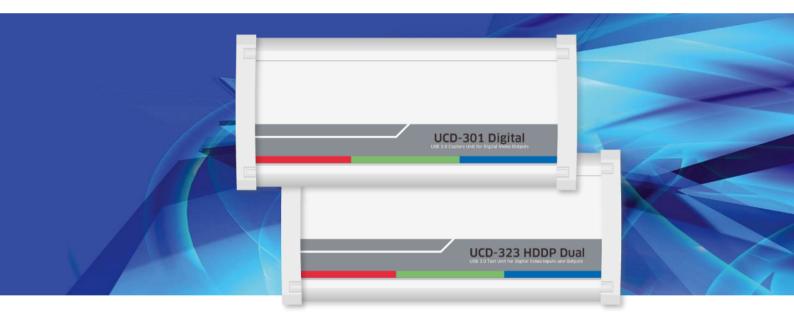
UCD Console for UCD-301 UCD-323



USER MANUAL

/// UNIGRAF

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Edition

UCD Console User Manual, Version 27 Date: 12 December 2019

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UCD Console User Manual

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UCD-300 products meet the essential health and safety requirements, is in conformity with and the CE marking has been applied according to the relevant EU Directives using the relevant section of the corresponding standards and other normative documents.

UNIGRAF UCD Console User Manual

Table of Contents

1.	About This Manual	5
	Purpose	5
	Product and Driver Version	5
	Notes	5
2.	Introduction	6
	Product Description	6
	Product Features	6
	Functional Description	6
	UCD-323 HDDP Dual	7
	UCD-301 Digital	8
3.	Installation	9
	Unpacking	9
	Installation Package	9
	Software Installation	9
4.	Firmware Update	. 10
	Updated Modules	
	Change Device Configuration	. 12
5.	License Manager	. 13
6.	UCD Console	. 15
	Device Selection	. 15
	Select Role	. 16
	Options	. 18
	Detaching Tabs	. 19
7.	HDMI Reference Sink	. 20
8.	DisplayPort Reference Sink	. 34
9.	HDMI Reference Source	. 51
10.	DisplayPort Reference Source	. 60
11.	S/PDIF Reference Sink	. 74
12.	Event Log	. 76
	DP AUX Analyzer	
13.	EDID Editor	
Appendix	A. Product Specification	
	UCD-323 HDDP Dual	
	UCD-301 Digital	
Appendix	B. Licensing	
	C: Predefined Timings	
	C D: Predefined Patterns	
	c E: Sink and Source DUT Tests	
rppendix	Electrical Test Set – HDMI Rx	
	Electrical Test Set – DP Rx	
	CEC Functional Test Set – HDMI Rx	
	CRC Based Video Test Set – HDMI & DP Rx	
	Link Test Set – DP Rx	

1. ABOUT THIS MANUAL

Purpose

This guide is the User Manual of UCD-300, USB-connected video capture units for use in a PC with Windows® 10 Windows® 8 or Windows® 7 operating system.

The purpose of this guide is to

- Provide an overview of the product and its features.
- Provide instruction for the user on how to install the software and the drivers.
- Introduce the HW features of the UCD-300 units.
- Provide instructions for the user how to use UCD Console software.

Product and Driver Version

This manual explains features found in UCD Console Software Package **1.8.** 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

2. INTRODUCTION

Product Description

UCD-300 family consists of two high speed, USB 3.0 connected video capture units *UCD-323 HDDP Dual* and *UCD-301 Digital*. The UCD Console is the common graphical user interface (GUI) for all UCD-300 family units. UCD Console provides access to all functions of the unit.

UCD-300 units feature a high-level Software Development Kit (SDK) for use in automated testing. It is called Test Software Interface (TSI). TSI allows for an easy integration of the Production and R&D testing routines into an automated test system environment. Please refer to TSI documentation for more details.

Product Features

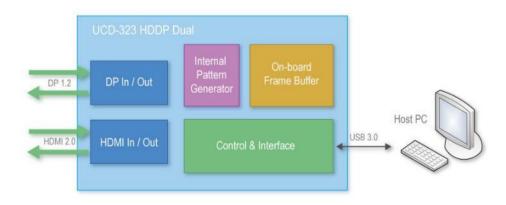
- High resolution video and audio capture up to 4K / UHD 60 Hz
- Support for multiple display interfaces including HDMI 2.0 and DP 1.2
- Compatible with HDCP versions 1.3/1.4 and 2.3
- 2 GB on-board high speed video buffer
- High speed USB 3.0 host PC interface

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

Functional Description

UCD-300 units consist of a multimedia signal input stage, a control stage with on-board frame buffer, an internal pattern generator (in some models) 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-323 HDDP Dual

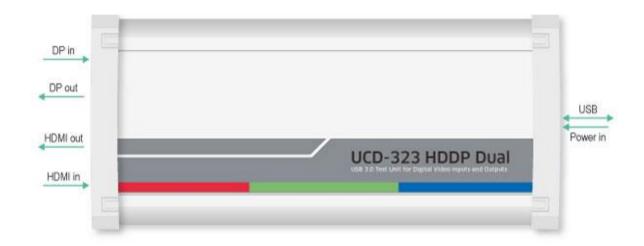




Introduction

UCD-323 HDDP Dual

The image below describes the connections in UCD-323 HDDP Dual



Name	Description
DP in	DisplayPort [™] 1.2 compliant input from the upstream Source
DP out	DisplayPort [™] 1.2 compliant output to the downstream Sink
HDMI in	HDMI 2.0 compliant input from the upstream Source
HDMI out	HDMI 2.0 compliant output to the downstream Sink
Power in	+12 Vdc Power Supply Input
USB	USB 3.0 connection to the host PC

Note Capturing and sourcing high resolution video modes, especially 4K video modes set stringent requirements on the video cables and connectors. Unigraf has ensured the capabilities of the cables that are delivered with the UCD-323 HDDP Dual unit. Please contact Unigraf for assistance and details about evaluated cables.

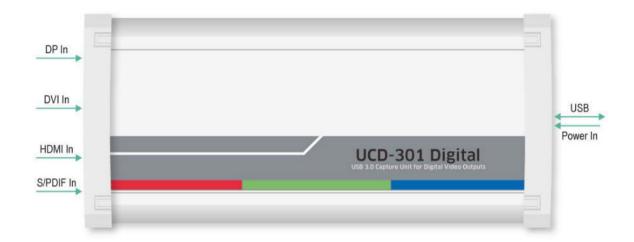
WarningIn order to avoid damage to the unit and the PC, please always attach the power
cord (Power In) to the unit first, and after that connect the USB cable to your PC.



Introduction

UCD-301 Digital

The image below describes the connections in UCD-301 Digital



Name	Description
DP In	DisplayPort 1.2 compliant input from the upstream Source
DVI In	Currently not in use
HDMI In	HDMI 2.0 compliant input from the upstream Source
S/PDIF In	Optical digital audio input
Power In	+12 Vdc Power Supply Input
USB	USB 3.0 connection to the host PC

Note	Capturing and sourcing high resolution video modes, especially 4K video modes set stringent requirements on the video cables and connectors. Unigraf has ensured the capabilities of the cables that are delivered with the UCD-301 Digital unit. Please contact Unigraf for assistance and details about evaluated cables.

WarningIn order to avoid damage to the unit and the PC, please always attach the power
cord (Power In) to the unit first, and after that connect the USB cable to your PC.

Installation

3. INSTALLATION

Unpacking

The UCD-300 product shipment contains:

- The UCD-300 unit
- AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
- USB 3.0 compliant cable

Installation Package

The UCD-300 software installation package can be obtained from Unigraf download page at <u>www.unigraf.fi/support/download-links</u>. Please log in the following credentials before an attempt to access download page: Username: *unigraf* Password: *ruukintie*

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

- Windows drivers (installed during set up)
- UCD Console software GUI (installed during set up)
- License Manager (installed during set up)
- UCD Configuration Utility (installed during set up)
- TSI SDK
- User Manuals including this document.

In some cases, you will need to update also the firmware of the unit. If in doubt, please contact Unigraf.

Note:	The software should be installed before connecting the UCD-300 unit in your PC.			
Note:	System administrator's privileges are required for performing the installation.			

Software Installation

Start the installation by running **Unigraf Software Bundle Setup.exe**

Once the installer has started, a welcome page is displayed. The welcome page shows the software package release version.

Click Next to continue. In the next dialogs, you will be able to define the software components installed.

The next two dialogs will allow you to define the installation folder in your PC and the Start Menu folder used.

- When you are ready with the selections, click **Install** to start the installation.
- Click **Finish** to exit the installation dialog.

4. FIRMWARE UPDATE

UCD Configuration Utility is used to load an updated firmware to the device. As an option, UCD Configuration Utility enables the user to select the operation roles present in the UCD-300 unit. The utility configures a firmware set for the selected operation roles and programs the firmware set to the device. Please contact Unigraf for details.

To update the firmware or create a new configuration on a UCD-300 device, please perform the following steps:

Connect the UCD-300 unit to a power supply and connect the USB cable.

• Open UCD Console. Select Tools > Firmware update.

You can launch the utility alternatively by running the UCD Firmware Configuration in Start Menu > Unigraf / UCD-300 /.

UCD Configuration Utility		- ×
		///
	Please click Next to update your UCD device.	
	Included components: UX 2 0.1 UF 1.3.1 BF 1.1.2/1.4.2 MC 0.14.34	
	< Back Next >	Cancel

The first page of the utility indicates the firmware component versions present in the package. Please click **Next**.

UCD Configuration Utility		×
Connected UCD Devices Please select the device		///
Multiple UCD-3xx applications durin	UCD-301 [1547C054] UCD-323 [1635C136] devices found. Make sure not to n. configuration.	un other Unigraf
	< Back	Next > Cancel

From the list of connected UCD-300 devices please select the one that you want to update. Click **Next**.

Updated Modules

The tool prompts you for selection of the firmware modules to be updated. It compares the modules in the selected device and omits the ones that are the same.

UCD Configuration Utility			-X
UCD Modules Please select the modules to update			
W UX-21.1 (Exetting 13.4) W UF 1.3.1 (Exetting 12.0) W DF 1.1.2/1.4.2 (Exetting 1.1.1/1.3.13) W MC 0.14.34 (Exetting 0.14.17)			
	< Back	Next >	Cancel

When you are done, click **Next**.

While the configuration is in progress you will be asked to power cycle the device between the parts.

D Configuration - Configuration in progres UCD-323 [1635C136] Part UX >UX 2.0.1 Erased in 3.0 seconds Written in 1.0 seconds Part UF >UF 1.3.1 Erased in 3.0 seconds Written in 2.0 seconds Part BF >BF 1.12/1.4.2	S	Info	
- address FCCB000 Writing image body		Powe	er cycle the device, press OK when done
		-	ОК
Erasing block # 10	< Back	Finish Cancel	

Note:	The procedure may take several minutes depending on the speed of the USB connection of the host PC.		
►	When completed, power cycle the device.		
Note:	The new firmware will be taken in use only when the device is powered up next time.		

Change Device Configuration

UCD-300 devices can feature four simultaneous interface Roles (please refer to UCD Console > Select Role below). Changing the role configuration is done by selecting the firmware packages loaded to the UCD-300 device. For selecting you need to open UCD Firmware Configuration utility in a special mode. The easiest way is to create a batch file with Notepad (e.g. config.bat) with the following content:

ucdconfig config

In the special mode, you will be able to initiate the configuration dialogs. For that, select **Change device configuration** check box.

UCD Configuration Utility	
	///
	Please select operation.
	< Back Next > Cancel

In the third dialog *UCD Device Roles* select the four roles that you prefer to be available in *UCD Console*.

UCD Configuration Utility	×
UCD Device roles Please select the roles you need	///
Selected device: UCD-323 [1703C168]	
< Back Next >	Cancel

After selection, please click Next to proceed to firmware update as described above.

5. LICENSE MANAGER

Licensing

The features of UCD Console GUI are divided into groups based on the target use of the device. Some basic features can be used without licenses. Advanced feature groups have their dedicated licenses that open the related part of the GUI or enable the related control.

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 Unigraf License Manager. By default, shortcut to Unigraf License Manager can be found in Start Menu under: All programs/Unigraf/TSI.

Please click **Yes** in the first dialog. License Manager can be run only with Administrator rights.

Note:

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

License Manager GUI

Once the application starts up, it will look for any licensing enabled Unigraf device. If no suitable device families are detected, License Manager will exit. Please first select one of the available device families by clicking one of the device family selector buttons.

🕖 Unigraf - License Manager	
A Back	License management for UCD-1, UCD-2, UCD-3xx Devices
Attached Devices:	
UCD-323 [7037AD960000008C] SW Emulated device [EMU001]	
	Select a device to edit licenses
Refresh	

In the list of Attached Devices please select the device in question. You can find the *serial number* and the *seed number* of your device in a sticker attached to the bottom of your device.

The **Back** button will bring you back to the device family selection screen. The **Refresh** button will re-scan the system for installed hardware.

Managing Licenses

Back		License ma	anagement for UCD-1, UCD-2	, UCD-3xx Devi
ttached Devices:	Enter new license for device with se	ed number <u>7037ad960000008</u>	<u>c</u>	
JCD-323 [7037AD96000008C] SW Emulated device [EMU001]				Install
	Installed licenses:			
	License	Кеу		
	TSI Advanced Test Software Set	8WFQ-	'9C-P0VD	
	TSI Basic Test Software Set	09VP-Q	SW-TJ2S	
	UCD Pro for HDMI Sink	KV2R-Y	(H-Q194	
	UCD Pro for DP Sink	KNRT-E	T4-722Y	
	UCD Pro for HDMI Source	KKLC-A	7H-F54Q	
	UCD Pro for DP Source	S1TA-N	VT9-YZA9	
	HDCP 2.2 Support	TZHU-1	CPX-DLQH	

Seed Number

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

The Seed Number link in the dialog will allow you to copy & paste the Seed Number of the selected device for e.g. ordering Licenses.

Adding New License Keys

To add a new license key for a device, please enter the characters from the license sticker to the boxes provided. The License Manager will automatically move the caret across the edit boxes as you type. If you have the key in text format, copy it and paste to the leftmost box.

Once the license key is fully entered, click the **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 you have typed the key correctly and that the seed number on the license key sticker matches the seed number displayed seed number for the device.

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

Also, please notice, that characters that can't 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 currently installed licenses for the currently selected device. The list shows the actual license key, and what that key unlocks.

Remove Selected will uninstall selected licenses. To uninstall a license, click on the license and then click the Remove Selected button.

