: • I2C Read SBM Read Virtual Sink #1 ~	🗌 Show Read Only 🛛 Recurse
Name	Editor Text DisplayID	
Section Data Block	Name Value	
 Product Identification Data Block 	0 Week of Year Manufactured 52	
Product ID Code Field V Week & Year of Manufacture or Model Year	1 Gregorian Year 2015	
Week of Year Manufacture of Moder real		
> Display Parameters Data Block		
> Display Interface Features Data Block		
 Type VII Timing – Detailed Timing Data Block Type X Timing – Formula-based Data Block 		
> Adaptive-Sync Data Block		
> CTA DisplayID Data Block		
	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	1
	000000 20 90 02 00 20 00 13 a4 c0 00 36 40 46 0a 56 01 000010 34 00 55 43 44 2d 34 30 30 21 81 1d 00 10 70	
	000010 34 01 07 55 45 44 2d 54 50 50 21 81 1d 00 10 70 000020 08 00 10 70 08 00 24 4a 57 fc c4 a2 88 52 10 00	
	000030 45 54 00 80 00 80 00 80 05 ff 26 00 09 3f 3f 1f	
	000040 1f 00 e0 7f 00 00 22 00 28 b2 90 1f 88 ff 1d 4f	I
	000050 00 07 80 1f 00 df 10 7a 00 6c 00 07 00 80 fa 29	
	000060 88 ff 27 4f 00 07 80 1f 00 df 10 7a 00 6c 00 07	
	000070 00 2a 00 06 02 ff 1d df 10 3b 2b 00 06 07 05 2d	
▲ Main Features	Editor Mode 🗌 HEX Edit Mode	Apply
- Main reactives		Save As Load
Read from TE Write to TE		

With *Load...* and *Save As...* a file can be read or written to from a 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) are read. If the device does not support all four blocks, the non-supported data is replaced with zeros.

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/DisplayID Editor

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

Source DUT Testing Tab

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

Tools Window Help														
P RX Event Log Memory Layout Termi	nal													
Link HDCP Video Audio Link Anal	yzer Capture	EDID/DisplayID	DPCD	SDP	DSC	FEC	Source DUT Testing	Panel Replay						
All tests	Name								Pass	Fail	Skip	Runs	Last status	IS
DP 1.4 LL CTS	✓ ■ DP 1.4 LL 0								0	0	0	0		
HDCP 2.3 CTS 1A HDCP 2.3 CTS 1B							HPD Plug Event (3200us)		0	0	0	0		
HDCP 2.3 CTS 18		Source Retry on In Source Device HPD				d after HP	D Plug Event		0	0	0	0		
HDCP 2.3 CTS 3B		Source Device IRQ							0	0	0	0		
CRC Video Tests	4.2.1.5	Source Device Inac	ctive HPD /	Inactive	AUX Test				0	0	0	0		
Audio Test Link Config Tests		DPCD Receiver Ca					g Event		0	0	0	0		
Pixel Level Video Tests		DPCD Receiver Cap EDID Read	pability Rea	ad upon	HPD Plug	Event			0	0	0	0		
HDR10+ Distribution Device Tests		EDID Read EDID Read Failure	#1-120-04	or-AUX N	JACK				0	0	0	0		
HDR10+ SSTM Tests for Source		EDID Read Failure							0	0	0	0		
		EDID Corruption D							0	0	0	0		
		Branch Device Det							0	0	0	0		
		EDID Read on IRQ E-DDC Four Block			anch Devi	ice Detec	tion		0	0	0	0		
		Link Status-Adjust			interval d	during Lir	k Training		0	0	0	0		
		Successful LT at Al							0	0	0	0		
		Successful Link Tra							0	0	0	0		
							e Swing During Clock Re	overy Sequence	0	0	0	0		
		Successful LT to a Successful LT to a							0	0	0	0		
							tting During Channel Equ	alization Sequence		0	0	0		
							Lock During Channel Equ			0	0	1	Pass	
		Unsuccessful LT at							0	0	0	0		
		Unsuccessful LT at					im Voltage Swing Sequence (loop count > 1		0	0	0	0		
							sequence (loop count > I Voltage Swing and Pre-			0	0	0		
		Source Device Lin							0	0	0	0		
		Source Device Lin							0	0	0	0		
	4.3.2.1	Successful Link Re-	-training A	fter IRQ I	HPD Pulse	e Due to	Loss of Symbol Lock	1.1	0	0	0	0		
							Loss of Clock Recovery L Loss of Inter-lane Aligne		0	0	0	0		
		Handling of IRQ H						err book	0	0	0	0		
	4.3.2.5	Lane Count Reduc	tion						0	0	0	0		
		Video Time Stamp		n :					0	0	0	0		
		Data Packing and Main Stream Data		d for the		Desilved 7			0	0	0	0		
		Main Stream Data							0	0	0	0		
		Main Video Stream							0	0	0	0		
		Power Managemer							0	0	0	0		
		Audio Stream Hea							0	0	0	0		
		Audio Time Stamp Audio InfoFrame P		n					0	0	0	0		
		Audio Stream Tran							0	0	0	0		
	4.4.4.6	Audio Start Seque	nce						0	0	0	0		
	4.5.1.1	FEC enable verifica	tion for all	support	ed Lane c	count and	Link Speed		0	0	0	0		
Run Checked Select Configure	Import	Export S	top on Fail	ure Rep	eats: 1	\$	Delay time, sec 1	•		Save	Report	Clear Selected	Clear	All
[2024-11-21, 13:03:15.887]; 0006.396 [2024-11-21, 13:03:15.887]; 0006.397 [2024-11-21, 13:03:15.887]; 0006.397 [2024-11-21, 13:03:15.887]; 0006.397 [2024-11-21, 13:03:15.887]; 0006.395 [2024-11-21, 13:03:15.887]; 0006.495 [2024-11-21, 13:03:15.887]; 0006.401 [2024-11-21, 13:03:15.887]; 0006.404 [2024-11-21, 13:03:15.887]; 0006.404	.036: AUX .094: Source 1 .160: Link Tra .449: AUX .706: AUX .075: Test PA:	WR: 00102h: DUT writes TRAI wining OK RD: 00107h: WR: 00107h: SED: "4.3.1.7	1 00 NING_PAT 1 00 1 00 Succes	_			nk Rate Due to Los	a of Symbol Lo	ck Duri	ng Chan	nel Equ	alization S	equence"	-
Tests execution finished.														
HPD														

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, 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 selected (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 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 to be later 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.

DP and DP Alt Mode Reference Sink

Role:	Product:	
DP Reference Sink (DP RX)	UCD-400	
USB-C DP Alt Mode Reference Sink (DP RX)	UCD-424	

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

- Status information and control of the upstream link (Link)
- DPCD editor (DPCD)
- Analyze Secondary-data Packets received (SDP)
- Display Stream Compression status and configuration (DSC)
- Forward Error Correction (FEC)

Link Tab

Link tab contains four panels: Cable / HPD, Link Status, Link Capabilities HDCP Status and Configuration, Video Status and HPD.



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 status of other link modes. The data is retrieved from the DPCD status registers of the UCD Sink. The status is updated automatically.

Lanes (count =	4):	0	1	2	3
CR/SL/EQ					
VS/PE (level)		0/1	0/1	0/1	0/1
Error count (clic	:k to clear):	0000	0000	0000	0000
ILA:					
	81 Ghns	Link	mode	86/10	06
Bit rate:	8.1 Gbps Enhanced		: mode: imbling:		
		Scra	: mode: imbling: status:		ed

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
Error count:	Content of DPCD Error Count registers
ILA:	LED indicator for 'Inter lane Alignment Done'
Bit rate:	Currently enabled link bit rate
Link mode:	Currently enabled channel coding (8b/10b only)
Framing mode:	Currently enabled Framing Mode (Normal or Enhanced)
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
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):	0	1	2	3
CR/SL/EQ				
VS/PE (level)	0/1	0/1	0/1	0/1
ILA:				
Bit rate: 8.1 Gbps	Link m	ode:	8b/1	DЬ
Lanes:	Indica	ites	the n	umber
CR/SL/EQ:	LED ir Equali			
VS/PE (level):	Voltag	ge Sv	wing	/ Pre-e
ILA:	Status	s LE	D for	Inter-l
Bit rate:	Currei	ntly	enabl	ed link
Link mode:	Curre	ntly	enabl	ed cha

Link Capabilities

Link capabilities allows the user to change the way the Sink capabilities are announced in the DPCD capability registers of the UCD Sink. To update the new status to the DPCD registers click *Apply*.

ink Capabilities					
Max Lanes					
0 1	С	2	0	4	
Max Bitrate, Gb	ps				
0 1.62	С	2.70	\bigcirc	5.40	
6.75	0	8.10	0	0 (eDP on	ly)
eDP Bitrate,	Gbps				
1.62	2.16	2.43	2.7		3.24
4.32	5.4	6.75	8.1		
Force Cable S	tatus to Plug	ged			
Enable Fast LT					
eDP AUX Prea	imble				
Sink count: 2 🖨	🛛 🗹 MST	FEC	TPS4	🗹 TPS3	DSC
HPD pulse or	Apply				Apply

Max lanes:	Maximum lane count used
Max Bitrate, Gbps	Maximum link rate used in LT
eDP Bitrate,Gbps	Available eDP bitrates.
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:	Indicate support for link training without AUX transactions.
eDP AUX Preamble,Gbps	Use eDP AUX Preamble protocol.
Sink count:	Selects the number of sinks capable of to transmitter.
MST:	Indicate support for MST mode and Sideband MSG handling.
FEC (8b/10b):	Indicate support for Forward Error Correction (FEC) feature.
TPS4, TPS3:	Indicate support for Link Training Pattern Sequence 4 and 3 correspondingly.
DSC (8b/10b):	Indicate support for Display Stream Compression (DSC) feature
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.

Scrambler Seed

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.

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

HDCP Status

Copy of the status from HDCP Tab. Please refer to chapter *HDCP Tab* later in this document for detailed description.

HDCP Status	
HDCP	2.X
Active	
Authenticated	
Declared as HDCP capable	
Keys loaded	
Keys loaded HDCP Configuration	
	2.X

HDCP Configuration

Enable and disable HDCP capability of UCD Sink. Duplicates of the controls found in HDCP tab. Currently, UCD-4XX devices support only HDCP 2.3 standard.

Stream Info

Framerate HTotal HStart HActive HSync VTotal VStart VActive VSync CEF BPC CRC (RGB/CrYCb) MVID/NVID DSC CRC (Eng. 59.995 2200 192 1920 44 (+) 1125 41 1080 5 (+) YCbCr4:2:2/ITU-R BT.601 8 E18E 0815 5A14 001777/008000 N/A	Streamin	n Info													
59.995 2200 192 1920 44 (+) 1125 41 1080 5 (+) YCbCr4:2:2/ITU-R BT.601 8 E18E 0815 5A14 001777/008000 N/A	Framera	erate HTo	Total	HStart	HActive	HSync	VTotal	VStart	VActive	VSync	CEF	BPC	CRC (RGB/CrYCb)	MVID/NVID	DSC CRC (Eng. 0 1 2)
	59.995	95 220	200	192	1920	44 (+)	1125	41	1080	5 (+)	YCbCr4:2:2/ITU-R BT.601	8	E18E 0815 5A14	001777/008000	N/A
59.995 2200 192 1920 44 (+) 1125 41 1080 5 (+) RGB/Legacy RGB mode 8 B69E B33E 1AB3 001777/008000 N/A	59.995	95 220	200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	001777/008000	N/A
59.995 2200 192 1920 44 (+) 1125 41 1080 5 (+) RGB/Legacy RGB mode 8 B69E B33E 1AB3 001777/008000 N/A	59.995	95 220	200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	001777/008000	N/A
59.985 2200 192 1920 44 (+) 1125 41 1080 5 (+) RGB/Legacy RGB mode 8 B69E B33E 1AB3 001776/008000 N/A	59.985	85 220	200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	001776/008000	N/A

Stream Info is achieved from the Main-Stream Attributes (MSA) of the stream.

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

Note that the MSA information used for Video Timing Details is provided by the Upstream Source. It is not measured by the UCD Local Sink.

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.
MVID/NVID:	Mvid and Nvid video time stamp values
	16-bit Cyclic redundancy check (CRC) calculated from compressed pixel stream. Value order Engine 0, 1, 2.

VCP Table

VCP Table	9					
Stream #	VCPID	Req.PBN	Alloc.PBN	First slot	Slot num	
0	1	532	540	1	9	
1	2	532	540	10	9	
2	3	532	540	19	9	
3	4	532	540	28	9	

VCP table shows allocation of Virtual Channel Payload for active virtual MST channels. The content of *VCP Table* can be copied by right-clicking on the table and selecting **Copy**.

Strem #:	Port number where the virtual channel is directed.
VCPID:	Stream identification number of the virtual channel
Req.PBN:	Requested PBN (payload bandwidth) 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.

HDCP Stream Status

HDCP Str	eam Status
Stream #	Status Type
0	Type 0
1	Type 0
2	Type 0
3	Type 0

Shows the MST HDCP Stream, Status and Type.

HPD

HPD Cable HPD	Assert Deassert Pulse HPD 500 🔦 Length, msec Short Pulse
Cable LED:	Indicates that the hardware has detected an upstream cable.
HPD LED:	Indicates that the HPD signal is Asserted (logical "high").
Deassert:	Click button to set HPD line to logical "low" (de-asserted) and hence no HPD pulse can be generated.
Assert:	Click to re-activate the HPD line (set to logical "high").
Pulse HPD:	Click to apply an HPD Pulse with programmable duration. Set duration in milliseconds in adjacent edit control.
Short Pulse:	Click to apply a short pulse. Set duration in microseconds in adjacent edit control.

Multistreaming

When Multistreaming (MST) is enabled, the details of the received virtual channels is shown in Stream Info table and VCP Table .

nk Status anes (count = 4): 0 1 2 3 R/SL/EQ	Link Capabilities		Capture Panel Replay	Link Analyzer AUX controller
				HDCP Status
1954 E G	Max Lanes			HDCP 2.X
S/PE (level) 1/0 1/0 1/0 1/0	0 1	O 2	• 4	Authenticated
rror count (click to clear); 0000 0000 0000 0000	Max Bitrate, Gbps			Declared as HDCP capable
A:	0 1.62	0 2.70	5.40	Keys loaded
it rate: 8.1 Gbps Link mode: 8b/10b	0 6.75	 8.10 	0 (eDP only)	HDCP Configuration
raming mode: Enhanced Scrambling: Enabled			O C (CDT ONIG)	2.X
IST mode: Enabled SSC status: Disabled	eDP Bitrate, Gb			HDCP Capable
SC status: Disabled FEC status: Disabled	1.62	2.16 2.43	2.7 3.24	
nk Training Result	4.32	5.4 6.75	8.1	Scrambler seed (8b/10b)
anes (count = 4): 0 1 2 3	Force Cable Statu	is to Plugged		• FFFFh (DP)
	Enable Fast LT	55		FFFEh (eDP ASSR)
S/PE (level) 1/0 1/0 1/0 1/0	eDP AUX Preamb	lo		🔿 Custom 0x 🛛 0 🌲
A:	Sink count: 4 🖨 💽	MST 🗌 FEC 🛛 TPS	54 🔽 TPS3 🗌 DSC	
	HPD pulse on Ap		Apply	
it rate: 8.1 Gbps Link mode: 8b/10b	HPD pulse on Ap	ψy	Арріу	
	VCP Table		HDCP Stream Status	
	Stream # VCPID Reg.F	BN Alloc.PBN First slot Slot nu	um Stream # Status Type	
	0 1 52		0 Type 0	
		8 540 10 9	1 Type 0	
	1 2 52			
	1 2 52 2 3 52	8 540 19 9	2 Type 0	
			2 Type 0 3 Type 0	
ream Info	2 3 52			
	2 3 52	8 540 28 9	3 Type 0	VID/NVID DSC CRC (Eng. 0 1 2)
ramerate HTotal HStart HActive HSync VTotal V	2 3 52 3 4 52	8 540 28 9	3 Type 0 BPC CRC (RGB/CrYCb) M	VID/NVID DSC CRC (Eng. 0 1 2) 776/008000 N/A
ramerate HTotal HStart HActive HSync VTotal V 59.995 2200 192 1920 44 (+) 1125	2 3 52 3 4 52 Start VActive VSync	CEF	3 Type 0 BPC CRC (RGB/CrYCb) M 8 B69E B33E 1AB3 001	
ramerate HTotal HStart HActive HSync VTotal V 59.995 2200 192 1920 44 (+) 1125 59.995 2200 192 1920 44 (+) 1125	2 3 52 3 4 52 Start VActive VSync 41 1080 5 (+)	CEF RGB/Legacy RGB mode	3 Type 0 BPC CRC (RGB/CrVCb) M 8 B69E B33E 1AB3 001 8 B69E B33E 1AB3 001 8 B69E B33E 1AB3 001	776/008000 N/A

DPCD Tab

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

ent Log	Term	inal		Merr	nory	Layo	ut	C	PT	ĸ	DF	RX																
Link HD	CP	Vie	deo		Audi	o	DP	CD		SDF		DS	c	FE	С	So	urce	DUT Testi	ng	EDID/DisplayID	Capture	Panel Replay	Link Analyze	r	AUX con	troller		
																							Load		Sav	e	Repor	rt
Address : 0x	0			\$	Num	ber	of B	ytes	: 0x	10			٥															
	00	01	02	03	04	05	5 06	5 0	7 0	8	9	0A	0B	0C	01	0 DE	. OF			Receiver Capability				_				
000000	14	le	e4	81	01	00	01	8	0 0	00	00	06	00	00	00	84	00)		DPCD_REV [RO] 0x00000 := 0x14								
000010	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00)		DPCD V1.4								
000020	07	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00)										
000030	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00											
000040	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00	0										
000050	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00)										
000060	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00	0										
000070	03	00	00	00	01	00	00	0	0 0	00	00	00	00	00	00	00	00	0										
000080	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00	0										
000090	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00	0										
0000A0	00	00	00	00	00	00	00	0	0 0	00	00	00	00	00	00	00	00)										
Address : 0x				-	Num								٥															
					04														1	Receiver Capability DPCD_REV [RO]								
000000	-																			0x00000 := 0x14 DPCD V1.4								
000010	00																			DPCD V1.4								
000020					00																							
000030					00																							
000040					00																							
000050					00														_									
000070	03																											
000080					00																							
0000000					00																							
	00																											
																									Refresh		/rite Char	_
Cat Dafaran	.e																								netrest		nite Char	ige
Set Referen																												

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 the PC (please see below).
Load:	Retrieve previously saved DPCD data (please see below).
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:	To program the data into the DPCD registers of UCD Local Sink
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.

Saving and Loading DPCD Content

DPCD data in the selected address areas can be saved as a file in your PC. There are three alternative formats listed below. Please select the intended format when saving:

- Binary DPCD Data File format (*.DPD). This is Unigraf proprietary format. You can also load the DPCD content stored in this format.
- Comma Separated Value format (.CSV)
- *HEX Dump* (*.HEX) in a human readable text format.

Note:	- User controls like Link Training or mode changes will modify the content of the DPCD registers
	- During a reboot of UCD-4XX 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 re-read the data. Show / hide the parsed data by clicking **Packets Info** in the divider bar.

The following packets are recognized:

Num Hoder Das Operation	HD	P V	lideo	Audio	DPCD	SDP	DSC	FEC	Source DUT Te	esting	EDID/DisplayII	D Capture	Pane	l Replay	Link Analyze	er AUX	(controller									
Name Description Operation O	Name	Header		Data																						1
Name Description Operation O		00 01	02 03	00 01	02 03 04	05 06	07 08 09	10 11 1	2 13 14 15 10	5 17 18	19 20 21 22 3	23 24 25 26	27 28 2	9 30 31	CI	annel C	ount:	Stereo								
Name Description Oct of the second of the s	ATS	00 01	17 48	00 03	91 00 00	03 91 0	0 00 03	91 00 0	0 03 91 00 00	00 08 0	00 00 80 00 0	00 08 00 00	00 00 8	0 00 00	Co	oding Ty	pe:	2- to 8-ch	annel L	-PCM a	udio					
<pre>cmm do do do do lo do se in a faita se to da al 24 52 of al 2</pre>	ASP	00 02	00 01	00 00	00 90 00	00 00 2	40 00 00	00 00 0	0 00 00 00																	2
in dis 1 die 0 die 1 m 48 01 00 00 00 00 00 00 00 00 00 00 00 00 0	CGP4	0C 0C	0C 0C	D5 A8	24 52 D5	A8 24	52 D5 A8	24 52 D	5 A8 24 52 11	7 0a 8a	BE 1F OA SA I	BE 1F OA SA	BB 1F 0	A 8A BB	CE	1[0]: 0x	00000000	S: 0x00	0000	V: 0	U: 0	C: 0	P: 0	PR: SFS	SP	2
<pre>v. Twidity Fiag 10 Wet dis 27 Waity Bit 27 Faaity Bit 27 Faaity Bit 27 - Sub-frame 1 and start of the sudio block (1101000 preamble). 27 - Sub-frame 1 and start of the sudio block (1101000 preamble). 27 - Sub-frame 1 28 Sample Present Bit 28 Sample Present Bit 28 Sample Present Bit 30 Present Bit 30</pre>	AIF	00 84	1B 48	01 00	00 00 00	00 00	00 00 00	00 00 0	0 00 00 00 00	00 00	00 00 00 00 0	00 00 00 00	00		CF	H[1]: 0x	00000000	S: 0x00	0000	V: 0	U: 0	C: 0	P: 0	PR: SFS	SP	1
															C: P: P: C: C: S: C: S: C: S: C: S: S: S: S: S: S: S: S: S: S: S: S: S:	Chann Parit SFS - SFS - SF2 - RSV - P: Sampl A: Chann OF Heade 0 02 00	el Statu y Bit ble Code Sub-fran Sub-fran Sub-fran RESERVE e Presen el Alloc r: 01	and its C me 1 and s me 2 D. t Bit ation: Cre	ate Inf	f the a	audio bl	lock (11	0 Press	ble:) preamble	1).	
																				_	_			-		
	Refresh		Save																							

- Audio_TimeStamp
- Audio_Stream
- Extension
- Audio_CopyManagement
- ISRC (International Standard Recording Code)
- Video Stream Configuration (VSC)
- Camera Generic 0 ... 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 choice. 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 defines in its DPCD register.

Enabling DSC

AC block size: 65536 bytes RC buffer size, in blocks: 4 bits per Pixel Increment: 1/16 bpp Block Prediction: Supported hroughput mode 0: 340MP/s Throughput mode 1: 340MP/s	RC block size: 65536 bytes RC buffer size, in blocks: 4 Bits per Pixel Increment: 1/16 bpp Block Prediction: Supported Supported Supported 340MP/s Throughput mode 0: 340MP/s Throughput mode 1: 340MP/s 340MP/s 340MP/s Supported Color Depths 16 bits Maximum Slice Width: 2560 Supported Color Channel 8 RGB 1 1 Slice / DSC Sink 1 0 Slice / DSC Sink 10 Bits per color channel 8 RGB 1 1 Slice / DSC Sink 1 0 Slice / DSC Sink 12 Bits per color channel Simple YCbCr 44:24 2 2 Slice / DSC Sink 1 1 Slice / DSC Sink 12 Bits per color channel Simple YCbCr 4:22 6 Slice / DSC Sink 2 0 Slice / DSC Sink 12 Bits per color channel YCbCr 4:24 6 Slice / DSC Sink 2 0 Slice / DSC Sink	DCC Malas Massian	DSC Enabled	DCC Miner Version	2			
iits per Pixel Increment: 1/16 bpp Block Prediction: Supported inroughput mode 0: 340MP/s Throughput mode 1: 340MP/s ine buffer depth: 16 bits Maximum Slice Width: 2560 Supported Color Depths Supported Color formats H-Slice Capabilities 2560 8 Bits per color channel 8 RGB 0 1 Slice / DSC Sink 0 1 Slice / DSC Sink 10 Bits per color channel 9 YCbCr 4:44 0 2 Slice / DSC Sink 0 2 Slice / DSC Sink 12 Bits per color channel 9 Simple YCbCr 4:2:2 0 4 Slice / DSC Sink 0 1 Slice / DSC Sink 12 Bits per color channel 9 Simple YCbCr 4:2:2 0 6 Slice / DSC Sink 0 2 Slice / DSC Sink 12 Bits per color channel 9 Simple YCbCr 4:2:2 0 6 Slice / DSC Sink 0 2 Slice / DSC Sink 12 Bits per color channel 9 Simple YCbCr 4:2:2 0 6 Slice / DSC Sink 0 2 Slice / DSC Sink 12 Bits per color channel 9 Native YCbCr 4:2:2 0 6 Slice / DSC Sink 0 2 Slice / DSC Sink	Bits per Pixel Increment: 1/16 bpp Block Prediction: Supported Color Throughput mode 0: 340MP/s Throughput mode 1: 340MP/s Une buffer depth: 16 bits Maximum Slice Width: 2560 Supported Color Depths Supported Color formats H-Slice Capabilities 15 Slice / DSC Sink 8 Bits per color channel 0 YCbCr 4:44 0 2 Slice / DSC Sink 0 1 Slice / DSC Sink 12 Bits per color channel Simple YCbCr 4:2:2 0 4 Slice / DSC Sink 1 5 Slice / DSC Sink 0 Aktive YCbCr 4:2:2 0 4 Slice / DSC Sink 0 5 Slice / DSC Sink 0 6 Slice / DSC Sink 0 Kits per color channel Simple YCbCr 4:2:2 0 4 Slice / DSC Sink 0 5 Slice / DSC Sink 12 Bits per color channel Simple YCbCr 4:2:2 0 4 Slice / DSC Sink 0 5 Slice / DSC Sink 0 Kuter YCbCr 4:2:0 0 4 Slice / DSC Sink 0 2 Slice / DSC Sink 0 2 Slice / DSC Sink							
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Jine buffer depth: 16 bits Maximum Slice Widht: 2560 Supported Color Depths Supported Color formats H-Slice Capabilities 8 8 Bits per color channel 8 RGB 1 1 Slice / DSC Sink 1 0 Slice / DSC Sink 10 Bits per color channel 9 YCbCr 4:44 2 2 Slice / DSC Sink 1 2 Slice / DSC Sink 12 Bits per color channel 9 Simple YCbCr 4:2:2 4 Slice / DSC Sink 1 6 Slice / DSC Sink 2 12 Bits per color channel 9 Simple YCbCr 4:2:2 6 Slice / DSC Sink 2 0 Slice / DSC Sink 2 YCbCr 4:2:0 6 Slice / DSC Sink 2 0 Slice / DSC Sink	Line buffer depth: 16 bits Maximum Slice Width: 2560 Supported Color Depths Supported Color formats H-Slice Capabilities 8 Bits per color channel 9 RGB 0 1 Slice / DSC Sink 10 Bits per color channel 9 VCbCr 4:44 0 2 Slice / DSC Sink 12 Bits per color channel 6 Simple VCbCr 4:2:2 0 4 Slice / DSC Sink 0 A Slice / DSC Vink 0 5 Slice / DSC Sink 0 5 Slice / DSC Sink 0 Simple VCbCr 4:2:2 0 4 Slice / DSC Sink 0 6 Slice / DSC Sink 0 S Native YCbCr 4:2:0 0 6 Slice / DSC Sink 0 2 Slice / DSC Sink 0 8 Slice / DSC Sink 0 8 Slice / DSC Sink 0 8 Slice / DSC Sink							
Supported Color Depths Supported Color formats H-Slice Capabilities 8 Bits per color channel 8 RGB 1 Slice / DSC Sink 10 Bits per color channel 1 YCbCr 4:44 2 Slice / DSC Sink 12 Bits per color channel 1 Simple YCbCr 4:2:2 2 Slice / DSC Sink 2 Slice / DSC Sink 21 2 Bits per color channel 2 Simple YCbCr 4:2:2 2 A Slice / DSC Sink 2 Slice / DSC Sink 21 2 Bits per color channel 2 Simple YCbCr 4:2:2 2 A Slice / DSC Sink 2 A Slice / DSC Sink 21 2 Bits per color channel 2 Simple YCbCr 4:2:2 2 A Slice / DSC Sink 2 A Slice / DSC Sink 2 YCbCr 4:2:0 2 Slice / DSC Sink 2 A Slice / DSC Sink 2 A Slice / DSC Sink	Supported Color Depths Supported Color formats H-Slice Capabilities 8 Bits per color channel 10 Bits per color channel 2 YCbCr 44:4 2 Slice / DSC Sink 3 Slice / DSC Sink							
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I 2 Bits per color channel I Simple YCbCr 4:2:2 I 4 Slice / DSC Sink I 6 Slice / DSC Sink I Native YCbCr 4:2:2 I 6 Slice / DSC Sink I 2 Slice / DSC Sink I 2 Slice / DSC Sink I YCbCr 4:2:0 I 8 Slice / DSC Sink I 2 A Slice / DSC Sink I 2 A Slice / DSC Sink	12 Bits per color channel I Simple YCbCr 4:2:2 I A Slice / DSC Sink I A Slice / DSC Sink I Native YCbCr 4:2:2 I A Slice / DSC Sink I A Slice / DSC Sink I A Slice / DSC Sink I YCbCr 4:2:0 I Slice / DSC Sink I A Slice / DSC Sink I A Slice / DSC Sink							
Image: Solution of the second seco	Image: Solution of the second seco							
Auto-Apply HPD pulse on Apply Reset Refresh Apply	Auto-Apply HPD pulse on Apply Reset Refresh Apply		VCbCr 4:2:0	🗷 8 Slice / DSC Sink 【	24 Slice / DSC Sink			
) Auto-Apply 🗌 HPD pulse o	on Apply Reset	Refresh Apply			

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

DSC Capable (8b/10b):	UCD is declared as DSC capable. Capability can be enabled or disabled in DP RX Link tab.
DSC Enabled:	LED indicating that the connected source has enabled DSC
Apply:	Write changes to UCD sink DPCD registers
Refresh:	Re-read the content of UCD sink DPCD and update the control status.
Reset:	Reset the content of UCD DSC related DPCD registers (0x00060 through 0x0006F) to the default values as defined in UCD firmware.

FEC Tab

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

Tools Window Help				Sink			
	mory Layo	ut DP	TX DP	PV			
vent Log Terminal Me	mory Layor	ut DP	DP				
Link HDCP Video	Audio	DPCD	SDP D	DSC FEC	Source E	UT Testing EDID/DisplayID Capture Panel Replay Link Analyzer	
						FEC Status Log	
FEC Capable (8b/10b)	🛃 Gener	rate HDP o	n Change	FEC	Enabled		
Error Counters (DPCD)						Current link is 8b/10b FEC Status: Decode Disable Detected / Sequence NOT detected	
	Lane #0	Lane #1	Lane #2	Lane #3	Sum	FEC Status: Decode Enable Detected	
Uncorrected block errors	0	0	0	0	-		
Corrected block errors	0	0	0	0	-		
Bit errors	0	0	0	0			
Parity block errors	0	0	0	0	-		
Parity bit errors	0	0	0	0	-		
Enable aggreg	gated error	s U	pdate	Clear Co	ounters		
						Clear Log	
HPD							
HPD	Assert	Deas	isert	Pulse HPD	500 msec	Short Pulse 750 usec	

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. This register in UCD-4XX sink can be controlled by **FEC Capable** checkbox.

Since source normally polls sink DPCD mainly after a new connection, selecting **Generate HPD on change** will force a new connection after the change of the FEC capability status.

Update:	Read FEC Error Counters from DPCD
Clear Counters:	Clear FEC Error Counters in DPCD.

FEC Status Log lists FEC events.

HDMI Reference Sink

Role:	Product:
HDMI Reference Sink (HDMI RX)	UCD-422

When HDMI Reference Sink role is in use, the following interface specific tabs are available.

- Status information and control of the upstream link (Link)
- Received InfoFrame packets (InfoFrames).

Link Tab

Link tab contains four panels: Behavior, Status, TMDS Status, FRL Capabilities, FRL Status, Audio Return Channel, HDCP Status and Configuration, Video Status and HPD.

nk HDCP Video Aud	io EDID Ir	foFrames Source	DUT Testing Ca	pture CEC	Link Analyzer		
Behavior		FRL Capabilities		HDC	P Status		
) 1.4 () 2.0 () 2.1		O Disable FRL		HDC		1.X	2.X
itatus		3 Lanes 🔿 3 📿	6 (Gbps)	Activ			
Lane 0 Lane 1	Lane 2 Lane 3	4 Lanes	6 0 8 0 10 0	0 12	enticated ared as HDCP capable		
hannel lock		FRL Start	FLT Ready		loaded		
rror count 0001 0000	0000 0003	FLT No Timeou	it 🗌 FRL Max				
uto Adjustment 4117 3a35	3cc0 0011	Check Patterns		HDC	P Configuration		
ehavior HDMI 2	.1	LTP Add 0	0 \$ 0 \$ 0	•			1.X 2.X
MDS Status		Re-Train	Apply	HDC	P Capable		\checkmark
Node:	HDMI						
MDS Bit Clock Ratio	1/10 3G mode	FRL Status					
nput Stream Lock			e 0 Lane 1 Lane 2 L	.ane 3			
		FRL data		0			
		LTP Request 0		0			
		FRL Mode	12Gbps 4	4-lane			
		LT Status	LTS:P				
		FLT Update					
		FLT No Retrain					
lorizontal	Vertical		Misc		CRC		
otal 2200	Total	1125	Frame Rate, Hz:	59.999	CRC 0: -		
tart 192	Start	41	Color Depth, BPC	8	CRC 1: -		
active 1920	Active	1080	Color Encoding:	RGB	CRC 2:		
ync Width (+)44	Sync Width	(+)5	Colorimetry:	Unknown	Update	Co	ру

Behavior

Selection of HDMI operation mode: HDMI 1.4, HDMI 2.0 or HDMI 2.1.

Please perform HPD *Deassert - Assert* after change of mode.

Status

Channel lock:	Status of Channel Lock in the four lanes and currently selected HDMI mode			
Error count:	Contents of the SCDC Error counter registers of the UCD-422 Sink.			
Auto Adjustment	Adjustment errors on lanes.			
Behavior:	Assigned HDMI mode			

TMDS Status (Only in TMDS Mode)

TMDS Status	
Mode:	HDMI
TMDS Bit Clock Ratio	1/10 3G mode
Input Stream Lock	

Mode:	Indication of HDMI / DVI mode
TMDS Bit Clock Ratio:	TMDS Bit Period / TMDS Clock Period ratio (1/10 or 1/40)

Input Stream Lock: Indication of TMDS character lock

FRL Capabilities (Only in FRL Mode)

FRL Capabilities allows the user to change the way the Sink capabilities are announced in the SCDC capability registers of the UCD-422 Sink.

FRL Capabilities							
O Disable FRL							
3 Lanes () 3 () 6 (0	Gbps)						
4Lanes 🔾 6 🤇	8 🖲 10 🔿 12						
FRL Start	FLT Ready						
FLT No Timeout	FRL Max						
Check Patterns							
LTP Add 0 🖨 0	• 0 • 0 •						
Re-Train	Apply						

Disable FRL:	Disable FRL mode
Capability Radio Buttons:	Selection of the maximum link count and link rate capability of UCD-422 sink. Written to FLR_Rate configuration register of UCD_422 Sink. Please click Re-train to apply
FRL Start:	Control of the HDMI sink's FRL_start bit (1/0)
FLT Ready:	Control of the HDMI sink's FLT_ready bit (1/0).
FLT No Timeout:	Status of the HDMI sink's FLT_no_timeout bit (1/0)
FRL Max:	Status of the HDMI sink's FRL_Max bit (1/0)
Check Patterns:	If Check Patterns in unselected then there's no pattern verification during link training
LTP Add:	Additional Requested Link Training pattern in HDMI sink's LnX_LTP_req (X=0-3) register.
Re-Train:	Request a new link training
Apply:	Store new settings

FRL Status (Only in FRL Mode)

FRL Status displays the status of the link training and the link parameters negotiated between UCD-422 Sink and the Upstream Source. The status is updated automatically.

FRL Status				
	Lane 0	Lane 1	Lane 2	Lane 3
FRL data				
FFE Level	0	0	0	0
LTP Request	0	0	0	0
FRL Mode			10Gbp	s 4-lane
LT Status			LTS:P	
FLT Update]
FLT No Retrain	n)

FRL Data 0/1/2/3:	Indication of data flow in FRL links 0 to 3
FFE Level:	Status of Feed Forward Equalizer Level that HDMI transmitter is using (only in FRL mode)
LTP Request:	Currently requested FRL link training pattern.
FRL Mode:	Lane count and link rate configuration used in FRL mode
LT Status:	Status of the FRL Link Training State
FLT Update:	Status of the UCD-422 sink's FLT_update bit (1/0) (only in FRL mode)
FLT No Retrain:	Status of UCD-422 Sink's FLT_no_retrain bit (1/0) (only in FRL mode)

HDCP Status

Copy of the status from HDCP Tab. Please refer to chapter HDCP Tab later in this document for detailed description.

HDCP Status		
HDCP	1.X	2.X
Active		
Authenticated		
Declared as HDCP capable		
Keys loaded		
HDCP Configuration		
		1.X 2.X
HDCP Capable		\bowtie

HDCP Configuration

Enable and disable HDCP 1.4 or HDCP 2.3 capability of UCD-422 Sink. Duplicates of the controls found in HDCP tab.

Note:	HDCP is not supported in 3.5 release
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Video Status

Video Timing and Color Details as retrieved from stream metadata. Frame rate is measured by UCD-422 Local Sink.

Horizontal		Vertical		Misc		CRC	
Total	9000	Total	4400	Frame Rate, Hz:	30.0	CRC 0:	0x3A65
Start	768	Start	64	Color Depth, BPC:	24	CRC 1:	0xF27C
Active	7680	Active	4320	Color Encoding:	RGB	CRC 2:	0x832F
Sync Width	(+)176	Sync Width	(+)20	Colorimetry:	RGB	Update	Сору

CRC

The 16-bit **CRC** (checksum, cyclic redundancy check) values of the three color components calculated by the Sink hardware. To re-calculate, click **Update**. Click **Copy** to store the information to the clipboard.

HPD

High:	LED indicates that the HPD signal is Asserted (logical "high").
Deassert:	Click button to set HPD line to logical "low" (de-asserted) and hence no HPD pulse can be generated.
Assert:	Click to re-activate the HPD line (set to logical "high").
HPD High	Assert Deassert

InfoFrame Tab

InfoFrame Tab displays received InfoFrames. Click **Refresh** to update the list. Show / hide the parsed data by selecting **Packet Info**.

ink Video Audio EDID InfoFrames Source DUT Testing Capture HDCP		
Name Head Dat. 0	Packet code: del2 Packet Bacdr: Packet Bacdr	13 3 ((k): present) (k): present) (k): present) (k): present (k):
Refresh Save		

Received InfoFrames

InfoFrames tab displays in hexadecimal format the following received InfoFrames:

- ACR (Audio Clock Regeneration)
- ASP (Audio Sample Packet)
- GCP (General Control Packet)
- ACP (Audio Content Protection Packet)
- ISRC1 (International Standard Recording Code)
- ISRC2 (International Standard Recording Code)
- OBA (One Bit Audio sample packet)
- DTS (DTS Audio packet)
- HBR (High Bitrate Audio stream packet)
- GMP (Gamut Metadata packet)
- EMP (Extended Metadata Packet)
- 3D ASP (3D Audio Sample packet)
- 3D OBA (3D One Bit Audio sample packet)
- AMP (Audio Metadata Packet)
- MST_ASP (Multi-stream audio sample packet)
- MST_OBA (One Bit Multi-stream audio sample packet)
- VSI (Vendor Specific InfoFrame)
- AVI (Auxiliary Video Information)
- SPD (Source Product Descriptor)
- AIF (Audio InfoFrame)
- MPEG (MPEG Source InfoFrame)
- DRM (Dynamic Range and Mastering InfoFrame)

Saving InfoFrames

Infoframe 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 *EMP_2022-07-28T15_54_24.bin*, where *EMP* 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

Infoframe Features

Observe features found in infoframes by selecting Features.

	HDMI TX	Event Log	Memory Laye	out Terminal						
ink V	Video Au	idio EDID	InfoFrames	Source DUT Testing	Capture	HDCP				
1 GCP 2 EMP 3 AVI	03 00 00 7F C0 00	10 04 00 00 84 00 01 00	00 00 00 10	08 09 10 11 12 13 1 04 00 00 00 00 00 0 01 00 32 00 00 00 0 00 00 00 00 00 00 0 00 00 00	0 04 00 00 0 00 00 00	00 00 00 10 00 00 00 00	04 00 00 00 00 00 00 00	00 00	Gaming VRR QMS QFT (FVA) SBTM	
	sh Si	ave								

CEC Tab

The *CEC Tab* is used for sending and receiving CEC (Consumer Electronics Control) protocol messages and data.

The CEC Tab is grouped into two panels: CEC Info and CEC Controls.

Log Memory Layout Terminal HD									
	InfoFrames Source DUT lesting Capture CEC								
CEC Info		C	EC Controls						
CEC Status			Logical address	Phy address	Destination	Operation code	OP Parameter	Device type	^
Version:	1.0	1	TV	0x84	PlayDevice1	0x83	0x0	TV;	
Operation number:	0								
Buffer status:	not overflowed								
	Refresh								
CEC Data									
		^							
		~							
		> 4							
Reset All Reset Refresh			SelectAll S	end Add	d Remove	Presets *			
ner on				1400					
)									

Use *CEC Controls* to send data a HDMI follower via CEC protocol. Select *Add* button to add an *Operation code* with parameters to be sent to various devices.

	Logical address	Phy address	Destination	Operation code	OP Parameter	Device type
	TV	0x84	PlayDevice1	0x83	0x0	TV;
2	TV	0x84	PlayDevice1	0x83	0x0	Audio System; TV;
	Form Logical Address Destination Physical Address Operation Code OP code parame Device Type TV TV Tuner Audio Syste Sa	0x83 eter 0x0 Rec Dev PB Device m CEC Switch				
<	SelectAll Se	end Ado	Remove	Presets 🔻		
	SelectAll	Add	Remove	Save		
				Load	•	
				Remove	•	
				Import		

Logical address	Logical address of destination
Phy address	Physical address of destination
Destination	Destination device
Operation code	Operation code to send
OP Parameter	Operation code parameter to send
Device type	Sender device type

Select the rows of items in the table (or press the *Select All button*) and press *Send* button to transmit via HDMI CEC protocol.

Select the rows of items in the table (or press the *Select All button*) and press *Rermove* to delete items.

Select the Presets button to Save..., Load, Remove, Import..., or Exportitem sets as shown above.

CEC data and status received can be seen in the CEC info panel.

HDMI RX HDMI TX Ev	ent Log 🛛 N	lemory Layout Te	rminal				
Link Pattern Generator	Playback	Audio Generator	HDCP	EDID	SCDC	CEC	Cable
CEC Info							
Version: Operation number:		1.0 1					
Buffer status:		not ov	verflowed				
CEC Data							
0x04, 0x83, 0x00							~
< Reset All Reset	Refre	esh					>

CEC Status shows the CEC Version, Operation number and Buffer status. Press Refresh button to refresh.

CEC Data shows the CEC data received. Select Reset All or Reset to remove all or selected rows. Select Refresh to check for new data.

USB-C Monitoring

Role:	Product:
USB-C DP Alt Mode Reference Source (USB-C TX) or	UCD-424
USB-C DP Alt Mode Reference Sink (USB-C RX)	000-424

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

• USB-C Power Delivery (PDC)

In *USB-C Power Delivery* tab (PDC) 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 roles for the UCD-424 test equipment and the optional capabilities for UCD-424 in the USB-C PD Contract. Controls allow 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-424 and the connected DUT.