Export will allow you to save all installed licenses for the currently selected device into an INI file for backup and distribution to other PCs. Please notice that licenses from multiple devices can be exported into the same INI file.

Import will install licenses from an INI file for the currently selected device.

UCD Console

6. UCD CONSOLE

UCD Console is the graphical user interface (GUI) of UCD-300 family for desktop use. It 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 the problem detection.

The various features of the UCD-300 are divided into interface specific screens and tabs. Each tab contains data and controls for a specific feature.

Device Selection

You can find the shortcut of UCD Console by default under Start Menu path All programs/Unigraf/UCD-300. Once UCD Console GUI is launched the dialog provides a list of UCD-300 devices connected in the PC. Please select your target device by clicking on the appropriate button. If you cannot find your device in the list, please confirm the power and USB connection to the device and click the **Rescan**... button.

	CD Con				- • •
File	View	Tools	Help		
Device					
				Select Device UCD-323 [1533C046]	
				UCD-301 [1601C001]	
				Rescan www.unigraf.fi UCD Console VI.1 [R4]	

Select Role

The use of UCD-300 devices with UCD Console is divided in display interface specific roles. The structure of UCD Console varies between roles by having a varying set of tabs dedicated to functionalities available in the enabled role. The table below lists the roles and tabs available in each role. Please find a detailed description of each role in the later chapters of this manual.

Each UCD-300 model features a unique set of modes available. In special occasions, Unigraf can create custom configurations. Please contact Unigraf Support for details.

Available Mode Configurations for UCD-301

In addition to the separate HDCP 2.3 enabled HDMI and DP Reference Sink roles, in UCD-301 you can select a combined mode where three roles are available in one configuration.

Role		Tabs available
HDMI	Reference Sink (HDCP 2.3)	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). HDCP 1.4 and 2.3 status monitor and control (HDCP). Monitor InfoFrame data (InfoFrames). Executing TSI Test cases (Source DUT Testing).
Display	yPort Reference Sink (HDCP 2.3)	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). DPCD editor (DPCD). HDCP 1.3 and 2.3 status monitor and control (HDCP). Monitor Secondary-Data Packets (SDP) Event log (Event log) Executing TSI Test cases (Source DUT Testing). Executing HDCP 2.3 CTS Tests (Source DUT Testing).
Mode	HDMI Reference Sink	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). HDCP 1.4 status monitor and control (HDCP). Read InfoFrame data (InfoFrames). Executing TSI Test cases (Source DUT Testing).
Combined Mode	DisplayPort Reference Sink	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). DPCD editor (DPCD). HDCP 1.3 status monitor and control (HDCP). Executing TSI Test cases (Source DUT Testing).
	SPDIF Reference Sink	Audio monitoring and saving (Audio).

Available Mode Configurations for UCD-323

Role HDMI Reference Sink (HDCP 2.3)	Tabs available Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). HDCP 1.4 and 2.3 status monitor and control (HDCP). Monitor InfoFrame data (InfoFrames). Executing TSI Test cases (Source DUT Testing).
DisplayPort Reference Sink (HDCP 2.3)	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information and control of the upstream link (Link). EDID editor (EDID). DPCD editor (DPCD). HDCP 1.3 and 2.3 status monitor and control (HDCP). Monitor Secondary-Data Packets (SDP) Event log (Event log) Executing TSI Test cases (Source DUT Testing). Executing HDCP 2.3 CTS Tests (Source DUT Testing).
HDMI Reference Source (HDCP 2.3)	Video pattern generator (Pattern Generator). Status information and control of the downstream link (Link). EDID editor (EDID). HDCP status monitor and control (HDCP).
DisplayPort Reference Source (MST – 2 streams, HDCP 2.3)	Video pattern generator 2 stream MST (Pattern Generator). Status information and control of the downstream link (Link). EDID editor (EDID). DPCD monitor (DPCD) HDCP status monitor and control (HDCP).
DisplayPort Reference Source (SST, HDCP 2.3)	Video pattern generator with custom patterns and SST (Pattern Generator). Status information and control of the downstream link (Link). EDID editor (EDID). DPCD monitor (DPCD) HDCP status monitor and control (HDCP). Executing HDCP 2.3 CTS Tests (Sink DUT Testing).

A full description of the functions and the licensing can be found in <u>Appendix B Licensing</u>.

Options

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

Options 💽
Video, Audio and Misc options AUX Analyzer options
Image File Format
Audio File Format
WAV
Audio Buffer size
Main buffer, Ksamples 16 🚔 Playback buffer, Ksamples 4
Folders
Directory to save images and audio
C:\Users\' 'C ' \C ! Browse
Presets directory
C:\Users\\
DSC test content directory
C:\Users\ \DSC Erowse
DSC Work folder
C:\Temp\DSC
Misc. options
Apply colour conversion to saved images
Disable firmware version check
Bypass 4:2:x -> 4:4:4 conversions HDCP protected monitor
V OK X Cancel

Video Audio and Misc. Options

Image File Format

You can save the captured frames either in PPM, BMP or JPG 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

Audio Buffer size

You can define how much memory is allocated in the PC for captured audio. 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.

Folders

Please select the directories in the PC for saving the captured images and audio and the saved Presets. DSC Related presets can be omitted with UCD-323 and UCD-301.

Misc. options

<u>Apply color conversions to saved images</u>: When saving captured frames, the Color Mode selected in *Video* tab will be applied also to saved images.

<u>Bypass 4:2:x \rightarrow 4:4:4 conversions</u>: 4:2:2 and 4:2:0 images are previewed and stored as received, without pixel doubling.

Disable firmware version check: UCD Console lets the user operate a non-matching Software / Firmware combination. NOT RECOMMENDED.

<u>HDCP protected monitor</u>: Text appearing if the monitor where UCD Console is viewed is HDCP compliant and HDCP is enabled. This feature enables preview of captured HDCP encrypted content in *Video* tab.

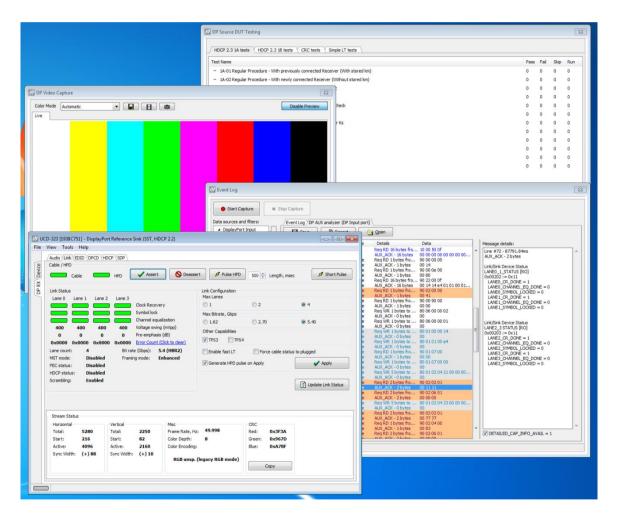
AUX Analyzer Options

Options for configuring the way data is presented in AUX Analyzer tab in Event Log.

Please find full description of the controls in chapter Event Log / DP AUX Analyzer later in this document.

Detaching Tabs

You can detach most of the UCD Console tabs into a separate window for being able to monitor and control separate features simultaneously. To detach a tab **Right-click** on a tab and select **Detach Page**. 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 your keyboard.

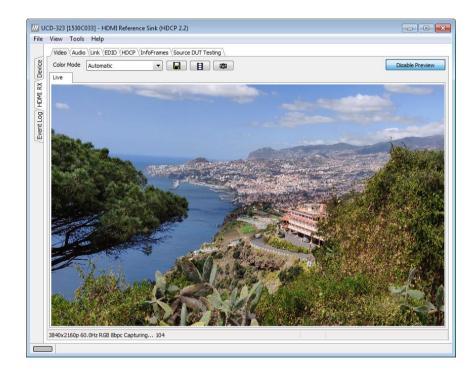


7. HDMI REFERENCE SINK

HDMI Reference Sink function is available in *UCD-323 HDDP Dual* and UCD-*301 Digital*. In HDMI Reference Sink role, the device is using one input channel, HDMI Sink (HDMI RX). The corresponding vertical tab can be seen on the left edge of the GUI.

The horizontal tabs on the top of the GUI enable the various functions available for the input channel. HDMI RX features the following tabs. Some of the tabs are enabled by default, some only when an applicable license is included.

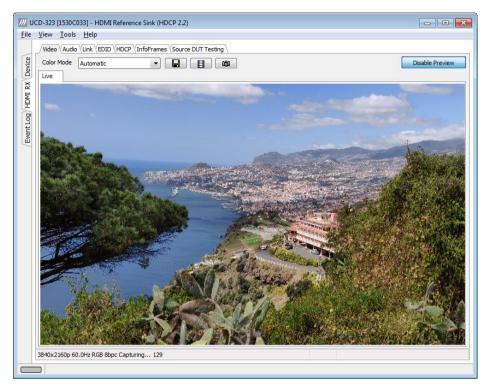
- Video preview and saving (Video). *Enabled by default*.
- Audio monitoring and saving (Audio). *Enabled by default*.
- Status information and control of the upstream link (Link). Enabled by default.
- EDID editor (EDID).
- HDCP status monitor and control (HDCP).
- Read InfoFrame data (InfoFrames).
- Executing TSI Test cases (Source DUT Testing).



Video Tab

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

Input video mode



The measured input resolution, frame rate and color format is shown below the preview window. The indication of the number of frames captured to the PC shows you the pace of the image data transfer to the PC.

3840x2160p 60.0Hz RGB 8bpc Capturing... 129

Disable / Enable Preview

Click the button to start or stop capturing video frames.

Color Mode for preview

YCbCr (ITU-709) -> RGB 💌

- No Conversion: The captured color components are interpreted as R, G and B respectively. No color conversion will be done.
- Automatic: The color mode is selected based on the information in the MSA. If there is no color information available, "No Conversion" is used.
- YCbCr (ITU-709) > RGB: The captured data components are interpreted as Y, Cb, and Cr respectively. Color conversion to RGB is done based on ITU-709 standard.
- SMPTE 170M > RGB: The captured data components are interpreted as Y, U, and V respectively. Color conversion to RGB is done based on SMPTE 170M standard.

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.



Save one frame

Capture and save one video frame as a bitmap file in the PC. The format and storage location can be selected in Tools > Options pull-down menu. The available bitmap formats are PPM, BMP and JPG.

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.

Note Please note that when HDCP is enabled, i.e. when HDCP protected content is received, no content can be saved.

Sequence recording



Clicking the button opens a dialog for definition of number of frames recorded. Buffered mode can also be enabled in this dialog.

Recording				x
Number of frames to record:	5	Buffered	V OK X Cancel	
Capacity of the buffer: 80 fram	ies			

In buffered mode, all input frames are captured non-drop until the on-board frame buffer will be full. The dialog also informs the capacity of the buffer with the selected video mode.

In non-buffered mode, 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.

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

Note Please note that when HDCP is enabled, i.e. when HDCP protected content is received, no content can be saved.



Snap preview



When clicked, one frame of the incoming video is captured and shown in a new *Snapshot* tab. The captured bitmap can be saved with **Save one frame** function described above.



Color Information of the Captured Bitmap can be evaluated by placing the mouse cursor on top of the preview image. The lower right-hand side ribbon of the GUI lists

- Location of the cross cursor on the bitmap
- The intensity of the Red, Green and Blue components of the pixel on the cursor location
- The HTML HEX color code of the pixel on cursor location

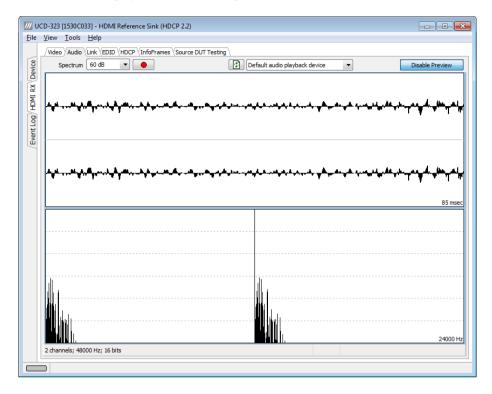
Zoom of the Preview Image can be altered by right clicking on top of the preview image and selecting between

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

While in the *Snap preview mode* clicking on the "Camera" icon will take additional snapshots

Audio Tab

Audio tab is enabled by default. Audio tab has a preview of the audio signal format and the controls for audio playback and recording.



The audio signal format is shown in two 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 80 dB.

The span of the preview window is defined with **Audio preview size** 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 *Audio preview* size depends on the sampling frequency. Please do not exceed the *Audio buffer size* set in the same dialog.

Disable / Enable Preview

Use this button to control capturing the audio data.

Playback device selection

You can enable audio playback in your PC by selecting the **Playback** check-box. Use the combo-box to select the audio device in the host PC through which the captured audio is played. By default, the Default Audio device of your PC is chosen. Please **Disable Preview** to make changes.

_								
/	<mark>7</mark> UC	CD-323 [1530C	33] - HDMI Referen	ce Sink (HDCP 2.2)				- • ×
E	ile	View Tools	<u>H</u> elp					
	Device			InfoFrames \Source DUT		lio playback device		Disable Preview
	g HDMI RX	******	₩ ₽₽₩₩₩₩₩₩₩₩₩₩₩	⋡ ≱ <mark>₩∊₩∊</mark> ₩ _₩ ╌₩ _₩ ∊,₩	ੑੑੑਫ਼ਫ਼ _{ਗ਼} ਫ਼੶ੑੑਫ਼ਖ਼ _{ਗ਼} ਫ਼ੑਫ਼੶੶੶੶ਖ਼	<mark>┟╇╷[╕]╷┑╷╷╺╡╴┲╇</mark> ┯┙	ھەرىھ دې،موردارورىقە.	_ଽ ┝╌ _┲ ╾┲ _╋ ╉ _╼ ╠┻┱┻╢ _╋

Note

Please note that the audio capabilities of the audio playback device of your PC are not automatically reflected in the audio capabilities description in UCD-300 EDID. Since UCD-300 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



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

Audio Buffer Size

You can define the amount of buffering used in the data transfer between the UCD-300 unit and the PC. **Audio buffer size** can be found in Tools > Options dialog. 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



Clicking the button, you can start or stop recording the captured audio in the PC using WAVeform audio format (*.wav) format. In the pop-up dialog, you can define the recording duration. The folder where the audio file will be saved can be selected in File > Options.

Recording			—
Recording duration, msec:	5000 ×	🗸 ок	X Cancel

Input audio mode

2 channels; 48000 Hz; 16 bits

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

Link Tab

Link tab is enabled by default.