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

The bottom panel indicates status of the cable connection and PD Control controls for role swaps

Status List Capabilities DP Alt Mode Power Source Power Source Cable Info Controls Data Role Up facing port (UFP) Devour Role Sink CC Pull-up O class Power Role Sink Uknown Off DEP/SRC UFP/SNK DRD/ORP O class Power Role Sink Nonon Reject PR Swap O class O status Power Source - - Power Source Ty Behavior Ty Sink POD Topte Fixed 3.00 A Power Source None POD Topte Fixed 3.00 A Power Source None POD Topte Fixed VCONN SWAP Ty Sink Ty Source POD Topte Fixed Dot Ald Identity Power Delivery Spec: P Drev 3.0 V J.0 Vemodrilby: Vendori ID: 0x424 Product Type: Unspecified VBS comm capable Yes Accessories Debug Accessory Debug Accessory VBUs current 1.04 A CC Voltage 0.22 V Orientation VBU current 1.04 A CC Voltage 0.22 V <th>PDC Link Video Audio Link Analyser HDC</th> <th>CP EDID DPCD FEC SDP DSC</th> <th>Source DUT Testing</th> <th></th>	PDC Link Video Audio Link Analyser HDC	CP EDID DPCD FEC SDP DSC	Source DUT Testing	
Data Role Up facing port (UFP) Power Role Sink VConn Off E-Marked Cable Unknown DP At Mode "C: DP V-13.4 lanes PD Contract Fixed 3.00 A / 9.00 V P D Contract Fixed 3.00 A / 9.00 V P D Contract Fixed 3.00 A / 9.00 V P DO Tayse Fixed 3.00 A / 9.00 V P DD O Tayse Fixed 3.00 A P DD O Tayse (urrent 3.00 A) 3.00 A P DO D max current 3.00 A 3.00 A P DO D opr current 3.00 A 3.00 A P DO D opr current 3.00 A 9.00 V - No USB suspend Ves VCO-424 Identity Power Delivery Spec: P Drev 3.0 v1.0 Vendor ID: 0.16A6 Product ID: 0.424 Vbus current 1.04 A CC1 voltage 0.22 V Vbus current 1.62 V	Status List	Capabilities DP Alt Mode Power Sour	ce PowerSink Cable Info Controls	
PDC Ontrol	Data Role Up facing port (UFP) Power Role Sink Vician Off E-Marked Cable Unknown DP Alt Mode "C": DP V1.3 4 lanes PD Contract Fixed 3.00 A / 9.00 V * PD Contract Fixed Power Source - - PDO Type Fixed - PDO Ontact 9.00 V - PDO Ontac current 3.00 A - PDO max current 3.00 A - RDO oper current 3.00 A - RDO oper current 3.00 A - NU SB suspend Yes - Capability mismatch No - Give back No - Wus voltage 9.28 V Vus urrent 1.04 A CCI voltage 0.22 V CCI voltage 1.62 V	DFP/SRC UFP/SNK DRD/DRP Reject PR Swap Reject DR Swap Reject DR Swap Reject CONN SWAP Reject FR Swap UCD-424 Identity Power Delivery Spec: PD rev 3.0 v Vendor ID: 0x424 Product ID: 0x424 Product Type: unspecified Accessories Audio Accessory Debug J	 Oefaut 1.5A 3.0A Try Behavior Try Sink Try Source None 	
Send PR_SWAP Send DR_SWAP Send VCONN_SWAP Send FR_SWAP PDC Status Reset OCC1 OCC2 Cable Orientation: Flipped				lipped

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 Down facing port (DFP) Power Role Source VConn On E-Marked Cable Yes DP Alt Mode "C": DP v1.4a 4 lanes PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source PDO Type Fixed PDO voltage 9.00 V PDO max current 3.00 A POWer Sink RDO max current 3.00 A No USB suspend Yes USB comm capable Yes Capability mismatch No 	Status List		
Power Role Source VConn On E-Marked Cable Yes DP Alt Mode "C": DP v1.4a 4 lanes PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	▼ TE Status		^
VCon On E-Marked Cable Yes DP Alt Mode "C": DP v1.4a 4 Ianes PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	Data Role	Down facing port (DFP)	
E-Marked Cable Ves DP Alt Mode "C": DP v1.4a 4 lanes PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	Power Role	Source	
DP Alt Mode "C": DP v1.4a 4 lanes PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	VConn	On	
PD Contract Fixed 3.00 A / 9.00 V ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	E-Marked Cable	Yes	
 ▼ PD Contract Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes 	DP Alt Mode	"C": DP v1.4a 4 lanes	
Power Source - PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	PD Contract	Fixed 3.00 A / 9.00 V	
- PDO Type Fixed - PDO voltage 9.00 V - PDO max current 3.00 A Power Sink - - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	▼ PD Contract		
PDO voltage 9.00 V PDO max current 3.00 A Power Sink RDO max current 3.00 A RDO oper current 3.00 A No USB suspend Yes USB comm capable Yes	Power Source		
PDO max current 3.00 A Power Sink RDO max current 3.00 A RDO oper current 3.00 A No USB suspend Yes USB comm capable Yes	- PDO Type	Fixed	
Power Sink - RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	- PDO voltage	9.00 V	
- RDO max current 3.00 A - RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	- PDO max current	3.00 A	
- RDO oper current 3.00 A - No USB suspend Yes - USB comm capable Yes	Power Sink		
- No USB suspend Yes - USB comm capable Yes	- RDO max current	3.00 A	
- USB comm capable Yes	- RDO oper current	3.00 A	
	- No USB suspend	Yes	
- Capability mismatch No	- USB comm capable	Yes	
	- Capability mismatch	No	
- Give back No	- Give back	No	

TE Status:

UCD-424 internal status (Data role, Power Role, VConn, E-marked cable, DP Alt Mode, PD Contract status)

PD	Contra	ct:
----	--------	-----

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	
PDO 1	Fixed 3.00 A / 5.00 V
PDO 2	Fixed 3.00 A / 9.00 V
 Bus Electical Status 	
Vbus voltage	9.38 V
Vbus current	1.07 A
CC1 voltage	1.67 V
CC2 voltage	0.00 V
VCONN voltage	0.00 V
VCONN current	0.00 A
SBU-1 voltage	0.27 V
SBU-2 voltage	2.70 V

Available source PDO:	(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)
 DUT Discovery 	
-----------------------------------	------------------------
Data Capable as Host	yes
Data Capable as Device	yes
Product Type	N/A
USB Vendor ID	0x16A6
USB Product ID	0x424
BCD Device	0x710
SVID0	0xFF01
SVID1	0x00
▼ DP Alt Mode support	
Supports DP v1.3	yes
Supports USB gen2	no
Pin Assignment supported	
- DFP_D	yes
- UFP_D	no
- DPAM Version	Version 2.0 or earlier

DUT Discovery:

DUT information (data capable as host, data capable as device, product type, USB vendor ID, USB product ID, BCD device, SVID0, SVID1)

DP Alt Mode support:

Supported DisplayPort Alt Mode features (Supports DP v 1.3, Supports USB gen2, Pin Assignments supported as DFP_D, UFP_D, and DPAM Version)

 TE DP Alt Mode Status 		
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	
Cable Active Component	Passive -or- cable type is unknown	
DPAM Version	Version 2.0 or earlier	
 DUT DP Alt Mode Status 		
Status	DFP_D is connected.	
Multi-function prefered	not relevant	
HPD state	asserted	
Power low	Normal operation.	
No DPAM Suspend	UFP_U/DP Sink device has no preference for entry into low power state	~

TE DP Alt Mode Status:	UCD-424 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)

Capabilities

Capabilities DP Alt Mode P	ower Source	Power Sink	Cable Info	Controls	
Initial Role DFP/SRC UFP/SNK FReject PR Swap Reject DR Swap Reject VCONN SWAP Reject FR Swap	DRD/DRP	CC Pull-up Defaut 1.5A 3.0A Try Behavior Try Sink Try Source None			
Vendor ID: 0 Product ID: 0	PD rev 3.0 v1.0 k 16A6 k 424 inspecified				
Accessories	Debug Acco	essory			

Initial Role:	Defines the role which UCD-424 presents itself in the start PD communication (both power and data role).					
Reject Swaps:	Allow or reject mode swap requests from the connected port partner.					
CC Pull-up:	Control of Rp that Source uses to advertise the initial current source capability using USB-C Current method.					
Try Behavior:	Control the USB-C PD role that UCD-424 initially takes in the connection handshake.					
UCD-424 Identity:	Status information provided by UCD-424.					

Accessories	
Audio Accessory	Debug Accessory

Accessories

Audio Accessory:	Enable simulation of Audio Accessory support
Debug Accessory:	Enable simulation of Debug Accessory support

Enabling *Audio Accessory* and *Debug Accessory* extends USB Type-C Connection State Machine with *.Accessory states. (Please refer to USB Type-C specification for details).

Note:	Please note that UCD-424 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.

Capabilities	DP Alt Mode	Power Source	Power Sink	Cable Info	Controls
Enter	r 2 lane mode (D) 4 lane mode (C,E it DP Alt Mode) UFP	t Mode Capabili _D C: 4 DP lanes	ties	
Disa	able DP Alt Mode		D: 2 DP lanes + 1 E: 4 DP lanes	USB SS	
	e-C Cable Adapte	er" 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.
"DP to Type-C Cable Adapter" mode:	Perform an automated procedure for connecting a DP to USB-C bidirectional cable. Please find an abstract of the issue below.
Multi-function preferred:	When entering DP Alternate Mode, select mode D.

DP to Type-C Cable Adapter

USB-C to DP Bi-directional Cable contains an active converter microchip that needs to be powered from USB-C interface. Therefore UCD-424 must be initially configured in power source role for USB Default Operation where it applies vSafe5V on Vbus to power up the microchip in the cable.

USB-C to DP Bi-directional Cable uses pin assignment E when acting as a source. In order to provide the "cable" a possibility to request the configuration it needs, UCD-424 has to initiate a Data Role Swap to be in UFP, Device, data mode.

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-424 when acting as Power Source Port.

SPR PDOs											
Source PDOs	PDO Type		Max Curren mA	ıt,	Voltage, mV		Peak Curi %	rent,	Max Power, mW	Max Voltage, mV	Min Voltage, mV
PDO1	Mandatory	~	3000	-	5000	-	125	~			
PDO2	Fixed	~	3000	•	9000	-	110	~	0	÷ 0	▲ 0
Refresh	Apply	Send	PDO Los	ad P	DO Sav	e PD	00				

PDO Type: Definition of power source type (Mandatory, 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-424 is not able to simulate as Source the electrical behavior of Variable and Battery source types.

Refresh	Re-read status from UCD-424
Apply	Program new values to UCD-424
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-424 when acting as Power Sink Port.

Controls SPR PDOs	
Flags	
Give back flag	
No USB suspend	
PDO type priority	FR_SWAP required current Max Operation Current
Prefer higher current $$	Disable v 500
Give back flag:	UCD-424 sets GiveBack flag in its Request Data Object
No USB suspend:	UCD-424 sets No USB Suspend flag in its Request Data Object
PDO type priority:	Setting of the policy used for automatic selection from available PDOs advertised by Source Device. (Prefer higher current / Prefer higher voltage / Prefer higher power)
Max Operation Current	Setting the highest current UCD-424 will ever require when operating a a Power Sink.
apabilities DP Alt Mode	Power Source Power Sink Cable Info Controls
apabilities DP Alt Mode Controls SPR PDOs	Power Source Power Sink Cable Info Controls
	Oper Current Voltage May Power May Voltage Min Voltage
Controls SPR PDOs	Type Oper Current, Voltage, Max Power, Max Voltage, Min Voltage, mA mV mV mV mV



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

Refresh	Re-read status from UCD-424
Apply	Program new values to UCD-424
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	e Power Sink	Cable Info	Controls
A6 16 00 1C 00	0 00 00 00 00 00 54 85 52 20 08 00	00 00 00 00 00 00 00	00 00	Refresh
USB Vendor Modal opera Product Typ	ation supported	16A6 yes Passive Cable	XID Assigned	by USB-IF 0x00000000
	- unications Capable as USB Devic		bcdDevice	0x0000
USB Comm	unications Capable as USB Host	no	USB product	ID 0x8554
USB SuperSp	eed Signalling Support	USB 3.1 Gen1 an	id Gen2	
VBUS throug	jh cable	Yes		
VBUS Currer	nt Handling Capability	5A		
SSRX2 Direct	tionality Support	Fixed		
SSRX1 Direct	tionality Support	Fixed		
SSTX2 Direct	ionality Support	Fixed		
SSTX1 Direct	ionality Support	Fixed		
Cable Termi	nation Type	VCONN not req	uired	
Cable Laten	cy	<10ns (~1m)		
USB Type-C	plug to USB Type-A/B/C/Captiv	e USB Type-C		
Firmware Ve	rsion	0		
Hardware Ve	ersion	0		

Note:

Please note that cable info can only be read when in DFP Data Role.

Controls

Control tab includes miscellaneous controls related to UCD-424 behavior as a USB-C PD Port Partner.

PD Contract Settings

Automatically negotiate power contract: When selected UCD-424 will start power contract negotiation if suitable configuration is found.

apabilities	DP Alt Mode	Power Source	Power Sink	Cable Info	Contro
PD Contrac	ct settings atically negotiate	power contract	USB Commu As PD So		ble
ET Cable U One	SB 2.0 diferential া ম	pairs wo			

ET cable USB2.0 differential pairs

There are two versions for Unigraf Electrical Test Cable. The difference is the number of USB D+/pairs included in the cable. The reasoning is that if an unused pair is not terminated, it is a receiver of EMI and disturbs the electrical circuitry.

Cable with P/N 546117 has two USB2.0 pairs (A6, A7 and B6, B7), while P/N 546114 has only one pair (A6, A7). Please update the control accordingly.

If DUT has shorted USB2.0 pins A6 to B6 and A7 to B7 at the receptacle then choose cable One: In order to minimize in-cable signal coupling only one USB D+/- pair is included in the cable

If DUT has shorted USB2.0 pins routed to mux or similar, then choose cable Two: In order to enable electrical cable flip in cases where USB D+ lines and USB D- lines correspondingly have not been shorted together on Device side, both USB D+/- pairs are included in the cable. This cable marked with a label "2xUSB 2.0 PAIRS".

USB Communication Capable

You can control the USB Communication Capable bit in its Request Data Object.

Note: Please click *Apply* to enable changes.

Bottom Panel

Bottom panel includes statuses and controls for the USB-C connection

<u>Status</u>

PDC	Orientation	PD
PDC Status Reset	• CC1 · CC2 Cable Orientation: Straight	DUT Attached Reconnect

PDC Status	LED for USB-C Power Delivery Control
------------	--------------------------------------

Reset:	Reset the PD Controller in UCD-424 to overcome abnormal situations.
Orientation:	Straight (CC1 terminated) or Flipped (CC2 terminated).
DUT Attached:	Indication that Attach is detected by the Source port in one of its CC lines.
Reconnect:	Restart USB-C Source-to-Sink attach procedure.

PD Control

PD Control

Send PR_SWAP Send DR_SWAP Send VCONN_SWAP Send FR_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.
Send FR_SWAP:	Send FR_Swap message to request a Fast Role Swap.

5. GENERATOR OPERATION

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

Please note that in most UCD-4XX 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.

Standard Tabs

Analyzer role features six standard tabs:

- Video pattern generator (Pattern Generator).
- Content Playback (Playback)
- EDID editor (EDID)
- HDCP status monitor and control (HDCP)
- Sink DUT Testing
- Adaptive-Sync

Interface Specific Tabs

Depending on the connected UCD device, additional interface specific tabs will be available

UCD-400, UCD-411, UCD-451 and UCD-424: DP and USB-C DP Alt Mode Reference Source

- Status information and control of the downstream link (Link).
- DPCD monitor (DPCD)
- Forward Error Correction (FEC)

UCD-422, UCD-452 and UCD-412: HDMI Reference Source

- Status information and control of the downstream link (Link).
- SCDC monitor (SCDC)

UCD-424: USB-C Reference Source

• USB-C Monitoring (PDC)

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

Standard Tabs

Pattern Generator Tab

DP				rminal												
ink Pat	tern Generato	er Playback	Audio Gen	erator	HDCP	DPO	CD	FEC Sink DU	JT Testing	Adaptive-Syn	c ALPM	Panel Replay	EDID/DisplayID	SDP		
Auto-App	oly Apply A	All 🗹 MST	Number of stre	eams 2	•	Force ED	ID pr	eferred timing af	ter LT 🗌 Use	Timings from	n EDID Mana	ge Timings				
	: 7.128 / 25.51	5 Gbps.														
	nerator Status															
	Fiming 1080 @ 60Hz	Patter Color B		CE /Legacy		BP ode 8		Sta			GB/CrYCb/012) E B33E 1AB3					
	1080 @ 60Hz	Color B		/Legacy				c			E B33E 1AB3					
	1080 @ 60Hz	Color B		/Legacy				C			0000					
1920 x	1080 @ 60Hz	Color B	ars RGB	/Legacy	RGB mo	ode 8		C	К		0000					
 Stream 0)															
CTA 1920	x 1080 @ 60H	z (VIC 76)	V 🝸 81	opc ~	O VE	sa 🔾	CTA	Pattern Scrollin	9			- I-				
Color	Bars		RGB	~				Enable Ho	rizontally 0	pixels		- L				
no options								Ve	tically -1	÷ pixels		- L				
			440 5001415					Ev	ery 0	\$ frame		- L				
Frame Kate	e 60,000Hz Horizontal	Pixel Clock Vertical	148,500KHz	Horizo	ontal	Vert	ical		Horizontal	Vertical		- L				
Active	1920 	1080 ‡	Front Porch	88		4	ŧ	Start	192 🖨	41		- L				
Total	2200	1125 \$	Sync Width	44	•	5	•	Sync Polarity	(+)	(+)	1	- L				
Blanking		45	Back Porch	148	•	36	٢	-,,		pply		- L				
												- I.				
Stream 1																
CTA 1920	x 1080 @ 60H	z (VIC 76)	▼_8	opc ~	O VE	5A 🔾 (CTA									
Color	Bars	~	RGB	~												
no options																
Frame Rate	e 60,000Hz	Pixel Clock	148,500kHz	-												
	Horizontal	Vertical		Horizo		Vert			Horizontal	Vertical						
Active	1920 🗘	1080 🗘	Front Porch	88	٢	4	٢	Start	192 🗘	41 🗘	1					
Total	2200 🗘	1125 🗘	Sync Width	44	\$	5	\$	Sync Polarity	(+)	(+)						
Blanking	280	45	Back Porch	148	\$	36	٢		A	pply						
 Stream 2 	2															
IPD																

Link Pat	tern Generator	Playback	Audio Gen	erator	HDCP	EDID		DUT Testing	Cable Info CE	2	
Auto-App		Chara					Use Timin	gs from EDID	Manage Timings		
	: 4.010 / 48.000 nerator Status -	GDDS.									
1	Timing	Pattern		CEF		BPC	St	atus			
1920 x	1080 @ 60Hz	Color Bar	rs RGB	/Legacy R	GB mode	8	(ОК			
CTA 1920	x 1080 @ 60Hz	(VIC 16) ~	8 bpc	~ • v	esa O c	TATIM	ing Generator				
Color	Bars	· · ·		~			cta O ovt	Generate			
no options	5					VIC	0				
		Pixel Clock	148.500kHz	1							
	Horizontal	Vertical		Horizon	tal ۱	/ertical		Horizontal	Vertical		
Active	1920 韋	1080 🗘	Front Porch		\$	-	Start	192 🗘	41 🜲		
Total	2200 🗘		Sync Width		\$ 5	-	Sync Polarity	✓ (+)	✓ (+)		
Blanking	280	45	Back Porch	148	\$	5 🗘		Ap	ply		

Note:		can be used in MST streams are limited by the overall capability of the capability of the connected DisplayPort Sink or Branch device.
	Auto-Apply (DP):	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>
	Apply All (DP):	want to upload image? See Sourcing DSC Compressed Patterns. 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 Sourcing DSC Compressed Patterns.
	MST (DP)	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 (DP)	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 Gbps (PIs see Note below).
	Auto-Apply (DP)	To avoid sourcing invalid video mode combinations new settings are being validated when the user is clicking Apply. Automatic validation will be applied when <i>Auto-Apply</i> is checked.
	Apply	Apply recent changes.
		<i>tus</i> panel shows the <i>Timing</i> , <i>Pattern</i> (Name), <i>CEF</i> (color format and netry), <i>BPC</i> (bits per color), <i>Status</i> , and <i>CRC</i> value, for each active stream.
Note:	A full description of Mi available. Please contac	nimum link configuration combinations for UCD standard video modes is t Unigraf for details.

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 *Manage Timings* function the user can add timings in the list and select which timings are shown in the selection.

Color Depth

Available color depths are: 6, 8, 10, 12 and 16 bpc. Color depth 6 bpc is only available when using RGB color format in DisplayPort or DisplayPort Alt Mode.

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 stream 0

Filter

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

HDMI timings are sorted by VIC number by default.

Timing Filterir	ng	
Enable		
Filter by ven	dor	
СТА		🗌 СУТ
Unigraf	Other	
Filter by reso	olution	
2k and le	ess 🗌 4k [8k and more
	N. 1. 17	
Sort timings b		

Custom Image Patterns

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

Please refer to *Link Pattern* in description of *DP* and *DP Alt Mode Reference Source Link tab* later in this manual for sending special DisplayPort 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 left top 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.

Note:

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.

✓ Enable Horizontally 10 ↓ Vertically 10 ↓ Every 1 ↓	pixels pixels 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.

Sourcing DSC Compressed Patterns

UCD Pattern Generator function can 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.

ile to compress						
Source File: C:/Temp/DSC/u	inigraf_default_image_16k.ppn	n				
16384 x 8640, RGB 24bpp						
Sink DSC capability registers	(DPCD range 0x60 -> 0x6f, hex	:)				
01 21 03 03 eb 07 01 00 00 1f	0e 11 08 07 00 00			Update		
Compression Options						
compression options						
	Output resolutions:					
Color space	✓ 2560 x 1600	∧ Co	mpression ratio:	8bpc -> 6bpp (2.7 to 1)		
Color space YCbCr 4:2:2	 2560 x 1600 2880 x 240 		mpression ratio: rizontal slices:			
Color space YCbCr 4:2:2 Color depth	✓ 2560 x 1600	Ho		4 Slices		
Color space YCbCr 4:2:2 Color depth	2560 x 1600 2880 x 240 2880 x 288 2880 x 288 2880 x 480 2880 x 576	Ho Ver	rizontal slices:	4 Slices		
Color space YCbCr 4:2:2 Color depth 8 Resize mode	 2560 x 1600 2880 x 240 2880 x 288 2880 x 480 2880 x 576 2880 x 1440 	Ho Ver	rizontal slices: tical slices:	4 Slices Custom		
Color space YCbCr 4:2:2 Color depth 8	 2560 x 1600 2880 x 240 2880 x 288 2880 x 480 2880 x 480 2880 x 1440 3840 x 2160 	Ho Ver	rizontal slices: tical slices:	4 Slices Custom		
Color space YCbCr 4:2:2 Color depth 8 Resize mode	 2560 x 1600 2880 x 240 2880 x 288 2880 x 480 2880 x 576 2880 x 1440 	Ho Ver Cu	rizontal slices: tical slices: stom vertical slices size:	4 Slices Custom		
Color space YCbCr 4:2:2 Color depth 8 Resize mode O Scale	 2560 x 1600 2880 x 240 2880 x 288 2880 x 288 2880 x 576 2880 x 1440 3840 x 2160 4096 x 2160 5120 x 2160 5120 x 2880 	Ho Ver Cu - Y	rizontal slices: tical slices: stom vertical slices size: UV Color range	4 Slices Custom		
Color space YCbCr 4:2:2 Color depth 8 Resize mode O Scale © Crop	 2560 x 1600 2880 x 240 2880 x 288 2880 x 480 2880 x 480 2880 x 1440 3840 x 2160 4096 x 2160 5120 x 2160 5120 x 2880 7680 x 4320 	Ho Ver Cu - Y	rizontal slices: tical slices: stom vertical slices size:	4 Slices		
Color space YCbCr 4:2:2 Color depth 8 Resize mode O Scale © Crop	 2560 x 1600 2880 x 240 2880 x 288 2880 x 288 2880 x 576 2880 x 1440 3840 x 2160 4096 x 2160 5120 x 2160 5120 x 2880 	Ho Ver Cu - Y	rizontal slices: tical slices: stom vertical slices size: UV Color range	4 Slices Custom		

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

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

-				1 (1997)		
CVT 3840 >	x 2160 @ 3	OHz [RB1]		8 bpc	· · •	VESA O CT
💐 Select	DSC Imag	e	~	RGB	~	
3840x216	0_RGB444	_BPY_bpc8	_bpp128_2	slicew_4sliceh_1	13lb.dsc @	Select
C D-t-	20.000		Charlt 25	020	Advention C	
Frame Rate	30.000	Pixel	Clock 262	.920 🔹	Adaptive-Sy	_
	30.000	 Pixel x 2160 	Clock 262	2.920 € Sync width	Adaptive-Sy 32 🔹	/nc
Active	3840	7			32 🗘	
Frame Rate Active Total Back Porce	3840 4 4000 4	x 2160	•	Sync width	32 € y ☑ (+)	x 5

When a DSC image is selected as the pattern, UCD Console will automatically enable DSC, provided that the connected Sink device declares support for DSC in its DPCD.

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	ning	×
?	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 will be indicated in the preview image.

MST Number of streams 2 🕏	Force EDID preferre	ed timing after LT 🗌 Use Timing	gs from EDID Manage Timings
Stream 0	Stream 1		
CTA 1920 x 1080 @ 60Hz (VIC 76) VESA	CTA 1920 x 1080 @ 60	Hz (VIC 76) 🗸 🝸 8 bj	pc 🗸 🖲 VESA 🔿 CTA
Select DSC Image ✓ YCbCr422 ✓ ITU601	✓ Color Bars	✓ RGB	✓
1920x1080_YUV422_BPY_bpc8_bpp112_2slicew_4sliceh_13lb.dsc_ 🔌			
Frame Rate 60.000 € Pixel Clock 148,500 € Adaptive-Syn Active 1920 × 1080 € Sync width 44 € Total 2200 × 1125 € Sync polarity (+) Back Porch 143 × 56 € Front Porch 88 €	1024 × 768 12	200 * 000	n 44 € x 5 € ity 2' (+) x 2' (+) h 88 € x 4 €
Start 192 7 x 41 V Status: OK	(CrYCb)	0xA653 0x2BA8 0xC4D6	UK I
DSC	CRC (Eng. 012)	0xB81F 0x800A 0xA42C	

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					
🛛 🔒 CTA 3840 x 2160 @ 30Hz (VIC 95)			Standard	CVT				
CTA 3840 × 2160 @ 50Hz (VIC 96)			ID	0				
🗋 🔒 CTA 3840 x 2160 @ 24Hz (VIC 103)			Frame Rate	60.000				
🗋 🔒 CTA 3840 × 2160 @ 25Hz (VIC 104)			Pixel Clock	556.744 Horizo	ntal		Verit	eal.
🗋 🔒 CTA 3840 x 2160 @ 30Hz (VIC 105)			Active	4096	÷	x	2160	cai :
□ 🔒 CTA 3840 × 2160 @ 50Hz (VIC 106)			Total	4176	\$	x	2222	
□ 🔒 CTA 3840 × 2160 @ 60Hz (VIC 107)			Start	72	*		14	
□ 🔒 CTA 3840 × 2160 @ 48Hz (VIC 114)			Sync width	32	A V		8	
□ 🔒 CTA 3840 × 2160 @ 48Hz (VIC 116)			Sync polarity	⊻ (÷)			(-)	
□ 🔒 CTA 3840 × 2160 @ 100Hz (VIC			Back Porch Front Porch	40 8	4 V		6 48	
□ 🔒 CTA 3840 × 2160 @ 100Hz (VIC				40 ,	Ŧ		48	
🗋 🔒 CTA 3840 x 2160 @ 120Hz (VIC		_	48	FrontP				
🗹 🔒 CVT 4096 x 2160 @ 60Hz [RB2]			8 VS	BackP				
☐			Fron	Ba				2222
🗹 🔒 CVT 4096 x 2160 @ 60Hz [RB3]			r o N t		ACTIVE VI	DEO	2	160
🗹 🔒 CVT 4096 x 2160 @ 144Hz [RB3]			P.	Р.				
☑ 🔒 CTA 4096 x 2160 @ 60Hz (VIC 102)				417	4096 6			
🗋 🔒 CTA 4096 x 2160 @ 120Hz (VIC								
GTA 4096 x 2160 @ 100Hz (VIC		~				Sav	re F	Revert

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
 indicates that a timing is a

 fixed timing which cannot be edited or deleted. Custom timings are indicated with a head icon
 .

 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 parameters will be sanity checked and will warnings issued for illegal combinations.

HDMI Timing Generator (UCD-422, UCD-412)

HDMI Timings can be generated and applied via the Timing Generator group.

Timing Generator					
$\bigcirc \mathbf{c}$	CTA OVT Genera	te			
RID	3: 1680 x 720 (64x27)	\sim			
FR	5: 30Hz	\sim			

Timing Generator				
● CTA ○ OVT	Generate			
VIC 77 🖨				

To do this select CTA or OVT timings radio button. Select desire RID and FR or VIC in combo boxes and then click the *Generate* button.

The generated values will be reflected in the Frame parameters. Click Apply to set timing.

Frame Rate	e 30.000Hz	Pixel Clock	44.400kHz	×				
	Horizontal	Vertical		Horizontal	Vertical		Horizontal	Vertical
Active	1680 韋	720	Front Porch	256 🗘	6	Start	64	14
Total	2000 🗘	740 🔶	Sync Width	32	8	Sync Polarity	✓ (+)	✓ (+)
Blanking	320	20	Back Porch	32	6		Арр	ly

Playback Tab

Role:	Product:
DP Reference Source (DP TX)	UCD-424, UCD-400, UCD-411
HDMI Reference Source (HDMI RX)	UCD-422, UCD-412

Playback allows for running predefined *Playlist* files. Playlist contains a set of *Scenarios* with definitions of the timing, video pattern, audio content and related metadata packets and their duration.

Term	Functionality
Playlist	<i>Playlists</i> (text files) specify the UCD devices and output protocol for transmission. It lists <i>scenarios</i> to be transmitted.
Scenario	Scenarios (text files) allow users to select video frames, metadata packets and audio to be transmitted and their order.
Advanced Playlists	Unigraf UCD devices can also be used as a compatibility test tools for dedicated standards such as Dolby Vision™ and HDR10+. Contact Unigraf for details.

Common Tab

The *Import* button is for importing *.json files into the *common* tab treeview. Sample content on windows can abe found at C:\Program Files\Unigraf\Unigraf UCD Tools\Resources\playback\ basic_library.json. Be **warned** that once imported, items cannot at present be removed. Actually you can but it involves using *Windows Register Editor* to remove values from (uninstall will not help):

Computer\HKEY_CURRENT_USER\SOFTWARE\Unigraf\UCD Console\Playback

Computer\HKEY_CURRENT_USER\SOFTWARE\Unigraf\UCD Console\MetadataScenario

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 *Run* button lable changes to *Stop* as a *Scenarios* run. Press *Stop* to stop playing the scenario. Press *Skip* to skip to next scenario (available when there are multiple scenarios in a playlist) while playing. While the *scenario* is loading the *Run* button lable changes to *Cancel* to allow cancelation.

nk	SDP	Pattern Ger	nerator	Adapti	ive-Sync	Panel	Replay	ALPM	P
Im	port								
Con	nmon	Metadata	HDR10	+ Test	Adaptiv	e-Sync			
~	 Basi Fran DSC HDF Gray 	Content c Video & Aud ne Rate Examp Example - DP & & Metadata I yscale - DP.txt X10+ SSTM Exa 1.txt	ile - DP.tx .txt Example -	t DP.txt	xt				
		Run				2	škip		

Status Log

Scenario commands are listed in the Status Log as they are run.

Stop	Skip
Iotal data size: 26542080 bytes.	^
Video data size: 26542080 bytes.	
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) #2/4 > Flip	-flop Silent 🗸

Selected Sequence

Running scenario video and audio details and their sources are shown in the *Selected Sequence* group panel.

Note that the triggered scenario or playlist to be run is the last selected: If an item was selected via the *treeview*, it is the triggered item to be run. If the *Select* button was used to select an item, it is the triggered item to be run (regardless of what is selected in the tree control).

Press the Select button to load a playlist or scenario to be run (selecting a sample from the Sample Content treeview will load them as the playlist or scenario to be run). Also it will be the scanario used as a template if the Scenario Editor is launched: default scenario values will be set if a playlist is selected.

Press the Editor button to launch the Scenario Editor (see below).

The Selected Sequence parameters are the transmission stream parameters.

Video		xample - DP.tx			
		T - 1 (D			
source:n Amount: -	igraf UCD	IOOIS/Resourc	es/playba	ack\content\Basic\In	nage i .jpg
– Horizonta	il	Vertical		Misc	
Total	2200	Total	1125	Frame Rate, Hz:	60
Start	192	Start	41	Color Depth, BPP:	8
Active	1920	Active	1080	Color Encoding:	RGB444
Sync Widt	h 44	Sync Width	5		
Source:n Amount: 1 Compresse	-			ack\content\Basic\R	nythm.wa
	d: NO 44100			16	
Sampling:	44100	D	it depth:	10	
Packets					
Packets Source: -					

Scenario Editor

Press the *Select* button above to select the scenario desired to use as a template for creating a new scenario. Press the *Editor* button to launch the *Scenario Editor*. The the dialog parameters will be generated from the scenario file shown under the panel *Source* label (*Philips FHD.txt* as seen above).

Press the Path :... for setting the Video, Packets or Audio paths.

Press *OK* to save. Your are presented with a save dialog. You need to navigate to a directory you can save to. Run Conssole 2 with **administration rights** if you want to save to default locations on windows such as: C:\Program Files\Unigraf\UnigrafUD Tools\Resources\playback\content.

Refer to Appendix H: Playlists and Scenarios later in this manual for details.

/// Scer	ario Editor		×
Video			
Dath-	goldenGate0.jpg		Select
raui.	4 files found		Jelect
	Align raw 10/12bit dat		
	Show frame numbers		
	🔒 CTA 3840 x 2160 @ 3	0Hz (VIC 95) V	RGB ~ 10 bpc ~
DSC:	HCActive:	HCBlank:	
	VTotal:	VStart:	
	VActive:	VSync:	
	Frame rate:		
Packe	ts		
Path:	frames_0000.bin		Select
	4 files found		
Audio			
, louie			
Path:			Select
	Compresse Little	Endia 44100 Hz 🗸	2 channels \checkmark 16 bits \checkmark
Playir	g order		
3:180	:0,2:512;		
Gener			
	-		
L Er	able scrambler Loading	color (R,G,B): 52,127	,150 HDCP: None ~
		Γ	OK Cancel

Metadata Tab

The Metadata tab is for creating scenarios with metadata.

Common	Metadata	HDR10+ Test	Adaptive-Sync	
Generate.	•			Delete

Select the *Delete* button to delete a *scenario* or the *Generate* button to launch the *Custom Metadata Scenario* dialog (shown below).

Import	Selected Sequence	
Common Metadata HDR10+ Test Adaptive-Sync	Sc 🗾 Custom Metadata Scenario	×
 ✓ Metadata Scenarios ✓ Playlist DP.txt Metadata: -generated- 	CTA 1920 x 1080 @ 60Hz (VIC 0) RGB444	
Generate Delete	Audio Unigraf UCD Tools/Resources/playback/content/Basic/Rhythm.wav Brow	/se
swap: taise; compressed: false; sampling: 44100; channels: 2ch; bits: 16; Audio upload succeeded! Loaded packet(s) Loaded playback scenario == Scenario started (3600000 ms) #1/1 == Scenario stopped (3600000 ms) #1/1 Playlist stopped.	Compressed Little Endian	16 ~ vse

Current *Pattern Generator* timing details are shown at the top. You can change the color mode (RGB444, YUV444, YUV422, YUV420) and color depth (8 bpc, 10 bpc, 12 bpc, 16 bpc) via the dropdown combo boxes.

Select the Add or Delete buttons to add or remove metadata from the scenareio.

Check the *Audio* checkbox and then the *Browse…* button to add an audio file. Sampling, channels and bits can be selected via the combo boxes.

The scenario Comment can be added in line edit box after the three dashes (---).

Use the Content folder Browse... button to select save location.

You can press Play to run the scenario, Export to save it or Cancel to cancel.

Export will create a folder something like Metadata1920x1080@60-RGB444-8bpc in the *Content folder*. In it you will find generated files frame.svg (displaed while running), the metadata files you selected and a scenario.txt file. You may edit and rename these files.

HDR10+ Test Tab

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

VRR/QMS tab

Click Generate to generate custom VRR and QMS scenarios. Custom Scenario Generator window will open.

GB444		~	8 bpc		
RR QMS					
Transition			Scenario duration		
Min frame rate, fps	20	A V	Step duration, sec	1.00	Å.
Max frame rate, fps	60	*	Step duration, cycles	2	Å V
Transition type	Fixed frame rate	\sim	Frame repetition	1	\$
	200; Base rate: 60		Duration in secon	ds	
RR min: 10; VRR max: 2 Video • Spinner Fast	200; Base rate: 60 ✓ Frames: 10 \$		Duration in secon	O Custom	Select
Video Spinner Fast			Duration in second		Select
Video Spinner Fast			Duration in secon		Select
Video Spinner Fast Spinners>			Duration in secon		Select

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



Click Browse... to select the folder.

<spinners></spinners>			
Available memory: 1879048192 bytes; 141 frames			
Content folder			
C:/Users/Tester/AppData/Local/Unigraf/UCD Console\Playback			Browse
Sequence 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) EDID (HDMI Forum VSDB; HDR Static MDB; HDR10+ VSVD	B; Dolby Vision VSVDB]	60fps
RGB444 ~	8 bpc	~

VRR settings

In the VRR tab 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. Please, note that when the fixed frame rate is selected, you can only select the number of times the frame is repeated.

Min frame rate, f	os 20	-	Step duration, sec	1.00	*
Max frame rate, f	ps 60	A V	Step duration, cycles	2	Å
Transition type	Fixed frame rate	\sim	Frame repetition	1	\$
			Duration in secon	ds	

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

Min fra	me rate, fps	20	*	Step duration, sec	1.00	
Max fra	ime rate, fps	60	•	Step duration, cycles	2	3
Transiti	on type	Min and max	\sim	Frame repetition	1	
				Duration in second	ds	

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.

Min frame rate, fps	20	-	Step duration, sec	1.00	A V
Max frame rate, fps	60	-	Step duration, cycles	2	4
fransition type	Gradual	~	Frame repetition	1	
			✓ Duration in secon	ds	

QMS settings

In the QMS settings dialogue you find all the frame rates included in the QMS specification. Select which frame rates you want to inlcude in your scenario. Also select the step duration in cycles. In the lower left corner details of the scenario as shown.

VRR QMS			
Next_TFR			
QMS-VRR is not active	30/1.001	50	120/1.001
24/1.001	30	60/1.001	120
24	48/1.001	60	None
25	48	100	All
		Step du	ıration, cycles 2 单
SCDC: QMS: 1; QMS-TFRmin:	l; QMS-TFRmax: 1		

Video

Video Spinner Fast V Frames: 10 ‡	O Custom Select
<spinners> Available memory: 1879048192 bytes; 141 frames</spinners>	
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 clicking *Play.* When the scenario is ready for playing, the scenario generator window will close. You can now inspect the progress in the log in the playback tab as shown below.

Adaptive-Sync tab

Common	Metadata	HDR10+ Test	Adaptive-Sync	
Generate.				Delete
Generate.	••			Delete

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

RGB444		~	8 bpc		×
daptive-Sync					
Transition			Scenario duration		
Min frame rate, fps	48	*	Step duration, sec	1.00	*
Max frame rate, fps	20	÷.	Step duration, cycles	2	÷
Transition type	Fixed frame rate	\sim	Frame repetition	1	÷.
			✓ Duration in seconds		
Video	t found.			O Custom	Select
Video Spinner Fast]			Select
daptive-Sync block no Video Spinner Fast		₽			Select
Video © Spinner Fast					Select
Video Spinner Fast Spinners>					Select

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).

Uustom Scenario Generator		×
CTA 1920 x 1080 @ 60Hz (EDID [HDMI Forum VSDB; HDR Stat	VIC 76) ic MDB; HDR10+ VSVDB; Dolby Vision VSVDB]	60fps
RGB444	✓ 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.

Transition			Scenario duration		
Min frame rate, fps	48	+	Step duration, sec	1,00	4
Max frame rate, fps	60	*	Step duration, cycles	2	
Transition type	Fixed frame rate	\sim	Frame repetition	1	

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		
Vin frame rate, fps	48	-	Step duration, sec	1,00	Ť
Max frame rate, fps	60	-	Step duration, cycles	2	×
Transition type	Gradual	~	Frame repetition	1	÷

<u>Video</u>

Video	
● Spinner Fast ∨ Frames: 10 ‡	O Custom Select
	2 6
< <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\VKK\-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-\frame0015.svg: 8 bpc C:\Users\Tester\Desktop\VRR\-generated-\frame0016.svg: 8 bpc C:\Users\Tester\Desktop\VRR\-generated-\frame0016.svg: 8 bpc	^
Loaded packet(s) Loaded playback scenario	
== Scenario started (3600000 ms) #1/1	~

Stop	
C:\Users\lester\Desktop\VRR\-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. Audio is played to all active ports.

```
III HDMI TX UCD Console - UCD-422 [2201C508]: HDMI Source and Sink
```

Link	Pattern Generator	Playback	Audio Generator	HDCP	EDID	SCDC	Sink DUT Testing	Cable Info
Audi	o Status							
Audi	o loaded: 2 channel	s @ 44100 Hz, 1	6 bits					
Play	Control							
		Source:	audio generator					
	Play Stop	Status:	playing					
Audi	o Content							
•	Generate Audio							
	Waveform:	Sine ~	Bits/Sample:	16	\sim			
	Signal Frequency:	1000	Amplitude(%):	60	\sim			
	Sample Rate (Hz):	44100 ~	Channels:	2	\sim			
ΟL	oad Audio from File							
	Path: -							
	Compressed			Open W	AV file			

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

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 Open.

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

To play the selected audio content, click the Play.

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

Audio Status displays current audio content status.

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, 20, 24.
Amplitude(%)	Selection of audio amplitude: 10%, 20%,, 90%, 100%.
Channels	Audio channels available: 1, 2,, 7, 8. Channels transmit LPCM (uncompressed) Audio.

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.



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.

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.

HDCP 1.3 / 1.4 and HDCP 2.3

DisplayPort currently only supports HDCP 2.X.

HDMI currently does not support HDCP 2.3.

See ReleaseNotes.txt, Known issues (Limitations) in bundle to see limitations:

C:\Program Files\Unigraf\Unigraf UCD Tools\documents\ ReleaseNotes.txt on Windows.

EDID/DisplayID Tab

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 in the host PC.
- Edit the 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

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

Ad	ld Item 💌 Remove Item 🛙 Filter			Read mo	de: O I2C Read O SBM Read Virtual Sink #1 🗸	Show Read Only	Recurse
	ime		Editor	Text EDID			
	VESA			Name	Value		
	> Vendor & Product ID EDID Structure Version and Revisi		0 Hea		0x00FFFFFFFFFF00		-
	> Basic Display Parameters / Feature Color Characteristics	es	1 Exte	ension Block Count N	2		
	> Established Timings I		2 Che	cksum	0x18		
	 Established Timings II Manufacturer's Timings 			Manufacturer Name	UFG		
	 Standard Timings: Identification 		ID P	roduct Code	0x4036		
	 > Preferred Timing Block > 18 byte descriptor 2 		E ID S	er 8t Product ID erial Number or 8t Product ID	22415942		
E.	18 hute descriptor 3 eatures CTA v3		6 Тур		Week & Year of Manufactured		
-	Name	Value					
1	Max Resolution	10240 x 4320			07 08 09 0A 0B 0C 0D 0E 0F		- 1
					00 54 c7 36 40 46 0a 56 01 78 3a 5f b1 a2 57 4f a2 28		- 1
2	10K Max Frame Rate	60 Hz			(f) (a (f) (f) (a (f) (f) (a (f) (f) (a (f) (f) (f) (a (f)		
3	8K Max Frame Rate	60 Hz			d000a0f0703e803020		
4	4K Max Frame Rate	145 Hz	00004	0 35005£59210000	1a565e00a0a0a02950		
5	2K Max Frame Rate	145 Hz			00001a00000fd0038		
6	HDR Static	Disabled			202020202000000fc		
8					30204450310a200218		
7	HDR Dynamic	Disabled			00 29 0f 7f 07 15 06 55 3d		
-	T Main Engluros			Mode 🗌 HEX Edit Mode			Apply
_						1	
	▼ Main Features wnload from Sink Upload to Sink		C Editor	Mode 🗌 HEX Edit Mode		Save As	Apply

	i 🕓 iry Displayid, else Edidi 💊 K	ead both DisplayID and EDID	
Add Item 💌 Remove Item	Filter	Read mode: • I2C Read SBM Read Virtual Sink #1 V	nly 🔽 Recurs
Name ✓ Section		Editor Text DisplayID	
Y Data Block		Name Value 0 Week of Year Manufactured 48	
 Product Identific Product ID G 			
	of Manufacture or Model Year Year Manufactured	1 Gregorian Year 2015	
✓ Display Paramete			
Feature Supp			
	Chromaticity (Primary Color 1 Ch Chromaticity (Primary Color 2 Ch		
	Chromaticity (Primary Color 3 Ch		
	Chromaticity (White Point Chro nance-related Fields		
Features	Donth and Display Davies Tasha		
Name	Value	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F	
1 Max Resolution	10240 x 4320	0000000 20 90 02 00 20 00 13 a4 c0 00 36 40 46 0a 56 01	
2 10K Max Frame Rate	60 Hz	000010 30 0f 07 55 43 44 2d 34 30 30 21 81 1d 00 10 70	
3 8K Max Frame Rate	60 Hz	000020 08 00 10 70 08 00 24 4a 57 fc c4 a2 88 52 10 00 000030 45 54 00 80 00 80 00 80 05 ff 26 00 09 3f 3f 1f	
		000030 45 54 00 80 00 80 00 80 05 FF 26 00 09 5F 3F 1F 000040 1f 00 e0 7f 00 00 22 00 28 b2 90 1f 88 ff 1d 4f	
		000050 00 07 80 1f 00 df 10 7a 00 6c 00 07 00 80 fa 29	
		000060 88 ff 27 4f 00 07 80 1f 00 df 10 7a 00 6c 00 07	
		000070 00 2a 00 06 02 ff 1d df 10 3b 2b 00 06 07 05 2d	
		000080 8f 00 05 81 00 0e 83 0f 00 00 29 0f 7f 07 15 06 000090 55 3d 1f c0 4d	
		000090 55 3a 11 60 4a	
		Editor Mode HEX Edit Mode	Apply
Main Features			

At 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.

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

Note: Four blocks (512 bytes) of EDID/DisplayID 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.

Panel Replay Tab

Init in the Generation Audio Generation Diversition Audio Generation Diversition Parel Replay: Separated Selective Update: Separated Biological Selection Applied Biological Selection Applied Biological Selection Applied Biological Selection Parel Replay: Separated Selective Update: Separated Biological Selection Applied Biological Selection Applied Biological Selection Applied Biological Selection Parel Replay: Separated Biological Selection Selection Applied Biological Selection Applied Biological Selection Parel Replay: Selection Selection Selection Selection Selection Applied Biological Selection Parel Replay: Selection Selection Selection Selection Selection Selection Selection Parel Replay: Selection Sele	Pattern Generator	Audio Generator SDP						
head Regins Separated PSPSR apported PSPSR apported Separated Selective Update CRC Supported Selective Update CRC Support			and the second se	D FEC. Sink DUT testing	Adaptive-Sync	Cable Info EDID/DisplayID	Panel Replay ADM	
PSI/PSI/PSI/PSI/PSI/PSI/PSI/PSI/PSI/PSI/								
Luff fame CDC: Supported Selective Update: CDC: Supported Selective Update: CDC: Supported Luff fame CDC: Supported Supported Luff fame CDC: S			Mode: PR ~				Ap	phy
biechter Update: Supported subcher Update: Die UPD, RO on statistick SS OP enrol Die UPD, RO on statistick SS OP enrol SS OP enrol SS OP enrol Notice SS OP enrol SS OP enrol Die UPD, RO on statistick SS OP enrol SS OP			Early transport		F	Enable CRC check	Main-link remains C	N during PSR1/PS
<pre>memory based in the out of some of any formation if the out of any of any</pre>			HPD_IRQ on missing AS SE	e .	E	HPD_IRQ on RFB storage error	Self refresh rate uni	lock
ery branch Support Sup								
The outer update and randy ra								
iomad Active mode Active mode Selective update total momad Status: No contraid Status: Active mode no: ' ' gran think is addeed Height 100 E Height 100 Height 100 E Height 100 Height 100 E Height 100 Height 100 Height 100 Free status arising strate : 0 C C C R 1 & C C C C C C C C C C C C C C C C C C	the current pattern does	not support early transport				2 30 Mg/m scan me capture		
Ivactive mode Active mode Image: Selective update Image: Selective	ommand		Region 1			Region 2		
tactor mode X coordinate 0 X coordinate x coordinate Selective mode V coordinate 0 X coordinate x coordinate Selective mode 0 X V coordinate x coordinate x coordinate Selective mode 0 X V coordinate x coordinate x coordinate x coordinate Width 0 X V coordinate 0 X x coordinate x coordinate Width 0 X V coordinate 0 X V coordinate x coordinate Width 00 X V coordinate 0 X V coordinate x coordinate Width 00 X V coordinate 0 X V coordinate x coordinate Width V00 X V coordinate V coordinate V coordinate V coordinate Width V00 X V coordinate V coordinate V coordinate V coordinate Height V00 X V coordinate V coordinate V coordinate V coordinate Vision V coordinate V coordinate V coordinate V coordinate V coordinate Vision V coordinate V coordinate	Dis	able						
Active mode roll V coordinate 0 100 Selective update 0 0 100 Mathemand Status: non: Active mode roll Active mode roll 0 0 100 Weth 100 0 0 0 0 0 Height 100 0 0 0 0 0 Woth 100 0 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
Full scene update Selective update Selective update With emmend Status: Active mode roc: Y gen limit is voldated With 100 Height 100 Height 100 Height 100 Section of the scene in the scene			X coordinate	0	2	X coordinate	300	\$
Solective update V coordinate Image: Coordinate Monoclassical and								
atter ammand Status: No command status: V gran find is violated width 100 B Width 100 Height 100 Height 100 B Status 10 B Status 10								
menand state: No constand state: V guan limit is volded With 100 C Height 100 Height 100 C Height 100 Height 100 C Height 100 Filter 2: Filter 100 Height 100 C Height 100 Filter 2: Filter 100 Height 100 Filter 2: Filter 100 Height 100 Filter 2: Filter 100 Height 100 Filter 2: Filter 100 Height 100 Height 100 Filter 2: Filter 100 Height	Selectiv	re update	Y coordinate	0	•	Y coordinate	300	0
Active mode root: Y gan limit is volded Width 100 C Width 100 Height 100 C Height 100 Finite C Height 100 Finit C Height 100 Finite C Height 100 Finit C Height 100 Finit	atus							
and Actor Mapor Transformer is soluted Height Heig	mmand Status:	No command			1000			
Height 100 Height 100 Height 100 Height 100 Height 100 Height 100 Height 100 Height 100 Height 100			Width	100	•	Width	100	0
Henory Finance Prome index define 16 frame: 0 Prome index define 300 0 CC 20 0 00000 CC 20 0 00000 Refer 11 Prome index define 300 Prome index	IOF:	Y gran limit is violated						
Factory Factory Factory Factory Final State Later Control (Later C								
UT devine index du frame 0 Frame index du frame 0 Content devine units gent 0 Content devine units gent 0 Content devine 11 200 Micro 21 Works 11 200 Micro 21 Works 12 Content devine 11 200 Micro 21 Content devine 11 200 Micro 21 Micro 21 M			Height	100	۵.	Height	100	٥.
Freme index daring for 0 control of except Control of except Control of except Control of except Control of Control			History					
Control valid: No Biller Control Vi 300 Oper 1445 Control VI 300 Oper 1445 Control VI 300 Heritari 100 14 fitabel 1 Provide 100 14 fitabel 1 Oper 100 14 fitabel 1 Cot Al Control 40 (100 10)								
				Frame Links string file of the second string f	RUI 0 RI 200 FI 200 FI 200 FI 200 FI 200 FI 200 RI 0 FI 200 FI 200			

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.
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.

ink SDP Pattern Generator Adaptive-S										
	Sync Panel Replay ALPN	1 Playback Audio Generator	HDCP EDID/DisplayID	DPCD FEC	Sink DU	Testing				
	Name				Pass	Fail	Skip		Last status	J,
IDCP 2.3 CTS 2C	✓ ■ DP 1.4 LL CTS				0	0	0	0		
IDCP 2.3 CTS 3C		yte from Valid DPCD Address ver Capability Read (Read 12 Bytes fro	am Valid DPCD Address)		1	0	0	1 I 0	Pass	
		yte to Valid DPCD Address	oni valid DPCD Address)		0	0	0	0		
		Bytes to Valid DPCD Addresses			0	0	0	0		
		Offset (One Byte I2C-Over-AUX Write)		0	0	0	0		
		DID Byte (One Byte I2C-Over-AUX Rea			0	0	0	0		
		1 Byte I2C-Over-AUX Segment Write,	1 Byte I2C-Over-AUX Offset W	/rite, 128 Byte I2C-C		0	0	0		
	5.2.1.8 Illegal AUX I				0	0	0	0		
	5.2.1.9 Glitch Reject				0	0	0	0		
	5.2.1.10 Interleaved	EDID and DPCD Receiver Capability F	Read		0	0	0	0		
	5.2.1.12 Downstream				0	0	0	0		
		zationally Unique Identifier (OUI)			0	0	õ	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 Addre				0	0	0	0		
	5.2.2.6 Number of I				0	0	0	0		
	5.2.2.7 Main Link C				0	0	0	0		
	5.2.2.8 ESI Field Ma				0	0	0	0		
	5.2.2.9 Sink Device	Symbol Error Count ink Training at All Supported Lane Co	unts and Link Spoods		0	0	0	0		
		ink Training at All Supported Lane Co ink Training with Request of Higher D		a Clock Recovery S		0	0	0		
		ink Training to a Lower Link Rate Due				ő	ő	0		
		ink Training with Request of a Change				0	0	0		
		ink Training at Lower Link Rate Due to				0	0	0		
	5.3.1.6 Lane Count				0	0	0	0		
	5.3.1.7 Lane Count	Increase			0	0	0	0		
024-11-22, 09:35:59.7971: 0000.082. 024-11-22, 09:35:59.7971: 0000.082. 024-11-22, 09:35:59.8671: 0000.082. 024-11-22, 09:35:59.8671: 0000.083. 024-11-22, 09:35:59.8871: 0000.084. 024-11-22, 09:35:59.8871: 0000.084.	.116: AUX RD: 0x00 .914: AUX_ACK .958: Defer Retry Count. .015: AUX data: 14 .102: Reference source	000: 1 er = 0 checks reply and verifies th	hat read bytes R0 match	Sink DUT's Re	ceiver C	apabilit	/ Field			
2024-11-22, 09:35:59.887]: 0000.084.	.163: Read byte R0 matc. .586: Test PASSED: "5.2	hes first byte of Sink DUT': .1.1 Read One Byte from Va	s Receiver Capabilities alid DPCD Address"							
** Test Complete PASSED ***										
** Test Complete PASSED ***										
** Test Complete PASSED *** are evacution finished D										
** Test Complete PASSED *** aste exacution finished D										
** Test Complete FASSED *** mere_avanution_finished D Asserted										
Test Complete FASSED *** Test Complete FASSED *** Asserted JCD Console - UCD-422 [2226C529]; HDMI S	Source and Sink									
Test Complete PASSED *** Test Complete PASSED *** Asserted CO Console - UCD-422 [2226C529]; HDMI S Tools Window Help										
** Test Complete FASSED *** D Asserted JCD Console - UCD-422 [2226C529]; HDMI S Iools Window Help IDMI RX Event Log Memory Layout	Terminal HDMI TX		Sink DIIT Testing	-FC				_		
** Test Complete FASSED *** D Asserted JCD Console - UCD-422 [2226C529]; HDMI S JOOIs Window Help HDMI RX Event Log Memory Layout Link Pattern Generator Playback	Terminal HDMI TX Audio Generator HDCP	EDID SCDC Cable Info	o Sink DUT Testing (CEC			in P.	-		~
** Test Complete FASSED *** D Asserted JCD Console - UCD-422 [2226C529]; HDMI 5 Jools Window Help IDMI RX Event Log Memory Layout Link Pattern Generator Playback All tests	Terminal HDMI TX Audio Generator HDCP Name		5 Sink DUT Testing (Pa			-p	uns Las		~
** Test Complete FASSED *** aste avanution_finishad D Asserted JCD Console - UCD-422 (2226C529); HDMI S Jcols Window Help IDMI RX Event Log Memory Layout Link Pattern Generator Playback All tests VRR Sink DUT Tests	Terminal HDMITX Audio Generator HDCP Name V	Tests	o Sink DUT Testing (Pa 0	0	0	0			~
Test Complete PA3SED *** Test Complete PA3SED *** D Asserted CD Console - UCD-422 [2226C529]; HDMI 9 Jools Window Help DMI RX Event Log Memory Layout Link Pattern Generator Playback All tests	Terminal HDMI TX Audio Generator HDCP Name VRR Sink DUT VRR Sink DUT	Tests	o Sink DUT Testing (Pa 0 0	0	0	0	uns Las		~
** Test Complete PASSED *** D Asserted JCD Console - UCD-422 [2226C529]; HDMI S Iools Window Help IDMI RX Event Log Memory Layout Link Pattern Generator Playback All tests VRR Sink DUT Tests HDMI TX DSC LL CTS	Audio Generator HDCP	Tests test	5 Sink DUT Testing (Pa 0	0	0 0 0	0 0 0			~
** Test Complete PA3SED *** este avanution finished D CD Console - UCD-422 [2226C529]; HDMI S Tools Window Help DMI RX Event Log Memory Layout Link Pattern Generator Playback All tests VRR Sink DUT Tests HDMI TX DSC LL CTS Connection Test	Terminal HDMI TX Audio Generator HDCP Name VRR Sink DUT VRR Sink DUT QRS test QMS test VRR VRR DVR	Tests test nic test	o Sink DUT Testing (Pa 0 0 0	0 0 0	0	0 0 0 0 0	uns Las		^
** Test Complete PASSED *** *** *** *** *** *** *** **	Terminal HDMI TX Audio Generator HDCP Name VRR Sink DUT VRR Sink DUT VRR Sink DUT QMS test VRR Dynan V HDMI TX SCI VRR Dynan	Tests test nic test LL CTS		Pa 0 0 0 0 0	0 0 0 0	0 0 0 0 0	0 0 0	uns Las		~
** Test Complete PASSED *** *** *** *** *** *** *** **	Audio Generator HDCP Varme VRR Sink DUT VRR Sink DUT VRR Static OMS test VRR Dynan VRR Dynan HDM ITX DSC HRC2+0S	Tests test nic test LL CTS ink Video Timing (FRL w/ DSC) - Si	ub-4320p 4:4:4 8 bpc Primary	Pa 0 0 0 0 9 y Compress 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	uns Las		^
** Test Complete PA3SED *** este avanution finished D CD Console - UCD-422 [2226C529]; HDMI S Tools Window Help DMI RX Event Log Memory Layout Link Pattern Generator Playback All tests VRR Sink DUT Tests HDMI TX DSC LL CTS Connection Test	Audio Generator HDCP Name VRR Sink DUT VRR Sink DUT VRR Sink DUT VRR Sink DUT HDMI TX DSC HFR2-80: S HFR2-80: S	Tests test nic test LL CTS	ub-4320p 4:4:4 8 bpc Primary 320p 4:4:4 8 bpc Primary Cor	Pa 0 0 0 0 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0	uns Las		^

	tio Generator HDCP EDID SCDC Cable Info Sink DUT Testing CEC						
All tests	Name	Pass	Fail	Skip	Runs	Last status	1
VRR Sink DUT Tests	VRR Sink DUT Tests	0	0	0	0		
HDMI TX DSC LL CTS	VRR static test	0	0	0	0		
Connection Test	QMS test	0	0	0	0		
Cable Test	VRR Dynamic test	0	0	0	0		
		0	0	0	0		
			0	0	0		
	HFR2-80: Sink Video Timing (FRL w/ DSC) - Sub-4320p 4:4:4 8 bpc Primary Compress						
	HFR2-81: Sink Video Timing (FRL w/ DSC) - 4320p 4:4:4 8 bpc Primary Compressed Fo		0	0	0		
	HFR2-82: Sink Video Timing (FRL w/ DSC) - Sub-4320p 10 bpc/12 bpc RGB Primary C		0	0	0		
	HFR2-83: Sink Video Timing (FRL w/ DSC) - 4320p 10 bpc/12 bpc RGB Primary Compr	0	0	0	0		
	HFR2-84: Sink Video Timing (FRL w/ DSC) - Sub-4320p 4:2:2 and 4:2:0 Primary Compr	0	0	0	0		
	HFR2-85: Sink Video Timing (FRL w/ DSC) - 4320p 4:2:2 and 4:2:0 Primary Compresse	0	0	0	0		
	✓ ☐ Connection Test	0	0	0	0		
	Continuity Connection Test	0	1	0	1	Fail	
	✓ □ Cable Test	0	0	0	0		
	Cable Check Test	0	0	0	0		
	e Import Export Stop on Failure Repeats: 1 Cable time, sec 1	•	0	0	0		
[2025-06-13, 13:24:31.546]: 0037.12 [2025-06-13, 13:24:31.546]: 0037.12	6.858: SCDC Sink Version(0x01) = 0x01 7.344: SCDC Status Flaq(0x40) = 0x4f 8.541: SCDC Lanel Error Count(0x50, 0x51) = 0 8.655: SCDC Lanel Error Count(0x52, 0x53) = 0 8.714: SCDC Lanel Error Count(0x57, 0x56) is invalid!!! 8.833: 9.960: 9.960: 0.519: SCDC Sink Version(0x01) = 0x01						
[2025-06-13, 13:24:32.559]: 0038.13 [2025-06-13, 13:24:32.559]: 0038.13							,

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 <i>selected</i> (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.

Adaptive-Sync Tab

Adaptive-Sync feature is available for Stream 0.

UCD Console - UCD-400	[1748C248]: DisplayPort Source and Sir	nk						
File Tools Window Hel	lp							
DP RX DP TX Even	t Log							
Link Pattern Generat	or Playback Audio Generator	HDCP	EDID	DPCD	FEC	Sink DUT Testing	Adaptive-Sync	
Status Enabled:	Error: No error							
Settings	ported by sink							
Fixed Average VTotal	~							
Target refresh rate, Hz:	60 • 1125.000 lines							
	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

to indicate the status.

DP and DP Alt Mode Reference Source

Role:	Product:
DP Reference Source (DP TX)	UCD-400, UCD-411, UCD-451
USB-C DP Alt Mode Reference Source (DP TX)	UCD-424

When roles *DP Reference Source* or *DP Alt Mode Reference Source* are in use, the following interface specific tabs are available.

- Status information and control of the downstream link (Link).
- DPCD monitor (DPCD)
- Forward Error Correction (FEC)

Link Tab

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

RX Event Log Memory Layout Terminal DP TX nk Pattern Generator Playback Audio Generator Link Status Image: Construct Status 0 1 2 3 CR/SI/EQ 0 1 2 3 3 3 VS/PE (level) 1/0 1/0 1/0 1/0 1/0 1/0 Link EQ_ILA: CDS_ILA: LT_FAIL: Bh/10b 5 Framing mode: Bh/10b Scrambling: Enabled SSC status: Disabled Sec and ACT Link Wortrides Sec and ACT Link Overrides Sec and ACT Link Pattern Apply Apply Apply	HDCP DPCD FEC Sink DUT Testing Adaptive-Sync ALPM Panel Reg Link Configuration DP Bitrate (8b/10b) DP Bitrate (8b/10b) Gbps 1 2 4 1.62 2.70 5.40 6.75 8.10 Additional DP Bitrate (8b/10b) Gbps 3.24 4.32 6.75 8.10 Additional DP Bitrate (8b/10b) Gbps 3.24 4.32 6.75 8.10 1.62 2.16 2.43 3.24 4.32 6.75 8.11 Link Options Try eDP Enhanced Framing Mode FEC (8b/10b) Force eDP eDP ALIX Preamble LTTPR Mode Default V Default V EQ pattern (8b/10b) TPS3 v Downspread Downspread	play EDID/DisplayID SDP HDCP Status 2,X Active Authenticated Keys loaded Authenticated stored Km HDCP Configuration 2,X Enable Encryption Authenticate Use stored Km Scrambler seed (8b/10b) Auto FFFFh (eDP ASSR) Custom 0x 0
Active Video Apply Stream Info Framerate HTotal HStart HActive HSync VTotal VStar 59.995 2200 192 1920 44 (+) 1125 41	Enable SSC Amp (%/10) 0,5 Freq (Hz) 31500 Link Training Fast LT VCP Table Stream # VCPID Req.PBN Alloc.PBN First slot Slot num 0 1 528 533 1 9 Type 0 Type 0 Type 0 Type 0 Type 0 Type 0	
PD Asserted		

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 status of other link modes. The data is retrieved from the DPCD status registers of the connected Sink. The status is updated automatically.

Lanes (count =	4):	0	1	2	3
CR/SL/EQ					
VS/PE (level)		1/0	1/0	1/0	1/0
Error count (cliv	li to road).	_		_	
Error count (clic ILA: EQ		CDS_ILA: [_	LT_FAIL:	
		CDS_ILA: [LT_FAIL: 86/10	
ILA: EQ	ILA:	-	ode:	-)
ILA: EQ Bit rate:	ILA:	Link Mo	ode: ling:	8b/10b	o d

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
Error count:	Content of DPCD Error Count registers
ILA:	Status LED for Inter-Lane Alignment
Bit rate:	Currently enabled link bit rate
Link mode:	Currently enabled channel coding (8b/10b only)
Framing mode:	Status of Enhanced Framing symbol sequence
Scrambling:	Status of link data scrambling (Enabled or Disabled)
MST mode:	Status of the Multistreaming (MST) mode
SSC status:	Status of down spreading of link frequency (SSC) function
DSC Status:	Status of Display Stream Compression (DSC) function
FEC status:	Status of Forward Error Correction (FEC) function.

Send ACT: Force sending an Allocation Change Trigger (ACT) sequence over the Main-Link

HPD

HPD		
Asserted		

Asserted:

LED indicates status of Hot Plug Detect (HPD) signal

Link configuration

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

ink Configura	ation								
DP Lane Cou	unt (8b/10b)	DP Bitrate (DP Bitrate (8b/10b), Gbps						
01	2 0 4	0 1.62 (2.70 🔾 5.4	40 🔘 6.75 🔍	8.10				
Additional D	P Bitrate (8b/10b), Gbps							
0 2.16	0 2.43	\bigcirc	3.24	0 4.32	0 4.32				
eDP Bitrate,	Gbps								
0 1.62	2.16	2.43	0 2.7	3.24					
0 4.32	5.4	6.75	0 8.1						
Link Options	5								
				Try eDP					
C Enhance	d Framing Mode	FEC (8b/10	b) 🗌	Force eDP					
				eDP AUX Prear	nble				
LTTPR Mode	9	De	fault		\sim				
EQ pattern (8b/10b) TPS3 ~									
Downspread	1								
Enable S	SC Amp (%/	10) 0,5	÷ Free	(Hz) 31500	* *				
			Link	Training Fa	st LT				

Number of Lanes	Lane count used when 8b/10b link coding is selected in LT
Bitrate, Gbps	Link rate used when 8b/10b link coding is selected in LT
Additional DP Bitrate (8b/10b), Gbps	Additional bit rates available.
eDP Bitrate, Gbps	Bitrates available for eDP.
Enhanced Framing Mode	Enable Enhanced Framing Mode.
FEC (8/10b)	Enable Forward Error Correction feature (only in 8b/10b coding).
Try eDP	Try to link with eDP.
Force eDP	Force eDP linking.
eDP AUX Preamble	Use eDP AUX Preamble protocol when linking.
LTTPR Mode	Select LTTPR mode; Default, Ignore, Transparent, Non-Transparent.
EQ pattern (8b/10b)	Pattern (8b/10b) to be used for equalization: auto, TPS2, TPS3 or TPS4.
Enable SSC	Enable Downspread of link frequency (SSC).
Amp (‰)	SSC Spreading Amplitude (0.1% to 2.5% in 0.01% steps).
Freq (Hz)	SSC Modulation frequency (30 to 33 kHz).

Link Overrides

Override Voltage Swing and Pre-emphasis levels selected during link training. Click **Apply** to validate changes.

			Apply
Pre-emphasis (level): 🔘 0	1	0 2	03
Voltage Swing (level): 🔘 0	1	0 2	03
Link Overrides			

Link Pattern

Link Pattern	
Active Video	~
Active Video	
Idle Pattern	
Training Pattern 1	
Training Pattern 2	
Training Pattern 3	
Training Pattern 4	
PRBS7	
HBR2 (CP2520 1)	
SER (Symbol Error Rate)	
Force Video	
Force Idle	
HBR2 (CP2520 2)	

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	Character error messages from sink will not interrupt video transmission.
Force Idle	Link Training and Active Video will not be initiated even after a re-plug.
HBR2 (CP2520 2)	Send HBR2 Compliance pattern CP2520 2.

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*.

Stream Info

Stream Info is achieved from the Main-Stream Attributes (MSA) of the stream.

Stream Info													
Framerate	HTotal	HStart	HActive	HSync	VTotal	VStart	VActive	VSync	CEF	BPC	CRC (RGB/CrYCb)	MVID/NVID	DSC CRC (Eng. 0 1 2)
59.985	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	001776/008000	N/A
59.995	2200	192	1920	44 (+)	1125	41	1080	5 (+)	RGB/Legacy RGB mode	8	B69E B33E 1AB3	001777/008000	N/A

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.				
MVID/NVID	Mvid and Nvid video time stamp values				
DSC CRC	16-bit Cyclic redundancy check (CRC) calculated from compressed pixel stream. Value order Engine 0, 1, 2.				

VCP Table

NCD T LL

VCP lable						
Stream #	VCPID	Req.PBN	Alloc.PBN	First slot	Slot num	
0	1	532	540	1	9	
1	2	532	540	10	9	
2	3	532	540	19	9	
3	4	532	540	28	9	

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

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

Stream #: Stream number where the virtual channel is directed.				
VCPID: Stream identification number of the virtual channel.				
Req.PBN: Requested PBN (payload bandwidth) 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.				

Scrambler Seed



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	

Copy of HDCP status and controls on HDCP tab.

HDCP Stream Status

Shows HDCP stream status for each stream.

HDCP Stream Status								
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.

DPCD Tab

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

Tools <u>H</u> e RX DP T	X Event Log	Playback	Audio Generator	HDCP ED	ID DPCD	FEC	Sink DUT Testing
Address : 0x	2200	Number of By	tes: 0x 100	÷			Load Save Report
002210 002220 002230 002240	14 le e4 8 08 00 00 00 00 00 00 00 00 00 00 00	1 01 00 0 0 00 00 0 0 00 00 0 0 00 00 0 0 00 0	00 00 00 00 00 00 00 00 00 00 00 00 00 00	06 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	00 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	~	Extended Receiver Capability MAX_LANE_COUNT (RO) 002020 : Prefer Methylese FRAME_CAP = 1 TFS3_SUPPORTED = 1 POST_LT_ADJ_REQ_SUPPORTED = 1
Set Reference Address : 0x	e	Number of By		•			Refresh Write Changes
000100 000110 000120 000130 000140	00 01 02 03 1e 84 00 00 00 00 00 00 3b 00 00 00 00 00 00 00 00 00 00 00	3 04 05 0 a 0a 0a 0 0 00 00 0 0 00 00 0 0 00 00 0 0 00 00	De 07 08 09 Da 00 01 00 D0 00 00 00 D0 00 00 00 D0 00 00 00 D0 00 00 00	OA OB OC 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 00 00 00	<	Link Configuration LANE_COUNT_SET 0001011 - 054 = 4 [Four lanes (Lanes 0, 1, 2, and 3)] POST_IT_ADI_REQ_GRAVITED = 0 ENHANCED_FRAME_EN = 1 NOTE: Decoded as MAIN_LINK_CHANNEL_COOJING_SET = 8b/10b
Set Reference							Refresh Write Changes
IPD Asser	ted						

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 the PC (please see below).
Load:	Retrieve previously saved DPCD data (please see below).
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:	To program the data into the DPCD registers of the connected Sink
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.

Saving and Loading DPCD Content

DPCD data in the selected address areas can be saved as a file in your PC. There are three alternative formats listed below. Please select the intended format when saving:

- Binary *DPCD Data File* format (*.DPD). This is Unigraf proprietary format. You can also load the DPCD content stored in this format.
- Comma Separated Value format (.CSV)
- *HEX Dump* (*.HEX) in a human readable text format.

FEC Tab

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

UCD Console - UCD-400 [1918C307]: DisplayPort Source and Sink	-	×
Eile Iools Window Help		
DP TX Event Log DP RX		
Pattern Generator Audio Generator EDID HDCP FEC Playback Sink DUT Testing Link DPCD		
Pattern Generator Audio Generator EDID HUCP FEC Playback Sink DUT lesting Link DPCD		
FEC Enabled Prefer FEC Enabled Enable FEC Disable FEC FEC Status Log		
Error Generator		
Number of errors to generate for Lanes: 0 0 0 0 0 0 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 0 0		
Corrected block errors 0 0 0 0 0 0 0		
Bit errors 0 0 0 0 0		
Parity block errors 0 0 0 0 0		
Parity bit errors 0 0 0 0 0		
Enable aggregated errors Update Clear Counters		
Debug FEC Sequencing		
Send FEC Enable Sequence Send FEC Disable Sequence		
Sink FEC Status: Decode Enable Detected		
Sink FEC. Status: Decode Enable Detected		
Clear Log		
HPD		
Asserted		
online		

Enable FEC	UCD will verify if connected sink supports FEC and begins the handshake for enabling FEC.
Disable FEC	UCD will start the FEC disable handshake.
Prefer FEC Enabled	If selected, and the connected sink supports FEC, UCD will start the FEC Enable Sequence after a successful connection.

Error Generator

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
	1 parity byte error with 1 error bit together

Each lane can have its individual error amount. When only one lane is enabled, errors can be injected to even and odd decoders by using **lane #0** and **lane #1** counters.

Apply	Start error injection
Update	Read sink DPCD FEC error counter registers

Note:

Clear counters	Clear sink DPCD FEC error counter registers
Send FEC Enable Sequence	UCD-4XX will start adding FEC Enable Sequence in its main link data.
Send FEC Disable Sequence	UCD-4XX will start adding FEC Disable Sequence in its main link data.

ALPM Tab

Event Log Terminal DP RX DP TX Memory L	avout			
Link Pattern Generator Playback Audio Generator Link Status Link Control Enable ALPM Power-on FW_SLEEP FW_STANDBY Power-off Automatic Power-off du Power-off Automatic Power-off du Power-off ML_PHY_SLEEP ML_PHY_SLEEP ML_PHY_SLEEP ML_PHY_STANDBY 	ator HDCP DPCD	Click to cle	X_PHY_WAKE_ACK not re	
PHY hold pattern length, symbols 50	LFPS_Cycle Count 16 <i>tSilence, ns</i> 120 ns ML_PHY_LOCK_1 time, us 1 ML_PHY_LOCK_2 time, us 0	AUX_F	HY_WAKE retries 0	TPS4

Link Status panel shows current ALPM status.

Link Control panel is for enabling ALPM and for setting ALPM state.

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*.

HDMI Reference Source

Role:	Product:
HDMI Reference Source (HDMI TX)	UCD-422, UCD-412, UCD-452

When roles HDMI Reference Source is in use, the following interface specific tabs are available.

- Status information and control of the downstream link (Link)
- SCDC monitor (SCDC)

Link Tab

Link tab shows the status and control items for the HDMI link.

0 1.4 0.20 0.21 O Disable FRL 3 Lane 0 0.20 0.20 0.20 0.20 3 Lane 0 1.20 0.20 0.20 0.20 4 Lane 2 0.20 0.20 0.20 0.20 5 hannel lock 0 0.000 0.000 0.000 0.000 0.20 2 behavior HDMI 2.1 LTI meout (ms): 2 2 2 Wold 0 HDMI FRL Status TRado (ms): 2 2 MDS Status FRL Status FRL Status 10Gbps 4-lane 1 MDS Control FRL Status FTR Ready 1 2 2 MDS Control FRL Statu FRL Status 1 1 2 2 2 MDS Control FRL Status 10Gbps 4-lane 1 2<	nk Pattern Generator Playback Au	dio Generator HDCP EDID SCDC Sink I	DUT Testing HDCP Status		 	_
Lance 0 Lance 1 Lance 2 Lance 3 4 Lances 6 0	○ 1.4 ○ 2.0 ● 2.1		The status	1.X 2.X		
Lane U Lane L Lane Z Lane 3 FFE Max: Q Q <th< td=""><td>Status</td><td>3 Lanes 🔿 3 🔿 6 (Gbps)</td><td>Active</td><td></td><td></td><td></td></th<>	Status	3 Lanes 🔿 3 🔿 6 (Gbps)	Active			
Landel lock Int Induct (mg): Int	Lane 0 Lane 1 Lane 2 Lane 3					
If mercault (ms): 200 5 If mercault (ms): 2 6 Wideo If Poll Timeout (ms): 2 If Poll Timeout (ms): 2 6 Image: Ima	Channel lock 💶 💶 💷		· · · · · · · · · · · · · · · · · · ·			
Video Link Training I Link Training I LX 2X MD5 Status FRL Status IIX 2M IIX 2X IIX 2X MD5 Status //10 3G mode FRL Status IISP/3 IIX 2X IIX 2X MD5 Status //10 3G mode FRL Mode 105bps 4-lane III IIII 2X MD5 Scottol FRL Mode III Polo IIII 2X IIIII 2X IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII			Additional Called Stored Kill			
MDS Satus FRL Status Int Value <			HDCP Configuration			
Mode HDMI FRL Status IndDs Bit Clock Ratio 1/10 3G mode ITS P/3 MOS Centrol FRL Status ITS P/3 Authenticate IC MOS Centrol FRL Status ITS P/3 Use stored Km IC Mode O U1 HDMI FRL Status ITS P/3 Use stored Km IC Mode O G 0 G IS IS IS IS Into Mode 0 G 0 0 O O IS		Link Training		1.X 2.X		
MDS Bit Clock Ratio 1/10 3G mode FRL Mode 10Gipps 4-lane Authenticate I Scrambling FIL Yoptat FIL Status TSP/200 MDS Control FRL Status FIL Yoptat FIL Status FIL Yoptat Mode 6 G 3 G FIL To Timeout FIL Status FIL Yoptat Ink Mode 6 G 3 G FIL To Timeout FIL Name FIL Name Inhelie Scrambler LUP 0 0 0 Pattern 0 0 0 0		FRL Status	Enable Encryption			
Strambling FLT Update FLT Update Use stored Km Image: Comparison of the comparison of	TMDS Bit Clock Ratio 1/10 3G mode		Authenticate			
MDS Control FLT Ready Vade DVI HDMI FRL Shart ink Mode 6G 3 G FIT Normation Fit Name Enable Scrambler FRL Max Lane 1 Lane 2 Lane 2 Lane 2 Lane 3 Phyter 0 0 0 0	Scrambling		Use stored Km			
Inable Scrambler FIT No Timeout Enable Scrambler FRL Max Lane 0 Lane 1 Lane 0 0 Pattern 0 0	TMDS Control					
InnuMode 0 0 0 0 Enable Strambler FRL Max Lane 0 Lane 1 Lane 2 LTP 0 0 0 0 Pattern 0 0 0 0	Mode: O DVI 💿 HDMI	FRL Start				
Enable Scrambler Lane 0 Lane 1 Lane 2 Lane 3 LTP 0	Link Mode: 🔘 6G 🛛 💿 3G					
LTP 0 0 0 0 Pattern 0 0 0 0	Enable Scrambler					
FFE level 0 0 0 0						
		FFE level 0 0 0 0				

HDMI Behavior

Selection of the HDMI version to be used (HDMI 1.4 / HDMI 2.0 / HDMI 2.1).

Status

Channel lock:	Status of Channel Lock in the four lanes.
Error count:	Contents of the SCDC Error counter registers of the connected Sink.
Behavior:	Assigned HDMI mode.
Video	Video signal status.

TMDS Status (only in TMDS mode)

TMDS Status			
Mode TMDS Bit Cloc		HDMI 1/10 3G mode	
TMDS Control			
Mode:		I I I I I I I I I I I I I I I I I I I	
Link Mode:	0 60	6 💿 3G	
Enable Sc	rambler		

Mode

Mode:	Status of the HDMI/TMDS mode (HDMI/DVI)
TMDS Bit Clock Ratio:	Status of TMDS_Bit_Clock_Ratio bit in SCDC – TMDS Configuration (1/10 or 1/40)
Scrambling:	Status of TMDS_Scrambler_Status bit in SCDC – TMDS Scrambler Status (1=LED on; 0=LED off)

TMDS Control (only in TMDS mode)

Mode:	Selection of the HDMI/TMDS mode (HDMI/DVI)
Link Mode:	Selection of TMDS Bit Period / TMDS Clock Period ratio (1/10 or 1/40) (3G / 6G)
Enable Scrambler:	Control of Scrambling_Enable bit

FRL Control

FRL Control								
O Disable FRL								
3 Lanes 🔿 3	06	(Gbps)						
4 Lanes	06	08	10	0 12				
FFE Max: 0 0 0 0 0 0 0 0 0 0 0 0								
LT Timeout (ms):								
LT Poll Timeout (ms):								
	Link 1	Fraining						

Disable FRL:	Disable FRL mode
Capability Radio Buttons:	Selection of the link mode used for FRL link training.
FFE Max:	Set the maximum FFE level (0 to 4) supported for each FRL rate
LT Timeout:	The time used for FLT Timer (default = 200 ms)
LT Poll Timeout:	Poll interval for FLT_update flag (default = 2 ms)

Please click Link Training to apply

FRL Status

FRL Statu	s									
FRL Mode 10Gbps 4-lane										
LT Status LTS:P/3										
FLT Upda	FLT Update									
FLT Read	у									
FRL Start	FRL Start									
FLT No Ti	meout									
FRL Max										
	Lane 0	Lane 1	Lane 2	Lane 3						
LTP	0	0	0	0						
Pattern	0	0	0	0						
FFE level	0	0	0	0						

FRL Mode:	FRL Mode used by UCD-4XX HDMI source
LT Status:	FRL link training status of UCD-4XX HDMI source
FLT Update:	Status of FLT_update flag in SCDC Update Flags register of the connected HDMI sink.
FLT Ready:	Status of FLT_ready flag in SCDC Status Flags register of the connected HDMI sink.
FRL Start:	Status of FLT_start flag in SCDC Update Flags register of the connected HDMI sink.
FLT No Timeout:	Status of FLT_no_timeout flag in SCDC Source Test Configuration register of the connected HDMI sink.
FRL Max:	Status of FRL_Max flag in SCDC Source Test Configuration register of the connected HDMI sink.

Lane Status Matrix

LTP:	Status of Lnx_LTP_req ($x = 0$ to 3) fields in SCDC Status Flags register of the connected HDMI sink
Pattern:	Link Training Pattern used (0 to 8)
FFE Level:	FFE level used (0 to 3)

HDCP Status

HDCP Status	
	1.X 2.X
Active	
Authenticated	
Keys loaded	
Authenticated stored I	(m
HDCP Configuration	
	1.X 2.X
Enable Encryption	
Authenticate	
Use stored Km	

Copy of the status from HDCP Tab. Please refer to chapter *HDCP Tab* later in this document for detailed description.

HDCP Configuration

Enable and disable HDCP 1.4 or HDCP 2.3 capability of UCD-422 and UCD-412 Sink. Duplicates of the controls found in HDCP tab.

Note:	Currently HDCP is not supported
-------	---------------------------------

HPD (Bottom panel)

The status LED indicates the state of the HPD signal Asserted (logical "high") or De-asserted (logical "low").

SCDC Monitor

SCDC monitor presents content of HDMI Status and Control Data Channel (SCDC) structured by its address range.

The SCDC Monitor panel on the right hand side shows the interpretation of the SCDC byte selected

	ern Gene					udio G		_				DID	SCDC	5111	K D O I	Testing								
ddress : 0x	0	•	Number	r of By	rtes: 0	× 100		÷ S	CDC	Deco	der:									Load		ave	Repo	ort
	00 01																	0x00000 :	= 0x00		Channe	1		
000000	<u> </u>																	<canno< td=""><td>ot deco</td><td>de></td><td></td><td></td><td></td><td></td></canno<>	ot deco	de>				
000010																								
000020																								
000030	00 35																							
000050	00 80																							
000060																								
000070	00 00	00	00 00	00	00 0	0 00	00	00	00	00	00	00 00	,											
000080	00 00	00	00 00	00	00 0	0 00	00	00	00	00	00	00 00)											
000090	00 00	00	00 00	00	00 0	0 00	00	00	00	00	00	00 00)											
040000	00 00	00	00 00	00	00 0	0 00	00	00	00	00	00	00 00)											
0000B0	00 00	00	00 00	00	00 0	0 00	00	00	00	00	00	00 00)											
0000C0																								
0000D0																								
0000E0																								
0000F0	00 00	00	00 00	00	00 0	00 00	00	00	00	00	00	00 00)											
								_		_	_													
Set Refere	nce												F	efresh	W	rite Chan	ges							

on the monitoring windows. The selected byte is shown with a green outline.

Save:	Select SCDC content to the PC (please see below).
Load:	Retrieve previously saved SCDC data (please see below).
Report:	Save parsed content of selected SCDC register ranges as HTML file
Refresh:	Re-read the data from the SCDC registers to the window in question
Write Changes:	To program the data into the SCDC registers of the connected Sink
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.

Saving and Loading SCDC Content

SCDC data in the selected address areas can be saved as a file in your PC. There are three alternative formats listed below. Please select the intended format when saving:

- Binary SCDC Data File format (*.DPD). This is Unigraf proprietary format. You can also load the DPCD content stored in this format.
- Comma Separated Value format (.CSV)
- HEX Dump (*.HEX) in a human readable text format.

Cable Info Tab

The Cable Info tab displays cable specifications.

Tools Window Help							
vent Log Terminal Memory L	ayout HDMI	TX					
Pattern Generator Audio Genera	ator HDCP	EDID	Playback	Sink DUT Testing	Link	SCDC	Cable Inf
Cable ID Data Category 1: Category 2: Category 3: HEAC:	Supported Supported Supported Supported	Manuf Manuf	acturer OUI acturer OUI 1 acturer OUI 2 acturer OUI 3	: 0xCD			
Cable Need PCA: Only Mono Direction: Mono Direction Error: Cable in PCA mode: Daisy Chained Cable Detection:	Required PCA Supported Happened Yes 4660			EDDCCBBAA202020			

CEC Tab

Source CEC Tab functions in exactly the same manner as for Sink CEC Tab CEC Tab.

USB-C Monitoring

Role:	Product:
USB-C DP Alt Mode Reference Source (USB-C TX) or	UCD-424

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

• USB-C Power Delivery (PDC)

USB-C Power Delivery Tab

When UCD-424 is used in *DP Alt Mode Reference Source* role, *USB-C Power Delivery* tab is available. The content of *USB-C Power Delivery* tab is similar to the tab available when in UCD-424 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.

C RX USB-C TX Event Log C Link Pattern Generator Playback Audio Generator	HDCP	EDID DPCD FEC Sink DUT	Testing	
Status List	×	Initial Role DFP/SRC UFP/SNK DFP/SRC DFP/SRC UFP/SNK DFD/3 Reject DR Swap Reject DR Swap Reject VCONN SWAP Reject FR Swap UCD-424 Identity UCD-424 Identity UCD-424 Identity UCD-424 Identity Product ID: 0x424 Accessories	O 1.5A ⊕ 3.0A Try Behnior O Try Sink O Try Source ⊕ None 3.0 v1.0	
PD Control Send PR_SWAP Send DR_SWAP Send VCONN_SWAP Send FR	SWAP		Orientation CC1 CC2 Cable Orientation: Flipped	
D Asserted				PD DUT Attached Reconne

6. HDMI LINK TIMELINE VIEWER

Role:	Product:
HDMI Reference Sink (HDMI RX)	UCD-422

HDMI Link Timeline Viewer is a tool for evaluating the content and timing of data captured via HDMI Link Analyzer functionality of UCD Console.

HDMI Link Timeline Viewer has three tabs (for three modes):

FrameView tab is the primary tab for analyzing captured events on the timeline.

Reports tab can be used to summarize events (AUX at present).

Images tab lets the user view captured video frame images.

The FrameView tab and its views are shown below.



Wave Form View zoomed out and zoomed in views are shown below. Event periods are shown under the timeline (at the top) in their proper row as *period rectangles* with text descriptions (or abbreviations or no text, space permitting). Double-clicking a *period rectangle* will highlight the timeline portion of the rectangle and the row header(s) as shown below. To zoom the *Wave Form View*, position the cursor and use the mouse wheel to zoom in or out with respect to the cursor location. Drag to scroll the *Wave Form View* and the *Symbols View* horizontally.



Wave Form and Symbols View Settings

Shown below are the WaveForms View and Symbols Views settings widgets.

					TMDS SCR				
FRAME_1		FRAME_2	FRAME_3	FRAME_4	FRAME_5	FRAME_6	FRAME_7	FRAME_8	
〕∓€б<	> « » (« »» 🕤 🔺	ia de 🖉						
		0:016.666.	828.267 0:000.000.2	93.274 0:000.	000.563.032	:000.000.832.789	0:000.001.102.546	0:000.001.3	372.304 0:016.668.794.0
HPD		8							
	Events								
12C	sda	8							
	scl	9							
CEC	Events								
Link	Signal	0				TMDS SCRAMBLED			
DINK	INVALID					TRUG SCRADLED			
	CTL						CTL PERIO)	
	DATA		DDD						
Periods	VIDEO								
	SSCP	S							
	HDCP					2			
	KEEP_OUT						KEEP_OUT		
	Horiz	à	HSYNC						
Sync	Vert	8							
	verc						WSYNC		
Frane							FRAME_2		
Lines							LINE_0		
Packets			GCP AVI						
Phy Lane 0									
Phy Lane 1									
Phy Lane 2									

					0:000.0							.997.765			:000.000			0:000.0				.668.017	
HPD		-	1111						1111				1				1 1 1 1 1				1111		-
		6																					_
eriods												CTL	PERIOD										_
	Horiz	ð																					
Sync		1																					
	Vert	0										V:	SYNC										-
rame/Lines												FRAME	2 LINE_0										
ackets																							
ymbols			c	TL										HI	CP								
			11000011:		0010001111	000011110	0111100011	1100001100	0111010000	0001111001	100011011	110111100000	101110000	00001101111	10001111000	1100001111	001111001	1100111000	00001111000	011110001:	1100111000	0110000111	11
hy Lane 0		1	387 10	03C 10	3E2 10	0F0 10	318 10	0C3 10	017	33C 10	3D8 10	018	01D 10	3D8 10	078	3C3 10	33C 10	039	078 10	31E 10	039	3C3 10	
		0111	01100111:	110000110	0000111011:		1101100000		111001000	0011000111	100011110	111100011000			00001011111	0011110000			000111100		000110113	1110011000	0.0
hy Lane 1		c	3CC 00	0C3	388	033	018	3E4 01	027	3C6 01	378 01	063	31B 01	047	3E8 01	03C 01	3D8 01	0E1 01	078	30F 01	3D8 01	033	
		00003	01110000		1110001100		1110000111		011110001	1111001000	011100100	000100011111	011000111		1110000100					111000010	001111001		63
hy Lane 2		7	01D	3D8	063	352	387	063	315	027	027	362	3C6	047	087	3E1 00	300	017	3C3 00	087	33C	01D	

Gear Icon



Select the *Gear* icon to select events to be displayed (+) or hidden (-). When *Gear* icon is selected, you can drag a row to reorder rows.



Save Icon



Select the Save icon to Save, Load or Remove named internal settings sets. You can also Import or Export named *.json files containing settings or Reset to default.

0	€. €. €. ()	« :
3	Save	þ.
AU	Load	→ Г
Li Fr	Remove	
Li	Import	
VB	Export	
MS.	Reset to default	

Zooming



Select *Zoom* + or – icons to zoom in and out or use the mouse wheel. The zooming in/out option applies to *Wave Form View* only.

Scrolling

Use the arrow keys to navigate the timeline. One arrow moves the timeline one page, two arrows 10 pages and three 100 pages.

You can also scroll by dragging (click and hold while dragging).

Clock icon



Move to a time point. Enter values and press OK.

Move to time point	×
Enter bit offset:	
1 376 340,937	
[-0:000.503.315.999 : 0:00	2.516.579.823]
Enter time:	
169 917 890,804	
[-0:062.137.505.894:0:31	0.687.507.793]
ОК	Cancel

Eraser



Removes all measurements on the timeline.

Move to Previous or Next Frame

Move back or forward to the same relative location in the previous or next frame.

Sync Data

Not synchronized. Synchronized.

FrameView Tab

Frame View tab has three tabs: *Main Link Events, Symbols,* and *Log Events.* The *Main Link Events* tab is the **primary** tab for analysis and is presented first.

Main Link Events Tab

Main Link Events tab consists of five panels: Event Selector View, Event Details View, Wave Form View, Symbols View and Frame Image View.

Each of these views are synchronized and actions in one will be reflected in others.



Event Selector View

Event Selector View events are presented as a folding list of *FRAME*s. Each *FRAME* contains a set of *BLANK LINEs* followed by a set of *ACTIVE* LINEs and finally by another short set of *BLANK LINEs*. *BLANK* LINEs contain items such as *CTR* periods and *DATA ISLAND* periods. *DATA ISLANDs* contain *HDMI data packets* such as *GCP* and *AVI* packets. *ACTIVE* LINESs contain *CTRL* and *VIDEO DATA* items.

Main Link Events Symbols Log	Events				
Search		2	Aa 🗌 RExp 🚺 🚺	/0	00
Туре	Id	Position	Duration	End	
FRAME	1	0:020.239.117.146 30 055 212 bits	0:016.666.598.436	0:036.905.715.582	
 BLANK(41 lines) 		0:020.239.117.146	0:000.607.404.920	0:020.846.522.066	
✓ LINE	0	0:020.239.117.146 30 055 212 bits	0:000.014.814.753	0:020.253.931.899 30 077 211 bits	
CTL PERIOD		0:020.179.265.539 29 966 332 bits	0:000.060.107.497 89 260 bits	0:020.239.373.036 30 055 591 bits	
✓ DATA ISLAND PERIOD		0:020.239.373.037 30 055 592 bits	0:000.000.242.422 360 bits	0:020.239.615.459 30 055 951 bits	
GCP		0:020.239.386.505 30 055 612 bits	0:000.000.215.486 320 bits	0:020.239.601.991 30 055 931 bits	
CTL PERIOD		0:020.239.615.460 30 055 952 bits	0:000.000.134.679 200 bits	0:020.239.750.139 30 056 151 bits	
✓ DATA ISLAND PERIOD		0:020.239.750.140	0:000.000.242.422	0:020.239.992.562	
AVI		0:020.239.763.608	0:000.000.215.486	0:020.239.979.094	
CTL PERIOD		0:020.239.992.563	0:000.607.808.959	0:020.847.801.522	
> LINE	1	0:020.253.931.900	0:000.014.814.753	0:020.268.746.653 30 099 211 bits	
> LINE	2	0:020.268.746.654	0:000.014.814.753	0:020.283.561.407	
> LINE	3	30 099 212 bits 0:020.283.561.408 30 121 212 bits	22 000 bits 0:000.014.814.753 22 000 bits	30 121 211 bits 0:020.298.376.161 30 143 211 bits	

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

The time format is as follows:

seconds:milliseconds.microseconds.nanoseconds.picoseconds

In the image above you can see the time format on top and the bit format underneath (smaller grey font).