HPD	Link (EDID (HDCP	√InfoFrames √Sr ✓ Assert	Durce DUT Testin				
Link Status	ck Ratio 1/4 Input Stream Lock	0 (6G mode)		TMDS Data TMDS Data TMDS Data	1		
Timing Horizontal Total: Start: Active: Sync Width	5280 216 4096 : (+) 88	Vertical Total: Start: Active: Sync Width:	2250 82 2160 (+) 10	Misc Frame Rate, Hz: Color Depth, BPP: Color Encoding: Colorimetry:	50.00 24 RGB RGB	CRC Red CRC: Green CRC: Blue CRC: Update	0x61AB 0x5210 0x5FF2 Copy
Audio Return	Channel Source HDMI RX Loo SPDIF RX	pback		e (Utility line only). ode (Utility + HPD line).			

Link tab contains four panels: HPD, Link Status, Timing and Audio Return Channel.

HPD

Status of the Hot Plug Detect (HPD) signal. Click **Assert** to permanently set the HPD signal to logical "High" state. Click **Deassert** to permanently set the HPD signal to logical "Low" state (de-activate).

Link status

This panel contains three indicators:

- The TMDS Bit Clock Ratio detected
- Input Stream Lock indicator
- Status of the three *TMDS data channels*

Timing

Measured timing information, frame rate and color format details are shown in this panel.

CRC

This panel contains the CRC (Cyclic redundancy check) calculated of all the red, green and blue sub-pixels correspondingly. Click **Update** to re-read.

Audio Return Channel (ARC) (UCD-301 only)

Select Enable to enable ARC function.

You can select the ARC audio Source to be either

- Loopback of captured HDMI audio, or
- Audio received in the S/PDIF input

Select one of the ARC modes via the Mode radio buttons

- Single mode (Utility line only)
- Common Mode (Utility and HPD line).

The Timing, CRC and ARC panels are enabled with UCD Pro for HDMI Sink license.

EDID Tab

EDID Tab is enabled with UCD Pro for HDMI Sink license.

	Video (Audio Link EDID (HDCP InfoFrames Source DUT Testing	
המורב	EDID Data:	EDID Files
2	000010 34 18 01 03 80 80 48 78 0a da ff a3 58 4a a2 29	Load
	000020 17 49 4b 21 08 00 31 40 45 40 61 40 81 80 01 01 000030 01 01 01 01 01 08 e8 00 30 f2 70 5a 80 b0 58 000040 8a 00 ba 82 10 00 00 1e 02 3a 80 18 71 38 2d 40	Save as
ביימו וו רטט	000050 58 2c 45 00 ba 88 21 00 00 1e 02 5a 80 18 71 58 2c 40 000050 58 2c 45 00 ba 88 21 00 00 1e 00 00 00 fc 00 55 000060 43 44 2d 33 32 33 20 48 44 0a 20 20 00 00 00 fd	
	000070 00 17 34 0f 88 3c 00 0a 20 20 20 20 20 20 01 f7 000080 02 03 56 f0 57 1f 10 14 05 20 21 22 13 04 12 03	HEX Editor
~	000090 16 07 60 61 5d 5e 5f 65 66 62 63 64 29 0f 7f 07 000000 15 06 55 3d 1f c0 7e 03 0c 00 10 00 fB 3c 2f 00	Clear
	0000b0 90 01 02 03 04 81 41 01 9c 06 16 08 00 18 00 96 0000c0 a6 98 00 a8 00 6a 48 54 c4 01 78 80 07 62 28 78	Append file
	0000d0 e2 00 4b e4 0f 00 60 0c 56 5e 00 a0 a0 a0 29 50 0000e0 30 20 35 00 ba 88 21 00 00 1a 66 21 56 aa 51 00	EDID Editor
	0000f0 1e 30 46 8f 33 00 ba 88 21 00 00 1e 00 00 00 ef	EDID Editor
		Sink EDID
		Read
		Write

This tab provides tools for accessing the EDID of the UCD-300 Sink presented to the Upstream Source Device. There are three basic functions:

- Load and save EDID data files in the host PC
- Edit the EDID contents
- Program and read the contents of the hardware EDID memory

EDID Files

With **Load...** and **Save as...** you can read and write a hex EDID file from your PC. Please note that the program does not alter the contents of the EDID file or verify its integrity during load and save operation.

Note Four blocks (512 bytes) of EDID code is read. If the device is not supporting all four blocks, the non-supported area is replaced with zeroes.

Currently the EDID Editor does not support Display ID. You can however modify hex EDID files with the HEX Editor or load and program externally generated hex EDID files that have Display ID content.

HEX Editor

When EDID content is either loaded from a file or read from the hardware EDID memory, it is shown in the *EDID Data* panel on the left-hand side of the dialog. You can edit the EDID contents by typing over the existing values. The altered content is highlighted with **RED**. Please note that Hex Editor itself does not alter the contents of the EDID data or verify its integrity.

Once you are done with editing the data, you can either save it to an *.ecd file in your PC with **Save as...** or program it to the hardware EDID memory with **Write**.



EDID Editor

You can edit the EDID structures of the data in the *HEX Editor* by clicking **EDID Editor**. EDID Editor is launched in a separate pop-up window. Please see the description of the EDID editor in Chapter <u>EDID Editor</u> later in this document.

O EDID_Editor		
E-EDID Encoder / Decoder		
Collection 1 Blocks in collection	Details of ":/0/Version/Vendor Pro	duct ID"
Block 0 [VESA EDID]	Key	Value
Checksum	ID Manufacturer Name	UFG
⊿ Version	ID Product Code	0x4036
Extension flag	ID Serial Number	0x3032344c
Vendor & Product ID		
▷ · Basic Display Parameters and Feature ▷ · Display x,y Chromacity coordinates	Manufacture or Model year	Manufacture Year and Week
Established timings I and II		
Manufacturer's Timings	Week of manufacture	Week 20
▷ · Standard Timings	Year of manufacture	Year 2012
▲ 18-Byte data blocks		
▷ · Descriptor 1		
> Descriptor 2		
▷ · Descriptor 3 ▷ · Descriptor 4		
■ Block 1 [CEA 861]		
Checksum		
 CEA Extensions Version 		
Sink Underscans IT video		
Basic audio		
YCbCr (4:4:4)		
Image: Image		
Load 🔚 Save 🛗 Show Hex	🕵 Show Log	

HDCP Tab

HDCP Tab is enabled with UCD Pro for HDMI Sink license.

File	View /Video	Tools (Audio)	46] - HDMI Reference Sink Help (Link \EDID) HDCP \		
HDMI RX Device	Sta		Active Authenticated Declared as HDCP capable Keys loaded	Configuration If HDCP Capable Keys Production Facsimile - "Test" None	
	Sta C C		Active Authenticated Declared as HDCP capable Keys loaded	Configuration HDCP Capable Keys Production None	
	HDC	P 2.2 lice	nse not found		

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the connected UCD-300 device.

Status

The status field indicates the HDCP status of the connected UCD-300 device.

- Active: The link between UCD-300 and the upstream source has been encrypted.
- *Authenticated*: The HDCP handshake between the UCD-300 and the upstream source has been completed successfully.
- *Declared as HDCP capable*: The UCD-300 unit recognizes HDCP handshake messages.
- Keys loaded: The HDCP keys are loaded to the UCD-300 unit.

Configuration

• *HDCP Capable*: Uncheck the box to disable HDCP.

Keys

You can select if you are using *Production* or *Facsimile* HDCP keys. To remove the keys, select *None*.



HDCP 1.4 vs. HDCP 2.3

UCD-300 devices support by default HDCP 1.4 standard with HDMI. HDCP 2.3 support is enabled with *HDCP 2.3 Support* license

/// U	CD-323 [1938C7!	51] - HDMI Reference Sink (HDC	:P 2.2)	- • ×
<u>F</u> ile	<u>V</u> iew <u>T</u> ools	<u>H</u> elp		
	Video Audio	Link EDID HDCP InfoFrames	Source DUT Testing	
/Event Log/HDMI RX Device	HDCP 1.4 Status	Active Authenticated Declared as HDCP capable Keys loaded	Configuration Image: HDCP Capable Keys Production Facsimile - "Test" None	
	HDCP 2.3 Status	Active Authenticated Declared as HDCP capable Keys loaded	Configuration I HDCP Capable Keys Production None	

InfoFrame Tab

InfoFrame Tab is enabled with UCD Pro for HDMI Sink license.

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ē	foFra	οι	.ink	(ED.	U (F	DCF) IL	norr	ame	: (50	ource	2 DU	i ies	sting	1										
Device		HB			PB																				
9		0		2	0	1			4		6					12									
ž																00									
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Event Log / HUMI																									
2																									
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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)
- 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)

Please click **Update** to re-read the InfoFrame data.

Source DUT Testing Tab

Source DUT Testing Tab is enabled with UCD Pro for HDMI Sink license.

Please refer to **Appendix B** later in this document for description of the tests available. Source DUT Testing enables testing of a HDMI Source DUT. Please refer to **Appendix E** of this document to get a full definition of the Test Cases and test parameters.

<i>///</i> U	CD-323 [1938C751] - HDMI Reference Sink (HDCP 2.2)		F	-	
<u>F</u> ile	<u>V</u> iew <u>T</u> ools <u>H</u> elp				
	/Video \Audio \Link \EDID \HDCP \InfoFrames \Source DUT Testing \				
8					
Device	CEC Functional tests CRC tests				
	Test Name	Pass	Fail	Skip	Run
M	CRC based single reference frame video test	2	0	0	2
E	CRC based single frame video stability test	1	0	0	1
Ľ	CRC based sequence of reference frames video test	1	0	0	1
Event Log/HDMI RX	CRC based continuous sequence of reference frames video test	1	0	0	1
<u> </u>					
	📔 Configure) 📋 Ir	nport] Е	xport
	Run Selected Stop on Failure Repeats: 1 A Delay time, sec: 1 Save Report	ſ		Clear	A11
	Kuriseetteu Stop of raidre Repeats. x v Deay ane, set. x v Save Report	ι	_	cical	
	Test Log:				
	0003.363.950: 0 mismatches were found. 0003.364.016: done.				*
	0003.364.058: Stage 5: - test data collection completed				
	0003.364.344: Test PASSED: "CRC based single reference frame video test"				
	*** Test complete PASSED ***				
					*
	"				

Select the tests for execution by clicking the corresponding row.

Clicking **Configure...** opens a dialog for defining the test parameters for that set. Please refer to *Test Parameters* below for description.

Parameters from *Test descriptor files* can be loaded with **Import** and stored with **Export**. Please refer to documentation of TSI software API for description.

Tests are started by clicking **Run Selected**. By clicking **Abort** the sequence is stopped.

Test flow can be controlled with **Repeats** of the test sequence, **Delay time** between individual tests or **Stop on Failure** that stops the whole sequence if one of the tests fail.

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.

Click **Save Report** to generate a HTML report file for sharing the results with other parties for viewing without UCD Console.

By clicking Clear All the test log and the results matrix are cleared.

Test Parameters

Each test set has its dedicated set of test parameters. Open a dialog for defining the parameters by clicking **Configure...**

Parameters of Electrical Test Group

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	0 00 00 00 00 0 0 00	00 00 00 00 0 0 0 00	00 00 00 00 0 0 0 00

Each test in the Electrical test set uses parameters to control test execution and acceptance criteria. Parameters for all tests are collected in the dialog *Electrical test parameters*.

Parameters of CRC Test Set

CRC Video test parameters				x
Base parameters			Reference CRC's	
Test timeout (milliseconds):	10000		0xB69E, 0xB33E, 0x1AB3	*
Run until timeout			0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Test length (# frames):	200	×	0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Errors allowed (# frames):	20	×	0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Repeat "Continuous motion picture test	" until timeout		0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Test iterations (# of repeats):	1	A. V	0xB69E, 0xB33E, 0x1AB3	
Expected Video Signal			0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Width (# pixels):	1920		0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Height (# pixels):	1080		0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Reference BPP:	24 BPP	•	0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	
Frame rate checking			0xB69E, 0xB33E, 0x1AB3 0xB69E, 0xB33E, 0x1AB3	E
-			0xB69E, 0xB33E, 0x1AB3	
Enable frame rate check Expected frame rate (mHz):	60000	A		Ŧ
		V	CRC Capture length (# frames)	_
Frame rate tolerance (±mHz):	100	¥	80 Capture now	
Presets			✓ OK X Cancel	
Structure				

CRC Video test parameters dialog allows you to define the test duration, number of frames captured, and errors allowed. It allows you to define the frame size and capture.

Click **Capture now** to record *Reference CRCs*. Please define the number of frames used as reference – either one or the number of frames in the predefined test sequence.

Presets

In both dialogs you can save the selected parameters as Presets. Please click **Presets...** to save your configuration. If you have saved configuration Presets, you can load one of the saved ones, save a new Preset or delete a Preset.

8. DISPLAYPORT REFERENCE SINK

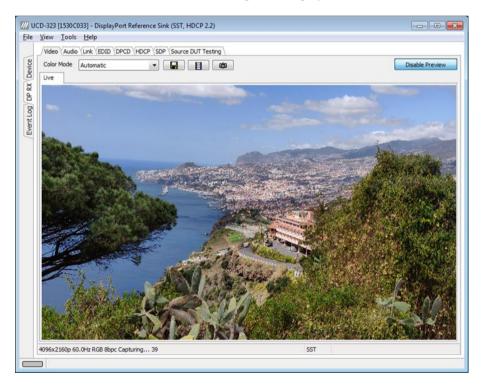
DisplayPort Reference Sink function is available in *UCD-323 HDDP Dual* and *UCD-301 Digital*. In DisplayPort Reference Sink role, the device is using one input channel, DisplayPort Sink (DPRX). The corresponding vertical tab can be seen on the left edge of the GUI.

The horizontal tabs on the top of the GUI enable the various functions available for the input channel. Some of the tabs are enabled by default, some only when an applicable license is included. DPRX features the following functions.

- Video preview and saving (Video). *Enabled by default*.
- Audio monitoring and saving (Audio). *Enabled by default*.
- Status information and control of the upstream link (Link). Partly enabled by default.
- EDID editor (EDID).
- DPCD editor (DPCD).
- HDCP status monitor and control (HDCP).

Video Tab

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



Input video mode

4096x2160p 60.0Hz RGB 8bpc Capturing... 85

The measured input resolution, frame rate and color format is shown below the preview window. The indication of the number of frames captured to the PC shows you the pace of the image data transfer to the PC.

Disable / Enable Preview

Click here the button to start or stop capturing video frames.