When clicking on a *Main Link Event*, both *Wave Form View* and *Symbol View* are focused, and the time stamp block of the item is highlighted as shown below.



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

Туре:	Type of item.
ld:	Items 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

Search

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

		× 🖬 🗆	Aa 🗌 RExp 🔀 💈	2. /77	00
Туре	Id	Position	Duration	End	^
✓ FRAME	2	0:036.905.715.583	0:016.666.598.437 24 750 000 bits	0:053.572.314.020 79 555 211 bits	
 BLANK(41 lines) 		0:036.905.715.583 54 805 212 bits	0:000.607.404.920 902 000 bits	0:037.513.120.503 55 707 211 bits	
✓ LINE	0	0:036.905.715.583 54 805 212 bits	0:000.014.814.753 22 000 bits	0:036.920.530.336 54 827 211 bits	
CTL PERIOD		0:036.845.863.976 54 716 332 bits	0:000.060.107.497 89 260 bits	0:036.905.971.473 54 805 591 bits	
> DATA ISLAND PERIOD		0:036.905.971.474 54 805 592 bits	0:000.000.242.423 360 bits	0:036.906.213.897 54 805 951 bits	
CTL PERIOD		0:036.906.213.898 54 805 952 bits	0:000.000.134.678 200 bits	0:036.906.348.576 54 806 151 bits	
✓ DATA ISLAND PERIOD		0:036.906.348.577 54 806 152 bits	0:000.000.242.423 360 bits	0:036.906.591.000 54 806 511 bits	
AVI		0:036.906.362.045 54 806 172 bits	0:000.000.215.487 320 bits	0:036.906.577.532 54 806 491 bits	
CTL PERIOD		0:036.906.591.001 54 806 512 bits	0:000.607.808.958 902 600 bits	0:037.514.399.959 55 709 111 bits	
> LINE	1	0:036.920.530.337 54 827 212 bits	0:000.014.814.754 22 000 bits	0:036.935.345.091 54 849 211 bits	
> LINE	2	0:036.935.345.092 54 849 212 bits	0:000.014.814.753 22 000 bits	0:036.950.159.845 54 871 211 bits	

Aa:	Makes search function case sensitive.
RExp:	Use regular expressions.
	Click the opter icon to apply filters
	Click the enter icon to apply filters.



Click *Find Prev* and *Find Next* icons to navigate. Also shown is the instance (here instance 2 out of 77).

0

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

Configure search	\times
Case Sensitive	
Use regular expression	
Columns:	
🗹 Туре	
🗹 Id	
Position	
Duration	
🗹 End	
Aş	pply



Click icons to synchronize data for view.

Symbols Tab

Symbols View lists all PERIODS.

Search			🛃 🗌 Aa 🗌 RExp 🚺 0 🛛 / 0 🛛 🗎 🚫	P
				· .
Туре	Position	Lí 🔻	Value] ^
VIDEO DATA PERIOD	0:020.077.434.306 29 815 112 bits	0	0000000	
CTL PERIOD	0:020.090.377.014 29 834 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.092.249.060 29 837 112 bits	0	0000000	
CTL PERIOD	0:020.105.191.768 29 856 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.107.063.814 29 859 112 bits	0	0000000	
CTL PERIOD	0:020.120.006.522 29 878 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.121.878.568 29 881 112 bits	0	0000000	
CTL PERIOD	0:020.134.821.276 29 900 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.136.693.323 29 903 112 bits	0	0000000	
CTL PERIOD	0:020.149.636.031 29 922 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.151.508.077 29 925 112 bits	0	0000000	
CTL PERIOD	0:020.164.450.785 29 944 332 bits	0	0000000	
VIDEO DATA PERIOD	0:020.166.322.831 29 947 112 bits	0	0000000	
CTL PERIOD	0:020.179.265.539 29 966 332 bits	0	0000000	
DATA ISLAND PERIOD	0:020.239.373.037	0	0000000	~

Selection and multiview highlighting behavior is as for Main Link Events above.

Search criteria are the same as for Main Link Events above.

Each column has a sort and filter icon. Shown below is for the *Type* sort and filter icon.

Type 🔽 Positio	n 🔽	La	
1 Sort Ascending	6	0	00000000
Sort Descending	4	0	0000000
The clear Solution of	0	0	0000000
T Search:	8	0	0000000
Select all	4	0	0000000
🗹 CTL PERIOD	2	0	0000000
	8	0	0000000
· 🗹 VIDEO DATA PERIOD	6	0	0000000
	3	0	0000000
	1	0	0000000
Apply Cancel	7	0	0000000
29 944 332 bits	5	0	0000000

Event Details View

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

Details Tab

The information shown in the *Details* tab depends on the selected item. A *FRAME* item is shown below.

[FRAME]		
Start : 0:020.239.117.146;	30 055 212 bits	
End : 0:036.905.715.582;		
Duration : 0:016.666.598.436;	24 750 000 bits	
HTotal : 2200		
VTotal : 1125		
HActive : 1920		
VActive : 1080		
HSyncWidth : 44		
VSyncWidth : 5		
HBackPorch : 148		
VBackPorch : 36		
HFrontPorch: 88		
VFrontPorch: 4		
HStart : 192		
VStart : 41		
BPP : 24		
Colorspace: RGB		
Sampling : 4:4:4		

Images Tab

Image for currently selected FRAME can be viewed (only when FRAME is selected).

Details Image



Wave Forms View

Wave Form View consists of two tabs: Wave Forms and Spatial View.

Wave Forms Tab

Wave Form View looks different depending on zoom level. Images below show the views in zoomed out and zoomed in states.

Event periods are shown under the timeline (at the top) in their proper row as *period rectangles* with text descriptions (or abbreviations or no text, space permitting). Double-clicking a *period rectangle* will highlight the timeline portion of the rectangle and the row header(s). To zoom the *Wave Form View*, position the cursor and use the mouse wheel to zoom in or out with respect to the cursor location. Drag to scroll the *Wave Form View* and the *Symbols View* horizontally.

FRAME 1			THOS SCRANSLED	
-		ANE_2 FRAME_3	TRAME_4 FRAME_5 FRAME_6 FRAME_7 FRAME_6	
+∓€G	< > < > <	K 🔉 🕙 🏤 IA DI 🔗		
		0:016.572.939.314	0:016.643.477.148 0:000.121.531.746 0:000.158.373.163 0:000.195.439.222 0:016.82	2.068.1
2D		<u></u>		
	Events			
c	nda	8		
	scl Events	*		
c	Signal	1		
n ke			THES SCRAMBLED	
	INVALID			
	CTL		CTL PERIOD CTL PERIOD	_
riods	VICEO			
	SUCP			
	HDCP			
	REEP_001			
	Horiz			
NC		1		-
	Vert		VSYNC	
une		FRAME_1	FRAME_2	
kets		155 2156 2157 2159 2159 2160 2161 21	2162 2163 2164 2165 2166 2167 LO LL L2 L3 L4 L5 L6 L7 L0 L1 L1 L2 L1	8 119
y Lane 0				
y Lane 1				
y Lane 2				
	« » « » t	0:016.667.207.275	01000.000.010.533 01000.000.015.155 01000.000.019.749 01000.000.024.371 01016.66	7.313.9
>	« » « » ;	0:016.667.287.275	01000.000.010.533 01000.000.015.155 01000.000.019.749 01000.000.024.371 01016.46	7.313.
		0:016.667.287.275		7.313.5
iods	K > K > :	0:016.667.287.275		7.313.
iods		0:016.667.287.275	CATA 19LAND	7.313.
iods	Horiz	0:016.667.287.275	DATA ISLANG VIDIC	7.313.
o o me/Lines kets	Horiz	0:016.667.207.275	EATA ISLAND VETTO: TRANS 2 LINE_0	7.313.
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137

						TMDS SCRAMBLED							
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IED Periods Dync Frame/Lines Packets Symbols Phy Lane 0	Image: Noriz 3 Wort 3 A PRES 011 0110 011 0120 011 01300 011	0:016.	GUARD BAND 101010001101 101010001101 10101100 11010 10101100 10110 1010 1010 1010 1010 1010 1010 1010 1010 1010 1010 1010 1010 1010 1010 1000 1000 1000 1000000	203 1 0010 2: 200 0	10010011100011 3C 18E 10 1010 63 2C3 63 2C3	FR FR 224 252 1010 1010 132 202 0001 0000	VSYNC ME 2 LINE_0 163 1010 1 163 0000 0	DATA IS DATA IS DATA PA INSTITUTION DATA PA INSTITUTION DATA PA INSTITUTION DATA IS DATA IS DATA IS DATA IS DATA IS DATA IS DATA IS	YLOAD 139 19 1010 111 271 20 271 20 0000 0000	C 254 00 1010 3 29C 00 0000	163 1010 1001 29C 0001	13C 13C 1010 263 0000 (0011001011 263 0010 00000
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Columns are:

HPD	Hot Plug Detect signal.
<i>12C</i>	I2C Events and signals sda and scl
CEC:	CEC Events and Signal
Link	Link type (TMDS SCRAMBLED for ex.)
Periods	INVALID, CTL, DATA, VIDEO, SSCP, HDCP, KEEP_OUT
Sync	HSYNC and VSYNC periods and signals
Frame	Frame number.
Lines	ACTIVE and BLANK lines
Packets	GCP and AVI packets
PHY Lane 0	Lane 0 data
PHY Lane 1	Lane 1 data
PHY Lane 2	Lane 2 data

The scroll bar at the top shows all captured frames. Select a frame by double-clicking.



F1 F2 F3 F4 F5 F6 F7 F8 F9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50

As you hover over the timeline, a timestamp for that position is displayed on the timeline at the cursor horizontal location.

Popups show details of events as you hover over them in Wave Form View.

Below illustrates how the different views align when you double click in the *Wave Form View* or the *Symbols View*.



Measuring

The ruler tool allows users to measure the time 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 illustrated below. Use the eraser tool to remove measures.

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		op	00	00	00	00	00	00	00	00	00	00	0.0	00	
hy Lane 2		328	354	354	354	354	354	354	354	354	33C	033	087	388	
		00	00	00	00	00	00	00	00		00	00	00	00	

Spatial View Tab

Frame pixel images are shown in Spatial View.

Drag to scroll Frames.

Double-clicking the timeline when Spatial View Tab is active will select the event in Event Selector View.

A popup showing details will be shown when hovering over a *Frame* or HDMI data packets such as *GCP* and *AVI*.

Hover over an event to see event details in a popup window. Double-click an event will to select it in and see details in *Event Details View*.

neView Reports Images					
in Link Events Symbols	og Events				Wave Forms Spatial View
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Type	Id	Position	Duration	End	< > < » <u> </u>
RAME	20	0.336.904,487,458 502,502,72 No	0:016.666.598.437	0:353.571.085.895	01326.037.364.039 01332.704.003.413 01346.037.282.163 01352
 BLANK(41 lines) 		0.336.904,487,458 500 88 212 Mil	0:000.607.404.920 N7 000 bes	0:337.511.892.378	
✓ UNE	0	0.336.904,487,458 501,855,212 https://doi.org/10.1016/j.001	0:000.014.814.753	0:336.919.302.211 302.227.211 km	mouse hover
CTL PERIOD		0:336.844.635.851	0:000.060.107.497	0:336.904.743.348	Introdal C 2200 Vrotal 1 1125
 DATA ISLAND PERIO 	0	0.336.904.743.349 500 305 302 hh	0:000.000.242.423	0:336.904.985.772 507.205.957 http:	Popup details
GCP		0.336.904.756.817	0.000.000.215.487	0.336.904.972.304	Vyperkidda 5
CTL PERIOD	-	0.336.904.985.773	320 km 0:000.000.134.678	0:336.905.120.451	IthickPorch 1149 VBackPorch 26
 DATA ISLAND PERIO 		0.136.905.120.452	0:000.000.242.423	0:336.905.362.875	HFreetSPeech: 00 VFreetSPeech: 4
	, ,	0.336.905.139.920	0:000.000.215.487	0:336.905.349.407	Hibart 1 192 Vitart 1
AVI		0.336.905.362.876	0:006 607 808 958	0.337.513.171.834	Device a set
CTL PERIOD		500 306 512 kin	0:000.017.808.958 0:000.014.814.754	0.337.513.171.834 507.209 717 als 0.336.934.116.966	Colorapace: RGB Seepling : 4:4:4
> LINE	1	0.336.919.302.212 500.327.212 km	22 000 aits	507 143 217 MN	PROPARTY - 1-1-1
> LINE	2	0.336.934.116.967	0:000.014.814.753	0:336.948:931.720 500.277.211.82	
> LINE	3	0.336.948.931.721 500 577 272 http://	0:000.014.814.753	0:336.963.746.474 500 595 211 bits	
> UNE	4	0.336.963.746.475	0:000.014.814.753	0.336.978.561.228	
> UNE	5	0:336.978.561.229	0:000.014.814.753	0.336.993.375.982	
> LINE	6	0.336.993.375.983	0:000.014.814.753	0:337.008.190.736	double click GCP here sets
> LINE	-	0.337.008.190.737	27 000 mills 0:000.014.814.754	0237.023.005.491	focus to event and updates popup with details
		0.337.023.005.492	22 000 am 0:000.014.814.753	00.401211 km 0:337.037.820.245	Details
> LINE		0.337.037.820.246	0:000.014.814.753	0.337.057.034.999	
> LINE	9	500 500 212 Mb	22 000 bits	500 525 217 bits	1 Hank (0)
> LINE	10	0:337.052.635.000 500 525 212 Mil	0:000.014.814.753 27 000 mm	0:337.067.449.753 300 547.211 km	
> LINE	11	0:337.067.449.754 500.547.212 kits	0:000.014.814.753	0:337.082.264.507 302.568.212.htm	
> LINE	12	0:337.082.264.508	0:000.014.814.753	0:337.097.079.261 301.597.217 Jun	
> LINE	13	0.337.097.079.262	0:000.014.814.754	0:337.111.894.016	
> LINE	14	0.337.111.894.017	0:000.014.814.753	0.337.126.708.770	
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Symbols View

Like *Wave Form View*, *Symbol View* presents HDMI transmission data and periods. As with *Wave Form View*, drag to scroll horizontally or use the *settings* ribbon arrow keys.

		0:	116.667	.029.54	6 0:000.	000.023.7	780		0:	116.66	1.084.860				0:000.000	.089.400		0:000.0	00.111.2	273	0:116	667.170	.994
Periods																				PERIOD			_
	Horiz	ð												2	SYNC								-
Sync	Vert	ð								_					ISYNC								-
Frame/Lines															8 LINE 0								-
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Phy Lane 0		7	2AB 11	2AB 11	2AB 11	2AB 11	2AB 11	2AB 11	2AB 11	2AB 11	3E1 11	078 11	033	31E 11	3E4 11	03C 11	3E1 11	033	027	3CC 11	3C6 11	047 11	
Phy Lane l		7	00101010 354 00	354 00	354 00	354 00	354 00	354 00	354 00	100101010 354 00	CTL Symbol			011110000	0F0 00	3E1 00	017	39C 00	39C 00	027	03C 00	3E2 00	
by Lane 2		8	00101010 354 00	100101010 354 00	354 00	11001010101 354 00	354 00	10010101011 354 00	001010101 354 00	100101010 354 00	10b symbol 2b symbol Start :	: 11	(101010) (101010)	8	047	3CC 00	3D8 00	078	027 00	387 00	328 00	078	111
											End : Duration : Start : End : Duration : Bitrate :	0:000.0	67.086.2 00.006.7 1 223 bit 1 232 bit 10 bit 1 bit	29 Ls Ls									

Periods	Transmission PERIODs
Sync	Horiz and Vert periods
Frame/Lines	Frame and Line number
Packets	HTML GCP and AVI packet identifiers
Symbols	HDMI transmission symbols.
Phy Lane 0	TMDS Channel 0 data.
Phy Lane 1	TMDS Channel 1 data.
Phy Lane 2	TMDS Channel 2 data.

Illustrated below are the TMDS channel values for *PIXEL*s for the color white. Note from the tool tip that the value has been scrambled.

00011101110	0110001101	0001001	1011	01111	1010	11010	0000101
1DC	2C6	2C8		171	D	20)B
FF	FF	FF		FF		F	F
11110000010	0000111011	0000000	1101	10111	0011	00001	0011111
107	10b sym	col :	0x	1DC	(01)	L1011	L100)
FF	scramble	e inde	x:	9039	4		
10000100100							
090	Start	: 0	:02	0.84	7.88	32.33	30
FF	End	: 0	:02	0.84	7.88	39.00	54
000000000000000000000000000000000000000	Duration	n: 0	:00	0.00	0.00	06.73	34
000	Start	1.0	30	959	232	2 bit	s
000	End	1	30	959	24:	L bit	s
INE (1920	Duratio	n :			10) bit	s

Illustrated below are the values for a SSCP period. Note from the tooptip that this is not scrambled.

CTL		
0110101010111010101010111010101011101010	1110101010101	11010101011
2AB 2AB 2AB 2AB 2AB 2AB	2AB	2AB
11 11 11 11 11 11	11	11
0001010101100101010100101010101010101010	1001010101	0010101011
354 354 354 354 10b symbol : 0	x2AB (10	10101011)
00 00 00 00	(,
10010101011001010101010101010101010101		
254 254 254 254	20.239.1	37 348
00 00 00 00	20.239.1	
	00.000.0	
	0 055 24	
511 001 000 511	0 055 25	
Duration :		0 bits

Each individual block contains the following information (tooltiup also shown).

First row	10b/8b symbol in HEX format
Second row	Descrambled value.

Frame Image View

Frame Image View can be used to select *Frames* and GCP or AVI periods and synchronizing with other views.

As shown below, selecting the AVI 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.



Mode can be Image or Rect (shows just a green rectangle to save processing time).

Stream combobox and Simple view checkbox do not work at present.

7. DP LINK TIMELINE VIEWER

Role:	Product:
DP Reference Sink (DP RX)	UCD-400
USB-C DP Alt Mode Reference Sink (DP RX)	UCD-424

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

Link Timeline Viewer main panel contains two tabs:

- *FrameView* provides the user ability to evaluate events within the captured data and their occurrence in time scale.
- *Reports* shows AUX channel activity at present.
- Images lets the user view frame images from the captured data.



ew Reports Images	
port	FRE-INFRASIS_LANE1 = level 1
	NUTE: Decoded as HAIM_LINE_COMMEL_COINS_SET = 65/105
	TK_TTE_PREDET_VALUE_LANE0 = 4
	TX_FFE_PRESET_VALUE_LANE1 = 4
	NOTE: Decoded as MAIN_LINK_CHANNEL_CODINO_SET = 1286/1326
	Link/fink bevice status
	ALJUST_REQUEST_LANE2_3 (RO)
	0x00207 := 0x44
	VOLTAGE_SNING_LANE2 = level 0
	TRE-EMPHASIS_LANE2 = level 1
	VOLTAGE_SNING_LANE3 = level 0
	FRE-EMPHASIS_LANE3 = level 1
	NOTE: Decoded as NAIN_LINE_CHARMEL_CODING_MET = Rb/10b
	TX_TTT_FPREST_VALUE_LANE2 = 4
	TX_TTE_PRESET_VALUE_LANE3 = 4
	NOTE: Decoded as NAIN_LINK_CHANNEL_CODINO_SET = 128b/132b
	Transaction Data 00 44 44
	Handhaster II codes: preseduis: L 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
	data: 0.1000100(0044) 0.100010000040 postawble1 H H L L


Note:

Phy Lane 3

When using Link Timeline Viewer with MST, it's possible that all information for all streams are not visible. Different streams are shown below in the Wave Form View and the Symbols View. The view handle may be use to adjust visibility. Remove rows via the gear icon optimize screen real estate. (See the next chapter for instructions.)



Wave Form and Symbols View Settings

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							BS-IDL8	5_1						11		FR	AME_3
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JX.																	
og AUX og MSA																	
og VB-ID																	
og Link																	
og VFRAME INFO																	
ink													_				
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BT Lines	1	LANK				E	в		A	CTIVE			в			ACTIV	E
ST VBID	3						-						-				
ST MSA						-											
ST SDP																	
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IX 32 AUX 33 MEA 34 MEA 34 VE-LD 35 LINE 37 LINES 37 VBLD 37 MEA	0:153.3	49.679.11	4									1 I I I 55T					
IX JQ AUX JQ MIA JQ VB-ID JQ LInk JQ VFIAMS INFO INK JT LINES JT MIA JT SOP	0:153.3	49.679.11	4														
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IX JQ AUX JQ MIA JQ VB-TD JQ VEADS JU LINK JQ VFRAME INFO INK FT LINES JT MID JT MIA JT SOP mbols ane 0	0:153.5	49.679.11	4					00			DO		E.	RAME 2 L	INE_0		
X Sg ADX Sg MAA Sg VB-LD Sg Link Sg VB-LD Sg Link This Sg VB-LD Sg Link TF VBLD TT MSA TT SDP TT MSA TT SDP me 0 me 1	0:153.5	19,679.11	4 3 35 7C	BC	VBID	MVID 76	MAUD	00	00	00	D02	201 2011 00	50	RAME 2 L	INE_0	SS SC	SC
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IX 99 AIX 99 MIA 99 VIA-10 99 VIA-10 99 VIA-10 99 VIA-10 99 VIA-10 99 VIA-10 97 VIA 97 VIA	0:153.3	49.679.11	35 7C 7C 7C 7C	BC BC BC BC BC BC	VBID 11 11 11 12 209/90 D16.4+	MVID 76 76 76 76 76 81/78	MAUD 00 00 00 29D/5D 229.2-	00 00 00 131/91 D17.4+	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	DOR 00 00 00 00 00 00 00 00 00 00 00 00 00	2017 00 00 00 100 100 100 100 100 100 100	00 00 00 00 00 00 00 00 00 00 00 00 00	RAME 2 L	INE_0	55 50 50 50 50 50	5C 5C 5C 5C
X ya JMX ya JMA ya JMA ya JMA ya Uwa JMA ya Uwa JMA ya Uwa JMA ya Uwa JMA ya Uwa JMA ya Uwa JMA ya JMA ya JMA ya Uwa JMA ya	0 : 153.: 0 : 153.:	19.679.11	55 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C	BC BC BC BC ITC/SC K28/SC	VBID 11 11 11 12 12 12 12 12 12 12 12 12 12	NVID 76 76 76 76 081/78 81/78 76	MAUD 00 00 00 28D/5D 229.2- 00	00 00 00 131/91 137.4+ 000	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	DOR 00 00 00 00 00 00 00 00 00 00 00 00 00	DY 00 00 00 32B/64 D4.3- 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	INE_0	55 50 50 50 50 50 50 50 50 50 50 50 50 5	5C 5C 5C 2BC/5C 828.2-
IX IX IX IX IX IX IX IX IX IX	0 : 153.: 0 : 153.:	49.679.11 	55 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C 7C	BC BC BC BC BC BC BC TC/BC	VBID 11 11 11 12 209/90 D16.4+ 11 10000100 2009/90	MVID 76 76 76 76 08L/78 5030.3+ 76 1900011100 08L/78	MAUD 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 131/91 D17.4+ 0.0 1000110910	00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 316/76 D22.3+ 00 316/76	EUX 00 00 00 00 04D/8b D13.7+ 00 04D/8b 01310000 04D/8b	MY 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	00 00 00 00 00 00 00 00 00 00 00 00 00	35 50 50 143/50 K28,2+	5C 5C 5C 2BC/5C K28.2-

Gear



The gear icon under the scroll bar allows users to select which events are shown in *Wave Form and Symbol Views*. Click the red circle to remove events. You can select which VBID events are shown by clicking the pen tool.

0	±⊕(Q < >	
0		0
0	AUX	
Ō	Link	
0	Frame	
Ō	Lines	D
•	VBID 🖍	0 0 34
0	MSA	
Ō	SDP	
0	Symbols	
Ō	Lane 0	
0	Lane 1	
•	Lane 2	
0	Lane 3	

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

/// VBID edi	itor X
VBID edi	
Bit 0	
🗌 Bit 1	
Bit 2	
🗹 Bit 3	
🗹 Bit 4	
Bit 5	
🗌 Bit 6	
🗹 Bit 7	
Accept	Cancel

Save

÷

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

	€, Q, < >	« :
43	Save	þ.
AU	Load	> [
Li	Remove	
Fr		— H
11	Import	- E
VB	Export	
MS.	Reset to default	
CDD		

Zoom

θQ

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

Scroll

You can use the arrow keys to move in the timeline. A single arrow shifts the timeline one interval, two arrows by 10 intervals and three arrows by 100 intervals.

Alternatively, you can scroll via mouse drag (clicki and hold).

Clock



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

Move to time poin	nt ×
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]
ОК	Cancel

Eraser



The eraser icon deletes all made measurements on the timeline.

Move to Previous or Next Interval

Move back interval and Move next interval.

Sync Data

Sync data for views.



FrameView Tab

Frame View tab consists of four areas shown below.

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

These will be described in detail. Note that all these views are synchronized (when the synchronize icons are blue).



Event Selector View

Main Link Events Tab

Main Link Events lists captured data: events, packets and symbols. Selecting items in *Main Link Events*, you can easily locate the items of interest and focus get the *Wave Form View* and *Symbols View* for items. Event Selector events are presented via a tree control. When expanded, each *FRAME* lists video *LINES* and their events.

Main Link Even	ts Symbols	Log Events		C.C.		
Search				🔄 🛃 🗌 Aa 🗌 R	Exp 📢 0 /0	ы
	Type	Id	Position	Duration	End	-
~ L	INE	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	
> L	INE	1	0:016.630.931.770	0:000.014.816.968	0:016.645.748.738	
> L	INE	2	0.016.645.748.739	0:000.014.821.907	0:016.660.570.646	
> L	INE	3	0.016.660.570.647	0:000.014.809.561	0.016.675.380.208	
> L	INE	4	0.016.675.380.209	0:000.014.812.029	0:016.690.192.238	
> L	INE	5	0:016.690.192.239	0:000.014.816.969	0:016.705.009.208	
> L	INE	6	0.016.705.009.209	0:000.014.813.264	0:016.719.822.473	
> L	INE	7	0:016.719.822.474	0:000.014.816.968	0:016.734.639.442	

The timing format used is text and bits formats.

The text time format is as follows:

seconds:milliseconds.microseconds.nanoseconds.picoseconds

The timing format is shown below. You can see the text format on top and the bit format below (small 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	N-186 030 183 371

Selecting a *Frame*, *Line*, *Event*, or *Symbol* will focus the *Wave Form View* and *the Symbols View*. The time stamp of the item is highlighted in light blue.



Event Selector View timing details columns are:

Туре:	Type of item. FRAME, LINE, or name of Event
ld:	Identification number
Position:	Start of the event from start of data capture
Duration:	Duration of the event
End:	End of the event from start of data capture

Main Link Events Symbo	ls Log Events			
cs: frame		🗌 🛃 🗌 Aa 🗌 RE	xp 🛛 0 / 0	N O
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	0:057.35
> FRAME	5	0:057.356.866.347	0:016.667.887.570	0:074.02
> FRAME	6	0:074.024.753.918	0:016.667.892.509	0:090.65
> FRAME	7	0:090.692.646.428	0:016.667.887.570	0:107.36
> FRAME	8	0:107.360.533.999	0:016.667.887.571	0:124.02
> FRAME	9	0:124.028.421.571	0:016.667.887.570	0:140.65
> FRAME	10	0:140.696.309.142 1 139 645 090 bits	0:016.667.892.509	0:157.3€ 1 274 655 6
<				>

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

Lane Events

These are events occuring for each lane (such as SST, TPS1, TPS3 and TPS4).

SST Stream

You can find all captured frames under SST Stream. When selecting a frame in the Event Selector View, it is highlighted and also focused in the Wave Form View and the 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, streams are displayed in the *Event Selector View* as shown below. Select a stream to inspect its events. All stream events and their handling are as for *SST* mode described previously.

File Options About						
FrameView Reports Images						
Main Link Events Symbols Log Events	Wave Forms Spatial V					
		arw.				
▶ Search	6 F1 FRAG_2 F1 FRAG_2	TRANE_3 TRANE_4 TRANE_ TRANE_3 TRANE_4 TRANE_		NST IANE 9 FRAME 9 FRAME 10 FRAME 0 FRAME 9 FRAME 10 FRAME		TRAME_14 FRAME_15
Type Id Position Duration	F1 F3A4E 2 F1 F3A4E 2 F1 F3A4E 2	TRAVE 3 TRAVE 4 TRAVE TRAVE 3 TRAVE 4 TRAVE TRAVE 3 TRAVE 4 TRAVE	FUARE_6 FUARE_7 FI	TANE 0 FEARE 0 FEARE 10 FEARE TANE 8 FEARE 9 FEARE 10 FEARE TANE 8 FEARE 9 FEARE 10 FEARE	11 FRAME 12 FRAME 13	TRAME 14 FRAME 15 TRAME 14 FRAME 15 TRAME 14 FRAME 15
> MST Stream 1						
> MST Stream 2	Q & Q Q ()	«» «ж» 🖲 🛃 н н 🔗				
> MST Stream 3	MST1 Frame			FDJHE 2		
> MST Stream 4	MHT1 Lines	LINE_43	LINE_44	LINE (5760)_45	LIN8(5760)_46	LINE(5760)_47
2 MSI Stream 4	MST1 VBID					
	MFT1 MPA					
	MST1 SDP MST1 B5					
	NST1 BE					
	MST2 Frame			HU22_2		
	MST2 Lines	LINE_43	LINE_44	LINE(5760)_45	1398(5760)_46	LINE(5760)_
	MHT2 VRID	14				
	MST2 SDP					
	MST2 B5			1	1	
	MST2 BE MST3 FIAMP			PRIAME 2		
	NST3 Lines	LINE_43	LINE_44	LIME (5760)_45	lINE (5760)_46	LINE(5760)
	NETS VEID	34				
	MST3 SDP					
	MST3 BS				1	
	MST4 Frame			TRAME_2		
	MST4 Lines	LINE_43	LINE_44	LINE (576)_45 LINE (5	760)_46 LIN	E(5760)_47
	MST4 VBID	1				
	MUT4 MDA					
	MST4 SDP	Channel 1 no data				
	MST4 SDF					
	NST4 SDP	Charmel 1 no data (Charmel 1 no data (Charmel 1 no data (Charmel 1 no data (Charmel 1 no data				
	NETA SDP					
	NST4 SDP					
(LINE)	NUTE SDP			F1005 2 1.130_44		
[LINE] Start : 0:007.571.394.036/ 61 328 560 bits End : 0:007.586.329.772/ 61 449 539 bits	NST4 SDP			FRAME 2 LINE_44		
[LINE] Start : 0:007.571.394.036; 61 328 560 bits End : 0:007.586.329.772; 61 449 539 bits Duration : 0:000.014.935.736; 120 980 bits	NET4 SUP SUT2 VELD NET2 VELD NET2 USA NET2 SUP NET2 LINES NET3 VELD NET3 VELD NET3 VELD			ennes 2 1.138, 44		
[LINE] Start : 0:007.571.394.0369 61 328 560 bits Start : 0:007.546.328.772; 61 448 539 bits Duction : 0:000.214.335.730 120 980 bits WHC 1 041	NUT4 SOP O L < > « » NUT2 VAID NUT2 SOP NUT2 USD NUT2 USD NUT2 VAID NUT2 NOA NUT2 SOP					
[LINE] Dart 1 0:007.571.394.036; 61 328 560 bits End 1 0:007.681.353 TTJ; 61 449 539 bits End 1 0:007.014.593.7354 UNED 1 VMED 1 FoldErs FoldErs	NET4 SOP NET2 VALD NET2 VALD NET2 SOP NET2 SOP NET2 SOP NET2 SOP NET3 SOP NET3 SOP NET3 SOP NET3 SOP			PAGE 2 1385,44 PAGE 1 1386 (1916) _45		
[11NE] Smart : 0:007.571.394.036; 61 328 560 bits End : 0:007.584.325.772; 61 449 539 bits Diration : 0:007.584.325.772; 61 449 539 bits Diration : 0:000.014.395.735; 120 980 bits Veltoslibaking 199E	NETS SEP ALE VALS NETS VALS NE					
LINE: LINE: Entri 0:007.571.394.0367 61 228 560 bits End 0:007.640.338.772 61 449 539 bits Mill 1 0.1 Mill 1 0.1 End 0.1 E	AUTE SEP AUTE VALE AUTE VALE AUTE VALE AUTE VALE AUTE JANA AUTE JANA AUTE JANA AUTE JANA AUTE JANA AUTE JANA AUTE JANA AUTE VALE AUTE VALA					
LINE: Line: 0:007.071.194.0367 61 328 560 bits Dratin: 0:000.014.339.7364 120 960 bits Dratin: 0:000.014.339.7364 220 960 bits Prilolalanting: THE Fridalinanting: THE Model and Annual A	AUTE SEP AUTE VALE AUTE VALE AUTE SEA AUTE SEA AUTE SEA AUTE SEA AUTE VALA AUTE SEA AUTE VALA AUTE SEA AUTE SEA AU			FRAME 2 LINE(1770)_45		
LIANG A 00000 111.184.2000 41 200 800 814 Northin 0 0000 011.080.794 120 800 814 Northin 0 0000 011.080.794 120 800 814 Northin 0 0000 011.080.794 Northin 0 0000 110.080 Northin 0 0000 110.080	NUTE SEC U U C V C V NUTE VALE NUTE VALE NUTE SEC NUTE VALE NUTE VALE NUTE NUTE VALE NUTE	< » Э <u>4</u> и и <i>р</i>	17000 1	FRANK 2 LINK(1710)_45 803 803	w i	FROM)
LIARE THE CONT. 571, 344, 636, 61 226 560 kits Datata (0000, 512, 538, 756) The Control (0000, 512, 538, 756) The Control (0000, 512, 538, 756) The Control (000, 512, 538,	ANTE DO ANTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE YOUT NOTE HAA NOTE H	★ H ≠ Ø	BS VBID MVID MAUD	77466 2 LINE(1710)_43 100 101 102 103 103 103 103 103 103 103 103	57 4 04 04 04 04 04	
LINE 1.1000 1.0007 171.284.085 0.0007 171.284.085 0.0007 1.00 1.000 1.0007 1.00 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	AND	К Ж О <u>4</u> К Н 4	BS VBID MVID NAUD C0 01 76 91 C0 C0 01 76 91 C0	PANE 2 LINE(1716)_45 100 4 -0 -0 -0 -0 2 4 -0	57 4 C4 C4 C4 C4 4 C4 C4 C4 C4	
LIANG LIANG 1 01007 171.184.201 41 225 800 814 01007 171.184.201 724 41 201 800 814 01007 11 0 0 1 0 0	ANTE DO ANTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE HAA NOTE YOUT NOTE HAA NOTE H	★ H ≠ Ø	Bd VBID HVID HAUD C0 01 76 81 C0 C0 01 76 91 C0	PARE 2 LIBERTION_10	57 4 C4 C4 C4 C4 4 C4 C4 C4 C4 4 C4 C4 C4 C4 4 C4 C4 C4 C4 C4 C4 C4 C4 C4 C4	C4 C4 C4 C4 C4 C4 C4 C4 C4
LIANG LIANG 1 01007 171.184.201 41 225 800 814 01007 171.184.201 724 41 201 800 814 01007 11 0 0 1 0 0	AND STATES SEE	К ж 3 <u>ж</u> к н р	2d VaiD MVID MAUD CO G1 76 31 CG OI 01 76 91 CG CO G1 76 91 CG	Page 2 List(170)_45	57 4 C4 C4 C4 C4	
LIANG LIANG 1 01007 171.184.201 41 225 800 814 01007 171.184.201 724 41 201 800 814 01007 11 0 0 1 0 0	AND STATES SEE	 Э.З. н. н. р. Э.З. н. р.	BS VELD SVID SAUD C0 01 76 31 C6 C1 01 76 51 C6 C0 01 76 51 C6 C0 01 76 51 C6 C0 01 76 91 C6 C0 02 76 91 C6 C1 02 76 91 76 S20 20 76 92 76 S20 20 76 92 76 S20 31 20 93 93	Page 2 138(1710)_45	57 4 C4 C4 C4 C4 4 C4 C4 C4 C4 4 C4 C4 C4 C4 7 C4 C4 C4 C4 7 C4 C4 C4 7	C4 C4 C4 C4 C4 Discrete C4/CVC 15/CVC S2/SVC S2C/D2 C4/CVC 15/CVC S2/SVC S2C/D2 S2/SVC S2/SVC S2/SVC
LIANG LIANG 1 01007 171.184.201 41 225 800 814 01007 171.184.201 724 41 201 800 814 01007 11 0 0 1 0 0	NUTL EXP C L < > < > < > NUTL WALK NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL FOR NUTL EXP D L = 1 L = 1	С » О ф к н р	BB WBID MUD BUUD C0 81 76 83 70 C1 01 76 93 70 C1 01 76 93 70 C1 01 76 93 70 C2 01 76 93 70 C3 01 76 93 70 C4 01 76 93 70 C5 01 76 93 70 C4 01 76 93 70 C5 01 76 93 70 C6 01 76 93 71 C7 02 70 93 71 C6 01 76 73 71 C7 02 72 73 71 C6 01 76 73 71 C7 02 73 71 71 C7	Page 3 List(199)_45	37 37 4 0.4	C4 C4<
LIANG LIANG 1 01007 171.184.201 41 225 800 814 01007 171.184.201 724 41 201 800 814 01007 11 0 0 1 0 0	A CALL CALL CALL CALL CALL CALL CALL CA		BB WBID MUD BUID 01 81 76 83 70 01 81 76 83 70 01 81 76 83 70 01 81 76 83 70 01 81 76 83 70 02 81 76 83 70 03 81 76 83 70 04 81 76 83 70 05 81 76 83 70 06 81 72 83 70 07 83 79 83 74/94 334 07 83 72/78 53/74 23/74 337 07 83 74/74 337 73 34 07 83 74/74 337 73 34	PARE J LIKETON 40	27 28 04<	C4 C4 C4 C4 S2C/DC S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4 S2L/C4
LIARE THE CONT. 571, 344, 636, 61 226 560 kits Datata (0000, 512, 538, 756) The Control (0000, 512, 538, 756) The Control (0000, 512, 538, 756) The Control (000, 512, 538,	A CALL CALL CALL CALL CALL CALL CALL CA		Bits VILD MUTD MUTD CI CI TR 8.1 CI CI TR TR S.1 CI CI TR TR S.1 CI CI TR TR S.1 CI CI TR TR TR S.1 CI S.1/7 TR TR TR		37 37 58 64 64 68 68 64<	C4 C4 C4 C4 C4 C4 C4<
LINE 1.1000 1.0007 171.284.085 0.0007 171.284.085 0.0007 1.00 1.000 1.0007 1.00 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	 With Star C L C A C A C A C A C A C A C A C A C A		Bit Value Monto Manual	Page 2 Link (1710) _45	27 27 4 0.1 0.1 4 0.1 0.1 4 0.1 0.1 4 0.1 0.1 4 0.1 0.1 4 0.1 0.1 7 25.7 25.1 25.1 7 25.7 25.3 25.7 7 25.7 25.3 25.7 7 25.7 25.3 25.7 7 25.7 25.3 25.7 7 25.7 25.3 25.7 7 25.7 25.3 25.7 7 25.7 25.3 25.7	C4 C4 C4 C4 C5 C5 C4 C4 C4 C4 C4<
LINE 1.1000 1.0007 171.284.085 0.0007 171.284.085 0.0007 1.00 1.000 1.0007 1.00 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000	 With Star C L C A C A C A C A C A C A C A C A C A		SE MOD MOD MOD C 000 100 100 100 C 000 100 100 100 100 C 000 100 <td< td=""><td></td><td>IF IF 4 64<td>C4 C4 C4 C4 C1 C1 C1 C1 C1 C1 C2 C1 C2 C1 C1 C2 C2 C3 C3 C2 C1 C2 C1 C2 C2</td></td></td<>		IF IF 4 64 <td>C4 C4 C4 C4 C1 C1 C1 C1 C1 C1 C2 C1 C2 C1 C1 C2 C2 C3 C3 C2 C1 C2 C1 C2 C2</td>	C4 C4 C4 C4 C1 C1 C1 C1 C1 C1 C2 C1 C2 C1 C1 C2 C2 C3 C3 C2 C1 C2 C1 C2

Search

Search for events in *Event Selector View* by typing the event name in the search bar and pressing enter. The events found are highlighted and shown in the *Wave Form View* and the *Symbol View*.

Link Timeline Viewer "C:\Users\karih\Pictures\capture_20241104_145850" [8100 Mbps, 4 lanes]

File Options About				
FrameView Reports Images				
Main Link Events Symbols Log I	vents			
VBID		L ×	🗌 Aa 🗌 RExp 🔀	3 / 18154 🕨 🗘 🔗
Туре	Id	Position	Duration	End
✓ LINE	1	0:034.617.505.338	0:000.010.113.535 81 920 bits	0:034.627.618.873
BS		0:034.617.505.338 280 403 020 bits	0:000.000.004.937 40 bits	0:034.617.510.275 280 403 059 bits
VBID		0:034.617.510.276 280 403 060 bits	0:000.000.001.234 10 bits	0:034.617.511.510 280 403 069 bits
MVID		0:034.617.511.511 280 403 070 bits	0:000.000.001.233	0:034.617.512.744 280 403 079 bits
MAUD		0:034.617.512.745 280 403 080 bits	0:000.000.001.234	0:034.617.513.979 280 403 089 bits
✓ LINE	2	0:034.627.618.874 280 484 940 bits	0:000.010.113.535 81 920 bits	0:034.637.732.409 280 566 859 bits
BS		0:034.627.618.874 280 484 940 bits	0:000.000.004.937 40 bits	0:034.627.623.811 280 484 979 bits
VBID		0:034.627.623.812 280 484 980 bits	0:000.000.001.234	0:034.627.625.046 280 484 989 bits
MVID		0:034.627.625.047 280 484 990 bits	0:000.000.001.233	0:034.627.626.280 280 484 999 bits
MAUD		0:034.627.626.281	0:000.000.001.234	0:034.627.627.515 280 485 009 bits
> LINE	3	0:034.637.732.410 280 566 860 bits	0:000.010.113.535 81 920 bits	0:034.647.845.945 280 648 779 bits
> LINE	4	0:034.647.845.946 280 648 780 bits	0:000.010.113.535	0:034.657.959.481 280 730 699 bits
> LINE	5	0:034.657.959.482 280 730 700 bits	0:000.010.113.535	0:034.668.073.017
> LINE	6	0:034.668.073.018	0:000.010.113.535	0:034.678.186.553



Click the enter icon to search.



Use Case Sensitive and/or Use regular expressions.

3 / 18154

Arrows navigate to next or previous filtered event.

0

The gear icon opens the *Configure search* dialog. Select which columns are used for searching and what criteria (*Case Sensitive* or *Use regular expression*) are used. Click the *Apply* to refresh.

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

Ø

Click to synchronize views.

Symbols Tab

Symbols tab lists PHY level events found.

Options Abo	bout	ictures\capture_20241104_145850* [8100 Mbp	
FrameView Re	leports Images		
Main Link Events			
P vbid	×	🛃 🗌 Aa 🗌 REip 🔣 🚹 / 18154	1 H O Ø
	Position 💌 L	Value	•
		0600011001	
MD 0:034	4.607.397.975 0	0x00	
44UD 0:034	4.607.399.209 0	0x00	
0.034	4.617.505.338 0	00000000	
0.034		0600011001	
0.034	4.617.511.511 0	0400	
0.034		0x00	
c 0:034.		00000000	
RID 0:034.	4.627.623.812 0	0600011001	
0.034		0x00	
0.034	4.627.626.281 Q	0x00	
s 0.034	4.637.732.410	00000000	
em 0:034.	4.637.737.348 Ø	0600011001	
0:034	4.637.738.583	0x00	
0.034	4.637.739.817 0	0x00	
< 0.034.	4.647.845.946 0	00000000	
	4.647.850.884	0600011001	
Туре:		Type of iten	n: FRAME, LINE or Event name
ld:		Identificatio	n number
n : 4: -		T :	to a stat of the sector
Positic	on:	Timestamp	from start of the capture
Lane:		The main lir	nk Symbol lane
Value:	•	Symbol valu	۱۵

Search

Search and filter symbols as described above for the *Main Link Events Tab*. Each column additionally has a drop down filter dialog (down arrow icon): Use these to sort and select events. The screenshots below show a *VBID* event search and a column filter dialog.

Frame\	/iew	Reports Im-	ages			
Main L	ink Even	ts Symbols	Lo	g Events		
PV	BID		×	🛃 🗌 Aa 🗌 RExp 🛛 🗌	1 / 276 🕨 🕻	£.
Ту	-	Position 💌	4-	Va	lue	1
VBID		53.253.239.391 1 256 670 bits	0	0600010001		
VBID	0:1	53.267.999.820 1 476 230 bits	0	0600010001		
VBID	0:1	53.282.814.570	0	0600010001		
VBID	0:1	53.297.634.258	0	0600010001		
VBID	0:1	1716 270 ын 53.312.449.008	0	0600010001		
VBID	0:1	1 836 270 bits 53.327.263.758	0	0600010001		
VBID	0:1	1 956 270 bits 53.342.078.508	0	0600010001		
VBID	0:1	2076270645 53.356.893.258	0	0600010001		
VBID	0:1	2 196 270 bits 53.371.712.946	0	0600010001		
VBID		23163106in 53.386.527.696	0	0600010001		
-	lue	Ascending	U		•	
1	lue Sort A Sort E	Ascending			•	
↑ ↓ 1	lue Sort A Sort E Clear	Ascending Descending Sort			-	
↑ ↓ 个 下	lue Sort A Sort E Clear Clear	Ascending Descending Sort Filter				
	lue Sort A Sort E Clear Clear Search	Ascending Descending Sort Filter				
	lue Sort A Sort E Clear Clear Search Selec	Ascending Descending Sort Filter n:				
	lue Sort A Sort E Clear Clear Search Selec	Ascending Descending Sort Filter n: t all 0000000				
	llue Sort A Sort I Clear Clear Search Selec Selec	Ascending Descending Sort Filter n: t all 00000000 000002c	g			
	Ilue Sort A Sort I Clear Clear Search Selec Selec · 🖸 0 · 🗹 0	Ascending Descending Sort Filter h: t: all 00000000 000002c b0001000	9			
	Ilue Sort A Sort I Clear Clear Search Selec Selec O O O O O O O O O O O O O O O O O O O	Ascending Descending Sort Filter 1: 1 0000000 000002c b0001000 b0001000	g 90 91			
	Ilue Sort A Sort C Clear Clear Selec	Ascending Descending Sort Filter 1: t all 0000000 000002c b0001000 b0001000 b0001000	g 90 91			
	Ilue Sort A Sort C Clear Clear Selec	Ascending Descending Sort Filter 1: t: all 00000002 b0001000 b0001000 b0001100 x00	g 90 91			

Searching will highlight all found event symbols. When selected, it will also be selected in the *Wave Form View*, the *Symbols View* and the *Event Details View*. You can browse through symbols using the next or previous arrow buttons.



Event Details

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

Details tab

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

Frame

<pre>[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 Vactive : 1080 lines</pre>
HStart : 192 pixels VStart : 41 lines HSync : 44 pixels VSync : 5 lines Total pixel count 6220800

Details shown above are FRAME details.

Line

Details	Image							
End Duration VBID Vertica FieldID Interla NoVideo AudioMu HDCP SYN	: 0:153. n : 0:000. 1 1Blanking: : ce: Stream:	FALSE FALSE FALSE FALSE FALSE	1	241	449	269	bits	
META	119 44 1 punt = 0	0x77 0x2c 0x1						

In the image above the selected *Line* is part of blanking (*VerticalBlanking* is *TRUE*). Audio is not being streamed (*AudioMute* is *FALSE*).

MSA

Details In	nage			
End	0:153.249 0:153.249 0:000.000	9.943.108;		
FIELD	DEC	HEX	BITS	
MVid NVid HActive HTotal HTotal HStart VStart VStart VSynWidth HSynWidth MISCO MISC1	1920 1080 2200 1125 192 41 5	0x1777 0x8000 0x780 0x488 0x898 0x465 0x20 0x29 0x5 0x2C 0x20 0x20 0x0	00100000	

MISCO.Synchronous Clock: Link clock and main video stream clock are asynchronous. MISCI.Interlaced Vertical Total Even: Number of lines per interlaced frame (consisting of two fields) is an odd number MISCI.Stereo Video 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

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SDP

Details	Image
End	: 0:034.894.928.816; 282 650 160 bits : 0:034.894.943.629; 282 650 279 bits : 0:000.000.014.813; 120 bits
Secondar HBO (ID) HB1 (Typ HB2 HB3 PB0 PB1 PB2 PB3	y-data Packet 0x00 0x01 Audio_TimeStamp 0x17 0x48 0x00 0x67 0x35 0xD1 necksum OK
Data che	cksum OK
Maud Naud	0x0000012C 300 0x00008000 32768
PB4 PB5 PB6 PB7 PB8 PB9 PB10 PB11	0xB4 0xB4 0xB4 0xF4 0x7F 0x7F 0x7F 0x7F

Different SDP events have individual details. An audio stamp event is shown above.

PHY Symbol

Details	Image				
End	: 0:1 : 0:1	70.271.298.270; 70.271.299.503; 00.000.001.233;		559	
	: ce: Stream: te: NC DETE	ng: TRUE FALSE FALSE FALSE FALSE CT: FALSE am: FALSE			

Events such as BS, VBID and MVID are shown as [PHY_SYMBOL]. A VBID event is shown above.

PHY Area

Details	Image						
[PHY AR	EA]						
Start		00.000.000.000;			0	bits	
End	: 0:0)00.854.703.667;	6	923	129	bits	
Duratio	n : 0:0)00.854.703.667;	6	923	130	bits	
TPS1							

[PHY Area] events are TPS events. A TPS1 event is shown.

Image tab

Image tab shows the captured *FRAME* active area. 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 hits
> 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	809 586 650 bits 0:116.612.888.590 944 584 470 bits	134 998 420 bin 0:004.740.585.679 38 399 560 bin	944 584 469 555 0:121.353.474.269 982 984 029 555
Details Image				
Image				

Wave Forms View

Wave Forms View consists of two tabs: Wave Forms and Spatial View.

Wave Forms

TPS4	788
	BS-IDLE_1 FRAME_2 FRAME_3 FRAME_5 FRAME_6 FR
$0 \pm 0 \in \langle \rangle$	x >> < x >> 3 = 4 = 10 - 2
	0:153,253,211,208 0:153,253,224,300 0:153,253,264,404 0:153,253,263,576 0:153,253
AUX	
Log AUX	
Log MSA Log VB-ID	
Log Link	
Log VERAME INFO	
Link	TRI
SST Frame	BS-IDLE_1 FRAME_2
SST Lines	LINE_11731 LINE_0
SST VBID	
SST MSA	
SST SDP	
SST SR	
SST BS	83
SST BE	
Lane 0	00 00 00 00 00 00 00 00 00 00 00 00 00
Lane 1 Lane 2	00 00 00 00 00 00 00 00 00 00 00 00 00
Lane 3	
JX:	AUX channel events
og Aux	Log packets for AUX
og MSA	Log packets for MSA
og VB-ID	Log packets for VB-ID
og Link	Log packets for Link (TPS1, TPS2, TPS3, TPS4 detection)
-	
og VFRAME	INFO Log video frame data
nk:	Link state (TPS1, TPS2, TPS3, TPS4, SST, MST etc.)
ST Frame	SST frame number
ST Lines	SST Line number
ST VBID	SST vertical blank
עופע וכ	SOI VEILIUU DIAIK
T MSA	SST MSA period

Captuared FRAMEs are shown at the top. As no triggers were set on the example below, the first *FRAME* is not fully captured.

Wave Forms S	atial Vi	ew							
				SST					
F1 FRAME (bad)	2	FRAME_3	FRAME_4	FRAME 5	FRAME	6	FRAME 7	FRAME 8	F9
O∓€d	>	« » « » 🕉	ng 14 🕨						

Select a frame by double-clicking it: It turns light purple and the Wave Form View will be focused.

SST SDP

SST SR SST BS

SST BE

Lanes (0-3):

SST SDP period SST SR symbol period

SST BS symbol period

SST BE symbol period

Data and control symbols

Wave Forms Spat	al Vi	ew																																			
		-				-									\$	SST																					
F1 FRAME (bad) 2			FRA	ME_3				FR	AME	4				FR	AME	5		Т		FRA	ME	6		Τ		FR	AME	7		Τ		FF	RAME	8		I	F9
♦±€€<	>	«	>>	《《)	» ;	Ել	n <mark></mark>	M	₽																												
	0 :	016	5.61	6.16	59.	687							0:	016	.61	6.1	98	.82	(0:	01	6.6	16.	20	9.2	51		0:0	16.	61	6.2	19.	06.80	16.	616	5.23	30
AUX	T							-											-																		1
Link	T																	S	ST																		
Frame																						I	FRAN	1E_3													
Lines																								<u> </u>													
VBID	0 3 4				-																																
MSA																			М	SA																	
SDP																																					
Symbols			BS																																		
Lane 0	00	BC	7C 7	7C BC	01	77	91 0	0 00	00	00	00	00 0	0 0	0 50	C 50	00	17	77	08 9	8 04	4 65	00	2C	FD	00 0	0 00	0 0	0 0	000	00	00	00	5C	80 8	0 0	1 00	C
Lane 1	00	BC	7C 1	7C BC	01	77 9	91 0	0 00	00	00	00	00 0	0 0	0 50	C 50	00	17	77	00 C	:0 00	29	00	05	FD	00 0	0 00	0 0	0 00	0 00	00	00	00	5C	04 0	4 0	0 00	C
Lane 2	00	BC	7C 1	7C BC	01	77 9	91 0	0 00	00	00	00	00 0	0 q	0 50	C 50	00	17	77	07 8	04	4 38	00	00	FD	00 0	0 00	0 0	0 00	0 00	00	00	00	5C	4B [0 70	0 00	C
Lane 3	00	BC	7C 1	7C BC	01	77 9	91 0	0 00	00	00	00	00 0	0 0	0 50	c 50	00	17	77	00 8	0 00	20	00	00	FD	00 0	0 00	0 0	0 00	00	00	00	00	5C	18 D	010	00 00	C

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As the cursor moves over the view, the timestamp is displayed.

															SS	T																					
F1 FRAME (bad) 2		FRA	ME_3				FRA	ME	4				ł	RAN	4E_5	5			1	FRAN	1E_(6				FRAI	ME_T	7				FRA	ME	8		Т	F
ዕ∓େପ୍<	> <	x >	« >	» :	b "	m	M	M																													
	d:	016.6	16.1	77.(9501	6.6	16.	188	3.3	81				0:0	16.	. 61	5.2	01.	707	0:0	016	. 61	16.	209	.25	1	0	:01	6.6	616	.21	9.0	6£9	16.	61	6.2	23
AUX			-			-							F		_	=	2					+				-			-	-	=	-	•	_	-	-	=
Link													t					SST													_						_
Frame																_						F	RAM	E_3							_						
Lines																						I	LINE	0_2													
VBID	034								_						_															_	_	_		_	_		
MSA	1												t		T	_			MSI	1																	
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Lane 0	00 1	BC 7C	7C BC	01	77 9:	00	00	00	00	00	00 0	00	00	5C	5C (00 1	7 7	7 08	98	04	65	00	2C	FD (0 0	0 00	00	00	00	00	00 0	0 5	C 8	30 8	0 0	10	0
Lane 1	00 1	BC 7C	7C BC	01	77 9:	00	00	00	00	00	00 0	00	do	5C	5C (00 1	77	7 00	C0	00	29	00	05	FD (0 0	0 00	00	00	00	00	00 0	0 5	ic (04 0	4 0	0 0	0
Lane 2	00 1	BC 7C	7C BC	01	77 9:	L 00	00	00	00	00	00 0	00	do	5C	5C (00 1	77	7 07	80	04	38	00	00	FD (0 0	0 00	00	00	00	00	00 0	0 5	ic 4	4B D	0 70	0 0	0
Lane 3		20 20	20 20	01	17 01	00	00	00	20	00	000	00	do	E.C.	50 0	00 1	77	7 00	00	00	20	00	00	ED (0 00	00	00	00	00	00 0	0 5	0 1	0 7	1 0	0 0	-

Move the mouse over an event period in Wave Form View to see details via a popover.

FrameView Reports Imag Main Link Events Symbols					Wave Forms Spati	al Minut		
Q void	tog trong		X d D As C	REap H 1 /8042 H Q	-			807
Type	M	Position	Duration	End	FI FRAME (bad) 2		FRAME 3	ENAME 4 FRAME 5 FRAME 6 FRAME 7 FRAME 8 FS
 SST Stream 		POSIDO	Laration	End III	0 F Ø Ø <			
> FRAME/badl	1	0.000.009.259.063	0.002.207.395.066	0.002.216.654.129	MIX	-	0:016.61	616.204.860 0:016.616.213.850 0:016.616.220.930 0:016.616.228.0199:016.616.23
> FRAME(bad)	2	0.002,216,654,130	0:014.399.524.856	0.016.616.178.996	Link	1		447
✓ FRAME	3	0.016.616.178.997	0.016.666.123.615	0.033,282,302,612	Fraze			25A405_3 11005_0
 BLANK(45 lines) 	,	0.016.616.178.997	0:000.666.590.772	0.017.282.769.769	VBID	3	_	
 BLANK(45 imes) LINE 	0	0.016.616.178.997	0:000.014.752.772	0016.630.931.769	AUA	1		1914 III
	0	0.016.616.178.997	0.000.000.004.938	0016.616.183.935	SOP Symbols			(State) Store Id. 2
BS		0.016.616.183.936	0.000.000.001.233	0016.616.185.169	Lane 0 Lane 1		77 08 77 00	
VBID		0.016.616.185.170	0.000.000.001.234	0016.616.186.404	Lane 2	00 1 37	77 07	IT and an and a second se
MVID					Lane 3	00 17	77 00	
MAUD		0:016.616.186.405	0:000.000.001.233	0.016.616.187.638				swid 6007 0x1777 swid 32766 0x8000
MSA		0.016.616.199.985 734 334 385 am	0.000.000.011.110	0.016.616.211.095				WACLINE 1920 0x700 WACLINE 1000 0x430
SDP_84	0	0.016.616.224.676	0.000.000.014.813	0.016.616.239.489				HTOTAL 2200 0x890 VTOTAL 1125 0x465
Details Image								NOTARI 192 DuCO 92Teri 41 De29
(FRAME)					0 ± < > «			VSymildeb 5 0x5 Milymildeb 46 0x20
Start : 0:016.616.1 End : 0:033.292.3		134 593 910 bits 169 592 379 bits			Q. C. Y. C.			M MINCO 32 0x20 0000000 MINCI 0 0x0 0000000
Duration : 0:016.666.13		134 998 470 bits			ACK	0:016.614	0.1/9.57	MISCO.Synchronous Clock: Link clock and main wideo stream clock are asynchronous.
BTotal : 2200 pixel:					Link	-		MIDCLIDITIACED Vestical Total Even: Number of lines per interlaced frame (consisting of two fields) is as odd num MIDCLISTERED Video Attribute: No ID stered video in-hand signaling
VTotal : 1125 lines EActive : 1920 pixel:					MIA/SDF			MIDC.Colorimetry Format Value: 1 0x1 00000001
					Symbols Lane 0	BC.	70	BE MIDC.Colorimetry Format: BiB unspecified color space (Legacy BUB mode), 8 hpc, Sbpc
					Lane 1 Lane 2	10		
RStart : 192 pixels VStart : 41 lines							- 10	00 00 00 01 17 17 17 17 77 77 77 77 08 00 07 00
SStart : 192 pixels					Lane 3	28.		98 C0 80 80 80 04 00 04 00 65 29 38 20 00 00 00
EStart : 192 pixels VStart : 41 lines ESync : 44 pixels					Lane 3 Phy Lane 0			20 05 00 00
EStart : 192 pixels VStart : 41 lines ESync : 44 pixels						- 828.54	33C/10 328.3-	12 05 00 00 00 125:34 125:5- 100:5- 100:3- 10:34 10:3- 10:34 10:34 10:34 10:4
EStart : 192 pixels VStart : 41 lines ESync : 44 pixels						2 201780 - 828.54 100010000 2 170/80	330/10 828.3- 003/70	11/2 cr 00 01 175.34 175.5 175.5 175.5 175.5 175.5 175.5 175.5 175.6 175.4 175.4 175.4 175.4 175.7 17
IStart : 192 pixels /Start : 41 lines ISync : 44 pixels					Hty Lane 0	2 222780 - 822.54 199911 1994 2 170780 + 822.55 199911 1991	330/10 328,3- 100000000 005/70 828,3+	12 2 10 0 01 12 1.1 2 12 1.2 50.5 50.5 10.2 14.4 00.7 10.7 10 12.4 10.4 10.4 10.4 10.4 10.4 10.4 10.4 10
EStart : 192 pixels VStart : 41 lines ESync : 44 pixels					Hty Lane 0	2 222/80 - 822.54 1000101000 2 170/80 + 820.55 1000100100 2 170/80	330/10 828.3- 003/30 828.3+ 10000000 603/30	100 (20 00 04) 100 (2- 00.4) 100 (2-
HStart : 192 pixels VStart : 41 lines HSync : 44 pixels					Hty Lane 0 Hty Lane 1	2 22.760 - 825.54 100011010 2 170/80 + 825.5- 100010100 2 170/80 + 825.5-	330/10 828.3- 003/30 828.3+ 003/30 828.3+	

Double-clicking anywhere in the *Wave Forms View* synchronizes the *Symbols View* and the event is selected in *Event Selector* when as shown below. The green vertical area in *Wave Form View* shows the position within an event.

TimeLineViewer C\Users\juha.esk File Options About	ola\Pictures\ci	ipture_20230717_1348	06																			-	- 0
FrameView Reports Image	ы																						
Main Link Events Symbols	Log Events					Wave Forms Spa	tial View																
vbid 🔍			X 🛃 🗆 Aa 🗌	RExp H 1 / 8042	н о	F1 FRAME (bad)	2	776	AME 3	-	FRAM	5.4	-	SS FRAME 5		51	RAME 6		FRAM	5 7	-	FRAME F	2 25
Fypa > Line(5780) > Line(5780) > Line(5780) Line(5780) Line(5780) NVD MVD BE Line(5780) Line(5780)	ld 354 355 356 357 358 358	Position 0.0221366.451.505 77710 6896 0.0213975258.598 0.0213910.079270 0.021390.079270 0.0213910.079270 0.0213910.075676 777205055 0.0213919.715676 0.0213919.715676 0.0213919.715676 0.0213919.715676 0.0213919.715676 0.0213919.715676	Duration 0:00:014.807.092 0:14 Science 0:00:014.821.0571 0:00:014.821.056 0:00:014.821.056 0:00:0014.821.056 0:00:0014.821.056 0:00:0014.821.056 0:00:0010.001.234 0:00:00.001.021.24 0:00:00.001.021.24 0:00:00.001.021.24 0:00:00.001.021.24 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.001.234 0:00:00.001.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.001.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.001.234 0:00:00.000.000.001.234 0:00:00.000.000.001.234 0:00:00.000.000.000.000.001.234 0:00:00.000.000.000.000.000.000.001.234 0:00:00.000.000.000.000.000.000.000.000	End 0.0111875285357 0.021189027289 0.021189027289 0.021199072829 0.021199709554 0.021199709554 0.0211997295557 0.021199755577 0.021199755577 0.021199751845 0.021199718.145 0.021199718.145 0.021199718.145 0.021199718.145 0.021199718.145 0.021199718.145 0.021199718.145 0.0211997218.145 0.021197218.145 0.021197218.145 0.0211977218.145 0.02119		AIX Link Frame Villo	> "	» «	» 3	Laura		-	0102	21,920,	867.57!		1:021.92	21.477.1			0102	1.937.3	
Details Image [LINE] Start : 0:021.919.70 Rnd : 0:021.934.52	1.535/ 1	77 553 420 bits 77 673 399 bits				0 ∓ ↔ «	<u>» «</u>		021.93		197		0.01	21.919.	212 401	0	1.021 91	19.721.	10'	01021	919 72	5 76'0+0	021.919.72
Duration : 0:000.014.81	2.030;	119 980 bits				AUX							0103		1471361	•				01044			
VBID 0 0x0						Link										TC							_
VerticalBlanking: FALSE						Lines MSA/SDP										PR	AME 3 LI	NE (5760)	358				
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CompressedStream: FALSE MVID 0 0x0 MAUD 0 0x0						Phy Lane 0	13 1 - E	7c/sc 28.5-	0c3/7c K28.3+	33c/7c 828.3-	283/8C 328.5+	2AC/4C D12.2- 00	0DA/7A D26.3- 77	1AA/CA D10.6- 91	DAM/04 D4.0- 00	110101010 157/87 D23.5- 00	26C/2C D12.1- 00	2c5/8r D15.4+ 00	292/42 D2.2* 00	22D/E2 D2.7- 00	25c/3c D28.1- 00	297/57 D23.2- 00	081/11 220 D17.0+ D2 00 0
HBlank = 0 HActive = 5760						Phy Lane 1	- E	83/8C 28.5+	33C/7C K28.3-	0C3/7C K28.3+	17C/BC #28.5-	2AC/4C D12.2- 00	31A/7A D26.3+ 77	1AA/CA D10.6- 91	354/04 D4.0+ 00	160/87 D23.5+ 00	26C/2C D12.1- 00	13A/0F D15.4- 00	2AD/42 D2.2- 00	1D2/E2 D2.7+ 00	25C/3C D28.1- 00	2A8/57 D23.2+ 00	371/11 1DG D17.0- D2 00 0
						Phy Lane 2	- 5	28.5-	K28.3+	828.3-	\$28.5+	D12.2- 00	D26.3- 77	D10.6- 91	D4.0-	D23.5- 00	D12.1- 00	D15.4+	D2.2*	D2.7- 00	D28.1- 00	D23.2- 00	081/11 220 D17.0+ D2 00 0
						Phy Lane 3							D26.3-	D10.6-	D4.0-	p23.5-	D12.1-	D15.4+			D28.1-	D23.2-	081/11 220 017.0+ 02 00 0

The image below shows you how the different areas of the Link Timeline Viewer synchronize when you double-click a *FRAME* in *Wave Form View*.

rameView Reports Image														
fain Link Events Symbols	Log Events	X	Aa 🗌 RExp. H	1 / 8042 🕨 🔇	Wave Forms Spa				201					
Type > LINE(5760) > TRAME > FRAME	id 1119 1120 1121 1122 1123 1124 4 5 6 7	Position 0.0333/01.227.644 0.033.200.227.644 0.033.222.23.050.785 0.033.222.23.050.785 0.033.222.73.786.644 0.033.222.745.644 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.033.2647.745.6447 0.035.755.755.755.7557 0.035.7557000000000000000000000000000000	Duration 0.000014.813.140 0.000014.823.140 0.000014.823.140 0.000014.825.55 173.0000 0.000014.815.056 0.000014.815.056 0.000014.815.056 0.000014.815.056 0.000014.815.056 0.000014.815.056 0.0000014.815.056 0.0016.666.111.268 0.016.666.111.268 0.016.666.111.268 0.016.666.111.268 0.016.666.111.268 0.016.666.111.268	End 0033208.227.543 0033223150.7843 0033223150.7845 0033223150.785 0033267.485.543 0033267.485.543 0033267.485.543 0033282.392.612 00459.3461.3861 00459.3461.3861 00459.4461 00459.4	TI FRAME (had) 2 ATX Link Frame Frame Lines WBID MOA STP STPD-18 Lane 0 Lane 1 Lane 2 Lane 3		172 FFW		\$40.571.94	PRAME_6 0:062.567. SST AVE_5	087.29		•	8 3.620.1
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Measuring

The ruler tool allows users to measure distance between two points on the timeline. Two right-clicks on the timeline (or on the same row) will display the distance between the two points as shown below.

Wave Forms Spatial Vie	w																												
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Zooming

Zoom happens via the mouse wheel. When zooming it is important to keep the cursor centered on your point of interest. Various events appear as vertical lines or solid areas when zoomed out. As you zooming in, spans begin to appear and finally text begins to appear. Images at various stages of zoom are shown below.

Original view.

TP34													
			BS-IDLE_1			FRAME	E FRA	ME_3	FRAME_4	FRAME	5 FRJ	ME_(FRAM
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> LINE(5760)	53	0:154.038.475.461	120 000 AM	0:154.053.290.210 1247.807.809.88	507 50.							-												
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> LINE(5760)	55	0:154.068.104.961 1.247.857 119.66	0:000.014.819.688 121 Ord Abs	0:154.082.924.649 1240/077149 kits	Lane 1	00 00 00 00	00 00	00 00	00 00	00 00	FB FF	FF 1	77 77	FF F	F FF	88 81	00	00 00	00 0	0 00 0	0 00	00 00	00 0	0 00
> LINE(5760)	56	0:154.082.924.650 1 245 077 108 etc.	0:000.014.814.749 UE OIX Adv	0.154.097.739.399 1.246 197 149 bis	Lane 2 Lane 3	00 00 00 00 00 00 00 00 00 00 00 00 00	00 00	00 00	00 00	00 00	19 FF	17 1	17 17	11 1	PP PP	FF F	00	00 00	00 0	00 00	00 00	00 00	00 0	
> LINE(5760)	57	0:154.097.739.400 1 Juli 107 108 em	0:000.014.814.749 UIT OTF AM	0:154.112.554.149 1.200.007 NO NO	Late J	60 00 60 60	00 00 1	00 00	00 00	00 00	10 11	4	n n	11 1	T IT	11 1	00	50 00	00 0	00000	10 00	00 00	00 0	00 00
> LINE(5760)	58	0:154.112.554.150	0.000.014.814.749	0.154.127.368.899																				
> LINE(5760)	59	0:154.127.368.900	0.000.014.819.687	0:154.142.188.587																				
> LINE(5760)	60	0:154.142.188.588	0.000.014.814.749	0.154.157.003.337																				
> LINE(5760)	61	0:154.157.003.338	0:000.014.814.749	0:154.171.818.087																				
> LINE(5760)	62	0:154.171.818.088	0.000.014.814.749	0:154.186.632.837																				
 LINE(\$760) 	63	0:154.186.632.838	0:000.014.814.749	0:154.201.447.587																				
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Zooming in so spans with text can be seen. Note that views are synchronized.

Spatial View

Spatial view shows the geometry of the frame.



FrameView Reports Images													
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TPS1		0.000.000.001.235	10 min 0:000.003.555.539	2.5h 0.900.003.556.774									
UNKNOWN		10 Alli 0.000.003.556.775	20.000.185.888.074	0:000.189.444.849									
TP51		0.000.189.444.850	0:000.650.178.636	0.000.839.623.486									
TP54		0:000.839.623.487	0:033.760.074.520	0.034.599.698.007									
UNKNOWN		6.002 980 bits 0.034.599.698.008	272-87-800-bit 0:000.007.693.793	200 250 779 em 0:034.607.391.801									
551		280 258 782 win 0.034,607,391,802 287 877 788 win	0213.942.609.675 7707 NOT BEE AM	200 227 DW an. 0:248.550:001.477									
> Lane 1		280 321 100 km	7 752 942 682 am	2-319-264-779-965									
> Lane 2													
> Lane 3													
✓ SST Stream													
✓ RS-IDLE	1	0:034.607.391.802	0.118.645.842.649	0:153.253.234.451									
> BLANK(11732 lines)		200 327 338 Million 0:034.607.391.802	0.118.645.842.649	0:153.253.234.451									
> FRAME	2	200327 X00 bits 0:153253234,452	901425530 Mill 01016.667.808.559	0:169.921.043.011									
> FRAME	3	0.169.921.043.012	0.016.667.803.620	0:186.588.846.632									
FRAME	4	0.186.588.846.633	0:016.667.803.620	0:203.256.650.253									
> BLANK(45 lines)		0.186.588.846.633 1.571.271.271.551	0000.666.653.873 5 209 527 bits	0:187.255.500.506 1.5% 776-78580		888.			E.e.a	NEA.			
> ACTIVE(1080 lines)		0.187.255.500.507	0:016.001.149.746	0/203/256/650/253					1.10				
> FRAME	5	0.203.256.650.254	0:016.667.808.559	0/219/924.458.813									
> FRAME	6	0.219.924.458.814	0:016.667.803.620	0/236/592/262/434									
> FRAME	7	0.236.592.262.435	0:011.957.739:042 H ## 071 65	0/248.550.001.477									
		1916-405710-656	96.228-CVI 6-5	2010/204/779-000	140				Actived				
					-				ALLING				
Details Image			-										
[FRAME] Start : 0:186.588.846													
End : 0:203.256.650 Duration : 0:016.667.803													
WTotal ; 2200 pixels													
VTotal : 1125 lines MActive : 1920 pixels													
WActive : 1080 lines													
HStart : 192 pixels VStart : 41 lines			1										
HSync : 44 pixels													

Selecting a FRAME in Event Selector View will display it in Spatial View.

Double-clicking on the timeline, will select the LINE in the Event Selector View as shown below.



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



If you double-click an event label in the *Spatial View* (*MSA* label shown here), it is selected in the *Event Selector View* and details are shown in the *Event Details View*. Details of the event will also be shown in a popover when hovering over the label.



Symbols View

Symbol View shows symbols from the *PHY* lanes in addition to those shown in *Wave Form View*. Scroll *Symbols View* via drag or by using the arrow keys.

	<u> </u>		170.0.	7.545.0		111	111	047.9	53				70.017.						017.55				0:170.	017.565	.830		:170.01	17.
AUX Log AUX																												
Log MSA																												
Log VB-ID																												
Log Link																												
Log VFRAME INFO																ST												_
Link HST Lines																ST	7	RAME 3 L	INE 0									-
	Q.à					-													1110_0									_
SST VBID	4	_		-	_	_	_		_	_						_												-
SST MSA																									3	ASA		
Symbols							VBID	MVI		AUD					DUNMY					SS	SS				MSA Pavlo			
Lane 0	F	BC	7C	70	2	c	11	76		00	00	00	00	00	(0	00	00	00	5C	SC	00	17	76	08	98	04	
Lane 1		BC		7C	B		11	76		00	00	00	00	00		0	00	00	00	5C	5C	00	17	76	00	C0	00	
Lane 2 Lane 3	F	8C		70	1		11	76		00	00	00	00	00	0	0	00	00	00	50	50	00	17	76	07	80	04	
Lane 3		1111010	110000110	0001111001	111000					1000011		100100011		101100001						110000101	0001111010	100011010:	100101001					
Phy Lane 0	F	C/BC 8.5-	0C3/7C K28.3+	33C/7C K28.3-	283 K28	.5+	D20.0-	199/ D25. 76	6- D1	13.3+ 00	14D/AD D13.5- 00	D29.3	00	- D30.	0	.7+	32B/64 D4.3- 00	D14.0+	25D/3D D29.1- 00	143/5C K28.2+	2BC/5C K28.2-	D8.0+	D4.6+	157/B7 D23.5- 76	D18.7+	31B/7B D27.3- 98	D1.5+	
Phy Lane 1	/AD 21	13/BC	33C/7C K28.3-	0C3/7C K28.3+		/BC		199/	D9 00	D/6D	14D/AD D13.5-	31D/7		E 09E/	1E 1D9	/E9	0D4/64 D4.3+	34E/0E		2BC/5C	143/50 K28.2+	0A7/08						
Phy Lane 2	/AD 1	C/BC	0C3/7C	33C/7C	283	/BC	374/14	199/	D9 30	D/6D	14D/AE	022/7	D 27A/2	F 361/	1E 219	/29	328/64	08E/0E	25D/3D	143/5C	28C/5C	358/08	194/C4	157/B		323/63		
	F 01010001		110000110	K28.3-		001010				00		00		00		0			00		K28.2-				07	80		
Phy Lane 3	/AD 11 .5- Ki F	C/BC 18.5-	0C3/7C K28.3+	K28.3-	283 K28	.5+	11 11	199/ D25. 76	6- DI	00	D13.5- 00	D29.3	+ D15.1	- D30.	0+ D25	0	D4.3- 00	D14.0+	25D/3D D29.1- 00	143/5C K28.2+	¥28.2-	D8.0+	194/C4 D4.6* 17	157/B7 D23.5- 76	D26.7*	0E3/63 D3.3- 80	D5.5- 00	
4 <i>UX:</i>				Εv	en	ts	of	the	Al	JX	cha	nne	el															
Link:				Li	nk	sta	ate	(TF	PS1	۱, ٦	ΓPS	2, T	PS3	, TF	PS4	, S	ST,	MS	T et	c.)								
Log Aux				Lc	g I	pa	cke	ts i	for	ΑL	J																	
Log MSA				Lc	g	pa	cke	ts i	for	M	S																	
Log VB-ID				Lc	g	pa	cke	ts i	for	VE	3-ID)																
Log Link				Lc	g	pa	cke	ts i	for	Lii	nk (TPS	51, 7	PS.	2, T	PS	3, 1	TPS-	4)									
Log VFRAM	E IN	FC		Lo	g	via	leo	fra	те	e d	ata																	
Link:				Li	nk	sta	ate	(TF	PS1	۱, ٦	ΓPS	2, T	PS3	, TF	PS4	, S	ST,	MS	T et	c.)								
Lines:				Fr	am	ne	anc	l lir	ie i	านเ	nbe	er																
VBID				Ve	erti	са	bl	ank	ing]																		
MSA				Μ	SA	p	eric	bd																				
SDP				SE	ΟP	(s	ecc	ond	ary	da	ata	pac	kets)														
Symbols:				Сс	ont	rol	an	d s	ре	cia	l sy	mb	ols p	beri	ods													
Lanes (0-3):	•			De	ecc	bde	ed o	lata	a ai	nd	cor	ntrol	syr	nbo	ls													
PHY Lanes (0-3):		Bi	na	ry	bit	stre	ear	n,	10b	/8b	scra	amb	led	sy	mb	ols,	syn	nbol	cod	le ar	nd					

Link Symbols

Thu tone O		3A8/F7	0A5/05			24B/2B			/BC 33C/7C				1E 09C/1C		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		10b symbol	0.000	(101000)	01		91	00	00
	1110011	1110101000	1010011011	1001011010	0100011110	1101001001	0100101100					1011)	100001110101	10010101011	0010011001	1011010010
100 C 100 C 100 C	1/31	057/F7	365/05	169/A9	1E2/FD	24B/2B	0D2/62	170	8b symbol	: 0xBC			E 35C/1C	354/04	264/3B	12D/82
Phy Lane 1	7.1-	K23.7-	D5.0-	D9.5-	D29.7+	D11.1-	D2.3+	K28	Symbol code			00000	- D28.0-	D4.0+	D27.1+	D2.4-
	00		00	00	00	00	00		Descramble	index :	53874 02	kD272	77	91	00	00
	1110011	1110101000	1010011011	1001011010	0100011110	1101001001	0100101100	00111					100001110101	10010101011	0010011001	1011010010
	1/31	057/F7	365/05	169/A9	1E2/FD	24B/2B	0D2/62	170	Start :	0:049.9	48.413.88	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	48.415.11	17	- D28.0-	D4.0+	D27.1+	D2.4-
	00		00	00	00	00	00		Duration :	0:000.0	00.001.23	35	77	91	00	00
	1110010	0001010111	1010010100	1001011010	1011100001	1101001001	1011010011	11000	Start :	404 59	0 750 bit	ts.	011001110010	01101010100	1101101001	010010110;
	1/31	3A8/F7	0A5/05	169/A9	21D/FD	24B/2B	32D/62	283	End :		0 759 bit		E 09C/1C	0AB/04	25B/3B	2D2/82
hy Lane 3	7.1-	K23.7+	D5.0+	D9.5-		D11.1-			Duration :		10 bit		+ D28.0+	D4.0-	D27.1-	D2.4+
	00		00	00	00	00	00		a an a c'h syster y			V 8	77	91	00	00

The lower part of the *Symbols View* displays the values of link symbols on the physical link lanes. You can see the individual bits above the symbol blocks. When you hover your mouse over a symbol, a popover shows details of the symbol:

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

A ink symbols is shown below.

Each block contains the following information

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

Scrambling

The result of scrambling can be seen in *Symbols View*. The first row of each block below shows 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	011.7+	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
	010 010 00	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* in light green. CD_ADJ symbols are highlighted in light red.

	67			В2		
B1				бA		
94	42		A0	2A		
94	42	F8	A0	2A		
1001101010	1110001100	1001011101	1001001101	0100111010	1100010001	10
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+	
1000111010	0011101001	1100010010	0110110010	0101011100	1110010011	01
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-	
0010110010	1011010101	0011001110	0110001010	0101011001	1010011011	01
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-	
0010110010	1011010101	0011001110	0110001010	0101011001	1010011011	01
134/94 D20.4+	2AD/42 D2.2-	1CC/F8 D24.7+	146/A0 D0.5+	26A/2A D10.1-	365/05 D5.0-	2
	B1 94 94 1001101010 159/B9 D25.5- 1000111010 171/B1 D17.5- 0010110010 134/94 D20.4+ 0010110010 134/94	B1 3C 94 42 94 42 1001101010110001100 110001100 159/B9 0C7/67 D25.5- D7.3- 1000011101000000000000000000000000000	B1 3C 83 94 42 F8 94 42 F8 100110101011100011001001011101 100101011001001011101 159/B9 0C7/67 2E9/89 D25.5- D7.3- D9.4- 100001110100000011100001001001001001001	B1 3C 83 90 94 42 F8 A0 94 42 F8 A0 1001101010101001001001010100100101010000	B1 3C 83 90 6A 94 42 F8 A0 2A 94 42 F8 A0 2A 100110101010100100100100100100100100100	B1 3C 83 90 6A 68 94 42 F8 A0 2A 05 94 42 F8 A0 2A 05 1001101010100000000000000000000000000

SDP

SDPs are highlighted in turquoise. You can see the start of the SDP event marked as SS and the end of the SDP event marked as SE.

										SST				
									BS-IDI	E 1 LINE	_3			
							SDP	01_7						
	SS													SE
	5C	00	60	00	01	2C	00	B4	00	80	00	00	7 F	FD
	5C	01	07	00	01	2C	00	B4	00	80	00	00	7 F	FD
	5C	47	D5	00	01	2C	00	В4	00	80	00	00	7 F	FD
	5C	18	31	00	01	2C	00	В4	00	80	00	00	7F	FD
. 0	1100001010	1100011100	0101101101	0101100101	0011100110	0100101110	0100011101	1000110001	1101100101	1100010110	0101001011	1010011010	0101101010	01000101110
	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	B4	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														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	B4	00	80	00	00	7 F	
. 0														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	7 F	

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.

	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
0010101101	10001010111	1100010001	0011101001	0110100101	1001011001	1100011010	1110001100	0110110100	0111001110	1100010101	1000010111	01000110100:
36A/0A	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
	01110101000	1100011110	0011101001	0110100101	1001011001	1100011010	0001110011	1001001011	0111001000	1100010101	0111101000	10111010100
A0/AA0	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
0010101010	01110101000	1100011110	0011101001	0110100101	1001011001	1100011010	0001110011	1001001011	0111001000	1100010101	0111101000	10111010100
A0/AA0	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
0010101101	10001010111	1100010001	0011101001	0110100101	1001011001	1100011010	1110001100	0110110100	0111001110	1100010101	1000010111	01000110100
36A/0A	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.

							SST						
	FRAME 4	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	0110100110
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		1001001001	0110011101	0011100101			0110100110
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	1010101011		0110100110
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					0110100110
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.

	es																		
in Link Events Symbols	Log Events				Wave Forms	Spatial View													
vbid		×	🛃 🗌 Aa 🗌 RExp	l4 1 / 34953 🕨 🔇	TP34	85-7	IDLE 1		72 73	T4 T5	F6 F 7	887 71 73	F10 F1	1 712 7	13 F14	715 7	16 117	F10 F11	720 7
Туре	Id	Position	Duration	End	0±@Q			34											
Lane Events							588.738.			d	034.588.	787.73	0:03	4.588.81	5.891	0.0	34.588.	844.006	134.588
SST Stream					AUX					+ 1					-				
BS-IDLE	1	0.034.588.782.007	0:118.982.428.831	0:153.571.210.838	Link Frame	UND	NOWN			_	_					8	SST 18-IDLE 1		
 BLANK(512 lines) 		0.034.588.782.007	0.005.178.151.418	0.039.766.933.425	Lines												LINE_0		
✓ LINE	0	0.034.588.782.007	0.000.010.113.535	0.034.598.895.542	VBID	34													
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						5R								
MVID		0.034.588.788.180	0.000.000.001.233	0.034.588.789.413	Lane 1						- 10								
MAUD		0.034.588.789.414	0.000.000.001.234	0.034.588.790.648	Lane 2 Lane 3					_									
> LINE	1	0.034.598.895.543	0.000.010.113.535	0.034.609.009.078															
> LINE	2	0.034.609.009.079	0.000.010.113.535	0.034.619.122.614															
> UNE	3	0:034.619.122.615	0.000.010.113.535	0.034.629.236.150															
> LINE	4	0.034.629.236.151	0.000.010.113.535	0.034.639.349.686															
> LINE	5	0.034.639.349.687	0.000.010.113.535	0.034.649.463.222															
> LINE	5	0.034.649.463.223	0.000.010.113.535	0.034,659,576,758															
> LINE		280 661 880 bits		202 742 798 kin															
			0.000.010.113.535																
	7	0.034.659.576.759 200 740 200 Mill 0.034.669.690.295	0.000.010.113.535 81 925 Min 0.000.010.113.535	0.034.669.690.294															
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> LINE > LINE	8	200 Tel 800 Mil 0.034.669.690.295 200 605 720 Mil 0.034.679.803.831 200 907 640 Mil	81 520 Min 0.000.010.113.535 81 520 Min 0.000.010.113.535 81 520 Min	0.034.669.690.294 200.625 729.605 200.625 729.603 200.627.629.603 200.607.629.605 0.034.689.917.366 200.607.59.605			38.781.			0:	034 588.	788.47	0:03	4.588.79	2.29	0:0	34.588.	796.111	034.588
> LINE	8	0.034.669.690.295 0.034.679.803.831	0.000.010.113.535 0.000.010.113.535 0.000.010.113.535	0.034.669.690.294 306.827 279.860 0.034.679.803.830 306.87.669.803.830 0.034.689.917.366	AUX Link					. 0:	034 588.	788.47	0:03	83	1		34.588.	796.10	034.588
> LINE > LINE > LINE	8	280 742 800 km 0.034,669,690,295 260 405 720 km 0.034,679,260 803,831 260 907 649 km 0.034,689,917,367	81 525 min 0:000.010.113.535 81 505 min 0:000.010.113.535 81 505 min 0:000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lines					• 0:	034 588.	788.47	0:03		1		34.588.	796.111	034.588
> LINE > LINE > LINE ails Image Y SYMBOL)	8 9 10	00034.669.690.295 0034.679.803.831 0034.679.803.831 0034.689.917.367 0034.689.917.367	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lines MMA/SDP Symbols	0:034.1	588.781.			VBI	D MVID	HAND		SS BS-IDLE 1	1 LINE_(0	MMY		
> LINE > LINE > LINE > LINE alls Image Y_SYMBOL] rt : 0:034.588.78 : 0:034.588.78	8 9 10 6.945; 2 8,179; 2	200 200 200 200 200 200 200 200 200 200	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lines MSA/SDP Symbols Lane 0 Lane 1	0:034.1	10 10	.113 .99 70 10	7C 7C	VB1 1C 13 1C 14	D MVID	MAUD 00 00	00	85-IDLE 1	00 00	0 DOP 00 00	00 00	00	00
> LINE > LINE > LINE alls Image Y_SYMBOL] rt : 0:1034.588.78 : 0:1034.588.78 ation : 0:000.000.00	8 9 10 6.945; 2 8,179; 2	000346699.690.295 00346699.890.295 0034679.803.831 0034689.917.367 0034689.917.367	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lines MMA/SDP Symbols Lane 0	0:034.1	10 10 10 10	.113 55 70 70 70 70 70	70 70 70 70	VB1 10 15 10 15 10 15	D MVID 00 00 00	MAUD 00 00 00	00 00 00	88 BS-IDLE 1 00 00 00 00	87 1 LINE_0 00 00 00	0 00 00 00 00	00 00 00 00	00 00 00	00 00 00
> LINE > LINE > LINE alls Image Y_SYMBOL] rt : 0:034.598.78 : 0:034.598.78 ation : 0:000.000.00	8 9 10 6.945; 2 8,179; 2	200 200 200 200 200 200 200 200 200 200	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lins MEA/SDP Symbols Lane 0 Lane 1 Lane 2 Lane 3	0:034.	10 10 10 10 10	.113 85 70 70 70 70 70 70 70 70	7C 7C 7C 7C 7C	V81 10 11 10 11 10 11 10 11 10 11	D MVID 00 00 00 00 00	HAUD 00 00 00 00 7 186/cD	00 00 00 374/14	89-IDL5 1 00 00 00 00 00 172/82 1	00 00 00 00 00 238/£7	0 00 00 00 00 00 00 00 00	12D/82	00 00 00 02/72	00 00 00 00 00
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> LINE > LINE > LINE > UNE Image r SYMEDL] r SYMEDL] r or 0.034,589,78 r or 0.004,589,78 r or 0.000,000,00 stion : 0.000,000,00 sticalBlanking: TRUE srlace: FALSE decofreman: TRUE	8 9 10 6.945; 2 8.179; 2 1.234;	200 200 200 200 200 200 200 200 200 200	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	AUX Link Lins MEA/SDP Symbols Lane 0 Lane 1 Lane 2 Lane 3	00 00 00 00 00 00 00 00 00 00 00 00 00	10 10 10 10 10 10 10 10 10 10 10 10 10 1	.113 55 70 70 70 70 70 70 70 70 70 70 70 70 70	70 70 70 70 803/70 828.3+ 82 80001100011 903/70 90	V80 1C 15 1C 11 1C 1 1C 11 1C	D MVID 00 00 00 00 00 00 00 00 00 00 00 00 00	HAUD 00 00 00 7 186/CD 7 186/CD 7 186/CD	00 00 00 374/14 520.0- 00 375/14	88-IDLE 1 00 00 00 00 00 00 00 172/82 118.5- 00 00 172/82 1172/82	00 00 00 00 00 00 00 00 00 00 00 00 00	0 00 00 00 00 00 00 00 00 00 00 00 00 0	00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 092/72 D18.3- 00 092/72	00 00 00 0022/62 D14.3- 00
> LINE > LINE > LINE - UNE III Image (_SYMBOL] - CO34.500.70 - CO34.500 - C - C - C - C - C - C - C - C	8 9 10 6.945; 2 9.179; 2 1.234;	200 200 200 200 200 200 200 200 200 200	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	ADX Link Lines MMA/SDB Symbols Lane 0 Lane 1 Lane 2 Lane 3 Fby Lane 0	00 00 00 00 00 00 00 00 00 00 00 00 00	10 10 10 10 10 822/10 828/0-	.113 89 70 70 70 70 70 70 70 70 70 70 70 70 70	7C 7C 7C 7C 8C3/7C 08 828.3+ 82 9C3/7C 08 828.3+ 82 9C3/7C 08 828.3+ 82	V80 10 11 10 1	D MVID 00 00 00 00 00 00 00 00 00 00 00 00 00	HAUD 00 00 00 1286/C0 + D0.6+ 00 7 186/C0 + D0.6+ 00	00 00 00 00 00 00 00 00 00 00 00 00 00	88-IDLE 1 00 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 00 238/E7 07.7+ 00 00 238/E7 00 00 00 00 00 00 00 00 00 00 00 00 00	0 00 00 00 00 00 00 00 00 00 00 00 00 0	122/82 D2.4- 00 122/82 D2.4- 00	00 00 00 02/72 D18.3- 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
> LINE > LINE > LINE - UNE III Image (_SYMBOL] - CO34.500.70 - CO34.500 - C - C - C - C - C - C - C - C	8 9 10 6.945; 2 9.179; 2 1.234;	200 200 200 200 200 200 200 200 200 200	41 000 ho 0.000010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535 41 000 ho 0.000.010.113.535	0.034.669.690.294 200.657 19 test 0.034.679.803.830 201 607 50 test 0.034.689.917.366 200 500 500 test 0.034.700.030.902	ADX Link Lines MMA/SDB Symbols Lane 0 Lane 1 Lane 2 Lane 3 Fby Lane 0	00 00 00 00 00 00 00 00 00 00 00 00 00	10 10 10 10 10 10 10 10 10 10 10 10 10 1	.113 113 	70 70 70 70 803/70 828.3+ 82 80001100011 903/70 90	VE 1C 11 1C 11	D MVID 00 00 00 00 00 00 00 00 00 00 00 00 00	HAUD 00 00 00 00 00 00 00 7 186/C0 7 186/C0 7 186/C0 7 186/C0	00 00 00 00 00 00 00 00 00 00 00 00 00	88-1016 1 00 00 00 00 172/82 1 00 172/82 1 00 172/82 1 00 172/82 1 00 00	00 00 00 00 00 00 00 00 00 00 00 00 00	0 00 00 00 00 00 00 00 00 00	12D/82 D2.4- 00 12D/82 D2.4- 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
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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.