The top ribbon of the tab has the following controls:

Color Mode for preview

YCbCr (ITU-709) -> RGB 💌

- No Conversion: The captured color components are interpreted as R, G and B respectively. No color conversion will be done.
- Automatic: The color mode is selected based on the information in the MSA. If there is no color information available, "No Conversion" is used.
- YCbCr (ITU-709) -> RGB: The captured data components are interpreted as Y, Cb, and Cr respectively. Color conversion to RGB is done based on ITU-709 standard.
- SMPTE 170M > RGB: The captured data components are interpreted as Y, U, and V respectively. Color conversion to RGB is done based on SMPTE 170M standard.

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.

Save one frame



Capture and save one video frame as a bitmap file in the PC. The format and storage location can be selected in Tools > Options pull-down menu. The available bitmap formats are PPM, BMP and JPG.

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.

Note Please note that when HDCP is enabled, i.e. when HDCP protected content is received, no content can be saved.

Sequence recording



Clicking the button opens a dialog for definition of number of frames recorded. Buffered mode can also be enabled in this dialog.



In buffered mode, all input frames are captured non-drop until the on-board frame buffer will be full. The dialog also informs the capacity of the buffer with the selected video mode.

In non-buffered mode, 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.

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

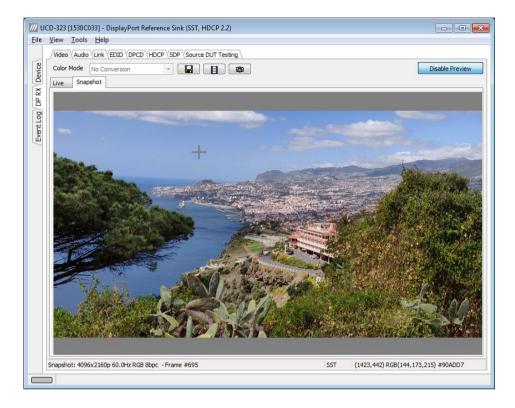
Note Please note that when HDCP is enabled, i.e. when HDCP protected content is received, no content can be saved.



Snap preview



When clicked, one frame of the incoming video is captured and shown in a new *Snapshot* tab. The captured bitmap can be saved with **Save one frame** function described above.



Color Information of the Captured Bitmap can be evaluated by placing the mouse cursor on top of the preview image. The lower right-hand side ribbon of the GUI lists

- Location of the cross cursor on the bitmap
- The intensity of the Red, Green and Blue components of the pixel on the cursor location
- The HTML HEX color code of the pixel on cursor location

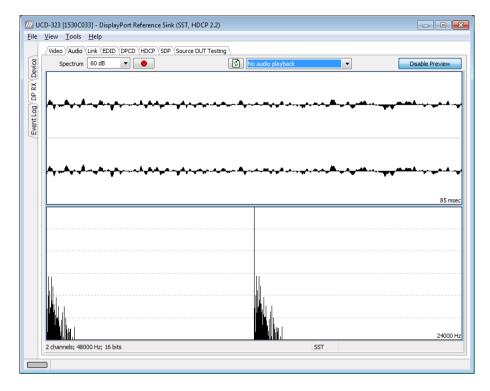
Zoom of the Preview Image can be altered by right clicking on top of the preview image and selecting between

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

While in the *Snap preview mode* clicking on the "Camera" icon will take additional snapshots

Audio Tab

Audio tab is enabled by default. Audio tab has a preview of the audio signal format and the controls for audio playback and recording.



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 80 dB.

The span of the preview window is defined with **Audio preview size** 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 *Audio preview* size depends on the sampling frequency. Please do not exceed the *Audio buffer size* set in the same dialog.

Disable / Enable Preview

Use this button to control capturing the audio data.



Playback device selection

You can enable audio playback in your PC by selecting the **Playback** check-box. Use the combo-box to select the audio device in the host PC through which the captured audio is played. By default, the *Default Audio* device of your PC is chosen. Please **Disable Preview** in order to make changes.



Note

Please note that the audio capabilities of the audio playback device of your PC are not automatically reflected in the audio capabilities description in UCD-300 EDID. Since UCD-300 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



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

Audio Buffer Size

You can define the amount of buffering used in the data transfer between the UCD-300 unit and the PC. **Audio buffer size** can be found in Tools > Options dialog. 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



Clicking the button, you can start or stop recording the captured audio in the PC using Waveform Audio File Format, WAV (*.wav) format. In the pop-up dialog, you can define the recording duration. The folder where the audio file will be saved can be selected in Tools > Options.

Recording			X
Recording duration, msec:	5000	🗸 ок	X Cancel

Input audio mode

2 channels; 48000 Hz; 16 bits

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

Link Tab

Link tab is partly enabled by default, partly with license: UCD Pro for DP Sink.

Cable / HP	dio Link D							
	Cable		HPD	🗸 Assert	🚫 Deassert	💋 Pulse HPD	500 🔔 Length,	msec 💋 Short Pulse
Link Statu	s					Link Configura	tion	
Lane 0	Lane 1	Lane 2	Lane 3	Clock Recovery		Max Lanes	© 2	(ii) 4
				Symbol lock		Max Bitrate, G		0,
				Channel equalization		0 1.62	0 2.70	@ 5.40
400 0	400 0	400 0	400 0	Voltage swing (mVpp) Pre-emphasis (dB))	Other Feature	s	✓ TPS3 Capable
Lane coun	ıt:	4		Bit rate (Gbps):	5.4 (HBR2)	√ Generate H	IPD pulse on Apply	Apply
Framing m		Enhanced		Scrambling:	Enabled			
MST mode		Disabled					🕄 Update Li	nk Status

Link tab contains four panels: Cable / HPD, Link Status, Link Configuration and Stream Status.

Cable / HPD

Indicator lights of the state of the cable. **Cable** indicates that the hardware has detected an upstream cable. **HPD** indicates that the HPD signal is logical "high".

Clicking the **Deassert** button will cause HPD line to be set to logical "low" (de-asserted) and hence no HPD pulse can be generated. Click the **Assert** to re-activate the HPD line (set to logical "high").

To apply a HPD Pulse with programmable duration click **Pulse HPD**. The duration will be defined in the provided field.

For applying a short pulse click Short Pulse. Pulse duration is 1 msec.

Link Status

Link Status displays the status of the link training and the link parameters negotiated between UCD-300 Sink and the Upstream Source. The data is retrieved from the DPCD registers of the UCD-300 Sink. The status is updated automatically.



Link Configuration

Link configuration is enabled with UCD Pro for DP Sink license.

File View Tools	<u>H</u> elp	rt Reference Sink (SST, HE CD \HDCP \SDP \Source D HPD \Assert)UT Testing	D 500 🔺 Length, mse	ec Short Pulse
Link Status Lane 0 40 400 0	Lane 1 Lane 2 400 400 0 0 0x0000 0x0000	Clock Recove Symbol lock Channel equ 400 Voltage swin 0 Pre-emphasiz	Max Bitrate, Gbps alization g (mVpp) Other Capabilities	© 2 © 2.70 254	45.40
Lane count: MST mode: FEC status: HDCP status Scrambling:	4 Disabled Disabled Enabled	Bit rate (Gbps):	5.4 (HBR2) Enable fast LT Enhanced I Generate HPD p	Force cable statu	us to plugged Apply Update Link Status
Stream Sta Horizontal Start: Active: Sync Widt	4400 216 4096	Vertical Total: 2250 Start: 82 Active: 2160 Sync Width: (+) 10	Misc Frame Rate, Hz: 60.000 Color Depth: 8 Color Encoding: RGB unsp. (legacy RGB mode)	CRC Red: 0xCF97 Green: 0x47E4 Blue: 0x511B	

Cable / HPD

Indicator lights of the state of the cable. **Cable** indicates that the hardware has detected an upstream cable. **HPD** indicates that the HPD signal is Asserted (logical "high").

Clicking the **Deassert** button will cause HPD line to be set to logical "low" (de-asserted) and hence no HPD pulse can be generated. Click the **Assert** to re-activate the HPD line (set to logical "high").

To apply an HPD Pulse with programmable duration click **Pulse HPD**. The duration will be defined in the provided field.

For applying a short pulse click Short Pulse. Pulse duration is 1 ms.

Link Status

Link Status displays the status of the link training and the link parameters negotiated between UCD-300 Sink and the Upstream Source. The data is retrieved from the DPCD registers of the UCD-300 Sink. The status is updated automatically.

Link Configuration

Link Configuration allows the user to change the way the Sink capabilities are announced in the DPCD registers of the UCD-300 Sink. Maximum Lane Count and Maximum Link Rate are set with their appropriate radio buttons. To update the new status to the DPCD registers click **Apply**.

Other Capabilities section includes controls of features like TPS3 and TPS4

When **Force cable status to plugged** is checked, sink functionality is active regardless of a failure of upstream device detection e.g. due to incorrect AUX Channel electrical termination.

To apply a Hot-Plug Detect pulse automatically after updating the status, select **Generate HPD pulse on Apply**. HPD pulse duration will be defined in the *Pulse* HPD field.



Stream Status

Stream status is enabled with UCD Pro for DP Sink license.

Video Timing Details are retrieved from the Main-Stream Attributes (MSA) of the monitored stream. Frame rate is measured by UCD-300 Local Sink.

Note: Please note that the MSA information used for Video Timing Details is provided by the Upstream Source, it is not measured by the UCD-300 Local Sink.

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 Link Status**.

The 16-bit **DSC CRC** values of the captured DSC compressed frame. "**Value 0**" is calculated from 1^{st} , 4^{th} , 7^{th} ... byte, "**Value 1**" from 2^{nd} , 5^{th} , 8^{th} ... byte and "**Value 2**" from 3^{rd} , 6^{th} , 9^{th} ... byte.

EDID Tab

EDID Tab is enabled with UCD Pro for DP Sink license.

	• 🗙
Eile <u>V</u> iew <u>I</u> ools <u>H</u> elp	
/Video (Audio (Link) EDID (DPCD (HDCP (SDP (Source DUT Testing)	
BDID Data: 000000 00 ff ff ff ff ff ff 00 54 c7 36 40 4c 34 32 30	
000000 00 ff ff ff ff ff ff 00 54 c7 36 40 4c 34 32 30	
🔀 000010 34 18 01 04 b5 3d 23 78 3a 5f b1 a2 57 4f a2 28 Load	
O 000040 35 05 9 10 00 1a 56 00 a0 a0 29 50 000050 30 20 35 05 59 21 00 01 a0 00 0 d0 38 00 00 1a 00 00 fd 00 38 00 <td< td=""><td></td></td<>	
9 000060 4b 1e 86 36 00 0a 20 20 20 20 20 00 00 00 fc	
HEX Editor	
000080 02 03 12 71 83 4f 00 00 29 0f 7f 07 15 06 55 3d 000090 1f c0 00 00 00 00 00 00 00 00 00 00 00 00	
0000b0 00 00 00 00 00 00 00 00 00 00 00	
0000d0 00 00 00 00 00 00 00 00 00 00 00	
Sink EDID	
Read	
Write	

This tab provides tools for accessing the EDID of the UCD-300 Sink presented to the Upstream Source Device. There are three basic functions:

- Load and save EDID data files in the host PC
- Edit the EDID contents
- Program and read the contents of the hardware EDID memory

EDID Files

With **Load...** and **Save as...** you can read and write a hex EDID file from your PC. Please note that the program does not alter the contents of the EDID file or verify its integrity during load and save operation.

Note

Four blocks (512 bytes) of EDID code is read. If the device is not supporting all four blocks, the non-supported area is replaced with zeroes.

Currently the EDID Editor does not support Display ID. You can however modify hex EDID files with the HEX Editor or load and program externally generated hex EDID files that have Display ID content.

HEX Editor

When EDID content is either loaded from a file or read from the hardware EDID memory, it is shown in the *EDID Data* panel on the left hand side of the dialog. You can edit the EDID contents by typing over the existing values. The altered content is highlighted with **RED**. Please note that Hex Editor itself does not alter the contents of the EDID data or verify its integrity.

Once you are done with editing the data, you can either save it to an *.ecd file in your PC with **Save as...** or program it to the hardware EDID memory with **Write**.



EDID Editor

You can edit the EDID structures of the data in the *HEX Editor* by clicking **EDID Editor**. EDID Editor is launched in a separate pop-up window. Please see the description of the EDID editor in Chapter <u>EDID Editor</u> later in this document.

O EDID_Editor		
E-EDID Encoder / Decoder		
Collection 1 Blocks in collection	Details of ":/0/Version/Vendor Pro	duct ID"
Block 0 [VESA EDID]	Key	Value
Checksum	ID Manufacturer Name	UFG
⊿ Version	ID Product Code	0x4036
Extension flag	ID Serial Number	0x3032344c
Vendor & Product ID		
▷ · Basic Display Parameters and Feature ▷ · Display x,y Chromacity coordinates	Manufacture or Model year	Manufacture Year and Week
Established timings I and II		
Manufacturer's Timings	Week of manufacture	Week 20
▷ · Standard Timings	Year of manufacture	Year 2012
▲ 18-Byte data blocks		
▷ · Descriptor 1		
> Descriptor 2		
▷ · Descriptor 3 ▷ · Descriptor 4		
■ Block 1 [CEA 861]		
Checksum		
 CEA Extensions Version 		
Sink Underscans IT video		
Basic audio		
YCbCr (4:4:4)		
Image: Image		
Load 🔚 Save 🛗 Show Hex	🕵 Show Log	

DPCD Tab

The DPCD tab is enabled with UCD Pro for DP Sink license.

/// UCD-301 [1642C158] - DisplayF	Port Reference Sink (SST, HDCP 2.2)		
<u>File View T</u> ools <u>H</u> elp			
Video Audio Link EDID			
은 DPCD Decoder 1.2 + DETAIL	ED_CAP_INFO_AVAIL = 1		🔄 Load 🛛 📮 Save
DPCD Address range: 0x 0	Number of bytes to read: 0x 100		
1 000010 00000 000000 000000 000020 0000000 0000000 0000000	11 01 01 80 02 00 06 00 00 00 80 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 00 20 00 00 00 00 00 00 00 00 00 00 00 00 0	Write Changes	MAX_LINK_RATE [RO] (Maximum link rate of Main Link lanes) 0x0001:= 0x14 MAX_LINK_RATE = 5.4Gbps
000230 00 00 00 00 00 000240 00 00 00 00 00 000250 00 00 00 00 00 000260 00 00 00 00 00	00 00 <td< td=""><td>E</td><td></td></td<>	E	
000280 00 00 00 00 00		-	
Set Reference	🕸 Refresh	Write Changes	-

DPCD tab is a tool for monitoring and editing the DPCD registers of the UCD-300 Sink.