veView Reports Images																							
n Link Events Symbols Log Even	N			Wave Forms Se	utial View																		
vbid			4 1 / 34953 N 🔇										101										
						83-1068_1		1	2 83	- 24	P5 P	6 87	P8 P9	P10	P11 P12	813	F14	F15 F	26 - 81	7 910	P19	¥20	721
	Id Position	Duration	End	• • • • • • • • • • • • • • • • • • •	> « » «	x 🔉 🕑 🖬	😤 н н																
we Events					-0:000.00	0.020.065		000.026	57!		0:000.0	000.054.7	3(0:00	0.000.08	82.88!		0:0	00.000.	.111.04		:000.0	100
Lane 0				AUTK Link	E.										TFEL								
HARAFE AN	100	0.000.000.001.234	2.52	Trane																			
TPS1	0.000.000.001.235	0:000.943.085.996	0:000.943.087.231	Lines	0			-															
1154	2 003 0 10 007 000 7 670 001 http://www.	2022 614 202 646 202 605 MONIN	2021001212020	VBID	34																		
UNKNOWN	0.034.584.317.829	0:000.004.464.177	0.034.588.782.006	NISA SDP																			
SST	0-034.588.782.007	0.462.511.480.206	0.497.100.262.213	Symbols Lane 0																			
Lane 1				Lane 1 Lane 2																			
Lane 2				Late 3																			
Lane 3																							
Stream																							
RS-IDLE 1	0.034.588.782.007		0:153.571.210.838																				
✓ BLANK(512 lines)	0.034.588.782.007	0:005.178.151.418																					
	380 170 380 Mis																						
	0-034.588.782.007	0:000.010.113.535	0:034.598.895.542																				
V LINE 0	0-034.588.782.007	0.000.010.113.535 0.000.000.004.937	0.034.598.895.542																				
SR	0.034.588.782.007	0.000.000.004.937	0.034.588.786.944																				
SR VBID	0-034 588 782.007 0-034 588 786.945		0:034.588.786.944 0:034.588.786.944 0:034.588.788.179																				
SR VIIID MVID	0.034.588.782.007 0.034.588.782.007 0.034.588.786.945 0.034.588.788.180 0.034.588.788.180	0:000.000.004.937 2" m 0:000.000.001.234 1" m 0:000.000.001.233 1" m	001252 201949 00334 588 786.944 20117 201949 00334 588 788.179 20117 401449 00334 588 789.413 20117 401449	0 ± ↔ •																			
SR VBID MVID MAUD	0.034 588 782.007 0.034 588 782.007 0.034 588 786 585 0.034 588 788 180 0.034 588 788 180	0:000.000.004.937 0:000.000.001.234 0:000.000.001.233 0:000.000.001.234	200 200 201 500 0.034 500 201 500 201 10 201 500 0.034 500 201 500 0.034 500 200 413 201 10 201 500 0.034 500 200 500 0.034 500 2010				M		.054		01000.0	000.011.2	5!	0100	0.000.0	16.46;		010	00.000	.021.66	. 0	:000.0	00
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SR VBID MVID MAUD	0.034 588 782.007 0.034 588 786 545 0.034 588 788 180 0.034 588 789 414 0.034 598 595 543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 30 0034 588 786.944 2011 70 786.944 0034 588 786.798 0034 588 786.179 0034 588 786.413 2011 76 4596 0034 588 790.648 2011 76 4596 0034 589 009.078	* ATX Link Lines				0.000.006	.05+		01000.0	000.011.2	:51			16.46;	•	010	00.000.	.021.66	1 0	1000.0	00
SR VBD MVID MAUD > LINE 1 5 Image 8 ABEA1	0.034.588.782.207 0.034.588.782.207 0.034.588.785.945 0.034.588.788.180 0.034.588.788.180 0.034.588.788.180 0.034.588.895.543 0.034.598.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 30 0034 588 786.944 2011 70 786.944 0034 588 786.798 0034 588 786.179 0034 588 786.413 2011 76 4596 0034 588 790.648 2011 76 4596 0034 589 009.078	 AUX Link Lines HSBAJD9 Symbols 					.05+		01000.0	000.011.2	151			16.44;	•	010	00.000.	.021.66	1 . 0	:000.0	00
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SR VBD MVID MAUD LINE 1 Insor 1 01000,0001,001,235; 1 01000,001,001,235;	0.014588.782.007 0.014588.786.945 0.034588.786.945 0.034588.786.945 0.034588.786.995.543 0.034596.895.543 0.034596.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 30 0034 588 786.944 2011 70 786.944 0034 588 786.798 0034 588 786.179 0034 588 786.413 2011 76 4596 0034 588 790.648 2011 76 4596 0034 589 009.078	 Affic Link Lines NBA/30P Symbols Lane 0 Lane 1 Lane 2 	0100	0.000.003	0. 0	66. 66. 66. 67. 67. 67. 67. 67. 67. 67.	4A 4A 4A 2282/4A 200.2-	4A 4A 4A 4A 4A 2AA/4A D10.2-	6A 6A 6A 23A/4A 010.2-	4A 4A 4A 4A 2AA/4A 2AA/4A 2AA/4A 2AA/4A 2AA/4A	4A 4A 4A 4A 4A 4A 4A 4A 4A 4A 4A 2AA/43 0.2- 210.2-	43. 43. 43. 2342/48. 5 D10.2-	44. 43. 43. 111111111111 238./48. D10.2-	64. 64. 63. 101-101-101 2843/48. 2010-2-1	AA/4A	65, 65, 65, 63, 10,111,1111, 233,743, D10,2-	43. 43. 43. 43. 23. 23. 44. 23. 23. 44. 210.2-	4A. 4A. 4A. 23A/4A. D10.2-	4A 4A 4A 4A 23A/4A 2010.2-	0, 0, 0, 254/43 D10.2-	
SR VHD MVD MVD LINE 1 10000.0001.021.235/ 10000.0001.021.235/ 10000.0001.021.235/	0.014588.782.007 0.014588.786.945 0.034588.786.945 0.034588.786.945 0.034588.786.995.543 0.034596.895.543 0.034596.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 30 0034 588 786.944 2011 70 786.944 0034 588 786.798 0034 588 786.179 0034 588 786.413 2011 76 4596 0034 588 790.648 2011 76 4596 0034 589 009.078	 ATK Link Link Lines MSA/3DP Symbols Lans 1 Lans 2 Lans 3 Fty Lane 0 	0100	0.000.003	.243 0±000 43. 43. 43. 43. 43. 43. 43. 43. 44. 43. 44. 254./ 50.2- 550.: 14./44. 254./	4A 4A 4A 4A 2AA/4A 200.2-	4A 4A 4A 2AB/4A 2D10.2- 2AB/4A	4A 4A 4A 4A 2AR/48 D10.2- 2AR/48	4A 4A 4A 4A 23A/4A 2 23A/4A 2	4A 4A 4A 4A 2AA/4A 2AA/4A 2AA/4A 2AA/4A 2AA/4A 2AA/4A	6A 6A 4A 6A 4A 6A 4A 6A 4A 6A 4A 6A 4A 6A 2AA/64 0.2- 20.0.2- 10.1-1111111111111111111111111111111111	43. 43. 43. 10. 24A/48. 10.2-	17241 43. 43. 43. 43. 43. 44. 43. 44. 43. 44. 43. 44. 43. 44. 44	GA GA GA D10.2 E D10.2 E	248/4A	65 65 65 65 910-2- 288/48 200-2-	0. 0. 0. 234/4A D10.2-	43. 43. 43. 238/48. 238/48. 238/48.	4A 4A 4A 238A/4A D10.2-	0, 6, 6, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	
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SR VHD MVD MVD LINE 1 10000.0001.021.235/ 10000.0001.021.235/ 10000.0001.021.235/	0.014588.782.007 0.014588.786.945 0.034588.786.945 0.034588.786.945 0.034588.786.995.543 0.034596.895.543 0.034596.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 50 0034 588 786 944 2011 70 786 594 0034 588 786 788 779 0034 588 786 788 0034 588 790 648 2011 76 4596 0034 588 790 648 2011 76 4596 0034 588 000,0078	 ATK Link Link HEM/3DP Bymbols Bymbols Lane 0 Lane 1 Lane 3 Hty Lane 0 Hty Lane 1 	0100	0,000,003	.243 0:000	6A 6A 6A 7A 7A 7A 7A 7A 7A 7A 7A 7A 7A 7A 7A 7A	4/4 4/4 4/4 1000.2- 1000.2- 1000.2- 1000.2-	0. 0. 0. 10. 288/48. 010.2- 288/48. 010.2-	4A 4A 4A 234A/4A 1 234A/4A 2 234A/4A 2 234A/4A 2 234A/4A 3	4A 4A 4A 520,2- D1 524,44, 22 510,2- D1 524,44, 22 510,2- D1 524,44, 23 510,2- D1	6h 6h	43 43 43 1234/48 1234/48 1234/48	1931 44 44 45 228,/48 200.2- 200.2-	43 44 43 43 43 43 43 44 44 44 44 44 44 4	288/48 010.2- 288/48 010.2-	45. 65. 46. 67. 288/48. 200.2- 11.00.00 288/48. 200.2-	4A 4A 4A 23A/4A DI0.2- IIIIIIIII 23A/4A DI0.2- IIIIIIIIII	44 44 45 538/44 500.2- 238/44 200.2-	4A 4A 4A 2BA/4A 000.2- 2BA/4A 000.2- 2BA/4A	65. 65. 65. 284/48. D10.2- 284/48. D10.2-	
SR VHD MVD MVD LINE 1 10000.0001.021.235/ 10000.0001.021.235/ 10000.0001.021.235/	0.014588.782.007 0.014588.786.945 0.034588.786.945 0.034588.786.945 0.034588.786.995.543 0.034596.895.543 0.034596.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 50 0034 588 786 944 2011 70 786 594 0034 588 786 788 779 0034 588 786 788 0034 588 790 648 2011 76 4596 0034 588 790 648 2011 76 4596 0034 588 000,0078	 ATK Link Link Lines MSA/3DP Symbols Lans 1 Lans 2 Lans 3 Fty Lane 0 	0100 0100 0100 0100 01000 000000	0.000.003	243 01000 04 03 05 00 05 000 05 000 05 000 05 000 05 000 05 000 05 000 0000000000	GA GA GA GA GA GA GA GA GA GA GA GA GA G	(A. (A. (A. (A. (A.)) 284,748, 000.2- 284,748, 000.2-	0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	4A 4A 4A 4A 23A/4A 1 010.2- 0 010.2- 0 23A/4A 1 010.2- 0	(A (A (A) (A) (A) (A) (A) (A) (A) (A) (A	4A 4A 4A 4A 4A 4A 4A 4A 0.2- 200.2- 10.2-1	43, 43, 44, 51, 51, 51, 51, 51, 51, 51, 51, 51, 51	1931 44. 44. 45. 45. 45. 45. 45. 45. 45. 45.	63. 64. 63. 63. 63. 63. 63. 63. 63. 63. 64. 64. 64. 64. 64. 64. 64. 64. 64. 64	28A/4A 010.2- 100.2-	40 40 40 50 200.2- 200.4A 200.2- 200.4A 200.2-	43. 43. 43. 238/43. 200.2- 101012- 228/43. 200.2- 2101011- 228/43.	44 44 45 45 234/44 010.2- 234/44 010.2- 234/44 010.2-	44 44 45 45 238/44 010.2- 238/44 010.2- 238/44 010.2-	0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	
SR VIED MVID MAUD > LINE 1 5 Inser 1 0:000,000,001,235r	0.014588.782.007 0.014588.786.945 0.034588.786.945 0.034588.786.945 0.034588.786.995.543 0.034596.895.543 0.034596.895.543	0100.000.004.937 0100.000.001.234 0100.000.001.233 0100.000.001.233 0100.000.001.234 0100.000.001.234 0100.000.001.13.555	2012 2019 50 0034 588 786 944 2011 70 786 594 0034 588 786 788 779 0034 588 786 788 0034 588 790 648 2011 76 4596 0034 588 790 648 2011 76 4596 0034 588 000,0078	 ATK Link Link HEM/3DP Bymbols Bymbols Lane 0 Lane 1 Lane 3 Hty Lane 0 Hty Lane 1 	0100 4. 4. 4. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.	0.000.003	243 01000 40 43 41 43 42 43 43 43	(A) (A) (A) (A) (A) (A) (A) (A) (A) (A)	0. 0. 0. 0. 0.0	(h (h) (h) 284/48, D10.2- 284/48, D10.2- 284/48, D10.2-	4A 4A 4A 23A/4A 1 23A/4A 2 210.2- 0 23A/4A 2 210.2- 0 23A/4A 2 210.2- 0	(A (A) (A) (A) (A) (A) (A) (A) (A) (A) (6h 6h	43, 43, 43, 44, 44, 44, 44, 44, 44, 44,	19-81 40. 40. 40. 40. 40. 40. 40. 40. 40. 40.	63 64 63 63 61 61 61 61 61 61 61 61 61 61 61 61 61	28A/4A 510.2- 1044/4A 210.2- 1044/4A 100.2- 1040/4A 100.2- 1040/4A	65 65 65 65 65 65 65 65 65 65 70 70 70 70 70 70 70 70 70 70 70 70 70	6A 6A 6A 6A 6A 6A 6A 6A 6A 6A 6A 6A 6A 6	43. 43. 43. 234./44. DD0.2- 234./44. DD0.2- 234./45. DD0.2-	4A 4A 4A 23A/4A D10.2- 23A/4A D10.2- 23A/4A	65 65 65 65 258/48 D10.2- 258/48 D10.2- 258/48 D10.2- 258/48	

The image below illustrates the transition from TPS1 to TPS4.

		0	:000.85	4.696.3	325		0:000	.854.7	01.43:	(0:000.8	54.705.	841	0:00	0.854.	710.25(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-	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	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	2AA/4A D10.2-	0101010101 2AA/4A D10.2-	0101010101 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 2	2AA/4A D10.2-	2AA/4A	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-		097/17 D23.0- 00	1B9/C0 D0.6- 00	0B4/14 D20.0+ 00	172/B2 D18.5- 00
Phy Lane 3	D101010101 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-	0101010101 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	172/B2 D18.5- 00

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Frame Image View

Frame Image View can be used to select frames and GCP or AVI periods 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.

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.





Event Timeline Viewer is an application for inspecting data captured in capture tab.

Event Timeline Viewer consists of four areas.

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

		[duration: 192 164 000			
				AME_2 FRJ	TRAME_3 FRAME_4 FRAME_5 FRAME_6 FRAME_7 FRAME_8 FRAME_9 FRAME_1
ipp		2 ·	• • • • • • • • • • • • • • • • • • •	FRAME_2	FRAME_3 FRAME_4 FRAME_5 FRAME_6 FRAME_7 FRAME_8 FRAME_9 FRAME_10
Search			Aa RExp Id		Details Image [Log Packet]
Туре	ID	Start	Duration	End	Start : 0:000.125.559.001; 0 bits End : 0:000.125.560.001; 0 bits
HDMI	3	0:000.125.556.000	0:000.000.001.000	0:000.125.557.000	Duration : 0:000.001.000; 1 bits
HDMI	9	0:000.125.558.000	0:000.000.001.000	0:000.125.559.000	Packet code: 0x84 Audio Channel Count = 2
HDMI		0:000.125.559.001	0:000.000.001.000	0:000.125.560.001	Audio Coding Type = Refer to Stream Header Audio Stream Encoding Standard = Refer to Stream Header
AME	7	0:000.126.164.000	0:000.016.000.000	0:000.142.164.000	Audio Stream Transport Standard = Refer to Stream Header Sample Size = Refer to Stream header
g HDMI		0:000.142.223.000	0:000.000.001.000	0:000.142.224.000	Sample State = Refer to Steam Header Sampling Frequency = Refer to Audio Coding Type (CT) Audio Coding Extension Type = Refer to Audio Coding Type (CT)
g HDMI		0:000.142.225.000	0:000.000.001.000	0:000.142.226.000	Audio Stream Encoding Standard = Refer to Audio Coding Type (CT)
g 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
AME	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
g HDMI		0:000.158.889.000	0:000.000.001.000	0:000.158.890.000	Transformed HDMI Data:
ig 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
IN 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
ia HDMI		0:000.175.556.000	0:000.000.001.000	0:000.175.557.000	- T
ig HDMI		0:000.175.557.001	0:000.000.001.000	0:000.175.558.001	
ag month		0:000.175.558.002	0:000.000.001.000	0:000.175.559.002	
og HDMI		0.000.173.338.002	0.000.000.001.000	0.000.173.339.002	
og HDMI	10	0:000.176.164.000	0:000.016.000.000	0:000.192.164.000	

Frame View

UCD Timeline Viewer [duration: 203 906 000 bit	s]										-		×
		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	F	RAME_4	FRAME	5	FRAME_6	FRAME_7	FRAME_8	FRAME_9	FRAME_10
Frames	FRAME_2			FRAME_3					FRAME_4			FRAME
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.
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.

Zooming	on	the	timeline
С ∓Ө́́́́́́́ С́́́́́́́ < > « » « »Э́ № и и			
Frames FRAME_4			
HEMI			
HPD			

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.

$\mathbf{O} \pm \mathbf{O} \mathbf{O}$	< > « » « » 🕄 🏤 🛛 🖬		
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.

1.0.0		> « » « » !		ME_2 FR	UNE_3 TRAVE_4 TRAVE_5 TRAVE_6 TRAVE_7 TRAVE_8 TRAVE_9 TRAVE_
ianes MI 7D		> « » «« »	L LOG HIM		Log wint Log Hitti
U.					
Search			Aa RExp H	0 10 N	O Details Image
					[Log Packet]
Type	ID	Start	Duration	End	Start : 0:000.092.225.000; 0 bits End : 0:000.092.226.000; 0 bits
4E	3	0.000.059.498.000	0.000.016.000.000	0:000.075.498.000	Duration : 0:000.000.001.000/ 1 bits
IDMI		0:000.075.556.000	0.000.000.001.000	0:000.075.557.000	Packet code: 0x82
IDMI		0.000.075.558.000	0.000.000.001.000	0:000.075.559.000	Packet Header: Packet Length: 13
HDMI		0.000.075.559.001	0.000.000.001.000	0:000.075.560.001	Version: 2
ME	4	0.000.076.164.000	0.000.016.000.000	0:000.092.164.000	Packet Data:
HDMI		0:000.092.223.000	0.000.000.001.000	0:000.092.224.000	Scan Info(0:1) 0(No Data) Bar Data(2:3) 0(Not present)
HDMI		0.000.092.225.000	0.000.000.001.000	0:000.092.226.000	Format Info(4) 0 (Not present) Color Space(5:7) 0 (RGB)
HDMI		0.000.092.226.001	0.000.000.001.000	0:000.092.227.001	AFD Aspect(8:11) 8((ATSC: Same as Ficture Aspect Ratio) (DVB: As the coded frame)) Coded frame AR(12:13) 0(No Data)
ME	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)
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)
HDMI		0:000.108.891.000	0.000.000.001.000	0:000.108.892.000	ITC Content(23) 0 (No Data) VIC(24:31) 16
HDMI		0.000.108.892.001	0.000.000.001.000	0:000.108.893.001	Pixel repets(32:35) 0 (No repeats) ITC Type(36:37) 0 (Graphics)
ME	6	0.000.109.497.000	0.000.016.000.000	0:000.125.497.000	YCC Quant (38:33) 0 (Limited range) ETB(40:55) 0
HDMI	-	0.000.125.556.000	0.000.000.001.000	0:000.125.557.000	SBB (56:71) 0 ELB (72:87) 0
		0.000.125.558.000	0.000.000.001.000	0:000.125.559.000	SRB (68:103) 0
LIDAR					
HDMI HDMI		0.000.125.559.001	0.000.000.001.000	0:000.125.560.001	Transformed HIMI Data: 82 02 0D 57 00 08 00 10 00 00 00 00 00 00 00 00

Event Log

Type	ID	Start	Duration	End	Info	1
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		۰,

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

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.		

Details / Image

Details Image		
[Log Packet]		1
Start : 0:000.092.225.000;	0 bits	- 8
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 00 38	
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.



9. 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.

Tools Window Hel						
PRX Event Log	Memory Lay	rout Terminal	DP TX			
Start Stop					Load	Save Report Open Timeline View
DP RX	Filter:				Apply *	Device ID = 01 Stream ID = 00
HPD	Search:				< 0 / 0 > Search *	Data length = 3 VerticalBlanking_Flag = 1[bit 0]
AUX		Source	Туре	Start	Info	FieldID_Flag = 0[bit 1] Interlace_Flag = 0[bit 2]
SDP 🔘	1	DP RX	HPD		HPD High, PWR High, CD High	NovideoStream_Flag = 0[bit 3] AudioNute_Flag = 0[bit 4] HDCF SYNC DETECT = 0[bit 5]
VB-ID	2	DP TX	HPD	00.00:00.002.13		HDCP SYNC DETECT = 0[bit 5] CompressedStream_Flag = 0[bit 6] Reserved = 0[bit 7]
MSA 💿	3	DP RX	VB-ID	00.00:00.003.34	VB-ID = 0x01;	Mvid $= 0x77$ Maud $= 0x91$
Link Pattern	4	DP RX	MSA	00.00:00.003.34	1920x1080 (HT 2200, VT 1125, HS 192, VS 41, HW 44, VW 5)	
AUX_BW	5	DP RX	VFRAME INFO	00.00:00.003.34	VFA TYPE: VIDEO_DP_MEAS, VFA LENGTH: 2	
VFRAME INFO	6	DP RX	SDP	00.00:00.003.34	0x84 DP Audio [INFOFRAME]	
Select all	7	DP RX	VB-ID	00.00:00.004.02	VB-ID = 0x00;	
DP TX	8	DP RX	VB-ID	00.00:00.020.01	VB-ID = 0x01;	
HPD	9	DP RX	VFRAME INFO	00.00:00.020.01	VFA TYPE: VIDEO_DP_MEAS, VFA LENGTH: 2	
AUX Select all	10	DP RX	SDP	00.00:00.020.01	0x84 DP Audio [INFOFRAME]	
	11	DP RX	VB-ID	00.00:00.020.69	VB-ID = Ox00;	
Select all	12	DP RX	VB-ID	00.00:00.036.68	VB-ID = 0x01;	
	13	DP RX	VFRAME INFO	00.00.00.036.68	VFA TYPE: VIDEO_DP_MEAS, VFA LENGTH: 2	
	14	DP RX	SDP	00.00:00.036.68	0x84 DP Audio [INFOFRAME]	
	15	DP RX	VB-ID	00.00:00.037.36	VB-ID = 0x00;	
	16	DP RX	VB-ID	00.00:00.053.35	VB-ID = 0x01;	
	17	DP RX	VFRAME INFO	00.00:00.053.35	VFA TYPE: VIDEO_DP_MEAS, VFA LENGTH: 2	
	18	DP RX	SDP	00.00:00.053.35	0x84 DP Audio [INFOFRAME]	
	19	DP RX	VB-ID	00.00:00.054.03	VB-ID = 0x00;	
	20	DP RX	VB-ID	00.00:00.070.01	VB-ID = 0x01;	
	21	DP RX	SDP	00.00:00.070.01	0x84 DP Audio [INFOFRAME]	
	22	DP RX	VFRAME INFO	00.00:00.070.01	VFA TYPE: VIDEO_DP_MEAS, VFA LENGTH: 2	
	23	DP RX	VB-ID	00.00:00.070.70	V8-ID = 0x00;	
	24	DP RX	Link	00.00:00.074.60	00 8A 00 00	
	25	DP RX	Link	00.00:00.074.60	00 0A 00 00	

UCD Console - UCD-422 [2226C529]: HDMI Source and Sink File <u>T</u>ools <u>W</u>indow <u>H</u>elp - 🗆 ×

Start Stop	>			Load Save Report Open Timeline View
HDMI RX	Filter:			Apply *
HPD	Search:			< 0 / 0 > Search *
✓ Packets 🛞	ur ceo		Start	
⊡ I2C 🕸	896	HDMI	00.20:29.340.51	0x82 HDMI AVI [INFOFRAME]
✓ CEC ✓ Select all	897	HDMI	00.20:29.357.17	0x03 HDMI GCP
	898	HDMI	00.20:29.357.17	0x82 HDMI AVI [INFOFRAME]
HDMI TX	899	HDMI	00.20:29.373.84	0x03 HDMI GCP
IZC Ø	900	HDMI	00.20:29.373.84	0x82 HDMI AVI [INFOFRAME]
□ 12C (2) □ CEC	901	INFO	00.20:29.380.33	I2C Plain text
Select all	902	INFO	00.20:29.884.96	I2C Plain text
	903	HDMI	00.20:29.890.50	0x03 HDMI GCP
Select all	904	HDMI	00.20:29.890.51	0x82 HDMI AVI [INFOFRAME]
	905	INFO	00.20:29.895.02	I2C Plain text
	906	HDMI	00.20:29.907.17	0x03 HDMI GCP
	907	HDMI	00.20:29.907.17	0x82 HDMI AVI [INFOFRAME]
	908	HDMI	00.20:29.923.84	0x03 HDMI GCP
	909	HDMI	00.20:29.923.84	0x82 HDMI AVI [INFOFRAME]
	910	HDMI	00.20:29.940.51	0x03 HDMI GCP
	911	HDMI	00.20:29.940.51	0x82 HDMI AVI [INFOFRAME]
	912		00.20:29.957.17	
	913	HDMI	00.20:29.957.17	0x82 HDMI AVI [INFOFRAME]
	914		00.20:29.973.84	
	915	HDMI	00.20:29.973.84	0x82 HDMI AVI [INFOFRAME]
	<			× •

online

Role	Logged Events
DP Sink (UCD-400) DP Alt Mode Sink (UCD-424)	HPD, AUX, SDP, VB-ID, MSA, Link Pattern, AUX_BW, VFRAME INFO
HDMI Sink (UCD-422)	HPD, Packets, I2C, CEC
DP Source (UCD-400, UCD-411, 451) DP Alt Mode Source (UCD-424)	HPD, AUX
HDMI Source (UCD-422, UCD-412, 452)	HPD, I2C, CEC
DP Alt Mode Sink (UCD-424) DP Alt Mode Source (UCD-424)	PD, LSE

Start:	Starts event logging and stop it by clicking Stop.
Save:	Save transactions as Event Log data.
Load:	Load Event Log data.
Report:	Store event logs as reports in HTML format.
Open Timeline Viewer	Open Event timeline Viewer to inspect the captured data. For detailed instructions refer to chapters 6 and 7 of this manual.
AutoScroll:	When selected, transaction list is scrolled vertically. The latest transaction is shown as the last item of the list. When not selected, the items shown before clicking <i>Start</i> 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 <i>Start</i> .
Logged Events

HPD

Status and status changes of Hot Plug Detect (HPD) signal, power detection status and cable connection status.

AUX

Log DP AUX Channel transactions and Sideband Messaging.

SDP

Log DP Secondary-data Packets. Click the ⁽²⁾ 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 Dialog	×
DP RX SDP filtering:	
Enable logging of following packets [IDs in hex]:	
Audio_TimeStamp [1] Audio_Stream [2]	
Extension [4] Audio_CopyManagement [5]]
☑ ISRC [6] ☑ VSC [7]	
Camera Generic	
🗹 CG0 [8] 🗹 CG1 [9] 🗹 CG2 [A] 🗹 CG3 [8]	
🗹 CG4 [C] 🗹 CG5 [D] 🗹 CG6 [E] 🗹 CG7 [F]	
Picture Parameter Set [10] VSC_EXT_VESA [20] VSC_EXT_CTA [21] Adaptive-Sync SDP [2: InfoFrames	2]
✓ VS [80 + 1] ✓ AVI [80 + 2]	
SPD [80 + 3] Audio [80 + 4]	
✓ MPEG Source [80 + 5]	
Enter packet type as hex value separated by comma:	_
loxo, oxr	
OK Can	cel

VB-ID

Log Vertical Blanking ID packets sent in DP stream. Click the ¹/₂ button to open the *Event Filter Dialog*. The dialog enables definition of which events will be logged.

VBID filtering				
	Disabled	0n set	On clear	On any
VBLANK	0	0	0	۲
FIELD_ID	0	0	0	۲
INTERLACE	0	0	0	۲
NO_VIDEO	0	0	0	۲
NO_AUDIO	0	0	0	۲
HDCP_SYNC	0	0	0	۲
COMPRESSED	0	0	0	۲
RESERVED	۲	0	0	0
On MVID change				
On MAUD change				
🔾 Log all	(Log on	change	

MSA

Log Main Stream Attributes sent in DP stream. Click the ²⁰ button to open the *Event Filter Dialog*. The dialog enables logging of all MSA:s or just changes to selected parameters.

📶 Event Filter	Dialog		×
MSA filtering			
Enable logging I	MSA packet on ch	ange in:	
MVID	VID	HTOTAL	VTOTAL
HSTART	VSTART	HSP	HSW
VSP	VSW	HWIDTH	VHEIGHT
MISC0	MISC1		
🔵 Log all		Log on cha	ange
		ОК	Cancel

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 squence that either splits into 10 bytes or 8b/10b encoded symbols. For 10b symbols, either K/D codes or hex values must be provided. For bytes, hex values must be provided.

W Event Filter Dialog	×	11 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, hex)	~	Type:	Bytes (8bit, hex)
			Bytes (8bit, hex)
0 0 0 0 0 ff ff	ff ff ff	0 0 0 0	Symbols (10bit, hex)
			K/D codes (8bit/10bit enc.)
C	K Cancel		OK Cancel
			Cancer

AUX_BW

Log AUX_Bitwise transactions as a series of Manchester II codes.

VFRAME INFO

Dimensions of the catured frame measured by the Sink

Packets

Log metadata sent by Source device in HDMI stream

🕖 Event Filter Dialog					
HDMI RX InfoFrames f	itlering:				
Enable logging of follo	wing packets [IDs in hex]:				
🗹 VS [81]	🗹 AVI [82]				
SPD [83]	Audio [84]				
MPEG Source [85]	VTSC VBI [86]				
🗹 DRM [87]					
Enter packet type as hex value separated by comma:					
0x0,					
	OK Cancel				

I2C

Log data sent over I2C communication lines of HDMI interface

PD

Log USB-C PD communication messages

CEC

Log HDMI CEC communication messages

LSE

Event Filter Dialog			:
USB-C LSE thresholds:			
VBUS threshold	20		
IVBUS threshold	5 0	🜩 mA	
VCC threshold	50	₽ mV	
VSBU threshold	20	➡ mV	
IVCONN threshold	50	🗘 mA	
		ОК	Cancel

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

Event Transaction List

Transaction data in Transaction List is ordered in columns. Each column provides additional information about the data line, facilitating its viewing and interpretation.

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.

Start	Stop											Load		Save	Report	Open Timeline View
DP RX		Filter	r: _									Apply	*	Device		= 01 = 00
HPD		Sear	ch:	VB-ID			<	2	/2	0	>	Search	*	Data le	ength	= 3 g_Flag = 0[bit 0]
aux SDP		1	ur	Type HPD	Start 00.00:00.001.52	HPD High, PWR High, CD High	In	fo					i	FieldII Interla NoVideo	D_Flag ace_Flag Stream_Fl	= 0[bit 1] = 0[bit 2] lag = 0[bit 3]
VB-ID		2		HPD	00.00:00.001.52								1	HDCP ST	nc DETECT	
MSA	_	3		VB-ID	00.00:00.004.20	VB-ID = 0x01;								Reserve	bd	<pre>n_Flag = 0[bit 6] = 0[bit 7]</pre>
Iink Pattern		4		MSA	00.00:00.004.20	1920x1080 (HT 2200, VT 1125, HS 192, VS 41, HW 44, VW 5)					Mvid = 0x76 Maud = 0x91					
AUX_BW		5		VFRAME INFO	00.00:00.004.20	VFA TYPE: VIDEO DP MEAS, VFA LEN	IGTH: 2									
VFRAME INFO)	6	***	SDP	00.00:00.004.20	0x84 DP Audio [INFOFRAME]										
Select all		7		VB-ID	00.00:00.004.8	have been										
DP TX		8		VB-ID	00.00:00.020.8	Time from start of logging Time from device reboot										
🛃 HPD		9		VFRAME INFO	00.00:00.020.8	The former former of	IGTH: 2									
aux 🛛		10		SDP	00.00:00.020.8	Show as microseconds										
Select all		11		VB-ID	00.00:00.021.5	Show as hours.min.s.ms.us.ns										
Select all		12		VB-ID	00.00:00.037.5	Configure colors										
		13		VFRAME INFO	00.00:00.037.54	Configure columns VFA TYPE: VIDEO_UP_MEAS, VFA LEN	IGTH: 2									
		14		SDP	00.00:00.037.54	0x84 DP Audio [INFOFRAME]										
		15		VB-ID	00.00:00.038.22	VB-ID = 0x00;										
		16		VB-ID	00.00:00.054.21	VB-ID = 0x01;										
		17		VFRAME INFO	00.00:00.054.21	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	IGTH: 2									
		18		SDP	00.00:00.054.21	0x84 DP Audio [INFOFRAME]										
		19		VB-ID	00.00:00.054.89	VB-ID = 0x00;										
		20		VB-ID	00.00:00.070.88	VB-ID = 0x01;										
		21		VFRAME INFO	00.00:00.070.88	VFA TYPE: VIDEO_DP_MEAS, VFA LEN	GTH: 2									
		22		SDP	00.00:00.070.88	0x84 DP Audio [INFOFRAME]										
		23		VB-ID	00.00:00.071.56	VB-ID = 0x00;										
		24		VB-ID	00.00:00.087.54	VB-ID = 0x01;										
		25		VFRAME INFO	00.00:00.087.54	VFA TYPE: VIDEO_DP_MEAS, VFA LEP	IGTH: 2									

Source:	The communication port: DP RX, DP TX, HDMI RX, HDMI TX or HDCP 1.X, HDCP 2.3
Туре:	The logged item: HPD, AUX, SDP, VB-ID, MSA, Link Pattern, AUX_BW, VFRAME INFO (DP or DP Alt Mode) HPD, Packets, I2C, CEC (HDMI)
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. User can also color highlight various types of transactions for better readability.

Right-click on the list to open the menu.

•	Time from device reboot	<u>00</u>
	Time from previous event	0
	Show as microseconds	01
•	Show as hours:mins:secs.msecs.mcsecs.nsecs	0
	Configure colors	20
	Configure columns	1

Configure Start

The time indicated in column Start can be either:

- Time from device reboot
- Time from previous event

The time can be expressed either:

- In microseconds (1/1 000 000 Second)
- Hours : minutes : seconds : milliseconds : 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 c	olors	L.	
Add	Config Remove	▲ ▼ Clon	
Rule(a	pplied in order shown)	Format	Applies to
1 Normal line	On Packet	AaBbCcYyZz	

Add: Add a new color highlight rule

	· · · · · · · · · · · · · · · · · · ·
Config:	Modify the selected rule
Remove:	Delete the selected rule
Clone:	Duplicate the selected rule
▲ ▼:	Change order where rules are applied.

The rules are applied from the bottom to the top of the list.

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: Event: Event: HPD Bad: T AUX Pype = Norm.USB-C Voltage color =#fffUUSB-C Event textColor =#f000000 font=MS Shell Dig 2:8		✓ Type: SDP ✓ SubType: Extension ✓ Event: Audo Tmestamo Audo Stream Audo Stream Badx: Text: Reserved Extension Extension
Apply	Арр	ply Apply

Configure Columns

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

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.

///	Configure columns					×
	Available	^			Active	
1	HPD:hpd (60)		>	1	Source (60)	
2	HPD:pwd (60)		<	2	Туре (70)	
3	HPD:cd (60)			3	Start (164)	
4	HPD:+5V (60)		T	4	Info (735)	
5	AUX:address (60)					
6	AUX-length (60)	¥				
	Presets 🗸				Appl	у

Type Filter

Type filter dialog lists the types of transactions found in the list and allows the user to select which

Configure filter	×
Case Sensitive	
Columns:	
Source	
🗹 Туре	
Start	
🗹 Info	
Types:	
Турез	
V DP RX	- 11
HPD	
MSA MSA	
D AUX	
VB-ID	
L	
Select all	
Арр	у

transaction lines are currently shown.

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:

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

Device ID	=	01	[DP	RX]												
Hot-Plug-Detect Level	=	HIG	H													
PWD Level	=	HIG	H (D	P Tz	(is	connected	to	Rx	and	has	power	applied	to	AUX	pull-up	resistor)
Cable Detect Level	=	HIG	H													

AUX (UCD-400, UCD-411, UCD-424, UCD-451)

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

RD:	Native AUX Request Transaction for read
WR:	Native AUX Request Transaction for write
12C 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)
EDID Trace:	Accumulated EDID content from I2C or sideband down messages
DisplayID:	Accumulated DisplayID content from I2C or sideband down messages
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

	= Source to Sink
Native AUX Request	= Read = 6
	= 6 = 0x00200
Address	= 0x00200
Link/Sink Device Stat	
SINK COUNT [RO]	
0x00200	
Link/Sink Device Stat	us
DEVICE_SERVICE_IRQ_VE	CTOR
0x00201	
Link/Sink Device Stat	us
LANE0_1_STATUS [RO] 0x00202	
0x00202	
Link/Sink Device Stat	
LANE2 3 STATUS [RO]	
0x00203	
Link/Sink Device Stat	us
LANE_ALIGN_STATUS_UPD	DATED [RO]
0x00204	
Link/Sink Device Stat	us
SINK_STATUS [RO] 0x00205	
0x00205	

Sideband Message Example

Sideband message header Link_Count_Total Link_Count_Remaining Broadcast_Message

proadcast_message Path_Message MSG_Body_Length Start_Of_MT End_Of_MT Message_Sequence_No

MSG_Header_CRC MSG_Body_CRC

Sideband message validity check

Header Reserved (Zero) fields Message Transaction decode Request_Identifier Port_Number

Native AUX Reply = AUX_ACK
I2C-over-AUX Reply = AUX_ACK
Link/Sink Device Status SINK_COUNT [R0] 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 CC_IRQ = 0 MCCS_IRQ = 0 DOWN_REP_MSG_RDY = 1 UP_REQ_MSG_RDY = 0 SINK_SPECIFIC_IRQ = 0
Link/Sink Device Status LANEO_1_STATUS [R0] 0X00202 := 0x77 LANEO_CR_DONE = 1 LANEO_CHANNEL EQ_DONE = 1 LANEO_SYMBOL_LOCKED = 1 LANE1_CR_DONE = 1 LANE1_CHANNEL EQ_DONE = 1 LANE1_SYMBOL_LOCKED = 1

= Sink to Source

Link/Sink Device Status

Direction

	Sideband message header	
1	Link Count Total	1
0	Link Count Remaining	0
0	Broadcast Message	0
1	Path Message	1
3	MSG Body Length	7
1	Start Of MT	1
1	End Of MT	1
0	Message_Sequence_No	0
	Sideband message validity check	
7 [Good]	MSG Header CRC	0[Good]
95 [Good]	MSG Body CRC	20[Good]
[Good]	Header Reserved (Zero) fields	[Good]
	Message Transaction decode	
0x10[ENUM_PATH	Reply Type	ACK
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 66 D4 99 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 (UCD-400, UCD-424)

DP Secondary-data Packets.

SDP ID: SDP Type: SDP Length: SDP Version:	0x84 0x01B		
		Channel Count Refer to Stream Header	2
		Sample Size Sampling Frequency	
Data Byte 3: CXT[4-0]:	0x00	Refer to CT (Data Byte 1)	
Data Byte 4: CA[7-0]:	0x00	Channel Allocation	1 2 3 4 5 6 FL FR
LSV[6-3]:	0x0	Level Shift Value	Unknown or refer to other inform OdB Permitted or no information about
	00 00 0	00 84 D7 D1) 0 00 00 00 00 00 00 00 00 0 0 00 00 00	

VB-ID (UCD-400, UCD-424)

Vertical Blanking ID packets sent in DP stream.

Device ID =		00					
Stream ID =		00					
Data length =		3					
VerticalBlanking	F	lag	=	1	[bit	0]	
FieldID Flag			=	0	[bit	1]	
Interlace Flag			=	0	[bit	2]	
NoVideoStream Fla	lg	r	=	0	[bit	3]	
AudioMute Flag			=	1	[bit	4]	
HDCP SYNC DETECT			=	0	[bit	5 j	
CompressedStream	F	lag	=	0	[bit	6]	
Reserved		_	=	0	[bit	7]	
Mvid =		0x33	3				
Maud =		0x00)				

MSA (UCD-400, UCD-424)

Main Stream Attributes sent in DP stream.

Device ID	= 01
Stream ID	
Data length	
Mvid	
Nvid	
H-Total	
V-Total	
H-Active	
V-Active	
H-Svnc Width	
V-Sync Width	= 5
H-Sync Start	
V-Sync Start	
-	
MISC0	= 0x20
MISC0.Clock	= Asynchronous
MISC1	= 0x00
MISC1.Interlace	d Vertical Total Even: Number of lines per interlaced frame (consist
MISC1.Interlace	d Vertical Total Even: No 3D stereo video in-band signaling

Link Pattern (UCD-400, UCD-424)

Status of link pattern detected in which lane.

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

AUX_BW (UCD-400, UCD-424)

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

Packet conter																						
					[Dat	ia 1	ne a	589	•]													
Packet size			= 24	[b	ytes	•1																
Direction			= 30	uro	e to	3.	ink															
Native AUX Re	equest	0.3	= Wr	ite																		
Length			= 2																			
Data			08	08																		
Address			= 0×	001	03																	
Link Configu	ration																					
TRAINING LANS																						
0x00103 := 0:																						
VOLTAGE SI		ET =	lev	-1	0																	
MAX SWING																						
PRE EMPHAN																						
MAX PRE-EN					0																	
NOTE: Dec:						INNE	EL.	cor	IN	3 3	121		. 8	b/1	ŐЪ							
			-							-												
TX FFE PRI	ESET V	ALUE	= 8																			
NOTE: Deco	oded a	a MA	IN L	INK	CHJ	INN	EL	cor	IN	3 3	se:		1	282	/1:	32b						
VOLTAGE_SU MAX_SWING PRE_EMPHAI MAX_PRE-EI NOTE: Deci TX_FFE_PRI	_REACH SIS_SE MPHASI oded a ESET_V	ED = T = 1 S_REL s MA1 ALUE	leve ACHE IN_L = 8	el l 1 D = INK	0 _CHJ		1															
MAX_SWING PRE_EMPHA MAX_PRE-ED NOTE: Deco	_REACH SIS_SE MPHASI oded a ESET_V	ED = T = 1 S_REL s MA1 ALUE	leve ACHE IN_L = 8	el l 1 D = INK	0 _CHJ		1									32b						
VOLTAGE_SI MAX_SWING PRE_ENPHAI MAX_PRE-EN NOTE: Deci TX_FFE_PRI NOTE: Deci Transaction 1	_REACH SIS_SE MPHASI oded a ESET_V oded a Data	ED = T = 1 S_REL s MA1 ALUE	leve ACHE IN_L = 8	el l 1 D = INK	0 _CHJ		1									32b						
VOLTAGE_SI MAX_SWING PRE_EMPHAI MAX_PRE-ED NOTE: Dec TX_FFE_PRI NOTE: Dec Transaction 1 80 01 03 01 (Manchester 1)	REACH SIS_SE MPHASI oded a ESET_V oded a Data 08 08 I code	ED = T = 3_REL s_MA ALUE s_MA s_MA	leve ACHE IN_L = 8 IN_L	el l 1 D = INK	о _сня _сня	UNN	EL_	cor	IN	a_1	SET	-	1	281	/1							
VOLTAGE_SI MAX_SWING PRE_EMPRAI MAX_PRE_E NOTE: Dec TX_FFE_PRI NOTE: Dec Transaction 1 80 01 03 01 (Manchester II) preamble: 3	_REACH SIS_SE NPHASI oded a ESET_V oded a Data 00 00 I code L 0 0	ED = T = S_REL s MA ALUE s MA s MA	leve ACHE IN_L = 8 IN_L	el l 1 D = INK	о _сня _сня	UNN	EL_	cor	IN	a_1	SET	-	1	281	/1		0 0	0 0) 8		L	
VOLTAGE SI MAX_SWING FRE_EMPRAI MAX_FRE_EMPRAI NOTE: Dec: TX_FFE_PRI NOTE: Dec: Transaction 1 80 01 03 01 (Mancheater I) preamble: 1 preamble: 1	_REACH SIS_SE MPHASI oded a ESET_V oded a Data 08 08 I code L 0 0 1 0 0	ED = 1 T = 1 3_REI 3 MA1 ALUE 3 MA1 3 MA1	leve ACHE IN_L = 8 IN_L 0 0 x8]	el l 1 D = INK INK	о _сня _сня	0 0	el	0 0	IN 0	0	0	0	0	281 0 0	0	0 (0 () 8	1 11	r	
VOLTAGE SI HAX SWING PRE_ENFRAI HAX PRE-ENFRAI NOTE: Deci TX_FFE_PRI NOTE: Deci Transaction 1 0 01 03 01 (Hanchester II) preamble: 1 command: address:	_REACH SIS_SE MPHASI oded a Data 08 08 I code L 0 0 1 0 0 0 0 0	ED = T = S_REL s MA ALUE s MA s MA s MA	leve ACHE IN_L = 8 IN_L 0 0 x8] 0 0	el l 1 D = INK INK 0 0 0 0	0 (0 (0 (2 0	el	0 0	IN 0	0	0	0	0	281 0 0	0	0 (0 () H	t H	L	
VOLTAGE 3 HAX_SWING PRE_EMPHAI HAX_PRE-EN NOTE: Dec: TX_FFE_PRU NOTE: Dec: Transaction 1 80 01 03 01 Preamble: D preamble: D address: deress: length:	_REACH SIS_SE MPHASI oded a ESET_V oded a Data 08 08 I code L 0 0 1 0 0 0 0 0 0 0 0	ED = T = S_RE s MA ALUE s MA s MA c (o) 0 0 0 0 0 0	leve ACHE IN_L IN_L IN_L 0 0 &8] 0 0 0 0	el l 1 D = INK INK 0 0 0 0 1 [0 0 _CHJ 0 (0 (0 (0 (0 (2 0 2 1	el	0 0	IN 0	0	0	0	0	281 0 0	0	0 (0 (н	1.11	r	
VOLTAGE # MAX_SWING FRE_ENHEMAINAX, FRE-EN NOTE: Dec: TX_FFE_FRI NOTE: Dec: Transaction 1 80 01 03 01 Manchester II preamble: 1 command: address: length: data:	_REACH SIS_SE MPHASI oded a ESET_V oded a Data 08 08 I code L 0 0 1 0 0 0 0 0 0 0 0 0 0 0	ED = T = 3_REL a MA ALUE a MA 0 0 0 0 0 0 0 0 0 0 0	leve ACHE IN_L = 8 IN_L 0 0 0 0 0 0 0 0 0 0	el l 1 D = INK INK 0 0 0 0 1 [0 [0 (0 (0 (0 (0 (0 (0 (0 (0 (0 (2 0 1 1]	el	0 0	IN 0	0	0	0	0	281 0 0	0	0 (0 0) =	t H	L	1
VOLTAGE # MAX_SWING FRE_ENHEMAINAX, FRE-EN NOTE: Dec: TX_FFE_FRI NOTE: Dec: Transaction 1 80 01 03 01 Manchester II preamble: 1 command: address: length: data:	_REACH SIS_SE MPHASI oded a ESET_V oded a Data 08 08 I code L 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ED = T = : 3_REI 3 MA: ALUE 3 MA: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1	leve ACHE IN_L = 8 IN_L 0 0 0 0 0 0 0 0 0 0	el l 1 D = INK INK 0 0 0 0 1 [0 [0 (0 (0 (0 (0 (0 (0 (0 (0 (0 (2 0 1 1]	el	0 0	IN 0	0	0	0	0	281 0 0	0	0 (0 () н	t H	L	1

VFAME INFO (UCD-400, UCD-424)

Measure dimensions of capture video frame.