The tool consists of two independent monitoring and editing windows for the DPCD data. The user can freely select the the DPCD address areas shown on each panel.

The *DPCD Decoder* panel on the right hand side shows the interpretation of the DPCD byte selected on the monitoring windows. The selected byte is shown with a green outline.

In the combo box above the DPCD Decoder window you can select how the DPCD data is interpreted, either as *DP 1.1 DPCD*, or as *DP 1.2 DPCD* with *Detailed Capability Info* selected or not (DETAILED_CAP_INFO_AVAIL = 1/0).

By clicking **Refresh** you can re-read the data from the DPCD registers to the window in question.

By clicking **Write Changes** you can write the portion of data shown in the window in question to the DPCD registers.

By clicking **Set Reference** you can store currently shown data as a reference for comparison.

When you refresh the data from the DPCD registers the changed bytes will be highlighted with gray background.

The fields edited by the user will be highligted with **red** color.

/Video Audio		HDCP			
DPCD Decoder	1.2 + DETAILED_CA	AP_INFO_AVAIL = 1	•		🔄 Load 🛛 🔛 Save
DPCD Address r	ange: 0x 0	Number of bytes to rea	ad: 0x 100		
000010 00 00020 00 00030 00 00040 00 00060 00 00060 00 00080 00 00080 00 00080 00 00080 00 00080 00 00080 00 00080 00	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	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 00 00 00 00 00 00 00 00	E	LANED_1_STATUS [RO] (Lane0 and Lane1 Status) 0x00202 := 0x77 LANE0_CPLONE = 1 LANE0_CHANNEL_ED_DONE = 1 LANE1_STMBOL_LOCKED = 1 LANE1_CHANNEL_ED_DONE = 1 LANE1_STMBOL_LOCKED = 1
Set Refe	rence		🗘 Refresh	Grand Write Changes	
DPCD Address r	ange: 0x 200	Number of bytes to rea	ad: 0x 100		
000210 00 000220 00 000230 00	80 00 80 00 80 00 00 00 00 00 00 00 00 00 00	44 44 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 00 00 00		
Set Refer	rence		Refresh	G Write Changes	

Saving and Loading DPCD Content

You can save the DPCD data in the address areas that you selected for the two windows as a file in your PC. You can save the content in three alternative formats:

- Binary *DPCD Fata File* format (*.DPD). This is Unigraf proprietary format. You can also load the DPCD content stored in this format.
- Comma Separated Values (*.CSV) for loading the data to a spreadsheet.
- *HEX Dump* (*.HEX) in a human readable text format.
- By Clicking **Save** you will be able to select the location and the format of the file.
- ▶ By Clicking Load you can load DPCD data saved in *DPCD Data File* (*.DPD) format to the editor.
- To program the data into the DPCD registers of UCD-300 Local Sink click Write Changes.

Note	 Writing DPCD data to the DPCD registers of the UCD-300 Local Sink will potentially affect the status and capabilities of UCD-300 as seen by the upstream source. User control like Link Training or mode changes will modify the content of the DPCD registers During a reboot of UCD-300 the DPCD registers will be returned to their default values
------	---



HDCP Tab

HDCP tab is enabled with UCD Pro for DP Sink license.

/// U	CD-323 [1530C0	33] - DisplayPort Reference Sink	(SST, HDCP 2.2)	- • •
<u>F</u> ile	<u>V</u> iew <u>T</u> ools	Help		
	Video Audio		Source DLIT Testion	
8			boarde bot rebuild	
evic	HDCP 1.3			
9	Status		Configuration	
2		Active	V HDCP Capable	
9			Keys	
Event Log/ DP RX Device			Production	
/ent		Keys loaded	◎ Facsimile - "Test"	
L.			() None	
	HDCP 2.3			
	Status		Configuration	
		Active	HDCP Capable	
		Declared as HDCP capable Keys loaded	Keys	
		Keys loaded	Production	
			None	
		ense not found		
	HDCP 2.3 lice	ense not found		

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the connected UCD-300 device.

Status

The status field indicates the HDCP status of the connected UCD-300 device.

Active: The link between UCD-300 and the upstream source has been encrypted.

Authenticated: The HDCP handshake between the UCD-300 and the upstream source has been completed successfully.

Declared as HDCP capable: The UCD-300 unit recognizes HDCP handshake messages.

Keys loaded: The HDCP keys are loaded to the UCD-300 unit.

Configuration

HDCP Capable: To disable HDCP uncheck the box.

Keys

You can select if you are using *Production* or *Facsimile* HDCP keys. To remove the keys, select *None*.



HDCP 1.3 vs. HDCP 2.3

UCD-300 devices support by default HDCP 1.3 standard with DisplayPort. The functionality supporting HDCP 2.3 is enabled with HDCP 2.3 Support license

/// u	JCD-301 [1	542C15	58] - DisplayPort Reference Sink	(SST, HDCP 2.2)	- • ×
<u>F</u> ile	<u>V</u> iew]	ools	Help		
	/Video V	Audio		Source DUT Testing	
Event Log/ DP RX Device	HDCP	1.3 5	Active Authenticated Declared as HDCP capable Keys loaded	Configuration Image: HDCP Capable Keys Production Fractimite - "Test"	
ŭ.				None	
		; 	Active Authenticated Declared as HDCP capable Keys loaded	Configuration IDCP Capable Keys Production None	

SDP Tab

SDP Tab is enabled with UCD Pro for DP Sink license.

In SDP Tab you will be able to monitor the *Secondary-Data Packets* sent by the Source device. Click **Update** to re-read the data.

	Aud	lio (Lir	nk (El		OPCD	HD	CP)	SDP	So	urce	DU	TTes	sting	7																			
SDP		HB			PB																												
	ACR ASP OBA		1 17 2 00 7 05	0 01 5 13	0 00 00 00	00 37 00	09 00	98 00	00 00	6E 00	09 00	A8 00	00 00	00 37 00	3E 09 00	00 98 00	00 00 00	00 6A 00	3E 09 00	00 A0 00	00 31	80 81	00 00		00	80	00	00	00	80	00	00	
•	-	_				-	-	-	-	-	-	_	-	-		-	-	_	-	_	_	-	-	_		-	-	-	_			Upda	ate

SDP Tab displays in hexadecimal format the following received SDP packets:

- Audio_TimeStamp
- Audio_Stream
- Extension
- Audio_CopyManagement
- ISRC
- Video Stream Configuration (VSC)
- Camera Generic 0
- Camera Generic 1
- Camera Generic 2
- Camera Generic 3
- Camera Generic 4
- Camera Generic 5
- Camera Generic 6
- Camera Generic 7
- Vendor-Specific Infoframe packet
- AVI InfoFrame packet
- Source Product Descriptor InfoFrame packet
- Audio InfoFrame packet
- MPEG Source InfoFrame packet
- Dynamic Range and Mastering InfoFrame
- Picture Parameter Set (PPS)

Source DUT Testing Tab

Source DUT Testing Tab is enabled with UCD Pro for DP Sink license.

Please refer to **Appendix E** later in this document for description of the tests available. Source DUT Testing enables the execution of HDCP 2.3 Compliance Tests for a DP Source DUT.

Source DUT Testing enables testing of a DP Source DUT. Please refer to **Appendix E** of this document to get a full definition of the Test Cases and test parameters.

<i>]]]</i> U	CD-323 [1635C136] - DisplayPort Reference Sink (SST, HDCP 2.2)					×
<u>F</u> ile	<u>V</u> iew <u>T</u> ools <u>H</u> elp					
	Video Audio Link EDID DPCD HDCP SDP Source DUT Testing					
8						
Device	/ DP RX CRC test set (DP RX Simple LT test set) DP HDCP CTS 1A test set (DP HDCP CTS 1B test set)					
X	Test Name	Pass	Fail	Skip	Run	
B	✓ 1A-01 Regular Procedure - With previously connected Receiver (With stored km)	1	1	0	2	
Event Log	 1A-02 Regular Procedure - With newly connected Receiver (Without stored km) 	1	0	0	1	
ent	✓ 1A-03 Regular Procedure - Receiver disconnect after AKE_Init	1	0	0	1	
l 🖻	✓ 1A-04 Regular Procedure - Receiver disconnect after km	1	0	0	1	
	🖌 1A-05 Regular Procedure - Receiver disconnect after locality check	1	0	0	1	=
	🖋 1A-06 Regular Procedure - Receiver disconnect after ks	1	0	0	1	-
	1A-07 Regular Procedure - Receiver sends REAUTH_REQ after Ks	1	0	0	1	
	🖌 1A-08 Irregular Procedure - Verify Receiver Certificate	1	0	0	1	
	 1A-09 Irregular Procedure - SRM 	0	0	0	0	
	 1A-10 Irregular Procedure - Invalid H' 	0	0	0	0	
	 1A-11 Irregular Procedure - Pairing Failure 	0	0	0	0	
	 1A-12 Irregular Procedure - Locality Failure 	0	0	0	0	-
	E Configure	Impo	rt		Export	
	Run Selected Stop on Failure Repeats: 1 A Delay time, sec: 1 Save Report]		Cle	ar All	
	Test Log:					
	0001.283.478: [TE-Snk] [Authentication and Key Exchange]					•
	0001.283.612: [TE-Snk] STEP 1A-01-2 0001.283.828: [TE-Snk] WARNING. DUT sends unencrypted video					
	0001.283.961: [TE-Snk] DUT initiates authentication by transmitting AKE_Init 0001.284.277: Test PASSED: "IA-08 Irregular Procedure - Verify Receiver Certificate"					
	*** Test complete PASSED ***					
	Test complete PASSED					-

Select the tests for execution by clicking the selector \Box in the left hand side of the corresponding row.

Clicking **Configure...** opens a dialog for defining the test parameters for that set. Please refer to *Test Parameters* below for description.

You can also load parameters from *Test descriptor files* with **Import** and store them with **Export**. Please refer to documentation of TSI software API for description.

Run the tests by clicking **Run Selected**. By clicking **Abort** you can stop the sequence.

You can control the test flow either with **Repeats** of the test sequence, **Delay** between individual tests or **Stop on Failure** that stops the whole sequence if one of the tests fail.

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.

Click **Save Report** to generate a HTML report file for sharing the results with other parties for viewing without UCD Console.

By clicking Clear All you can clear all results – the test log and the results matrix.

Test Parameters

Each test set has its dedicated set of test parameters. You can open a dialog for defining the parameters by clicking 🔲 button in the set header.

Parameters of CRC Test Set

CRC Video test parameters dialog allows you to define the test duration, number of frames captured, and errors allowed. It allows you to define the frame size and capture.

Base parameters			Reference CRC's	
est timeout (milliseconds):	100000	-	0x372F, 0xEB62, 0xC4EE	-
Run until time-out			0x372F, 0xEB62, 0xC4EE 0x372F, 0xEB62, 0xC4EE	
			0x372F, 0xEB62, 0xC4EE	Ξ
Test length (# frames):	2000		0x372F, 0xEB62, 0xC4EE	
	2		0x372F, 0xEB62, 0xC4EE	
Errors allowed (# frames):	2	×	0x372F, 0xEB62, 0xC4EE	
			0x372F, 0xEB62, 0xC4EE	
Expected Video Signal			0x372F, 0xEB62, 0xC4EE	
Vidth (# pixels):	1280		0x372F, 0xEB62, 0xC4EE	
vidth (# pixels):	1200		0x372F, 0xEB62, 0xC4EE	
leight (# pixels):	720		0x372F, 0xEB62, 0xC4EE	
leight (# pixels):	/20		0x372F, 0xEB62, 0xC4EE	
Reference BPP:	24 BPP	-	0x372F, 0xEB62, 0xC4EE	
dererence brr.	ZTUFF		0x372F, 0xEB62, 0xC4EE	
Frame rate checking			0x372F, 0xEB62, 0xC4EE	
Frame rate checking			0x372F, 0xEB62, 0xC4EE 0x372F, 0xEB62, 0xC4EE	
Enable frame rate check			UX3/2F, UXEB62, UXC4EE	-
Expected frame rate (mHz):	60000	A V	CRC Capture length (# frames)	
Frame rate tolerance (±mHz):	100	A V	80 Capture now	

Click **Capture now** to record *Reference CRCs*. Please define the number of frames used as reference – either one or the number of frames in the predefined test sequence.

Parameters of Electrical Test Group

Each test in the Electrical test set uses parameters to control test execution and acceptance criteria. Parameters for all tests are collected in the dialog *Electrical test parameters*.

Test timeout in milliseconds	0	
Main link low voltage limit, mV	0	
Main link high voltage limit, mV	0	
HPD line logical zero low voltage limit, mV	0	
HPD line logical zero high voltage limit, mV	0	
HPD line logical one low voltage limit, mV	0	
HPD line logical one high voltage limit, mV	0	
AUX + line idle low voltage level limit, mV	0	
AUX + line idle high voltage level limit, mV	0	
AUX – line idle low voltage level limit, mV	0	
AUX – line idle high voltage level limit, mV	0	
AUX + line signal trigger low level, mV	0	
AUX + line signal trigger high level, mV	0	
AUX – line signal trigger low level, mV	0	
AUX – line signal trigger high level, mV	0	
AUX signal capture timeout, milliseconds	0	
AUX signal capture attempts, times	0	
Maximum lanes count supported by DUT	0	
Maximum data rate supported by DUT in 0.2	0	
DUT Capabilities flags	0	-

HDCP CTS Test Set

The HDCP Tests have test timeout as a given parameter.

Presets

In both dialogs you can save the selected parameters as Presets. Please click **Presets...** to save your configuration. If you have saved configuration Presets, you can load one of the saved ones, save a new Preset or delete a Preset.

9. HDMI REFERENCE SOURCE

HDMI Reference Source function is available in *UCD-323 HDDP Dual*. In HDMI Reference Source role, the device is using one output channel, HDMI Source (HDMI TX). The corresponding vertical tab can be seen on the left edge of the GUI.

The horizontal tabs on the top of the GUI enable the various functions available for the output channel. Some of the tabs are enabled by default, some only when an applicable license is included. DPTX features the following functions.

- Video pattern generator (Pattern Generator). Enabled by default.
- Status information and control of the downstream link (Link). *Enabled by default*.
- EDID editor (EDID).
- HDCP status monitor and control (HDCP).

Pattern Generator Tab

Pattern Generator tab is enabled by default.

Cta 3840 x 2160 @ 60.0Hz 8 bpc v RGB v v 8 bpc v Q Q RGB v v 8 bpc v Q Q V 0 <th>Video Pattern Gener</th> <th>ator</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Custom image</th>	Video Pattern Gener	ator							Custom image
RGB •	CTA 3840 x 2160 @	0 60.0Hz	▼ 8b	рс	•	Color	Bars	•	
Image with the second secon	RGB	•				0			
RGB Image for the second s					_	_	¥ -		
Image: Spc Im			- 8 b	pc	T				
Image: Seption of the sector of the secto	RGB	▼][-			0	× 0	×	
RGB Image to load Image values Image values Custom 0 H-Total 4400 H-Sync Width 88 V-Sync Width 88 V-Sync Negative polarity Image to load			- 8h	DC.	Ţ			-	* cont
RGB Image to load Timing values 0 0 Custom 0 0 H-Total 4400 H-Start 3840 H-Start 3840 H-Sync Width 88 V-Sync Width 82 V-Active 2160 V-Sync Nigative polarity Image to load				p.					
RGB Image to load Timing values Image to load Custom 0 H-Total 4400 H-Start 3840 H-Sync Width 88 V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000	RGB		T			0	v 0	v	
RGB 0 0 0 Timing values 0 0 0 Custom 0 0 0 H-Total 4400 0 0 H-Start 3840 0 0 H-Sync Width 88 0 0 V-Total 2250 0 0 V-Start 82 0 0 V-Sync Width 10 0 0 Frame Rate 60.000 0 0 V-Sync Negative polarity 0 0 0			- 8b	pc	-			-	
Custom 0 H-Total 4400 H-Start 384 H-Active 3840 H-Sync Width 88 V-Total 2250 V-Active 2160 V-Sync Width 10 Frame Rate 60.000	RGB	•				0	<u> </u>		Click on image to load
Custom 0 H-Total 4400 H-Sync Width 840 H-Sync Width 88 V-Total 2250 V-Sync Width 10 Frame Rate 60.000						-		¥.	
H-Total 4400 H-Start 384 H-Active 3840 H-Sync Width 88 V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000	-								
H-Start 384 H-Active 3840 H-Sync Width 88 V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000	Custom			-					
H-Active 3840 H-Sync Width 88 V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000									
H-Sync Width 88 V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000									
V-Total 2250 V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000									
V-Start 82 V-Active 2160 V-Sync Width 10 Frame Rate 60.000									
V-Active 2160 V-Sync Width 10 Frame Rate 60.000 H-Sync Negative polarity IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII									
V-Sync Width 10 Frame Rate 60.000 H-Sync Negative polarity Image: Comparison of the sync Negative polarity									
Frame Rate 60.000 H-Sync Negative polarity V-Sync Negative polarity									
H-Sync Negative polarity				_					
V-Sync Negative polarity		Frame Rate	60.000)					
	H-Sy	nc Negative polarity			[
Pattern Generator Settings	V-Sy	nc Negative polarity			[
	Manag	e Timinas							Pattern Generator Settings



Predefined Timings

UCD-300 includes a set of common predefined video timings. Please find a list of the timings with their major details in <u>Appendix C</u> of this document.

Color Mode

RGB color mode with full range quantization levels will be used with all patterns except with *Color Square* pattern. This pattern allows the user to select RGB, YCbCr 4:4:4, YCbCr 4:2:2 and YCbCr 4:2:0 color modes. When YCbCr is selected, the Colorimetry dropdown box is enabled and allows selection between ITU-709 and ITU-601. Please find a description of the available test patterns in <u>Appendix D</u> of this document.

Color Depth

You can set the color depth used. The available color depths are: 8, 10, 12 and 16 bpc.

Predefined Video Patterns

UCD-300 has a set of predefined patterns and a possibility to user defined custom pattern. You can select the pattern in the provided combo box. By selecting **Disabled** you can have the links activated but no video data transferred.

Please find a description of the available test patterns in Appendix D of this document.

Custom Image Patterns

BMP, PNG, JPG and TIFF files can be loaded from the PC to be used as custom images. The bitmaps will be aligned to the top left hand side corner, displayed at the original resolution, no scaling, cropped to the active area. Select **Custom Image** pattern.

Pattern Generator Settings

In order to avoid sourcing invalid video mode combinations, the new settings need to be validated by the user by clicking **Apply**. Automatic validation will be applied when **Auto-apply when valid** is checked. The situation that parameters have been changed but not applied is indicated by **bold values** of the parameter.

_	D-323 [15300 <u>V</u> iew <u>T</u> ools	033] - HDMI Reference s <u>H</u> elp	Source (HDCP 2.2)					
Device	Pattern Gen Video Patter	erator Audio Generator n Generator					Custom image	
ğ	CTA 3840	x 2160 @ 50.0Hz	▼ 12 bpc ▼	Color	Ramp	-	UNIGRAF	
Ĕ	RGB	-	-	0	× 0	A V	at 10	
IMOH			▼ 8 bpc ▼			~		
Do J	RGB	v	T	0		A. V	[702] 	
, ti			v 8 hnc v			-		

Note

Please note that the changes in Pattern Generator tab will not be applied unless the user validates them by clicking **Apply** or when **Auto-apply when valid** is checked.



Custom Timing

Custom Timing feature is enabled with UCD Pro for HDMI Source license.

Custom		0			
Cubronn	H-Total	5280			
	H-Start	384			
	H-Active	3840			
	H-Sync Width	88			
	V-Total	2250			
	V-Start	82			
	V-Active	2160			
	V-Sync Width	10			
	Frame Rate	50.000			
H-	Sync Negative polarity				
V-	Sync Negative polarity				
Man	age Timings]			Pattern Generator Settings
					Apply Auto-apply when valid

The timing parameters can be modified by selecting the **Custom** check-box and editing the fields of the matrix. Enable the new parameters by clicking **Apply** button.

Manage Timings

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

urrent timings:							
Show/Type	Name		Timing \	/alues			
Fixed	VESA 4096 x 2160 @	60.0Hz	Active ((4096 x 2160), Total (41	76, 2222), Syr	nc (32, 8)	
Fixed	CEA 3840 x 2160 @ 3	0.0Hz	Active ((3840 x 2160), Total (44	00, 2250), Syr	nc (88, 10)	
Fixed	CEA 3840 x 2160 @ 5	0.0Hz	Active (3840 x 2160), Total (52	30, 2250), Syr	nc (88, 10)	
Fixed	CEA 4096 x 2160 @ 5	0.0Hz	Active ((4096 x 2160), Total (52	30, 2250), Syr	nc (88, 10)	
Fixed	CEA 3840 x 2160 @ 6	0.0Hz	Active ((3840 x 2160), Total (44	00, 2250), Syr	nc (88, 10)	
Fixed	CEA 4096 x 2160 @ 6	0.0Hz	Active ((4096 x 2160), Total (44	00, 2250), Syr	nc (88, 10)	
Fixed	VESA 3840 x 2160 @	120.0Hz	Active (3840 x 2160), Total (40	00, 2222), Syr	nc (59, 5)	
Fixed	VESA 3840 x 2160 @	120.0Hz	Active (3840 x 2160), Total (39	20, 2287), Syr	nc (32, 6)	
Fixed	Other 5120 x 2880 @	60.0Hz	Active (5120 x 2880), Total (52	30, 2962), Syr	nc (32, 5)	
Fixed	Other 7680 x 4320 @	30.0Hz	Active (7680 x 4320), Total (78	40, 4381), Syr	nc (32, 5)	
Custom	VESA 1280 x 800 @ 6	0.0Hz1	Active ((1280 x 800), Total (144), 823), Sync	(32, 6)	
Delete Selecter	d Horizontal timing	Vertical ti	ming				
1	Total 1440	823		Frame rate (Hz)	60		
A	ctive 1280	800		Pixel Clock (MHz)	71,1072		Clear
5	Start 112	20					
Sync v	vidth 32	6					Update timing
Sync pol	arity 📃 Negative	V Negat	ive	Name	VESA 1280 x	800 @ 60.0HzCustom	Add new timing

►

In order to create a new custom timing based on one of the standard fixed, timings select the fixed timing and change its name and click **Add new timing** to store.

In order to modify an existing custom timing, select it, modify and click Update timing.

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

Customize Timings List

The timings are shown on the pull-down menu by un-checking the **Show** box. The timings will remain in the list and can be brought back to the pull-down menu, when needed.

Audio Generator Tab

Audio Generator tab is enabled by default.

	ew <u>T</u> ools <u>H</u> elp					
	Pattern Generator A Audio Status	udio Generator \Lir				
	audio Status Judio loaded: 2 chann	nels @ 44100 Hz, 16	bits			
		idio from: Audio gen aying	erator.			
	Audio Content					
0	Generate audio:					
	Waveform:	Sine 💌	Bits/Sample:	16 bits 💌		
	Signal frequency:	1000	Amplitude:	60% 💌		
	Sample Rate:	44100 Hz 🔹	Channels:	2 Channels 💌		
0) Load audio from file	e:				
	Open W	/AV file				

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

- To load internally generated audio, select **Generate audio**, and adjust the controls to the desired audio format.
- ► To load an audio file from your PC, select Load audio from file, click the Open WAV file... button, browse and select the file and click Open
- ► To play the selected audio content, click the **Play** ► button.

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

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

Link Tab

Link tab is enabled by default.

Device	/Pattern Generator \Audio Generator \Link \ HPD Asserted	EDID (HDCP \		
/Event Log/HDMI_TX (D	Transmitter HOMI Behaviour 1.4 2.0 2.1 Status Mode: HDMI Behaviour: HDMI 2.0 TMDS Bit Clock Ratio: 1/40 (66 mode) Scrambling Video	TMDS Control Mode:	Receiver Sink Capabilities Mode: Behaviour: TMDS Bit Clock Ratio: FRL Support: VRR Support: ALLM Support:	6G 78 Not supported 0/0/28/000 Supported

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

HPD

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

Transmitter

The panel shows the link mode used, the clock information and the status of the video and data scrambling.

HDMI Behavior

Select between HDMI 1.4, HDMI 2.0 and HDMI 2.1 behaviors

Mode

Select between HDMI and DVI modes. In DVI mode no audio and metadata is provided and color depth limited to 24 bpp maximum.

Link Mode

Select between 3.4 Gbps (3G) and 6.0 Gbps (6G) TMDS Link Rate

Enable Scrambler

Enable or disable scrambling of the TMDS data channels.

EDID Tab

EDID tab is enabled with UCD Pro for HDMI Source license.

<u>///</u> U	CD-323	(1533C0	46] - HDM	I Referen	ce Sourc	e						
File	View	Tools	Help									
	Patte	rn Gener	ator (Link)	EDID								
Device	EDID D	ata:										EDID Files
<u>S</u>	0000	00 00	ff ff f:		ff 00	54 c7	36 40	4c 34	32	30	^	
Ĕ			18 01 03 49 4b 23						_			Load
XT IMOH			01 01 01 03									Save as
E			00 ba 8									
			2c 45 00 44 2d 3									
			17 3d 0									HEX Editor
			03 55 f									
			06 55 30									Clear
			01 02 03									Append file
			98 00 at 0f 00 6									
	0000	e0 00	ba 88 2	1 00 00	1a 66	21 56	aa 51	00 1e	30	46		EDID Editor
	0000	f0 8f	33 00 bi	a 88 21	00 00 3	1e 00	00 00	00 00	00	2e	Ξ	
												Connected Sink EDID
												Read
												Write
											•	

EDID tab will enable analyzing and saving the EDID read from the connected Sink device.

There are three basic functions:

- Read the contents of the EDID of the downstream sink over the HDMI link.
- Load and save EDID data files in the host PC
- Edit the EDID contents

EDID Files

With **Load...** and **Save as...** you can read and write a hex EDID file from your PC. Please note that the program does not alter the contents of the EDID file or verify its integrity during load and save operation.

Currently the EDID Editor does not support Display ID. You can however modify hex EDID files with the HEX Editor or load and program externally generated hex EDID files that have Display ID content.

HEX Editor

Note

When EDID content is either loaded from a file or read from the hardware EDID memory, it is shown in the *EDID Data* panel on the left hand side of the dialog. You can edit the EDID contents by typing over the existing values. The altered content is highlighted with **RED**. Please note that Hex Editor itself does not alter the contents of the EDID data or verify its integrity.

Once you are done with editing the data, you can either save it to an *.ecd file in your PC with **Save as...** or program it to the hardware EDID memory with **Write**.



EDID Editor

You can edit the EDID structures of the data in the *HEX Editor* by clicking **EDID Editor**. EDID Editor is launched in a separate pop-up window. Please see the description of the EDID editor in Chapter <u>EDID Editor</u> later in this document.

O EDID_Editor		
E-EDID Encoder / Decoder		
Collection 1 Blocks in collection	Details of ":/0/Version/Vendor _Prod	luct ID"
 Block 0 [VESA EDID] 	Key	Value
Checksum	ID Manufacturer Name	UFG
⊿ Version	ID Product Code	0x4036
Extension flag	ID Serial Number	0x3032344c
Vendor & Product ID		
▷ · Basic Display Parameters and Feature ▷ · Display x,y Chromacity coordinates	Manufacture or Model year	Manufacture Year and Week
Established timings Land II.		
▷ · Manufacturer's Timings	Week of manufacture	Week 20
▷ · Standard Timings	Year of manufacture	Year 2012
▲ · 18-Byte data blocks		100 00 10
▷ · Descriptor 1		
▷ · Descriptor 2		
Descriptor 3		
▷ · Descriptor 4		
BIOCK I [CEA 861] Checksum		
CEA Extensions Version		
- Sink Underscans IT video		
Basic audio		
۰ III +		
Coad Save Show Hex	🕵 Show Log	



HDCP Tab

HDCP tab is enabled with UCD Pro for HDMI Source license.

	CD-323 View		46] - HDMI Reference Source		
File					
Device	HDCF	P 1.4	ator \Link \EDID \HDCP \	Configuration	
HDMI TX Device			Active Authenticated Authentication in progress Keys loaded	Comparador Comparador Comparador Authenticate Keys Production Facsimile - Test* None	
		us	Active Authenticated Authentication in progress Keys loaded	Configuration Enable encryption Authenticate Keys Production So None	
	HDC	P 2.2 lice	nse not found		

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the connected UCD-300 device.

Status

The status field indicate the HDCP status of the connected UCD-300 device.

Active: The stream between UCD-300 and the downstream sink has been encrypted.

Authenticated: The HDCP handshake between the UCD-300 and the sink unit has been completed successfully.

Authentication in progress: The HDCP handshake is in process between the UCD-300 and the downstream sink unit.

Keys loaded: The HDCP keys are loaded to the UCD-300 unit.