PD (UCD-424)

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_Capabil	ities(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 e	muals Toc(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 e	quals Ioc(0x0)
Voltage (1910)	9000mV(0x0B4)	
Maximum Current(90)	3000mA(0x12C)	
CRC	0x18F3953D	
End of packet		

LSE (UCD-424)

Status of USB-C Low Speed Electrical signals

Device ID	= 01
Packet size	= 40 [bytes]
Data length	= 40
Vbus TimeStamp	= 02:53:20.750.932.000
Vbus voltage	= 5420 mV [updated]
Vbus currens	= 88 mA
Vcc 1	= 5337 mV [updated]
Vcc 2	= 1680 mV [updated]
Vsbu 1	= 234 mV
Vsbu 2	= 2865 mV
Ivconn	= 5337 mA [updated]

Packets (UCD-422, UCD-452)

Log metadata sent by Source device in HDMI stream

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)
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 00 00 00	00 38
00 00 00	

I2C (UCD-422, UCD-452)

Log data sent over I2C communication lines of HDMI interface

Message: HDRX SCDC: RD 0x10:UPDATE[0] 0x0

CEC (UCD-422, UCD-452)

CEC messages

Flags: 00 Data length: 7 Ackonledges vector: 0x001F	
Header:	
Initiator address:	0x00
Destination address:	OxOF
Opcode Block:	
Opcode:	<report address="" physical="">(0x84)</report>
[Physical Address]	0.0.0.0
[Device Type]	TV(0x00)

EDID/DISPLAYID EDITOR 10.

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 that 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.

EDID DisplayID								
Add Item V Remove Item Filte	н			Editor Mod	e 🗌 Show Rea	d Only 🔽 Recur	se Read mode: O I2C Read	SBM Read Virtual Sink #1
Name		Editor	Text EDID					
✓ VESA			Name				Value	
> Vendor & Product ID EDID Structure Version at	d Revision Numbers							
 Basic Display Parameters 								
Color Characteristics								
Established Timings I Established Timings II								
Manufacturer's Timings								
Standard Timings: Identif	ication							
 Preferred Timing Block 18 byte descriptor 2 								
> 18 byte descriptor 3								
18 byte descriptor 4								
✓ CTA Info								
Features CTA v3								
Name	Value		00 01 02 0	3 04 05 04	07 08 09 0	DA OB OC OD	OE OF	
1 HDR Static	Disabled	000000	00 ff ff :	f ff ff fi	00 54 c7 3	36 40 46 0a	56 01	
2 HDR Dynamic	Disabled	000010	34 18 01 0	4 e5 3d 23	78 3a 5f k	ol a2 57 4f	a2 28	
Bate block collection 3 HDR10+	Disabled					81 c0 81 80		
Dally Misian						£2 70 5a 80		
⁴ Data block collection	Disabled					00 a0 a0 a0		
SBTM Data block collection	Disabled	~				00 00 00 fd 20 20 00 00		
	Disabled					50 31 0a 20		
	Enabled					7f 07 15 06		
						00 00 00 00		
		000000	00 00 00 0	0 00 00 00	00 00 00 0	00 00 00 00	00 00	
		0000B0	00 00 00 0	0 00 00 00	00 00 00 0	00 00 00 00	00 00	
		000000	00 00 00 0	0 00 00 00	00 00 00 0	00 00 00 00	00 00	
▼ Main Features		HEX Ed	dit Mode					Clear Apply
								Save As Load
Read from TE Write to TE								

Add	ltom	

Add Item	Add a new EDID or DisplayID block. Available when in <i>Editor Mode</i> exclusivly and a top node in treeview (CTA or VESA) is selected.
Remove Item	Delete the selected EDID or DisplayID block. Available when in <i>Editor Mode</i> exclusivly and a top node in treeview (CTA or VESA) is selected.
Filter	Show only items having the filter string in the field name.
Editor Mode	See below.
Show Read Only	Automatically generated non-editable fields are additionally shown.
Read mode	Data read mode: I2C (using I2C protocol) or SBM (MST mode only): virtual channels read via SBM protocol.
Recurse	All subitems of the selected item are presented in Editor View.
Virtual Sink #1 (DP)	Dropdown labled with the currently selected virtual sink (MST).

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*).

Main Features Read from TE Write to TE	HEX Edit Mode Clear Save As
Read from TE (Analyzer)	Read device local EDID/DisplayID blocks into editor (<i>HEX Edit Mode</i> must be unchecked).
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 paiars 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, txt and xml.
Load	Load EDID/DisplayID data from disk. Same formats as above available.

Note:

A source device is always able to read EDID data of the connected Sink device. A source device can read the DisplayID data of the sink device if the sink device permits. The connected sink device may or may not allow its EDID/DisplayID content to be modified.

Select the *Main Features* button to view items of common interest. For example, whether the sink is capable of HDR, or Dolby Vision, etc.

	Name	Value
	Max Resolution	10240 x 4320
	10K Max 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
0	SBTM	Disabled

The *Main Features* view *CTA v3* tab (avalable only in EDID tab not DisplayID tab) allows enabling/disabling features. You enable/disable a feature by selecting the *Value* field with *Editor Mode* enabled (<u>AND</u> HEX Edit Mode disabled). When a value is disabled and you want to enable it, the *Editor View* will be blank as focus has been set on the values to be enabled (and are zero when disabled). 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 left tree view.

Features CTA v3	
Name	Value
1 HDR Static Data block collection	Disabled
2 HDR Dynamic Data block collection	Disabled
3 HDR10+ Data block collection	Disabled
4 Dolby Vision Data block collection	Disabled
5 SBTM Data block collection	Enabled ~
	Disabled
	Enabled

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. Contents can be browsed. The Editor has a support for automatic variables, such as the block checksum. When a value in a block is modified, the checksum will be updated. Automatic variables are read only. A log print will be made when an automatic variable is updated by the editor.

Editing Tips

Editing is straightforward:

Select property fields to edit.

Red values in *HEX View* show that values have been modified. Press *Enter* to apply 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.

Values may be entered as hexadecimal or decimal regardless of presentation.

Floating point values must have a period "." decimal separator.

Click Set after changing a bit-value presented as a single checkbox if you want the new value applied.

Note: EDID Editor does not have an *Undo* function. Therefore, it is highly recommended that you back up un-edited EDID contents to a file before editing it.

11. PACKET EDITOR

Packet Editor enables creation and editing metadata packets.

Unigraf Packet Editor	- 🗆	×
Protocol Display Port V Type Audio V	New Save As Load	
Add Item , Remove Item Filter	Show read only properties	Recurse
Name	Name Value	^
✓ Audio InfoFrame	0 Audio Channel Count 2 channels	
Packet Header	1 Audion [Coding Type / Stream Encoding Stream Header	
 Packet Data Channel allocation (0 - 49) 		
	2 Sample Size Refer to Stream Header	- 1
	3 Sampling Frequency Refer to Stream Header	
	4 Type Channel allocation (0 - 49)	
	5 CA Channel allocation (0 - 49) 0	
	Channel allocation (0 - 49)	*
	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E	OF
	000000 00 84 1b 48 01 00 00 00 00 00 00 00 00 00 00	00
	000010 00 00 00 00 00 00 00 00 00 00 00	00
	000020 00 00 00 00	
	HEX Edit Mode Apply	

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)
- SBTMEM Source-Based Tone Mapping Extended Metadata (HDMI)
- 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.



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.

le						
Image Source	Logs					
xml version ="1.0<br Description > <scription ABSOLUTE COLORRGB 256 0 0 BOX 0 0 MAXX MAX SET H VS/2 SET H VS/2 SET H2 VS/4*3 SET C 1023*V/MAX SET C 1023*V/MAX SET C 1023*V/MAX COLORRGB 1023-C CIRCLE X 49 49 FCIRCLE X 49 49 FCIRCLE X 49 40 REPEAT A 10 MAX CIRCLE X 49 40 REPEAT A 10 MAX LINE X NO A H LINE X NO A H LINE X NO A H LINE X NO A H SET Z 100/3+5*2 COLORRGB 1023 10 BOX MAXX*6/16 MA COLORRGB 1023 11 EXTPOS MAX/2 M ALIGN C</scription 	t> 100 X ed green 3*C C 45 0 XY*7/16 MAXX; 23 1023		rue"> <description></description>	Sample pa	attern </th <th>~</th>	~
		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	_	×
File		
Image Source Logs		
		^
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 49 CIRCLE 50 49 20		
LINE 50 50 10 181		
LINE 50 181 10 270 LINE 50 362 10 270		
LINE 50 362 10 270 LINE 50 50 55 181		
LINE 50 50 55 181 LINE 50 181 55 270		
LINE 50 362 55 270		
LINE 50 502 55 270		
LINE 50 100 100 101 LINE 50 181 100 270		
LINE 50 362 100 270		
LINE 50 502 100 270		
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		
LINE 50 502 255 270		\checkmark

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.

13. 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.

IICL Converter		-		×
Advance mode		Ab	out	
Source image	Destination in	nage		
No image selected	Colorspace:	YCbCr		\sim
Select	Colorimetry:	ITU-R BT.	601	\sim
	Sampling:	4:4:4		\sim
	Bit depth:	8		\sim
			Conv	rert

Image Converter has two operating modes: Standard mode and Advanced mode. In Standard mode typical image file formats are used as Source image and the user sets basic color formats for the Destination image. In Advanced mode, the user is able to define the Source and Destination image parameters in detail.

Click Select to load the Source image. Click Convert to store the Destination image. File name for

UICL Converter			- 🗆	×
Advance mode			About	
Source image		Destination image		
Colorspace:	RGB ~	Colorspace:	YCbCr	\sim
Colorimetry:	ITU-R BT.601 ~	Colorimetry:	ITU-R BT.601	\sim
	full range		🗌 full range	
Sampling:	4:4:4 ~	Sampling:	4:4:4	\sim
Packing:	Planar ~	Packing:	Planar	\sim
Component order:	RGB ~	Component order:	YCbCr) ~
Alignment:	LSB ~	Alignment:	LSB	\sim
Bit depth:	8	Bit depth:	8	
Monochrome:		Monochrome:		
Width:	1920			
Height:	1080			
Path:	Select			
Selected file:	C:/Users/Tester/Pictures/capture_20221130_031408/capture_20221130_031408.mainlink.bin			
			Conv	/ert

the Destination image is of form:

Source_image_1920x1080_8bits_yuv444_lsb.bin

Source_image	Name of the image file used as Source image
1920x1080	Resolution of the Source Image
8bits	Bit depth of the Destination image
yuv444	Color space and sampling of the Destination image
lsb	Data alignment of the Destination image

APPENDIX A: PRODUCT SPECIFICATION

UCD-400 and UCD-411

Input	DisplayPort™ 1.4a compliant (DP Rx) <i>(UCD-400 only)</i>
Output	DisplayPort™ 1.4a compliant (DP Tx)
Max video mode	7680 × 4320 p30 input and output 3840 × 2160 p120 input and output
Audio	LPCM, 2 – 8 channels, 44.1 to 192 kHz
Content Protection	HDCP 2.3, HDCP 1.3
DSC Capability	DSC Sink with off-line decompression DSC Source using pre-compressed content
Additional features	FEC, LTTPR, DSC DP 1.4a LL CTS, DP DSC CTS HDCP 2.3 CTS
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, +12 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	280 × 200 × 80 mm
Weight	1.2 kg w/o power supply

UCD-422 and UCD-412

Input	HDMI 2.1 (10K@30Hz) (HDMI Rx) (UCD-422 only)
Output	HDMI 2.1 (10K@30Hz) (HDMI Tx)
HDMI 2.1 Features	FRL, TMDS, ALLM, VRR, QMS-VRR, SBTM
Content Protection	HDCP 2.2, HDCP 2.3
Additional features	eARC, DSC*, FEC*
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, +12 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	272 × 170 × 60 mm
Weight	1.2 kg w/o power supply

*) Please contact Unigraf for detailed availability

UCD-424

Input	USB-C DP Alt Mode 1.4a compliant (USB-C Rx)
Output	USB-C DP Alt Mode 1.4a compliant (USB-C Tx)
Max video mode	7680 × 4320 p30 input and output 3840 × 2160 p120 input and output
Audio	LPCM, 2 – 8 channels, 44.1 to 192 kHz
Content Protection	HDCP 2.3, HDCP 1.3
DSC Capability	DSC sink with off-line decompression DSC source using pre-compressed content
Additional features	FEC, LTTPR*, DSC DP 1.4a LL CTS, DP DSC CTS HDCP 2.3 CTS
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, +12 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	280 × 200 × 80 mm
Weight	1.2 kg w/o power supply

UCD-451

Output	DisplayPort™ 1.4a compliant (DP Tx)
Max video mode	7680 × 4320 p30 3840 × 2160 p120
Content Protection	HDCP 2.3, HDCP 1.3
Additional features	FEC, LTTPR, DSC DP 1.4a LL CTS, DP DSC CTS* HDCP 2.3 CTS*
DSC Capability	DSC source using pre-compressed content
User Interface	Computer with monitor, keyboard and mouse
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.
Video memory	Extended video memory up to 32 GBytes
Connections	6 x USB 3.0, 2 x Ethernet, 1 x HDMI
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 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	329 × 188 × 215 mm
Weight	3.9 kg w/o power supply

*) Please contact Unigraf for availability

UCD-452

Output	HDMI 2.1 (HDMI Tx)
Max video mode	10240 x 4320 @ 30Hz 10240 x 4320 @ 60Hz with DSC
HDMI 2.1 Features	FRL, TMDS, ALLM, VRR, QMS-VRR, SBTM DSC 1.2a, FEC, eARC*
Content Protection	HDCP 2.3, 1.4
User Interface	Computer with monitor, keyboard and mouse
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.
Video memory	Extended video memory up to 32 GBytes
Connections	6 x USB 3.0, 2 x Ethernet, 1 x HDMI
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 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	329 × 188 × 215 mm
Weight	3.9 kg w/o power supply

*) Please contact Unigraf for availability

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APPENDIX B: PRODUCT FEATURES

UCD-400, UCD-411, UCD-424 and UCD-451 Features

Input / Output Role	UCD-4XX 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)	•											
Playback	•											
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		•	٠							
AUX-less ALPM		•	٠							
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									•	

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UCD-400, UCD-411, UCD-424 and UCD-451 Features (cont.)

Input / Output Role	UCD-4XX 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 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	•											
Sink DUT Testing	•											
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 *			٠						
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*								•	

* Check availability for UDC-451 from Unigraf.

UCD-422, UCD-412 and UCD-452 Features

Input / Output Role	UCD-4XX Default	HDMI 1.4 Link Analyzer	TSI Basic
HDMI Reference Sink (UCD-422 only)			
Video status, preview and saving	•		
Buffered capture	•		
Audio monitoring, graphical preview and saving	•		
Link status	•		
Link control	•		
HPD status and control	•		
EDID read and write	•		
EDID Editor	•		
HDCP 1.4 status and control*	•		
HDCP 2.3 status and control*	•		
FEC Feature	•		
DSC Decoder, DSC Control	•		
ALLM, VRR	•		
Event Log	•		
InfoFrame status	•		
eARC	•		
Source DUT Testing	•		
HDMI 1.4 Link Analyzer		•	

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

HDMI Reference Source		
Video pattern generator (fixed patterns and timings)	•	
Custom video patterns and timings	•	
Playback	•	
Audio Generator	•	
Link status	•	
Link control	•	
EDID read and write	•	
EDID Editor	•	
DSC Encoder	•	
SCDC Editor	•	
Event Log	•	
Sink DUT Testing	•	
HDCP 1.4 status and control*	•	
HDCP 2.3 status and control*	•	

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

UCD-424 USB-C Features

Input / Output Role	UCD-4XX Default	TSI Basic
USB-C Modes Common		
USB-C Data Role status & control	•	
USB-C Power Role status & control	•	
USB-C Vbus / CC / Vconn voltage / current monitoring	•	
Power Delivery protocol monitoring	•	
Cable Info (E-marker details)	•	
Event Logger	•	
Support for USB-C Power for 5V/3A	•	
Support for USB-C Power for 9V/3A	•	
DP Alt Mode Common		
USB-C DP ALT Mode status	•	
USB-C DP ALT Mode control	•	

Product Options

UCD-400, UCD-411 and UCD-424 Product Options

Product	P/N	Product	P/N
HDCP 2.3 CTS for testing Source DUT on DP	MT6634	DSC Decoder for testing Source DUT on DP	MT6670
HDCP 2.3 CTS for testing Sink DUT on DP	MT6636	DSC Encoder for testing Sink DUT on DP	MT6671
HDCP 2.3 CTS for testing Repeater DUT on DP	MT6638	DP 2.1 Adaptive-Sync CTS for testing Source DUT (8b/10b)	MT6648
DP 1.4a LL CTS for testing Sink DUT	MT6635	DP 2.1 Adaptive-Sync CTS for testing Sink DUT (8b/10b)	MT6649
DP 1.4a LL CTS for testing Source DUT	MT6637	HDR 10+ Display Device and SSTM Test for testing Sink DUT on DP	MT6676
DP 1.4a DSC CTS for testing Source DUT	MT6642	HDR 10+ Distribution Device for testing Source DUT on DP	MT6678
DP 1.4a DSC CTS for testing Sink DUT	MT6643	DP 1.4a Link Analyzer	MT6655
DP 2.1 DisplayID / EDID CTS for testing Source DUT (8b/10b)	MT6646	DP 2.1 Panel Replay support for testing Sink & Source DUT	MT6685
DP 2.1 DisplayID / EDID CTS for testing Sink DUT (8b/10b)	MT6647	eDP support for testing Sink & Source DUT	MT6686

UCD-412, UCD-422 Product Options

Product	P/N	Product	P/N
DSC Decoder for testing Source DUT on HDMI	MT6672	HDR10+ DD and SSTM Tests for HDMI Sink DUT	MT6675
DSC Encoder for testing Sink DUT on HDMI	MT6673	HDR10+ DD and SSTM Tests for HDMI Source DUT	MT6677
HDMI 1.4 Link Analyzer	MT6658		

APPENDIX C: PREDEFINED TIMINGS

Description*	HA	VA	НТ	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (MHz)
CVT 640 × 480 @ 60 Hz	640	480	800	525	144	35	96	2	60	25,20
CTA 640 × 480 @ 60 Hz (VIC 1)	640	480	800	525	144	35	96	2	60	25,17
CTA 720 × 480 @ 60 Hz (VIC 2)	720	480	858	525	122	36	62	6	60	27,03
CTA 720 × 480 @ 60 Hz (VIC 3)	720	480	858	525	122	36	62	6	60	27,00
CTA 720 × 576 @ 50 Hz (VIC 17)	720	576	864	625	132	44	64	5	50	27,00
CTA 720 × 576 @ 50 Hz (VIC 18)	720	576	864	625	132	44	64	5	50	27,00
CTA 720 × 576 @ 100 Hz (VIC 42)	720	576	864	625	132	44	64	5	100	54,00
CTA 720 × 576 @ 100 Hz (VIC 43)	720	576	864	625	132	44	64	5	100	54,00
CTA 720 × 480 @ 120 Hz (VIC 49)	720	480	858	525	122	36	62	6	120	54,00
CTA 720 × 480 @ 120 Hz (VIC 48)	720	480	858	525	122	36	62	6	120	54,05
CTA 720 × 576 @ 200 Hz (VIC 52)	720	576	864	625	132	44	64	5	200	108,00
CTA 720 × 576 @ 200 Hz (VIC 53)	720	576	864	625	132	44	64	5	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 Eh)	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 10h)	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 17h)	1280	768	1664	798	320	27	128	7	60	79,67
DMT 1280 × 800 @ 60 Hz (ID 1Bh) [RB1]	1280	800	1440	823	112	20	32	6	60	71,11
DMT 1280 × 800 @ 60 Hz (ID 1Ch)	1280	800	1680	831	328	28	128	6	60	83,76
DMT 1280 × 960 @ 60 Hz (ID 20h)	1280	960	1800	1000	424	39	112	3	60	108,00
DMT 1280 × 1024 @ 60 Hz (ID 23h)	1280	1024	1688	1066	360	41	112	3	60	107,96
DMT 1360 × 768 @ 60 Hz (ID 27h)	1360	768	1792	795	368	24	112	6	60	85,48
DMT 1400 × 1050 @ 60 Hz (ID 29h) [RB1]	1400	1050	1560	1080	112	27	32	4	60	101,09
DMT 1400 × 1050 @ 60 Hz (ID 2Ah)	1400	1050	1864	1089	376	36	144	4	60	121,79

*) CVT: Coordinated Video Timings (CVT; VESA-2021-09-27 v2.0)

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

CTA: A DTV Profile for Uncompressed High Speed Digital Interfaces (CTA-861-H)

										Pixel
Description*	HA	VA	HT	VT	HST	VST	HSYN	VSYN	FR	Clock (MHz)
CTA 1440 × 240 @ 60 Hz (VIC 8)	1440	240	1716	263	238	18	124	3	60	27,00
CTA 1440 × 240 @ 60 Hz (VIC 9)	1440	240	1716	263	238	18	124	3	60	27,00
CTA 1440 × 480 @ 60 Hz (VIC 14)	1440	480	1716	525	244	36	124	6	60	54,00
CTA 1440 × 480 @ 60 Hz (VIC 15)	1440	480	1716	525	244	36	124	6	60	54,00
CTA 1440 × 576 @ 50 Hz (VIC 22)	1440	576	1728	625	264	22	126	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 33h)	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 @ 30 Hz (VIC 81)	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 39h) [RB1]	1680	1050	1840	1080	112	27	32	6	60	119,23
DMT 1680 × 1050 @ 60 Hz (ID 3Ah)	1680	1050	2240	1089	456	36	176	6	60	146,36
DMT 1792 × 1344 @ 60 Hz (ID 3Eh)	1792	1344	2448	1394	528	49	200	3	60	204,75
DMT 1856 × 1392 @ 60 Hz (ID 41h)	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 52h)	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; VESA-2021-09-27 v2.0) DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings

CTA: A DTV Profile for Uncompressed High Speed Digital Interfaces (CTA-861-H)

Description*	HA	VA	нт	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (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 45h)	1920	1200	2592	1245	536	42	200	6	60	193,62
DMT 1920 × 1440 @ 60 Hz (ID 49h)	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 4Dh)	2560	1600	3504	1658	752	55	280	6	60	348,58
DMT 2560 × 1600 @ 60 Hz (ID 4Ch) [RB1]	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 12)	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 3440 x 1440 @ 60 Hz	3440	1440	4688	1493	992	50	368	10	60	419.951
CVT 3440 x 1440 @ 60 Hz [RB1]	3440	1440	3600	1481	112	38	32	10	60	319.896
CVT 3440 x 1440 @ 60 Hz [RB2]	3440	1440	3520	1481	72	14	32	8	60	312.787
CVT 3440 x 1440 @ 120 Hz	3440	1440	4800	1545	1064	102	384	10	120	889.92
CVT 3440 x 1440 @ 120 Hz [RB1]	3440	1440	3600	1525	112	82	32	10	120	658.80
CVT 3440 x 1440 @ 120 Hz [RB2]	3440	1440	3520	1525	72	14	32	8	120	644.16
CVT 3440 x 1440 @ 165 Hz	3440	1440	4832	1588	1080	145	384	10	165	1266.081
CVT 3440 x 1440 @ 165 Hz [RB1]	3440	1440	3600	1559	112	116	32	10	165	926.046
CVT 3440 x 1440 @ 165 Hz [RB2]	3440	1440	3520	1559	72	14	32	8	165	905.467
CVT 3440 x 1440 @ 103 Hz [KB2]	3440	1440	4848	1622	1088	179	384	10	200	1572.691
CVT 3440 x 1440 @ 200 Hz [RB1]	3440	1440	3600	1586	112	143	32	10	200	1141.92
CVT 3440 x 1440 @ 200 Hz [RB1] CVT 3440 x 1440 @ 200 Hz [RB2]	3440	1440	3520	1586	72	143	32	8	200	1116.544
CVT 3440 x 1440 @ 200 Hz [RB2] CVT 3440 x 1440 @ 240 Hz	3440	1440	4848	1663	1088	220	384	10	200	1934.934
CVT 3440 x 1440 @ 240 Hz CVT 3440 x 1440 @ 240 Hz [RB1]	3440	1440	3600	1619	112	176	304	10	240	1398.816
CVT 3440 x 1440 @ 240 Hz [RB1]	3440	1440	3520	1619			32	8	240	1398.810
CVT 3440 X 1440 @ 240 HZ [RB2] CVT 3840 × 2160 @ 30 Hz [RB1]	3840	2160	4000	2191	72	14 28	32	5	240 30	
	3840		3920			28 14	32	5 8		262,92
CVT 3840 × 2160 @ 30 Hz [RB2]		2160		2191	72				30	257,66
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; VESA-2021-09-27 v2.0) DMT: VESA and Industry Standards and Guidelines for Computer Display Monitor Timings CTA: A DTV Profile for Uncompressed High Speed Digital Interfaces (CTA-861-H)

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
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
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 [RB2]	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 [RB2]	7680	4320	7760	4443	72	14	32	8	60	2068,66
CVT 7680 × 4320 @ 100 Hz [RB2]	7680	4320	7760	4529	72	14	32	8	100	3514,50
CVT 7680 × 4320 @ 60 Hz [RB1]	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
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 @ 60Hz (VIC 199)	7680	4320	9000	4400	768	64	176	20	60	2376,00

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CTA: A DTV Profile for Uncompressed High Speed Digital Interfaces (CTA-861-H)

Description*	HA	VA	нт	VT	HST	VST	HSYN	VSYN	FR	Pixel Clock (MHz)
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
Unigraf 10240 x 4320 @ 30 Hz [RB1]	10240	4320	11000	4500	112	58	32	5	30	1485,00
Unigraf 10240 x 4320 @ 30 Hz [RB2]	10240	4320	11000	4500	72	14	32	8	30	1485,00
CTA 10240 x 4320 @ 24 Hz (VIC 210)	10240	4320	12500	4950	768	614	176	20	24	1485,00
CTA 10240 x 4320 @ 25 Hz (VIC 211)	10240	4320	13500	4400	768	64	176	20	25	1485,00
CTA 10240 x 4320 @ 30 Hz (VIC 212)	10240	4320	11000	4500	472	164	176	20	30	1485,00
CTA 10240 x 4320 @ 48 Hz (VIC 213)	10240	4320	12500	4950	768	614	176	20	48	2970,00
CTA 10240 x 4320 @ 50 Hz (VIC 214)	10240	4320	13500	4400	768	64	176	20	50	2970,00
CTA 10240 x 4320 @ 60 Hz (VIC 215)	10240	4320	11000	4500	472	164	176	20	60	2970,00
CTA 10240 x 4320 @ 100 Hz (VIC 216)	10240	4320	13200	4500	768	164	176	20	100	5940,00
CTA 10240 x 4320 @ 120 Hz (VIC 217)	10240	4320	11000	4500	472	164	176	20	120	5940,00

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CTA: A DTV Profile for Uncompressed High Speed Digital Interfaces (CTA-861-H)

APPENDIX D: PREDEFINED PATTERNS

Fixed Patterns					
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	lcon	Description
Select Image	O,	Custom image uploaded by the user. Click on Select to browse.
Select DSC Image	O.	Custom DSC compressed image file uploaded by the user. Click on Select to browse.
Unigraf PM5544	2	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 cross-hatches, 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	X	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

Extended Patterns (cont.)

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 DisplayID / EDID CTS (8b/10b)*	DP 2.1 Adaptive-Sync CTS (8b/10b)*	HDCP 2.3 CTS*	HDR10+ Distribution Device Tests
Audio Test	Validate audio signal frequency and glitch-free audio reproduction	•						
CEC Functional Test Set (HDMI) (UCD-422)	CEC functional test, CEC PHY Addr test, CEC Complete test, CEC Wake up test, CEC Standby test	•						
CRC Video Tests (UCD-400, UCD-422, UCD-424) Will be available in future UCD-4XX versions	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	•						
Link Config Tests (DP) (UCD-400, UCD-424)	Link Training at All Supported Lane Counts and Link Rates	•						
Pixel Level Video Tests	Compare video frame sequence with a single reference							
VRR Source DUT Tests (HDMI) (UCD-412, UCD-422)	VRR static test, QMS Test, VRR Dynamic test	•						
DP 1.4a Link Layer CTS (UCD-400, UCD-424)	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, 4.4.4.1 – 4.4.4.6, 4.5.1.1 – 4.5.1.2		•					
DP 1.4 DSC CTS (UCD-400, UCD-424)	4.6.1.1 – 4.6.1.9			•				
DP 1.4 DisplayID-EDID CTS (UCD-400, UCD-424)	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				•			
DP Adaptive-Sync CTS (UCD-400, UCD-424)	4.8.1.1 - 4.8.1.2, 4.8.2.1 - 4.8.2.3					•		
DP HDCP 2.3 CTS 1A Test Set (UCD-400, UCD-424)	HDCP2.3 CTS 1A-01 - HDCP2.3 CTS 1A-12						•	
DP HDCP 2.3 CTS 1B Test Set (UCD-400, UCD-424)	HDCP2.3 CTS 1B-01 - HDCP2.3 CTS 1B-10						•	
HDR10+ Distribution Device Tests (HDMI RX / DP RX) (UCD-400, UCD-422, UCD-424)	Tests from: HDR10+ TEST SPECIFICATION, HDR10+ Distribution Device							•
HDR10+ SSTM Tests for Source (HDMI RX / DP RX) (UCD-400, UCD-422, UCD-424)	Tests from: HDR10+ TEST SPECIFICATION, Source Side Tone Mapping for Source Device							•

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

Sink DUT Testing		Default	DP 1.4a LL CTS*	DP 1.4a DSC CTS Sink DUT*	DP 2.1 DisplayID / EDID CTS (8b/10b)*	DP 2.1 Adaptive-Sync CTS (8b/10b)*	DP HDCP 2.3 CTS*	HDR10+ DD & SSTM CTS
VRR Sink DUT Tests (HDMI) (UCD-412, UCD-422)	VRR static test, QMS Test, VRR Dynamic test	•						
DP 1.4a Link Layer CTS (UCD-400, UCD-411, UCD-424)**	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 1.4a DSC CTS (UCD-400, UCD-411, UCD-424)**	5.6.1.1 – 5.6.1.26, 5.6.2.1 – 5.6.2.14			•				
DP 1.4a DisplayID-EDID CTS (UCD-400, UCD-411, UCD-424)**	$\begin{array}{l} 5.7.1.1-5.7.1.2,\ 5.7.1.3.1-5.7.1.3.4,\ 5.7.1.4.1-5.7.1.4.9,\ 5.7.1.5-5.7.1.6,\ 5.7.2.1-5.7.2.2,\\ 5.7.2.3.1-5.7.2.3.5,\ 5.7.2.4.1-5.7.2.4.2,\ 5.7.2.5.1-5.7.2.5.2,\ 5.7.2.6.1-5.7.2.6.2,\ 5.7.2.7.1,\ 5.7.2.8,\\ 5.7.3.1-5.7.3.5,\ 5.7.4.1-5.7.4.3,\ 5.7.4.5,\ 5.7.5.1,\\ 5.7.6.1-5.7.6.5,\ 5.7.7.1-5.7.7.6,\ 5.7.8.1-5.7.8.6,\ 5.7.9.1-5.7.9.3,\ 5.7.10.1-5.7.10.3,\\ 5.7.11.1-5.7.11.5,\ 5.7.12.1-5.7.12.4,5.7.13.1-5.7.13.2,\ 5.7.14.1-5.7.14.6,\ 5.7.15.1-5.7.15.9,\\ 5.7.16.1-5.7.16.7,\ 5.7.17.1-5.7.17.5,\ 5.7.18.1,\\ 5.7.20.1-5.7.20.3,\ 5.7.21.1-5.7.21.5,\ 5.7.22.1-5.7.22.7\\ \end{array}$				•			
DP Adaptive-Sync CTS (UCD-400, UCD-411, UCD-424)**	5.8.1.1 – 5.8.1.3					•		
DP HDCP 2.3 CTS 2C Test Set (UCD-400, UCD-411, UCD-424)**	HDCP2.3 CTS 2C-01 – HDCP2.3 CTS 2C-06						•	
HDR10+ CTS Tests (HDMI & DP)	HDR10+ Display Device and SSTM Tests							•
Cable test (UCD-422)	Cable Test Check	•						

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

**) Please check availability for UCD-451 from Unigraf

Repeater DUT Testing		Default	DP HDCP 2.3 CTS*
DP HDCP 2.3 CTS 3A Test Set (UCD-400, UCD-411, UCD-424)	HDCP2.3 CTS 3A-01 – HDCP2.3 CTS 3A-06		•
DP HDCP 2.3 CTS 3B Test Set (UCD-400, UCD-411, UCD-424)	HDCP2.3 CTS 3B-01 – HDCP2.3 CTS 3B-07		•
DP HDCP 2.3 CTS 3C Test Set (UCD-400, UCD-411, UCD-424)	HDCP2.3 CTS 3C-01 – HDCP2.3 CTS 3C-25		•

*) Separate licenses for testing Sink, Source and Repeater DUT (HDCP)

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Compliance Tests

Role:	Product:
DP Reference Sink (DP RX)	UCD-400, UCD-424
DP Reference Source (DP TX)	UCD-400, UCD-411, UCD-424, UCD-451*

*) Please check availability for UCD-451 from Unigraf

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-400.pdf*. It can be downloaded in Unigraf Document Center at https://www.unigraf.fi/documents/. 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 to 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.

eneral Audio DSC DisplayID Adaptive-S	ync					
Test Timeouts	Colorimetry				Test Automat	tion
Test Timeout (ms) 5000 💿	RGB G bpc VESA S bpc VESA 10 bpc VESA 6 bpc CTA 8 bpc CTA	□ 10bpc CTA (ITU.601) [□ 8bpc CTA (ITU.709) [] 10] 86	YCbCr 4:4:4 opc CTA (ITU.60 Obpc CTA (ITU.6 opc CTA (ITU.70 Obpc CTA (ITU.7	(01)	D_READ
	Select All				Event indicat	Always ready
DUT Capabilities Max lanes supported 4 ~	Video Modes					
Aax lanes supported 4 ~ Aax Bitrate supported HBR3 (8.10 Gbps) ~	Fail-safe video i	mode:			640 x 480 @ 60Hz 6 BP	с
	Maximum cum	orted video mode:	- 3840 x 2160 @ 60Hz 8 I	PDC		
Voltage Swing level 3 (1.2V) supported	waximum supp	onted video mode:			5640 X 2100 @ 00H2 61	DPC .
Pre-Emphasis level 3 (9.5dB) supported	Most Packed Tir	mings				
Fixed timing DUT	1 Lane				DMT 1280 x 768p @ 60	Hz, RB1, 6 bpc
Spread Spectrum Supported	2 Lanes				DMT 1400 x 1050p @ 6	0Hz, RB1, 8 bpc
Video format change without LT supported.	4 Lanes				CTA 1920 x 1080p @ 60)Hz. 10 bpc
Lane count reduction without LT supported.						
E-DDC supported	Time-stamp ger	neration				
Audio Info Frame supported for 2 channel audio		1 lane			2 lanes	4 lanes
DUT is Type-C Device	RBR	848 x 480 @ 60Hz 8 BPC	~	1280 x 720 @	60Hz 8 BPC V	1920 x 1080 @ 60Hz 8 BPC
FEC supported	HBR	1280 x 720 @ 60Hz 8 BPC	~	1280 x 960 @	60Hz 8 BPC V	1920 x 1080 @ 60Hz 8 BPC
FEC disable sequence supported	HBR2	1280 x 960 @ 60Hz 8 BPC	\sim	1920 x 1080 @) 60Hz 8 BPC 🛛 🗸 🗸	1920 x 1080 @ 120Hz 8 BPC
Audio without Video supported	HBR3	1920 x 1440 @ 60Hz 8 BPC	~	3840 x 2160 @) 30Hz 8 BPC 🗸 🗸	3840 x 2160 @ 60Hz 8 BPC

For a detailed description of capabilities listed on the tab please refer to Chapter 3 Compliance Test Operation of document VESA DisplayPort v1.4a Link Layer Compliance Test Specification.

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-400 firmware implements the test according to the test specification.

For running a test, select it and click **Run selected**. 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.

Test flow parameters like **Test timeout** and **Test cycle delay** can be defined in *Test Parameter* dialog launched by clicking **Configure**.

RX DP TX	Event Log Audio HI	CP EDID	DPCD DS	C Link Analyser	FEC SDP	Source DUT T	festing					
	RC Video Tests	Audio Test	DP 1.4 LL CTS				P 2.3 CTS 1B	HDCP 2.3 C	IS 3A	HDCP 2.3 C	TS 3B Pixel	evel Vide 4
Name								Pass	Fail	Skip	Runs L	ast status 🧹
	urce DUT Retry o	No-Reply Duri	ng AUX Read af	ter HPD Plug Event (3	(200us)			0	0	0	0	
4.2.1.2 So	urce Retry on Inv	alid Reply Durin	g AUX Read afte	er HPD Plug Event				0	0	0	0	
4.2.1.3 So	urce Device HPD	Event Pulse Len	gth Test					0	0	0	0	
4.2.1.4 So	urce Device IRQ_	HPD Pulse Leng	th Test					0	0	0	0	
4.2.1.5 So	urce Device Inact	ive HPD / Inacti	ve AUX Test					0	0	0	0	
	CD Receiver Cap							0	0	0	0	
	CD Receiver Cap	ability Read upo	n HPD Plug Eve	ent				0	0	0	0	
4.2.2.3 ED								0	0	0	0	
	ID Read Failure #							0	0	0	0	
	ID Read Failure #		DEFER					0	0	0	0	
	ID Corruption De							0	0	0	0	
	anch Device Dete							0	0	0	0	
	ID Read on IRQ H		Branch Device D	letection				0	0	0	0	
	DDC Four Block E							0	0	0	0	
	nk Status-Adjust							0	0	0	0	
	ccessful LT at All			ik Speeds				0	0	0	0	
	ccessful Link Trai							0	0	0	0	
				oltage Swing During C	lock Recovery S	equence		0	0	0	0	
	ccessful LT to a L							0	0	0	0	
				nimum Voltage Swing				0	0	0	0	
				sis Setting During Cha				0	0	0	0	
				nbol Lock During Cha	nnel Equalizatio	n Sequence		0	0	0	0	
	successful LT at L							0	0	0	0	
				nimum Voltage Swing				0	0	0	0	
				tion Sequence [loop o				0	0	0	0	
J 4.3.1.11 Sc	iccessful LI with	simultaneous R	equest for Differ	rential Voltage Swing a	and Pre-emphas	as during Clock I	Recovery Sequ	ence 0	0	0	0	`
Run Selecte	d Select	 Configu 	re Import	Export	Stop on Failur	e Repeats: 1	Delay 1	time, sec 1	•		Save Report	Clear All
				rential Voltage Swing a		-			0	0	0 Save Report	С

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 viewing without UCD Console.
Clear Log	Clear the test log and the results matrix

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 or with TSI scripting or sharing.
- Export parameters in *Sink 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 UCD 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.

	Pre	esets 🔻		
6		Save		
		Load	•	
		Remove	•	
		Import		
		Export		

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.

III Test operator feedbac	ck required X	
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 feedbac	k required	×
i	Check information field values Please 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.