Configuration

Authenticate: Perform the HDCP initiation handshake between the UCD-300 and the sink unit.

Enable encryption: Check to enable the encryption of the stream between UCD-300 and the downstream sink.

Keys

You can select if you are using *Production* or *Facsimile* HDCP keys. To remove the keys, select *None*.



HDCP 1.4 vs. HDCP 2.3

UCD-300 devices support by default HDCP 1.4 standard with HDMI. HDCP 2.3 support is enabled with *HDCP 2.3 Support* license.

HDCP 1.4 Status Active Authenticated Authentication in progress Keys loaded	Configuration Enable encryption Authenticate Keys Production Facsimile - "Test" None
HDCP 2.3	Configuration
Status	Configuration
Active	Authenticate
Authenticated	Keys
Authentication in progress	Production
Keys loaded	None

10. DISPLAYPORT REFERENCE SOURCE

DP Reference Source function is available in *UCD-323 HDDP Dual*. In DisplayPort Reference Source role, the device is using one output channel, DisplayPort Source (DPTX). The corresponding vertical tab can be seen on the left edge of the GUI.

The horizontal tabs on the top of the GUI enable the various functions available for the output channel. Some of the tabs are enabled by default, some only when an applicable license is included. DPTX features the following functions.

- Video pattern generator (Pattern Generator). *Enabled by default*.
- Status information and control of the downstream link (Link). *Enabled by default*.
- EDID editor (EDID).
- DPCD monitor (DPCD)
- HDCP status monitor and control (HDCP).

Pattern Generator Tab

You can enable the DP Reference Source role either with or without the support to Multistreaming (MST). The names of the roles are *DisplayPort Reference Source MST2* and *DisplayPort Reference Source SST*. The two roles have a slightly different pattern generator functionality.

Rol	ما
1.0	ιu

Features

Single stream only

- 7 fixed patterns
- 3 adjustable and 2 special patterns
- Custom bitmap patterns
- Deep color
- HDCP 1.3 and HDCP 2.3. support

DisplayPort Reference Source MST2

DisplayPort Reference Source SST

Up to two DP streams

• 7 fixed patterns HDCP 1.3 and HDCP 2.3. support

		nk (EDID (DPCD (H	OCP Sink DUT Testing		
Video Pattern Gen					1.	
MST Num	per of streams 2 🕃				Â	
CTA 1920 x 1080	@ 60.0Hz	• 8 bp	•	Color Bars	-	
RGB	-					
VESA 2560 x 144		▼ 8 bp	•	Color Bars		
			- •			
RGB	T	T			A V	
		-	-		-	
RGB	v				Å	
			Ψ		_	
RGB	_	Ŧ			A V	
Timing values					-	
Custom		0	1		_	
	H-Total	2200	2720			
	H-Start	192	112			
	H-Active	1920	2560			
	H-Sync Width	44	32			
	V-Total	1125	1481			
	V-Start	41	38			
	V-Active	1080	1440			
	V-Sync Width	5	5			
	Frame Rate	60.000	60.000			
H-	Sync Negative polarity					
V-	Sync Negative polarity		1			
	- ,					Pattern Generator Settings
Mana	age Timings					Apply Auto-apply when valid

Please find below Pattern Generator tab in *DisplayPort Reference Source MST2* mode.

Please find below Pattern Generator tab in DisplayPort Reference Source SST mode.

Pattern Generator A	udio Generator \Link			DCP Sink	DUT Testing \		
Video Pattern Genera	tor						Custom image
CTA 1920 x 1080 @ 6	50.0Hz	▼ 8 bp	c 🔻	Color	Bars	•	
RGB 👻		T		0	× 0	A V	1000
		-	-			-	
RGB 👻		-		0	0	A V	
				_	v v		
		-	-			-	
RGB 💌		-		0	▲ 0 ▼	A	-
							Default.bmp
		×	*			T	Click on image to load
RGB 👻		-		0	- O		-
	H-Total H-Start H-Active H-Sync Width V-Total V-Start V-Active V-Sync Width Frame Rate c Negative polarity	2200 192 1920 44 1125 41 1080 5 60.000					
	c Negative polarity						
Manage	Timings						Pattern Generator Settings
							Apply Auto-apply when val

Note

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



Predefined Timings

UCD-300 includes a set of common predefined video timings. Please find a list of the timings with their major details in <u>Appendix C</u> of this document.

Color Mode

RGB color mode with full range quantization levels will be used with all patterns except with *Color Square Pattern*. This pattern allows the user to select RGB, YCbCr 4:4:4, YCbCr 4:2:2 and YCbCr 4:2:0 color modes. When YCbCr is selected, the Colorimetry dropdown box is enabled and allows selection between ITU-709 and ITU-601. Please find a description of the available test patterns in <u>Appendix D</u> of this document.

Color Depth

You can set the color depth used. The available color depths are: 6, 8, 10, 12 and 16 bpc. Color depth 6 bpc is only available with RGB.

Predefined Video Patterns

UCD-300 has a set of predefined patterns and a possibility to user defined custom pattern. You can select the pattern in the provided combo box. By selecting **Disabled** you can have the links activated but no video data transferred.

Please find a description of the available test patterns in Appendix D of this document.

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

Custom Image Patterns

BMP, PNG, JPG and TIFF files can be loaded from the PC to be used as custom images. The bitmaps will be aligned to the top left hand side corner, displayed at the original resolution, no scaling, cropped to the active area. Select **Custom Image** pattern.

Enable / Disable Multistreaming

In *DisplayPort Reference Source MST2* mode you can switch between Single Stream and Multistream operation of the source with **MST** check box. When **MST** is selected you can define the number of streams enabled in **Number of streams**. Currently only up to 2 streams are supported.

Pattern Generator Settings

In order to avoid sourcing invalid video mode combinations, the new settings need to be validated by the user by clicking **Apply**. Automatic validation will be applied when **Auto-apply when valid** is checked. The situation that parameters have been changed but not applied is indicated by **bold values** of the parameter.

	D-323 [1530C033] - DisplayPort Ref View <u>T</u> ools <u>H</u> elp	erence Source (SST, HDO	CP 2.3)		
	/Pattern Generator Audio Generator		CP \Sink DUT Testing \		
Device	Video Pattern Generator			Custom image	
Ĕ	VESA 1920 x 1440 @ 60.0Hz	• 10 bpc •	Solid Black	UNIGRAF	
B	RGB			Darra -	
Event Log		T	×		
entl	RGB	T			
P		•	v		
	RGB 🔻	-		· · · ·	A.A.A. (44

Note

Please note that the changes in Pattern Generator tab will not be applied unless the user validates them by clicking **Apply** or when **Auto-apply when valid** is checked.

Custom Timing

Custom Timing feature is enabled with UCD Pro for DP Source license.

Timing values					
Custom	H-Total	0			
		2600			
	H-Start	552			
	H-Active	1920			
	H-Sync Width	208			
	V-Total	1500			
	V-Start	59			
	V-Active	1440			
	V-Sync Width	3			
	Frame Rate	60.000			
H-S	Sync Negative polarity	V			
V-5	Sync Negative polarity				
Mana	ge Timings]			Pattern Generator Settings
					Apply Auto-apply when valid

The timing parameters can be modified by selecting the **Custom** check-box and editing the fields of the matrix. Enable the new parameters by clicking **Apply** button.

Manage Timings

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

-			
now/Type	Name	Timing	ng values
Fixed	VESA 4096 x 2160 @ 6	0.0Hz Active	/e (4096 x 2160), Total (4176, 2222), Sync (32, 8)
Fixed	CEA 3840 x 2160 @ 30	.0Hz Active	/e (3840 x 2160), Total (4400, 2250), Sync (88, 10)
Fixed	CEA 3840 x 2160 @ 50	0.0Hz Active	/e (3840 x 2160), Total (5280, 2250), Sync (88, 10)
Fixed	CEA 4096 x 2160 @ 50	0.0Hz Active	/e (4096 x 2160), Total (5280, 2250), Sync (88, 10)
Fixed	CEA 3840 x 2160 @ 60	0.0Hz Active	/e (3840 x 2160), Total (4400, 2250), Sync (88, 10)
Fixed	CEA 4096 x 2160 @ 60	0.0Hz Active	/e (4096 x 2160), Total (4400, 2250), Sync (88, 10)
Fixed	VESA 3840 x 2160 @ 1	20.0Hz Active	/e (3840 x 2160), Total (4000, 2222), Sync (59, 5)
Fixed	VESA 3840 x 2160 @ 1	20.0Hz Active	/e (3840 x 2160), Total (3920, 2287), Sync (32, 6)
Fixed	Other 5120 x 2880 @ (60.0Hz Active	/e (5120 x 2880), Total (5280, 2962), Sync (32, 5)
Fixed	Other 7680 x 4320 @ 3	30.0Hz Active	/e (7680 x 4320), Total (7840, 4381), Sync (32, 5)
Custom	VESA 1280 x 800 @ 60	.0Hz1 Active	/e (1280 x 800), Total (1440, 823), Sync (32, 6)
	_		
Delete Selected	Horizontal timing	Vertical timing	
		Vertical timing	Frame rate (Hz) 60
т	Horizontal timing		Frame rate (Hz) 60 Pixel Clock (MHz) 71,1072 Clear
T Ac	Horizontal timing Total 1440	823	
T Ac S	Horizontal timing Total 1440 1280	823 800	

In order to create a new custom timing based on one of the standard fixed, timings select the fixed timing and change its name and click **Add new timing** to store.

In order to modify an existing custom timing, select it, modify and click Update timing.

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

Customize Timings List

The timings are shown on the pull-down menu by un-checking the **Show** box. The timings will remain in the list and can be brought back to the pull-down menu, when needed.



Audio Generator

Audio Generator tab is enabled by default.

_	CD-323 [1703C168] - DisplayPort Reference Source (SST, HDCP 2.2)
File	<u>View</u> <u>T</u> ools <u>H</u> elp
	/Pattern Generator/Audio Generator (Link (EDID (DPCD (HDCP (Sink DUT Testing)
8	Audio Status
Devi	Audio loaded: 3 channels @ 32000 Hz, 16 bits
DP TX Device	
8	Play control
	Audio from: Audio generator.
Event Log	Playing
Ker	Audio Content
-	
	Generate audio:
	Waveform: Sine Bits/Sample: 16 bits
	Signal frequency: 1000 Amplitude: 40%
	Sample Rate: 32000 Hz Channels: 3 Channels
	O Load audio from file:
	Open WAV file
_	

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

- To load internally generated audio, select **Generate audio**, and adjust the controls to the desired audio format.
- To load an audio file from your PC, select Load audio from file, click the Open WAV file... button, browse and select the file and click Open
- ► To play the selected audio content, click the **Play** ► button.

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

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



Link Tab

Link tab is enabled with *UCD Pro for DP Source* license. The Link tab shows the status and control items for the DisplayPort link.

HPD	Asserted	o Genera	tor / Link \ED	ID (DPCD (HDCP (Sink DUT	Testing \			
Link Status Lane 0		Lane 2		lock Recovery vmbol lock	Link Configuration Number of Lanes	© 2		@ 4
600	600	600	600 V	, hannel equalization oltage swing (mVpp)	Bit rate, Gbps © 1.62	◎ 2.70		5.40
0 0x0000 Lane count MST mode:					Enhanced Fran	ning Mode		
FEC status: HDCP statu						💋 Lir	nk training	
Output Lev Voltage Sw © 400	ving, mVpp:	0 800	◎ 1200	Link Pattern Active video Idle Pattern		CRC Red CRC: Green CRC:	0xB69E 0xB33E	
Pre-Empha		© 6.0	© 9.5	 Training Pattern 1 Training Pattern 2 Training Pattern 3 	 Training Pattern 1 Training Pattern 2 			Сору
	💋 Apply (Overrides		 Training Pattern 4 PRBS7 HBR2 Compliance EYE 	E pattern ate)			

HPD

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

Link status

The panel shows the result of the link training with the connected downstream sink and status of connection features.

Output Level

Override output level and pre-emphasis values selected during link training. Click **Apply Overrides** to validate changes.

Note Please note that connected Sink and Source actively maintain the link. If the override settings result in link failure, the link will be automatically re-trained and proper values set.

Link configuration

Set capabilities of the DisplayPort source in the link training:

- Set the Number of Lanes used,
- Set the maximum Link Rate,
- Enable Enhanced Framing Mode

Link Pattern

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

CRC

The 16-bit **CRC** (checksum, cyclic redundancy check) values of the three color components calculated by the Sink hardware.

EDID Tab

EDID tab is enabled with UCD Pro for DP Source license.

	View Tools Help /Pattern Generator / Link / EDID / DPCD / HDCP /		
- T			
Levice	EDID Data:		EDID Files
3	000000 00 ff ff ff ff ff ff 00 54 c7 36 40 4c 34 32 30	~	
<	000010 34 18 01 04 b5 3d 23 78 3a 5f b1 a2 57 4f a2 28		Load
×	000020 Of 50 54 bf ef 80 71 4f 81 00 81 c0 81 80 a9 c0		
ъI	000030 b3 00 95 00 d1 c0 4d d0 00 a0 f0 70 3e 80 30 20		Save as
	000040 35 00 5f 59 21 00 00 1a 56 5e 00 a0 a0 a0 29 50		
	000050 30 20 35 00 5f 59 21 00 00 1a 00 00 00 fd 00 38		
	000060 4b 1e 86 36 00 0a 20 20 20 20 20 20 00 00 00 fc		
	000070 00 55 43 44 2d 33 30 31 20 44 50 0a 20 20 01 1f		HEX Editor
	000080 02 03 12 41 83 4f 00 00 29 0f 7f 07 15 06 55 3d		
	000090 1f c0 00 00 00 00 00 00 00 00 00 00 00 00		Clear
			Append file
	0000f0 00 00 00 00 00 00 00 00 00 00 00	=	EDID Editor
		-	
			Connected Sink EDID
			Connected ank EDID
			Read
			reau
			Write
		-	VIIIC

EDID tab will enable analyzing and saving the EDID read from the connected Sink device.

There are three basic functions:

- Read the contents of the EDID of the downstream sink over the DisplayPort link.
- Load and save EDID data files in the host PC
- Edit the EDID contents

EDID Files

With **Load...** and **Save as...** you can read and write a hex EDID file from your PC. Please note that the program does not alter the contents of the EDID file or verify its integrity during load and save operation.

Note Currently the EDID Editor does not support Display ID. You can however modify hex EDID files with the HEX Editor or load and program externally generated hex EDID files that have Display ID content.