Link HDCP Video Audio EDD DPCO SDP DSC FEC Source DUT Retrig All test Audio Test CRC Video Tests DP1ALL CTS HDCP23CTS18 HDCP23CTS38 HDCP23CTS38 Link config Tests Preal Lest Stat Variable 42.11 Source DUT Retry on No-Reply During AUX Read after HPD Plug Event (3200x) 1 0 1 Pass 42.11 Source DUT Retry on No-Reply During AUX Read after HPD Plug Event (3200x) 1 0 1 Pass 42.11 Source DUT Retry on No-Reply During AUX Read after HPD Plug Event (3200x) 1 0 1 Pass 42.13 Source Derice RRCiv MPD/ Instite Length Test 1 0 0 1 Pass 42.15 Source Derice RRCiv MPD/ Instite AUX Test 1 0						
Name Pass Fail Sky Runs Last at Last at Wirs 24.1.1 Source DUT Retry on Noi-Reply During AUX Read after HPD Plug Event (3200us) 1 0 0 1 Pass 24.2.1 Source Device Reply During AUX Read after HPD Plug Event 1 0 0 1 Pass 24.2.1 Source Device ROLPD Poly Lee night Test 1 0 0 1 Pass 24.2.1 Source Device RoLPDP During AUX Read after HPD Plug Event 0 0 1 Pass 24.2.1 Source Device RoLPDP Nuel Length Test 1 0 0 1 Pass 24.2.1 Source Device RoLPDP Mind EDD Read upon HPD Plug Event 0 0 0 0 0 4.2.2.2 DPCD Receiver Capability Read upon HPD Plug Event 0					-	
24.2.1.1 Source DUT Retry on No-Rephy During AUX Read after HPD Plug Event (3200us) 1 0 1 Pass 24.2.1.2 Source Retry on Invalid Rephy During AUX Read after HPD Plug Event 1 0 0 1 Pass 24.2.1.3 Source Device HDO Iven Hole Length Text 1 0 0 1 Pass 24.2.1.3 Source Device HDO Iven Hole Length Text 1 0 0 1 Pass 24.2.1.4 Source Device RDOI: Merk HDO Ivals Length Text 1 0 0 1 Pass 24.2.1.3 DPCD Receiver Capability and EDD Red upon HPD Plug Event 0 0 0 0 24.2.2.4 DPCD Receiver Capability Red upon HPD Plug Event 0 0 0 0 24.2.2.4 DPCD Receiver Capability Red upon HPD Plug Event 0 0 0 0 24.2.2.5 EDD Read Failure #1: I2C-Over-AUX NACK 0 0 0 0 0 24.2.2.5 EDD Cenve Bolex Hare Branch Device Detection 0				-	1	-
□ 2.1.2 Source Retry on Invalid Regiv Duing AUX Read after HPD Plug Event 1 0 0 1 Pass □ 2.1.2 Source Denice HD0 rend Weble Ength Text 1 0 0 1 Pass □ 2.1.4 Source Denice HD0 rend Weble Ength Text 1 0 0 1 Pass □ 2.1.4 Source Denice HD0 rend Weble Ength Text 1 0 0 1 Pass □ 2.4.2.1 Source Denice HD0 rend Weble Ength Text 0 0 0 0 1 Pass □ 4.2.1 Source Denice INDEX Media Upon HD0 Plug Event 0		atus	us:	\$	f	
□ 1.3 Source Device HoPe Liven Duise Length Text 1 0 0 1 Pass □ 4.2.1.4 Source Device Roch/PDP Duise Length Text 1 0 0 1 Pass □ 4.2.1.5 Source Device Roch/PDP Duise Length Text 1 0 0 1 Pass □ 4.2.2.1 DCD Readver Capability Read upon HDP Duig Event 0 0 0 0 □ 4.2.2.2 DPCD Readver Capability Read upon HDP Duig Event 0 0 0 0 □ 4.2.2.3 EDD Read Failure #1; I2C-Over-AUX NACK 0 0 0 0 0 □ 4.2.2.5 EDD Read Failure #1; I2C-Over-AUX DEVER 0 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
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□ 4.2.1 DPCD Receive Capability Read upon HPD Plug Event 0 0 0 0 □ 4.2.2 DPCD Receive Capability Read upon HPD Plug Event 0 0 0 0 □ 4.2.2 ADD Read 0 0 0 0 0 □ 4.2.2 ADD Read Failure #1:12C-Over-AUX NACK 0 0 0 0 0 □ 4.2.2 ADD Read Failure #2: CO-Over-AUX NACK 0 0 0 0 0 □ 4.2.2 ADD Read Failure #2: CO-Over-AUX NETR 0 0 0 0 0 □ 4.2.2 ADD Read Failure #2: CO-Over-AUX NETR 0 0 0 0 0 □ 4.2.2 ADD Read Failure #2: CO-Over-AUX NETR 0 0 0 0 0 □ 4.2.2 ADD Read Failure #2: CO-Over-AUX NETR 0 0 0 0 0 □ 4.2.2 ADD Read Interval during Link Training 0 0 0 0 0 0 0 001-045.221 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<>						
□ 42.22 DPCD Receiver Capability Read upon HDP Ding Event 0 0 0 0 □ 42.22 DPCD Read 0 0 0 0 0 □ 42.24 DPD Read 0 0 0 0 0 □ 42.24 DPD Read Failure #212C-Over-AUX DEFER 0 0 0 0 □ 42.25 DPD Compton Detection 0 0 0 0 □ 42.25 TBanch Device Detection upon HPD Plug Event 0 0 0 0 □ 42.25 TBanch Device Detection bevice Detection 0 0 0 0 □ 42.25 TBanch Device Detection Link Trainina 0 0 0 0 0 □ 42.25 TBAnch Device Detection Link Trainina 0 0 0 0 0 0 □ 42.25 TBANCh Device Detection Link Trainina 0	ass					
□ 42.23 EDD Read 0 0 0 □ 42.24 EDD Grad Fluxe #12 CC-Over-AUX NACK 0 0 0 0 □ 42.25 EDD Read Fluxe #12 CC-Over-AUX NECK 0 0 0 0 □ 42.25 EDD Read Fluxe #12 CC-Over-AUX NECK 0 0 0 0 □ 42.25 EDD Read Fluxe #12 CC-Over-AUX NECK 0 0 0 0 □ 42.25 EDD Read on RR HPD Event after Enroh Device Detection 0 0 0 0 □ 42.25 EDD Read on RR HPD Event after Enroh Device Detection 0 0 0 0 □ 42.25 EDD Read on RR HPD Event after Enroh Device Detection 0 0 0 0 □ 42.25 EDD Read Texture Request AUX Read Interval during Link Training 0 0 0 0 0001-045.272 AVX RB: 000201: 2 0 0 0 0 0 0001-045.474: AVX RB: 000201: 2 11 1 0 0 0 0 0001-045.474: AVX RB: 0020201: 2 11 1 0 0 0 0 0 0 0 0 0 0 0 0 0						
□ 42.24 EDD Read Failure 2: Cover-AUX MACK 0 0 0 0 □ 42.25 EDD Comption Detection 0 0 0 0 0 □ 42.25 EDD Comption Detection 0 0 0 0 0 □ 42.25 EDD Comption Detection 0 0 0 0 0 0 □ 42.25 EDD Construction UPD Play Event 0 0 0 0 0 0 □ 42.25 EDD Const Block EDD Read 0						
□ 42.25 EDD Read Failure #2:UC-Over-AUX DEFER 0 0 0 0 □ 42.25 EDD Read Failure #2:UC-Over-AUX DEFER 0 0 0 0 0 □ 42.25 EDD Read Device Detection 0 0 0 0 0 0 □ 42.25 EDD Comption Detection 0 0 0 0 0 0 □ 42.25 EDD Read on RRO-HDPC Went after Branch Device Detection 0 0 0 0 0 □ 42.25 EDD Read 0 0 0 0 0 0 0 □ 42.25 EDD Core Block EDD Read 0 0 0 0 0 0 0 □ 42.25 EDD Core Block EDD Read 0						
□ 42.26 EDD Comption Detection 0 0 0 0 □ 42.26 EDD Comption Derice Detection upon HPD Plug Event 0 0 0 0 □ 42.25 EDD Read on IRQH EDD Sixent after Branch Device Detection 0 0 0 0 □ 42.25 EDD Read on IRQH EDD Sixent after Branch Device Detection 0 0 0 0 □ 42.25 EDD Read on IRQH EDD Sixent after Branch Device Detection 0 0 0 0 □ 42.210 Inter Addux Resent AUX read interval during Link Training 0 0 0 0 001.045.242: AUX RDF: 00202h: 2 0 00 0 0 0 001.045.472: AUX RDF: 00202h: 2 0 00 0 0 0 001.045.472: AUX RDF: 00202h: 2 1 11 00 0 0 0 0 0001.045.473: AUX RDF: 00202h: 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
□ 42.22 Branch Device Detection upon HPD Plug Yeart 0 0 0 0 □ 42.22 Branch Device Detection with fare Branch Device Detection 0 0 0 0 0 □ 42.23 EDDC Four Biock EDDD Read 0 0 0 0 0 0 □ 42.23 EDDC Four Biock EDDD Read 0 0 0 0 0 0 0 Run Selected ■ Stect all more stateschinn Configure Import Export Stop on Failure Repeats: 1 © Delay time, sec 1 Save Report Classical Stateschinne 0001-045.476: ATX BD: 00020h: 2 1 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
□ 42.24 EDD Read on NBC HPD Event after Banch Device Detection 0 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>						
14.22.2 F-DOC Four Block EDDD Read 0						
4.22.10 Link Status-Aduxt Request AUX read intercal during Link Training 0 0 0 0 Run Stetched © Setext all Invert settection Configure Import Export Stop on Failure Repeats: 1 © 0						
Run Selected © Select all Invert selection Configure Import Export Stop on Failure Repeats: 1 © Delay time, scc 1 © Save Report Ctr 0001-065.2264 AIX BD 00202h: 2 00						
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0001.063.772: AXX WB; 00103h: 4 0.0101 0001.064.387: AXX WB; 00103h: 2 11 11 0001.064.387: AXX WB; 00102h: 2 11 11 0001.064.6387: AXX WB; 00102h: 5 07 01 01 01 01 0001.047.373: AXX WB; 00202h: 2 77 77 0001.047.831: AXX WB; 00202h: 2 11 11 0001.047.831: AXX WB; 00202h: 2 11 11 0001.048.117: Deasser: HEP 0001.048.117: Deasser: HEP 0001.048.311: UUT has 3 ms to finish AXX activity 0001.048.311: UUT has 3 ms to finish AXX activity 0001.048.313: End of protection interval 0001.048.813: Test PASSED: "4.2.1.5 Source Device Inactive HEP / Inactive AXX Test" Test Complete						^
0001.046.148: ANX RD: 00202h: 2 11 11 0001.046.459: ANX RD: 00202h: 2 11 11 0001.046.459: ANX RD: 00202h: 2 71 77 0001.047.407: ANX RD: 00202h: 2 71 77 0001.047.407: ANX RD: 00202h: 2 11 11 0001.048.051: Source DUT completes Link Training 0001.048.051: Source DUT completes Link Training 0001.048.101: Dessert HBD 0001.048.101: Test PASSED: "4.2.1.5 Source Device Inactive HBD / Inactive AUX Test" Test Complete						
0001.046.463: ANX MR: 00102h: 5 07 01 01 01 01 0001.047.473: ANX BR: 00020h: 2 777 0001.047.407: ANX BR: 00204h: 1 81 0001.048.057: Source DUT completes LLM: Training 0001.048.107: Beasert HRD 0001.048.107: Beasert HRD 0001.048.107: Beasert HRD 0001.048.107: MV HR: 0015LLM ARCTIVITY 0001.048.107: MV HR: 0015LLM ARCTIVITY 0001.048.107: MV HR: 0015LLM ARCTIVITY 0001.048.107: Source DUT does not generate AUX transaction while HRD is low 0002.048.8137: Test PASSED: "4.2.1.5 Source Device Inactive HPD / Inactive AUX Test" Test Complete						
0001.047.373: AUX BD: 00202h: 2 77 77 0001.047.371: AUX BD: 00202h: 1 81 0001.047.381: AUX BD: 00202h: 2 11 11 0001.048.075: Source DUT completes Link Training 0001.048.117: Deassert HPD 0001.048.117: Deassert HPD 0001.048.118: Ownitor AUX for transactions 0001.048.131: GNITOR To transactions 0001.048.131: End of protection interval 0001.048.131: Fast FARSED: "4.2.1.5 Source Device Inactive HPD / Inactive AUX Test" Test Complete						
0001-047.e07: AUX BD: 00204h: 1 81 0001-047.e07: AUX BD: 00204h: 2 11 1 0001-048.057: Source DUT completes Link Training 0001-048.17: Dessert HBD 0001-048.200: Monitor AUX for transactions 0001-048.18: DUT has 3 me to finish AUX activity 0001-048.18: AUX BD: 0120h: 1 00 0001-048.18: Source DUT does not generate AUX transaction while HBD is low 0002-048.19: Test PASED: "4.2.1.5 Source Device Inactive HBD / Inactive AUX Test" Test Complete						
0001.047.831: AUX RD: 00206h: 2 11 11 0001.048.057: Source DUT completes Link Training 0001.048.117: Deaser: HRP 0001.048.2117: Deaser: HRP 0001.048.2111: UUT has 3 ms to finish AUX activity 0001.048.313: End of protection interval 0001.048.133: End of protection interval 0002.048.103: Test PASSED: "4.2.1.5 Source Device Inactive HPD / Inactive AUX Test" Test Complete						
0001.048.057; Source DUT completes Link Training 0001.048.157; Beassert HBP 0001.048.260; Monitor AXX for transactions 0001.048.358; AUX MRT, 00102h; 1 00 0001.048.358; AUX MRT, 00102h; 1 00 0002.048.358; Source DUT does not generate AUX transaction while HED is low 0002.048.3137; Test PASSED; "4.2.1.5 Source Device Inactive HED / Inactive AUX Test" Test Complete						
0001.048.117: Deaser: HFP 0001.048.20: Konitor XXX for transactions 0001.048.311: UUT has 3 ms to finish AUX activity 0001.048.43: AUX WR: 0012h: 1 00 0001.048.43: End of protection interval 0002.048.103: Test PASSED: "4.2.1.5 Source Device Inactive HFD / Inactive AUX Test" Test Complete						
0001.048.260: Monitor ATX for transactions 0001.048.210: DUT has 3 ms to finish ATX activity 0001.048.133: End of protection interval 0002.048.195: Source DUT does not generate ATX transaction while HED is low 0002.048.191: Test FASED: "4.2.1.5 Source Device Inactive HED / Inactive ATX Test" Test Complete						
0001-048.311; UUT has 3 ms to finish ATX activity 0001-048.435; ATX HR; 0012b; 1 00 0001-051.333; End of protection interval 0002-048.195; Source DUT does not generate ATX transaction while HFD is low 0002-048.191; Test FASSED: "4.2.1.5 Source Device Inactive HFD / Inactive ATX Test" Test Complete						
0001.048.436; ANX WR: 00102h: 1 00 0001.051.333: End of protection interval 0002.048.196: Source DUT does not generate AUX transaction while HFD is low 0002.048.191: Test PASSED: "4.2.1.5 Source Device Inactive HFD / Inactive AUX Test" Test Complete						
0002.048.190: Source DUT does not generate AUX transaction while HED is low 0002.048.813: Test PASSED: "4.2.1.5 Source Device Inactive HPD / Inactive AUX Test" Test Complete						
0002.048.813: Test PASSED: "4.2.1.5 Source Device Inactive HPD / Inactive AUX Test" Test Complete						
Test Complete						
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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 by clicking Save Report.

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

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- Audio I - Audio I - Audio I - Audio I	Mode 3: L-PCI	M, 2 channel: M, 2 channel: bled bled	s, 16 bit @ 48 kHz s, 24 bit @ 44.1 kl s, 24 bit @ 48 kHz	(Hz (CD)						
- DÚT se - Device - Device - Adaptiv - 1920x1 - 2560x1 - 2560x1 - 3840x2	ve-Sync range 1080p maximu 1080p maximu 1440p maximu 2160p maximu	tiveSync ed Average V ration Increase minimum re um refresh ra um refresh ra um refresh ra um refresh ra	se and Decrease fresh rate suppor te: 120Hz te: 120Hz te: 120Hz	constraints rted by the Source: 23	.976 Hz					
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- 5120x2 - 7680x4 - 10240x Test Lo	2160p is not s 4320p is not s x4320p is not s v4320p is not s og	upported upported supported		ource DUT Retry o	on No-Reply Duri	ng AUX Read afte	er HPD Plug E	Event (3200)	15) "	
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- 5120x2 - 7680x4 - 10240x Test Lo 0000.0 0000.0 0000.0 0000.0 0000.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0	2160p is not s 4320p	upported upported supported supported supported test MAX_LIN test Extende hable TP83 able TP84 able TP84 able TP84 sint for Sc AUX RD: to for sc AUX RD: to for a c AUX RD: to for a c A	<pre>vy = 14 K RATE = 16h d Receiver C: support support use (1000 ms ink is set n user beceived ink does not uurce DUT iss 00002h: 1 : request rec ink is set t : request rec ink is set t</pre>	A, MAX LANE COUNT Capabilities Fiel () () () () () () () () () ()	<pre>c = 4 ld Present = 1 > any AUX reques est to AUX request request 35us</pre>	e	r HPD Plug E	2vent (3200)	13) "	
- 5120x2 - 7680x4 - 10240x Test Lo 0000.0 0000.0 0000.0 0000.0 0000.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0	2160p is not s 4320p is not s 4320p is not s 4320p is not s 4320p is not 00.002: st 000.752: s 000.822: se 001.126: Er 001.210: Er 001.226: L 101.235: s 35.311: A. 35.31: A. 35.31: A. 35.41: We 33.726: Ar 33.726: Ar 33.927: R 33.927: R	upported upported supported supported to DPCD_REX table TPS3 hable TPS3 hable TPS4 hable	<pre>vy = 14 K_RATE = 16h d Receiver C: support support is support unce DUT iss 0000Eh: 1 vurce DUT iss 0000Eh: 1 C request rec ink is set t 0000Eh: 1 C request rec ink is set t</pre>	A MAX LANE COUNT apabilities Fiel biot to respond to uses an AUX reque ??? i send any reply uses another AUX ??? seived within 433 or respond to AU2 80 14	<pre>r = 4 Id Present = 1 o any AUX request set to AUX request request SSus (requests norma)</pre>	e	r HPD Plug E	2vent (3200)	15)"	
- 5120x2 - 7680x4 - 10240x Test Lo 0000.0 0000.0 0000.0 0000.0 0000.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0 0001.0	2160p is not s 4320p is not s	upported upported supported supported test MAX_LIN test Extended table TP45 able TP45 able TP45 ference S AUX RD: uother AUX ference S AUX RD: AUX RD: AUX RD: AUX RD: AUX RD: AUX RD: AUX RD: AUX RD: AUX RD:	<pre>vy = 14 K_RATE = 16h d Receiver C: support support is support unce DUT iss 0000Eh: 1 vurce DUT iss 0000Eh: 1 C request rec ink is set t 0000Eh: 1 C request rec ink is set t</pre>	, MAX LANE COUNT Dapabilities Fiel b) tot to respond to ver an AUX reque ver an	<pre>r = 4 Id Present = 1 o any AUX request set to AUX request request SSus (requests norma)</pre>	e	or HPD Plug E	2vent (3200)	15) "	

Audio Test Set

Role:	Product:
DP Reference Sink (DP RX)	UCD-400
HDMI Reference Sink (HDMI RX)	UCD-422
DP Alt Mode Reference Sink (DP RX)	UCD-424

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 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 ± 1 Hz.

In the second stage, received audio is checked for random glitches, such as dropped or duplicated samples. This is achieved by examining how the RDV ("Relative Distortion Value") changes over time within the sampled audio.

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.

III Audio Test			\times
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	0		
Presets 👻		ОК	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)

Click Location where the captured audio is to be saved to browse for the folder to store tests.

CEC Functional Tests Set

Role:	Product:
HDMI Reference Sink (HDMI RX)	UCD-422

Parameters in use

- Test timeout, in milliseconds
- Local CEC physical address

CEC functional Test Set	×
Name	Value
Test timeout, in milliseconds	5000
Local CEC physical address	4.0.0.0
Presets 🔻	OK Cancel

CEC Functional Test

Test is intended to check that DUT does CEC initialization correctly after HPD. TE initialize EDID with configured address. Apply HPD and expected that Logical Physical addresses that presented in EDID will be applied with Report Physical Address message to inform TE about the mapping Logical and Physical addresses. That is expectation of CEC behavior.

CEC Phy Address test.

Test is intended to check that CEC line is working properly, and DUT can receive CEC Report Physical Address or customized OP Code. TE checks that HPD is high and CEC line available and send Report Physical Address (or customized OP Code) message in broadcast mode (or with specific destination).

CEC Wake Up test

Test is intended to check that CEC line is working properly, and DUT can send CEC Wake Up command. TE checks that HPD is high and CEC line available and wait for Wake Up message.

CEC Stand By test

Test is intended to check that CEC line is working properly, and DUT can send CEC Stand By command. TE checks that HPD is high and CEC line available and wait for Stand By message.

CEC Complete test

Test is intended to check that CEC line is working properly, and DUT can send sequence of commands from Stand By mode. TE checks that HPD is high and CEC line available. TE waiting for sequence of commands from DUT Wake UP and then again Stand By.

Note:	The default physical address in UCD EDID is 1:0:0:0. In order to simulate a change in the address, please use another address range
Note:	As a side effect, the CEC will also verify functionality of HPD and EDID reading if the test passes.

CRC Based Video Test Set

Role:	Product:	
DP Reference Sink (DP RX)	UCD-400	
HDMI Reference Sink (HDMI RX)	UCD-422	
DP Alt Mode Reference Sink (DP RX)	UCD-424	

Configuration

CRC Video Tests							
Base parametrs				CRC (RGB/0	CrYCb) of	Captured Ref	erence Frames
Test timeout (1/1000 sec):	10000		\$	0xB69E,0x	B33E,0x1	AB3,	
Repeat until timeout							
Test length (# frames):	200		\$				
Errors allowed (# frames):	20		:				
Repeat "Sequence Test" until timeout							
"Sequence Test" length	1		•				
Expected Video Format							
Width (# pixels):	1920		\$				
Height (# pixels):	1080		\$				
Reference BPP:	24		~				
Expected Frame Rate							
Expected frame rate (1/1000 Hz):	0		•				
Frame rate tolerance (#1/1000 Hz)	0		\$	Number of	captured	l reference fra	mes
				20	•	Capture Refe	erence Frames
Save Failed Fram <mark>e</mark> s							
Folder to save failed frames:		Browse					
Max number of saved frames		0	\$				
		Binary file	~				
Format of saved frames							
Format of saved frames		Align 12					

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.

Pixel Level Video Tests

Role:	Product:
DP Reference Sink (DP RX)	UCD-400
HDMI Reference Sink (HDMI RX)	UCD-422
DP Alt Mode Reference Sink (DP RX)	UCD-424

Compare video frame sequence with a single reference

The test compares captured frames to the provided reference image at the pixel level by buffering the indicated number of captured frames first in the local UCD device frame buffer and after that downloads them to the PC for evaluation.

III Pixel Level Video Tests	×
Reference image settings	
Load image: 0	Browse image
Colorimetry: ITU-R BT.601 🗸 🔯	
Image width (# pixels)	640
Image height (# pixels)	480
Image format	RGB ~
Bits per component (bpc)	8 ~
Data format align:	MSB ~
Comparison configuration	
Frames count:	60
Maximum number of failed frames allowed per test:	0
Maximum number of failed pixels allowed per frame:	0
Tolerance between pixel values:	0
Export properties	
Folder to save failed images:	Browse
Maximum number of exported frames	0
Export format	Binary file ~
	Align to MSB
Presets 👻	OK Cancel

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.

Browse image:	Load reference image from disk
Image width:	Width expected
Image height:	Height expected
Image format:	Image format expected
Bits per component:	Bits per component expected
Data format align:	Video data alignment 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 directory where failed frames are stored.
Maximum number of exported frames:	Maximum number of failed frames stored to PC
Export format:	Format of exported image: Binary file, PPM image, BMP image
Align to MSB	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

Capturing Reference Image

User can capture received video as reference:

1. In Settings dialog click the enable live preview icon \bigotimes .

	settings										
.oad image:	a	f/UCD Console/c	ache/DUT/s[19	20x1080_rgb	_8bpc_Packe	d_RGB_LS	B].bin		Browse in	nage	
С	olorimetry:	ITU-R BT.601	\sim	۲	Crc: 0x1F83,	OxFCEB, 0	x47CF	0 0	010	2 0 3	3
			-				-				
mage width (# p	pixels)						1	1920			\$
								1920 1080			¢
mage height (#											
mage height (# mage format	pixels)						1	1080			\$
mage width (# p mage height (# mage format Bits per compon Data format aligi	pixels) ent (bpc)						1	1080 RGB			¢
mage height (# mage format its per compon Data format align	pixels) ent (bpc) n:						1	1080 RGB B			* ~ ~
mage height (# mage format Bits per compon Data format align Comparison con	pixels) ent (bpc) n:							1080 RGB B			* ~ ~
mage height (# mage format Bits per compon Data format alig Comparison con rames count:	pixels) ent (bpc) n: figuration	ames allowed pe	er test:					1080 RGB B LSB			* * *
mage height (# mage format lits per compon Data format aligi Comparison con rrames count: Maximum numb	pixels) ent (bpc) n: figuration er of failed fr	ames allowed per						1080 RGB 8 LSB 50			 ↓ × × × ↓ ↓
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mage height (# mage format lits per compon Data format aligu comparison con rames count: Aaximum numb Jaximum numb Jolerance betwee ixport propertie: older to save fa Aaximum numb	pixels) ent (bpc) n: figuration er of failed fr er of failed p en pixel value s iled images:	ixels allowed per						1080 RGB 8 LSB 50 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		ie ie	

2. When the preview has been enabled click the *Capture reference* icon **c** to store a frame and use it as reference. Before accepting the frame, stability of the video is verified with a CRC stability check. Captured CRC can also be verified by the user.

Link Config Tests

Role:	Product:
DP Reference Sink (DP RX)	UCD-400
DP Alt Mode Reference Sink (DP RX)	UCD-424

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)

VRR Source DUT Tests – HDMI Rx

Role: HDMI Reference Sink (HDMI RX)		Product:	
		UCD-422	
Configure			
VRR Source DUT Tests	×		
Name	Value		
Test timeout, in milliseconds	10000		
VRR Max value	60		
VRR Min value	30		
VRR Static value	45		
VRR Step value	1		
VRR Time step value	1000		
VRR Enable and M_CONST	3		
VFront value	0		
Base Refresh Rate	50		
Presets 🔻	OK Cancel		
rioco	Cancer		
VRR Max value:		Maximum VRR frame rate	
VRR Min value:		Minimum VRR frame rate	
VRR Static value); 	Static VRR frame rate	
VRR Step value:		Change of current VRR value during a test	
VRR Time step value:		Change of current VRR value during a test	
VRR Enable and	M_Const:	Click to open dialog for enabling <i>VRR Enable</i> and <i>M_CONST</i>	
VFront value:		Click to open dialog for enabling Base VFront and RB	
Base Refresh Ra	ate:	Set Base Refresh Rate	

VRR Static Test

Test verifies that DUT Source applies expected static VRR value.

After configuring the parameters operator starts the test. Test waits until DUT Source starts VRR mode. When VRR mode is detected, test verifies that received timing matches the VRR Value parameter and the data in received EMP packets match the timing.

Quick Media Switching (QMS) Test

Verify that VRR is set correctly when frame rate is changing with a set time interval. For example, change VRR from 30 to 60 Hz with step for each 1 second.

After configuring the parameters operator starts the test. Test waits until DUT Source starts VRR mode. When VRR mode is detected, test verifies that VRR is changed after each time interval set by VRR Time parameter, and the applied VRR change is as set in the parameter. Test also verifies that data in received EMP packets match with applied VRR.

VRR Dynamic Test

Verify that VRR is set correctly when frame rate is changing with each frame. For example, change VRR from 60 to 120 Hz with step 1 each frame.

After configuring the parameters operator starts the test. Test waits until DUT Source starts VRR mode. When VRR mode is detected, test verifies that VRR is changed between each frame. Test also verifies that data in received EMP packets match with applied VRR.

VRR Sink DUT Tests – HDMI Tx

Role:	Product:
HDMI Reference Source (HDMI TX)	UCD-422, UCD-412, UCD-452

Configure

Name	Value
Test timeout, in milliseconds	10000
/RR Max value	60
/RR Min value	30
/RR Static value	45
/RR Step value	1
/RR Time step value	1000
/RR Enable and M_CONST	3
/Front and RB	0
Base Refresh Rate	50

VRR Max value:	Maximum VRR frame rate
VRR Min value:	Minimum VRR frame rate
VRR Static value:	Static VRR frame rate
VRR Step value:	Change of current VRR value during a test
VRR Time step value:	Change of current VRR value during a test
VRR Enable and M_Const:	Click to open dialog for enabling <i>VRR Enable</i> and <i>M_CONST</i>
VFront value:	Click to open dialog for enabling Base VFront and RB
Base Refresh Rate:	Set Base Refresh Rate

Static VRR Test

Test verifies that DUT Sink correctly applies a static VRR value.

After configuring the parameters operator starts the test. Operator verifies that DUT Sink has applied VRR correctly and provides the information in the dialog of the test.

Quick Media Switching (QMS) Test

Verify that VRR is set correctly when frame rate is changing with a set time interval. For example, change VRR from 30 to 60 Hz with step 1 each 1 second.

After configuring the parameters operator starts the test. Operator verifies that DUT Sink has applied VRR correctly and frame rate is changing as expected. Operator provides the information in the dialog of the test.

Dynamic Test

Verify that VRR is set correctly when frame rate is changing with each frame. For example, change VRR from 60 to 120 Hz with step 1 each frame.

After configuring the parameters operator starts the test. Operator verifies that DUT Sink has applied VRR correctly and frame rate is changing as expected. Operator provides the information in the dialog of the test.

Cable Test

Role:	Product:
HDMI Reference Source (HDMI TX)	UCD-422

Cable Check Test

Test is intended to check that cable can be properly used with UCD-422. Cable should be connected in loopback mode.

Test tries to pass Link training on different rates. If errors are presented on the lanes, then TE applies different FFE level to find configuration where is the best quality (minimum of errors). If Link training can be done without errors on all link rates then cable quilified as acceptable for usage with UCD-422.

Configure

/// Cable Test	×
Name	Value
Test timeout, in seconds	120
Cable test mode	All
Minimum FRL rate	3G 3 Lane
Maximum FRL rate	12G 4 Lane
Threshold of allowed errors per lane	10
Timeout for capturing errors, in seconds	5
Low Speed Line Select	31
	1
Presets 🔻	OK Cancel

Test timeout, in seconds:	Timelimit for the test
Cable test mode:	High speed can include detection errors on the high speed lanes. Low speed - detect that i2c and ddc lanes are working properly. All modes checks both High speed and low speed.
Minimum FRL rate:	Determine minimum of range for detection of cable quility
Maxmum FRL rate:	Determine maximum of range for detection of cable quility
Treshold of allowed errors per lane:	Determine allowed number of errors
Timeout for capturing errors, in seconds:	Determine period for screening errors
Low speed line select:	Configure witch lines of Low speed will be checked.

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 is providing 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:

- The VTP is a text-based, interpreted language.
- Commands, variables, and constant names are not case-sensitive.
- All text to the right of a semicolon (';') is treated as a comment.
- All strings are delimited by quotation marks ("a string").
- Quotation mark and backslash characters must be prefixed by a backslash character (a quotation mark character = \") (a backslash character = \\).
- 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 2560×1600 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 the 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 and 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:



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).

<u>CIRCLE</u>

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	
<i>TEXTPOS 100 100</i>	; Text starting point 100 pixels from left edge and ; 100 display lines down from top
TEXT "HRES=" HR " PIXE	LS" ; This will draw the text HRES then the value of variable HR ; and PIXELS
TEXT "Quote character \"	and backslash \\"

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

The user can assign the used colors in two basic ways: either by giving the actual Red, Green and Blue (or R, G and B) color component values or using pre-defined color palettes. The first method is referred as True Color Mode and the latter as Palette Mode.

In True Color Mode the numerical values given for R, G and B will be the actual output signal intensity values for the pixel in question. The numerical color value in Palette Mode will act as an address (or index) to a pre-defined color in a 256 color table. The output signal intensity will be the R, G and B value entry in the cell where the address points to.

Palette mode can only be used with True Color Mode is .

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 the 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></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?)
HA	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 have always positive integers or zero value. When an expression evaluates 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:	000
Image:	Output image is cleared (all black)
Variables:	All variables are initialized to zero
Color depth:	COLORDEPTH 10

APPENDIX G: FIRMWARE UPDATE WITH QUARTUS

The chapter below describes a procedure for updating UCD-4XX Series Firmware when the normal FW Update procedure fails.

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 Lite Edition Design Software Version 18.1 for Windows. The tool can be downloaded from the Intel® FPGA website: https://www.intel.com/content/www/us/en/software-kit/665990/intel-quartus-prime-lite-edition-design-software-version-18-1-for-windows.html

1. On the download page, please select section "Individual Files". Please download the software under "Intel® Quartus® Prime (includes Nios® II EDS)".

2. Please download and install the tool using defaults on the PC.

neel Intel® Quartus® Prime Lite			and the law of				~ - • ×
		Quartus® I		sign-software-version-18-1-for-window		on 18.1 for	X * C (Prused) :
	ID 665990	Date 9/23/2018	Software Type FPGA Development	Software Package V Quartus® Prime Lite	Version Version	Operating Systems Windows *	
	A newer ve	rsion of this software is	available, which includes fun	ctional and security updates. Custo	omers should <u>click here</u> to upda	ite to the latest version.	
Feetback	security updat contact our su The Intel® Qui available in a 1 subscribe to o Critical Issues Knowledge Ba Problems and Downloa Multiple Do	tes. If you must use this upport team. artus ^a Prime Lite Edition newer version, or all dee uur subscribe to our cus and Patches for the Int see: Search for Errata. Al Answers on specific IP adds	version of software, follow th I Design Software, Version 18, rices supported by this version tomer notification mailing list. et Quartus [®] Prime Lite Edition so see Critical Issues and Pate or Products.	i Software, Version 18.1. ihes.	elp improve security. For critica eb when support for all devices	l support requests, please s in this release are	
	ModelSin	n-Intel® FPGA Edition Dowr ModelSimSetup-18.1		Size: 1.1 GB SHA1: f4b428584c780016	d119c0b1fd16c26dee880dcc	•	
	Intel® Qua	artus® Prime (include Dowr QuartusLiteSetup-18.	load	Size: 1.7 GB SHA1: 70faf36e2c8d69aa5	243de767242a75832fa749e	~	

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-4xx_recovery.zip* file. By default the file is at C:\Program Files\Unigraf\Unigraf UCD Tools\recovery.

- 4. Extract the content of the ZIP file in a folder on your PC (e.g., C:\Temp).
- 5. Open Windows Command Prompt application.
- 6. Navigate to the directory to where the ZIP file was extracted (e.g. cd \Temp).
- 7. Connect a micro-USB cable to the **JTAG** connector on 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
- 9. On line three, the parameter "QUARTUS_DIR" is set to point to the folder where the Qartus Programmer was installed (by default C:\intelFPGA_lite\18.1). Edit and save as needed.

📒 reco	very4xxbat 🖸
1	ECRO OFF
2	
3	SET QUARTUS DIR-C:\intelFFGA lite\18.1
4	SET QUARTUS_BINS=%QUARTUS_DIR%/quartus/bin64 meticcal_ENABLEDELAYDEDEXPANSION
6	setioal Enabledelaredexpansion
7	if EXIST %QUARTUS DIR%\ (
8	
9	ECHO
10	ECHO Programming al0_isp.sof to FPGA. Wait for ~1-2 minutes
11	ECHO
12	call %QUARTUS_BINS%\jtagconfig.exesetparam 1 JtagClock 6000000
13	
14 15	if iERRORLEVEL! EQU 0 (ECHO
16	ECRO Set parameter 1 JtagClock 6000000 - SUCCESS
17	
18) else (
19	ECHO
20	ECHO Set parameter 1 JtagClock 6000000 - FAIL
21	ECHO
22	exit !ERRORLEVEL!
23 24	
24	<pre>\$QUARTUS BINS\$\quartus pgm.exe -c 1mode=JTAGoperation="p;al0 isp.sof@1"</pre>
26	egonator_ines(dualcus_puncee e i mode-orac opilation-pulls_isp.sore)
27	if [ERRORLEVEL] EQU 0 (
28	ECHO
29	ECHO Please check if al0_isp.sof was programmed successfully, i.e. no errors on log above
30	ECHO Please run FW update utility to complete recovery procedure
31	ECHO
32 33) else (ECHO
34	ECHO Programming operation - FAIL
35	
36	exit !ERRORLEVEL!
37)
38) else (
39	ECHO "%QUARTUS_DIR% directory does not exist. Find Quartus programming tool location and correct QUARTUS_DIR variable in the script

- **10.** In the **Command Prompt** application make sure that the current directory is still the same (e.g. C:\temp).
- 11. Launch batch recovery.bat by typing "recovery.bat" at the prompt.
- 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 completed, you can delete the files (in e.g., C:\Temp).
APPENDIX H: PLAYLISTS AND SCENARIOS

UCD Console's Playback enables you to run scripts called playlists. Use playlists to stream video, audio and metadata. See the Unigraf UCD Console Playback Tutorial at www.unigraf.fi/resource/tutorial-run-edit-and-create-sdr-and-hdr-scenarios-with-unigrafs-playback-tool/

nk Pattern Generator Playback Audio Generator HDCP EDI		
Import V80/QMS Common H-Dish-Test V80/QMS > Sample Content > Sample - HOM.test > V80 Example - HOM.test > > > URGR Reserved - HOM.test > >	Source - Select Editor Vete Amount - Horscontal Vertical Mac Stat - Total - FranceRet, He - Stat - Stat - Color Depth 699 -	
) Gryseler - HOMbet) HOME: Smith Sample - HOMItet > Deby Yalen DBMO > Playfort HOMbet	Start - Stort - Color Dign, EPP - Active - Active - Color Fixeding - Sync Width - Sync Width - Audio	
	Compressed: - Amount of channels: - Sanging - Bit depth: - Packets Source - Amount: -	
	Status: Idle	
10		

Playlist

A *Playlist* is a text script consisting of a [*Device*] block and [*Scenario*] block(s). A [*Device*] block lists the serial number of the device and *connectortype* (such as a displayport transmitter). [*Scenarios*] blocks have a *caption* (which are used to display sample content), a period (*Scenario* duration in milliseconds) and a relative path to a script text file (ex. Scenario_PSR1_Entry_N.txt). Scenarios are played in sequence.

Scenario

A *scenario* is a script text file to specify a sequence of video frames, metadata packets and audio to be transmitted.

Frame Memory

Before transmission content is loaded to frame memory buffer of the UCD device. Frame buffer memory limits content (number of frames) that can be played. UCD-5XX devices by default feature 16 gigabytes of memory. This enables loading up to 320 4K or 80 8K video frames. Contact Unigraf for information for larger frame buffer sizes.

Sample Content

You can us sample content as a basis for creating custom test sequences: see UCD Console *Playback* tab. Sample content is stored by default (on Windows) at *C:\Program Files\Unigraf\Unigraf\Unigraf UCD Tools\Resources\playback\content*. See <u>Sample Content in Playback</u> in this Appendix.

Playlists

A *playlist* defines the UCD device to be used and the output destination for transmission. It lists *scenarios* the played (video and audio sequences including metadata) to be transmitted and their duration.

Note: *Playlists* and *Scenarios* are technology dependent. Metadata (or packets) differ for HDMI and DisplayPort.

Device block

Section describes what device and what output connector to use.

Кеу	Description	Possible values
[Device]	Required. Start of the Device block.	
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 type to be used. Playlists shall not contain scenarios for different connector types.	'HDMI Out' 'DisplayPort Out' 'USBC Out'
reset	Only applies to UCD-323.	

Scenario block

Section describes selected scenario and its playback parameters. Playlist runs scenarios in the order they are listed.

Key	Description	Possible values
[Scenario]	Required. Start of a <i>Scenario</i> block. <i>Playlists</i> can have multiple <i>Scenario</i> blocks.	
caption	Optional. Title. Any character string accepted.	'Scenario 1'
path	Required. Specifies relative path to scenario file.	Any valid path
period	Required. Duration of Scenario in msec. The duration is ignored if close-after-upload is set to '1'.	'60000' '5000'
close-after-upload	Optional. When set to '1', command line version of the Playback tool will exit after loading scenario content and starting playback.	'0' or '1' Default '0'
execute-after-upload	Optional. Executes provided command in cmd.exe or bash and waits for its completion. Calculation of 'period' starts after the command is executed.	'script.bat && dir' 'rmdir /home/user/test/'

Scenarios

A Scenario is text file for specifying a specific sequence of video frames, events (packets) and audio to be played in order. *Scenarios* also set up the device state for transmission.

Parameters

Scenario parameters are defined below. 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.	
mappin		
align1	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	
audiosync	Audio sync	
colorspace	Video color space: RGB; YUV444; YUV422; YUV420	
bitspercolor	Video color depth (bits per color)	
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	Timing: frame rate	
hdcp	HDCP version used (can be 1.4 2.3 or 'none')	
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 Gbps link rate. DP: Link rate = Value × 0.27 Gbps. (E.g., 20 = 5.4 Gbps/lane (HBR2)).	
linkRateMin	Minimum link rate desired. Scenario will fail if not achieved	
DSC timing parameters	Parameters are different for DP and HDMI. 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

Play order is a sequence of steps. Steps are delimited with semicolons (;).

Each step has:

Range (possibly numbered e.g. allm_000.jpg, allm_001.jpg, ...) of video frame(s)

How many times the frame(s) are played

 $\label{eq:packet} Packet(s) \ (possibly numbered \ e.g. \ allm_0.bin, \ allm_1.bin, \ \ldots) \ indices \ to \ be \ sent \ during \ the \ video \ frame(s) \ transmission$

Color format

Optional frame rate when VRR/Adaptive-Sync is enabled

Format

Each scenario step is of the form :

pV:R:E:FvXX;

Parameters

Please see table below for description of used parameters.

Char	Description	Possible values	Examples
:	Separator between step parameters.	·	See below
;	Step delimiter.	"." "	See below
р	Optional. Indicates assertion of a HPD pulse on HDMI RX connector of UCD device during current step. Preceding video frame index. Only for HDMI playback.	ʻp'	ʻp1:60:1:256;' ʻp0-59:60:1:256;'
V	Required. Video frame indices (zero based). Parameters are applied to all frames in the step. Images (possibly numbered) are loaded from the <i>video</i> file path.	'1' '1,2,5' '0-59'	'1:60:16:256;' '1,2,5:60:16:256;' '0-59:60:16:256;'
R	Required. Repetitions of current step. For example, '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. Metadata packet indices (zero based): A single packet or a comma separated list of packets. The index may be of the form 3I15 (lower case 'l'). At which vertical line do we want to put our packet in. 3I15 means insert packet 3 at line 15. Packets are loaded from the <i>packets</i> path.	'0' '4,1,29' none 3I15	'1:30:0:256;' '1:30:4,1,29:256;' '1:30::256;' 0:10000:3115:256;
F	Required. Color format and color depth. See 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. To enable VRR/Adaptive-Sync, the corresponding HDMI VSIF event must be included. The parameter is in the form 'vXX', where 'XX' is the frame rate.	'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 parameter value is encoded as follows:

[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 are shown below:

	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 description of Playlist SDR-HDR-HLG – HDMI.



Playlist file (Playlist SDR-HDR-HLG - HDMI.txt)

Playlist item and example content	Description
[Device]	Start of device section
serialnumber=*	Only one UCD device present.
connectortype=HDMI Out	HDMI output
[Scenario]	Start of Scenario 1
caption = SDR	Scenario title "SDR"
period = 10000	Duration 10 sec
path = Scenario_SDR_HDMI.txt	Scenario file: Scenario_SDR_HDMI.txt in current folder
[Scenario]	Start of Scenario 2
caption = HDR	Scenario title "HDR"
period = 10000	Duration 10 sec
path = Scenario_HDR_HDMI.txt	Scenario file: Scenario_HDR_HDMI.txt in current folder
[Scenario]	Start of Scenario 3
caption = HLG	Scenario title "HLG"
period = 10000	Duration 10 sec
path = Scenario_HLG_HDMI.txt	Scenario file: Scenario_HLG_HDMI.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_HDMI.txt	Scenario file: Scenario_SDR-HDR_HDMI.txt in current folder
[Scenario]	Start of Scenario 5
caption = SDR – HLG	Scenario title "SDR – HLG"
period = 10000	Duration 10 sec
path = Scenario_HDR_HDMI.txt	Scenario file: Scenario_SDR-HLG_HDMI.txt in current folder

Scenario File (Scenario_SDR-HDR-HDMI.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=HDMI\Infoframes_0000.bin	Packet files in folder HDMI 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 Content in Playback Tab

Use UCD Console's Playback examples to create custom test content. On Windows, examples can typically be found at C:\Program Files\Unigraf\UnigrafUCD Tools\Resources\playback\content.

Note: Playlists and Scenarios are interface technology dependent. The provided examples are different for HDMI and DisplayPort.

Provided examples include:

HDMI

Playlist Name	Description
Basic Video & Audio Example	Example playlist for demonstrating the use of video and audio files.
VRR Example	Playlist for demonstrating Variable Refresh Rate (VRR) capability of a DUT monitor.
QMS-VRR Example	Playlist for demonstrating Quick Media Switching VRR (QMS-VRR) capability of a DUT monitor.
ALLM	Playlist for demonstrating Auto Low-latency Mode (ALLM) capability of a DUT monitor
HDR & Metadata Example	Example playlist that demonstrates the use of video files and metadata packets in testing a DUT monitor

DP

Playlist Name	Description	
Basic Video & Audio Example	Example playlist for demonstrating the use of video and audio files.	
HDR & Metadata Example	Example playlist that demonstrates the use of video files and metadata packets in testing a DUT monitor	
Frame Rate Example	Playlist for demonstrating use of multiple frame rates with FHD and UHD resolution.	

Playlist: Basic Video & Audio Example

The playlist transmits video and audio as described below.

Video

Frames used for Scenario 1 and Scenario 2 (Image1.jpg, Image 2.jpg)



Frame used for Scenario 3 and Scenario 4 (Philips.svg)



Description of Scenarios

	Name	Duration	Repeated sequence
1	Flip-flop with LPCM Audio	60 s	CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, 60 frames Image1.jpg, 60 frames Image2.jpg, Audio: Rhythm.wav
2	Flip-flop with AC3 Audio	60 s	CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, 60 frames Image1.jpg, 60 frames Image2.jpg, Audio: 44100Hz_16bit_AC3_2channels_60sec_sine.iec61937.bin
3	Flip-flop Silent	60 s	CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, 60 frames Image1.jpg, 60 frames Image2.jpg, No Audio.
4	Philips 1920x1080p + 1kHz	60 s	CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, 60 Frames Philips.svg, Audio: 1 kHz sine wave (1kHz.wav)
5	Philips 3840x2160p + 1kHz	60 s	CTA 3840 x 2160 @ 60Hz (VIC 97), RGB 8 BPC 60 Frames Philips.svg, Audio: 1 kHz sine wave (1kHz.wav)

Playlist: HDR & Metadata Example

Example demonstrates the use of metadata packets.

Video:

The Scenarios use four versions of the same image: GoldenGate0.jpg, GoldenGate1.jpg, GoldenGate2.jpg and GoldenGate3.jpg.

All four images use the same dynamic range in pixel data but contain a text label indicating pixel dynamic range applied in the metadata. If DUT behaves correctly, applying different metadata changes the appearance of the image on DUT screen.



Scenarios for HDMI Output

Video mode in all steps: CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, No audio.

Name	Duration	Repeated sequence		
SDR	10 sec	180 frames GoldenGate0.jpg, Packet: Infoframes_0002;		
HDR	10 sec	180 frames GoldenGate1.jpg, Packets: Infoframes_0002, Infoframes_0000		
HLG	10 sec	180 frames GoldenGate2.jpg, Packets: Infoframes_0001, Infoframes_0002		
HDR10+	10 sec	180 frames GoldenGate3.jpg, Packets: Infoframes_0002, Infoframes_0003, Infoframes_0000		
SDR – HDR	10 sec	180 frames GoldenGate0.jpg, Packets: Infoframes_0002; 180 frames GoldenGate1.jpg, Packets: Infoframes_0002, Infoframes_0000		
SDR – HLG	10 sec	 180 frames GoldenGate0.jpg, Packet: -; 180 frames GoldenGate2.jpg, Packets: Packets: Infoframes_0001, Infoframes_0002 		
SDR – HDR10+	10 sec	180 frames GoldenGate0.jpg, Packet: Infoframes_0002; 180 frames GoldenGate3.jpg, Packets: Infoframes_0002, Infoframes_0003, Infoframes_0000		

Playlist: VRR Example (HDMI)

Playlist demonstrates controlling VRR (Variable Refresh Rate) in Scenarios when using HDMI output.

Video

The image used for the test contains a combination of color bars, gray scales, and rotating items. The test uses a sequence of images creating a full rotation in 60 frames.



Scenario with Video Mode 1920×1080 60 Hz

The scenario uses 1920×1080 59.94/60 Hz video timing (VIC 16). No audio.

	Name	Duration	Repeated sequence
1	FHD VRR 4859 switch	60 s	VRR enabled. RGB 8 BPC. Packets: infoframe_00, infoframe_01 300 frames with 48 Hz frame rate, 300 frames with 59 Hz frame rate.

Scenario with Video Mode 3840×2160 60 Hz

The scenario uses 3840×2160 59.94/60 video timing (VIC 97). No audio.

	Name	Duration	Repeated sequence
1	UHD VRR 4859 switch	60 s	VRR enabled. RGB 8 BPC. Packets: infoframe_00, infoframe_02 300 frames with 48 Hz frame rate, 300 frames with 59 Hz frame rate.

Playlist: Frame Rate Example (DP)

Playlist for demonstrating use of multiple frame rates with FHD and UHD resolution when using DisplayPort output.

Video

The image used for the test contains a combination of color bars, gray scales, and rotating items. The test uses a sequence of images creating a full rotation in 60 frames



Executed Scenarios

The test is using four scenarios (RGB 8 BPC, No audio)

	Name	Duration	Repeated sequence
1	Spinners FHD 59fps	60 s	1920×1080 59.94/60 Hz video timing (VIC 16), 60 frames 'colorBarsSpinning-X.svg' X= 0 to 59
2	Spinners FHD 119fps	60 s	1920×1080 119.88/120 Hz video timing (VIC 63), 60 frames 'colorBarsSpinning-X.svg' X= 0 to 59
3	Spinners UHD 59fps	60 s	3840×2160 59.94/60 Hz video timing (VIC 97) 60 frames 'colorBarsSpinning-X.svg' X= 0 to 59
4	Spinners UHD 119fps	60 s	3840×2160 119.88/120 Hz Hz video timing (VIC 120) 60 frames 'colorBarsSpinning-X.svg' X= 0 to 59

Playlist: ALLM (HDMI)

Playlist for demonstrating Auto Low-latency Mode (ALLM) capability of a DUT monitor.

Video:

The Scenarios use a series of images: allm_on_off_000.jpg to allm_on_off_0011.jpg. Text panel on the images indicate if ALLM is enabled or not. The first scenario is presented with ALLM enabled and the second by switching ALLM on and off sequentially.





Scenarios for HDMI Output

Video mode in all steps: CTA 1920×1080 60 Hz (VIC 16), RGB 8 BPC, No audio.

Name	Duration	Repeated sequence	
ALLM Static 60 sec		10 frames allm_on_off_000.jpg, Packet: allm_0.bin; 10 frames allm_on_off_001.jpg, Packet: allm_0.bin; 10 frames allm_on_off_002.jpg, Packet: allm_0.bin; 10 frames allm_on_off_003.jpg, Packet: allm_0.bin; 10 frames allm_on_off_004.jpg, Packet: allm_0.bin; 10 frames allm_on_off_005.jpg, Packet: allm_0.bin	
		10 frames allm_on_off_000.jpg, Packet: allm_0.bin; 10 frames allm_on_off_001.jpg, Packet: allm_0.bin; 10 frames allm_on_off_002.jpg, Packet: allm_0.bin; 10 frames allm_on_off_003.jpg, Packet: allm_0.bin; 10 frames allm_on_off_004.jpg, Packet: allm_0.bin; 10 frames allm_on_off_005.jpg, Packet: allm_0.bin; 10 frames allm_on_off_006.jpg, Packet: allm_0.bin; 10 frames allm_on_off_007.jpg, Packet: allm_1.bin; 10 frames allm_on_off_008.jpg, Packet: allm_1.bin; 10 frames allm_on_off_009.jpg, Packet: allm_1.bin; 10 frames allm_on_off_0010.jpg, Packet: allm_1.bin; 10 frames allm_on_off_0010.jpg, Packet: allm_1.bin; 10 frames allm_on_off_0011.jpg, Packet: allm_1.bin;	