HEX Editor

When EDID content is either loaded from a file or read from the hardware EDID memory, it is shown in the *EDID Data* panel on the left-hand side of the dialog. You can edit the EDID contents by typing over the existing values. The altered content is highlighted with **RED**. Please note that Hex Editor itself does not alter the contents of the EDID data or verify its integrity.

Once you are done with editing the data, you can either save it to an *.ecd file in your PC with **Save as...** or program it to the hardware EDID memory with **Write**.



EDID Editor

You can edit the EDID structures of the data in the *HEX Editor* by clicking **EDID Editor**. EDID Editor is launched in a separate pop-up window. Please see the description of the EDID editor in Chapter <u>EDID Editor</u> later in this document.

O EDID_Editor			
E-EDID Encoder / Decoder	-		
Collection 1	Details of ":/0/Version/Vend	or Product ID"	
Blocks in collection Block 0 [VESA EDID]	Key	Value	
- Checksum	ID Manufacturer Name	UFG	
▲ Version	ID Product Code	0x4036	
Extension flag	ID Serial Number	0x3032344c	
Vendor & Product ID		0.00020110	
Basic Display Parameters and Feature	Manufacture or Model year	Manufacture Year and Week	
Display x,y Chromacity coordinates	Manufacture of Model year	Manufacture real and week	
▷ · Established timings I and II ▷ · Manufacturer's Timings	Week of manufacture	Week 20	
Standard Timings	Year of manufacture		
✓ 18-Byte data blocks	rear of manufacture	Year 2012	
▷ Descriptor 1			
▷ · Descriptor 2			
▷ · Descriptor 3			
▷ Descriptor 4			
Block 1 [CEA 861] Checksum			
CEA Extensions Version	9		
Sink Underscans IT video			
Basic audio			
YCbCr (4:4:4)			
< >			
🔁 Load 🔚 Save 🏢 Show Hex	🕵 Show Log		

DPCD Tab

The DPCD tab is enabled with UCD Pro for DP Source license.

_	ICD-323 [1533C046] - DisplayPort Re View Tools Help	eference Source		
	Pattern Generator \Link \EDID \D	PCD HDCP		
8	DPCD Decoder 1.2 + DETAILED_CA			🔄 Load 🛛 📮 Save
DPTX Device	DPCD Address range: 0x 0	Number of bytes to read: 0x 100		
TPU	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$		*
	Set Reference	Refresh	Write Changes	
	DPCD Address range: 0x 200	Number of bytes to read: 0x 100		
	000210 00 80 00 80 00 80 000220 00 00 00 00 00 00 000230 00 00 00 00 00 00 00	44 44 00<	-	
	Set Reference	😰 Refresh	G Write Changes	•

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

The tool consists of two independent monitoring and editing windows for the DPCD data. The user can freely select the the DPCD address areas shown on each panel.

The *DPCD Decoder* panel on the right hand side shows the interpretation of the DPCD byte selected on the monitoring windows. The selected byte is shown with a green outline.

In the combo box above the DPCD Decoder window you can select how the DPCD data is interpreted, either as *DP 1.1 DPCD*, or as *DP 1.2 DPCD* with *Detailed Capability Info* selected or not (DETAILED_CAP_INFO_AVAIL = 1/0).

By clicking **Refresh** you can re-read the data from the DPCD registers to the window in question.

By clicking **Write Changes** you can write the portion of data shown in the window in question to the DPCD registers.

By clicking **Set Reference** you can store currently shown data as a reference for comparison.

When you refresh the data from the DPCD registers the changed bytes will be highlighted with gray background.

The fields edited by the user will be highligted with **red** color.

/Video Audio Li		HDCP			
DPCD Decoder 1	2 + DETAILED_CA	AP_INFO_AVAIL = 1	•		🔄 Load 🛛 🔚 Save
DPCD Address ran	ge: 0x 0	Number of bytes to rea	ad: 0x 100		
000010 00 0 000020 00 0 000040 00 0 000040 00 0 000050 00 0 000060 00 0 000060 00 0 000080 00 0 000080 00 0 000080 00 0 000080 00 0 000080 00 0 000080 00 0 000080 00 0 000080 00 0	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	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 00 00 00 00	₹ Write Chances	LANE0_1_STATUS [RO] (Lane0 and Lane1 Status) 0x00202:=0x77 LANE0_CR_DONE = 1 LANE0_CR_DONE = 1 LANE1_CR_DONE = 1 LANE1_CR_DONE = 1 LANE1_CHAINEL_E0_DONE = 1 LANE1_STME0L_LOCKED = 1
DPCD Address ran		Number of bytes to rea		9 mile changes	
000210 00 8 000220 00 0 000230 00 0	000 80 00 80 000 00 00 00 00 000 00 00 00 00	44 44 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 00 00 00 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00 00 00 00 00		
Set Referen	ce		🚯 Refresh	😼 Write Changes	

Saving and Loading DPCD Content

You can save the DPCD data in the address areas that you selected for the two windows as a file in your PC. You can save the content in three alternative formats:

- Binary *DPCD Fata File* format (*.DPD). This is Unigraf proprietary format. You can also load the DPCD content stored in this format.
- Comma Separated Values (*.CSV) for loading the data to a spreadsheet.
- *HEX Dump* (*.HEX) in a human readable text format.
- By Clicking **Save** you will be able to select the location and the format of the file.
- By Clicking Load you can load DPCD data saved in *DPCD Data File* (*.DPD) format to the editor.
- In order to program the data into the DPCD registers of UCD-300 Local Sink click Write Changes.

Note	- Writing DPCD data to the DPCD registers of the Sink will potentially affect the
	status and capabilities of sink as seen by the source.
	- User control like Link Training or mode changes will modify the content of the
	DPCD registers



HDCP Tab

HDCP tab is enabled with UCD Pro for DP Source license.

<i>///</i> U	CD-323	[1533C0	46] - DisplayPort Reference Source		
File	View	Tools	Help		
	Patte	ern Gener	ator Link EDID DPCD HDCP		
/ DPTX / Device /	HDC Sta	CP 1.3	Active Authenticated	Configuration Config	
	Sta (((P 2.2 Itus	Active Authenticated Authentication in progress Keys loaded	Configuration Enable encryption Authenticate	
	HDC	CP 2.2 lice	nse not found		

HDCP tab is the dialog for monitoring the HDCP (for *High-Bandwith Digital Content Protection*) status and controlling the HDCP capabilities of the connected UCD-300 device.

Status

The status field indicate the HDCP status of the connected UCD-300 device.

Active: The stream between UCD-300 and the downstream sink has been encrypted.

Authenticated: The HDCP handshake between the UCD-300 and the sink unit has been completed successfully.

Authentication in process: The HDCP handshake is in process between the UCD-300 and the downstream sink unit.

Keys loaded: The HDCP keys are loaded to the UCD-300 unit.

Configuration

Authenticate: Perform the HDCP initiation handshake between the UCD-300 and the sink unit.

Enable encryption: Check to enable the encryption of the stream between UCD-300 and the downstream sink.

Keys

You can select if you are using *Production* or *Facsimile* HDCP keys. To remove the keys, select *None*.



HDCP 1.3 vs. HDCP 2.3

UCD-300 devices support by default HDCP 1.3 standard with DisplayPort. The functionality supporting HDCP 2.3 is enabled with HDCP 2.3 Support license.

/// UCD-323 [1530C03	33] - DisplayPort Reference Sourc	e (SST, HDCP 2.3)	- • •
<u>File View Tools</u>	Help		
/Pattern Genera	ator \Audio Generator \Link \EDID	OPCD HDCP Sink DUT Testing	
HDCP 1.3 Status	Active Authenticated Authentication in progress Keys loaded	Configuration Enable encryption Authenticate Keys Production Facsimile - "Test" None	
HDCP 2.3 Status	Active Authenticated Authentication in progress Keys loaded	Configuration Image: Configuration Image: Configuration Image: Configuration Image: Configuration	

Sink DUT Testing Tab

Sink DUT Testing Tab is enabled with UCD Pro for DP Source license.

Please refer to **Appendix E** later in this document for description of the tests available. Sink DUT Testing enables the execution of HDCP 2.3 Compliance Tests for a DP Sink DUT.

Sink DUT Testing enables testing of a DP Sink DUT. Please refer to **Appendix E** of this document to get a full definition of the Test Cases and test parameters.

<i>]]]</i> Ud	:D-323 [1530C033] - DisplayPort Reference Source (SST, HDCP 2.3)					x				
<u>F</u> ile	<u>V</u> iew <u>T</u> ools <u>H</u> elp									
DP TX Device	∫ HDCP 2.3 2C tests \									
	Test Name	Pass	Fail	Skip	Run					
	✔ 2C-01 Regular Procedure - With transmitter	1	0	0	1					
8	2C-02 Irregular Procedure - New Authentication after AKE_Init	1	0	0	1					
Event Log	2C-03 Irregular Procedure - New Authentication during Locality Check	1	0	0	1					
Ev	2C-04 Irregular Procedure - New Authentication after SKE_Send_Eks	1	0	0	1					
	2C-05 Irregular Procedure - New Authentication during Link Synchronization	1	0	0	1					
	E Configure	Impor	rt	[]	Export					
	Run Selected Stop on Failure Repeats: 1 & Delay time, sec: 1 Save Report			Clea	ar All					
	TestLog: 0003.025.680: [TE-Src] Enables HDCP Encryption within 200ms after SKE_Send_Eks 0003.075.548: [TE-Src] DUT completes the authentication process 0003.075.08: [TE-Src] DUT completes the authentication process 0003.075.890: Test PASSED: "2C-05 Irregular Procedure - New Authentication during Link Synchronization" *** Test complete PASSED ***									

Select the tests for execution by clicking the corresponding row.

Clicking **Configure...** opens a dialog for defining the test parameters for that set. Please refer to *Test Parameters* below for description.

Parameters from *Test descriptor files* can be loaded with **Import** and stored with **Export**. Please refer to documentation of TSI software API for description.

Tests are started by clicking **Run Selected**. By clicking **Abort** the sequence is stopped.

Test flow can be controlled with **Repeats** of the test sequence, **Delay time** between individual tests or **Stop on Failure** that stops the whole sequence if one of the tests fail.

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.

Click **Save Report** to generate a HTML report file for sharing the results with other parties for viewing without UCD Console.

By clicking Clear All the test log and the results matrix are cleared.

Test Parameters

Each test set has its dedicated set of test parameters. Open a dialog for defining the parameters by clicking **Configure...**

HDCP CTS Test Set

The HDCP Tests have test timeout as a given parameter.

Presets

You can save the selected parameters as Presets. Please click **Presets...** to save your configuration. If you have saved configuration Presets, you can load one of the saved ones, save a new Preset or delete a Preset.

Click Clear Results to clear the result panel.

11. S/PDIF REFERENCE SINK

S/PDIF Reference Sink function is available in *UCD-301 Digital*. In S/PDIF Reference Sink role the device is using one input channel, S/PDIF (SPDIF). The corresponding vertical tab can be seen on the left edge of the GUI.

This role contains only one tab:

• Audio monitoring and saving (Audio). *Enabled by default*.

	CD-301 [1601C001] - SPDIF Reference View Tools Help	e Sink		
	Audio			
evice	Spectrum 60 dB 💌		Default Audio	Disable Preview
SPDIF (Device				85 mpec
				 24000 H
	1 channels; 48000 Hz; 16 bits			

Audio Tab

Audio tab is enabled by default. Audio tab has a preview of the audio signal format and the controls for audio playback and recording.

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 24 000 Hz. The amplitude scale of the spectrum display can be selected between 'Linear' to 80 dB.
- The horizontal sound level indicator is in the bottom of the dialog.

The span of the preview window is defined with **Audio preview size** 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 *Audio preview* size depends on the sampling frequency. Please do not exceed the *Audio buffer size* set in the same dialog.

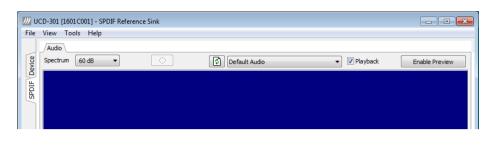
Disable / Enable Preview

Use this button to control capturing the audio data.



Playback device selection

You can enable audio playback in your PC by selecting the **Playback** check-box. Use the combo-box to select the audio device in the host PC through which the captured audio is played. By default, the *Default Audio* device of your PC is chosen. Please **Disable Preview** in order to make changes.



Note

Please note that the audio capabilities of the audio playback device of your PC are not automatically reflected in the audio capabilities description in UCD-300 EDID. Since UCD-300 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 in order to monitor the waveforms in UCD Console.

Refresh audio device list



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

Audio Buffer Size

You can define the amount of buffering used in the data transfer between the UCD-300 unit and the PC. **Audio buffer size** can be found in Tools > Options dialog. 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



Clicking the button you can start or stop recording the captured audio in the PC using WAVeform audio format (*.wav) format. In the pop-up dialog you can define the recording duration. The folder where the audio file will be saved can be selected in File > Options.

Recording			—
Recording duration, msec:	5000 ×	🗸 ок	X Cancel

Input audio mode

2 channels; 48000 Hz; 16 bits

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

12. EVENT LOG

UNIGRAF

The *Event Logger* (Event Log) vertical tab can be seen on the left edge of the GUI. Event Log is enabled with *UCD Pro for HDMI Sink, UCD Pro for HDMI Source, UCD Pro for DP Sink* and *UCD Pro for DP Source* license.

Start Capture	S	top Capt	ure					
Start Capture Data sources and filters	:	/Event	Log					
▲ HDMI Input			Save	Report	0	ben		
HPD								653:
100		#	Timestamp	Туре	From F	Data		2039275.564ms
		648	2037723.983	HPD	2	HDP Low, +5Vcc Connected		
		649	2039167.737	HPD	3	HPD High, +5Vcc Connected		48 44 52 58 20 53 43 44 43 3A 20 57 52 2
		650	2039269.041	INFO	0	HDRX SCDC: RD 0x20:TMDS CONFIG 0x		30 78 32 30 3A 54 4
		651	2039269.624	INFO	0	HDRX SCDC: WR 0x20:TMDS CONFIG 0.		44 53 20 43 4F 4E 46
		652	2039275.016	INFO	0	HDRX SCDC: RD 0x20:TMDS CONFIG 0x		49 47 20 30 78 30 3 0A 00 00 00 00
		653	2039275.564	INFO	0	HDRX SCDC: WR 0x20:TMDS CONFIG 0.		UA 00 00 00 00
		654	2039558.655	INFO	0	HDRX EDID: RD 0x00: 0x00		HDRX SCDC: WR
		655	2039558.843	INFO	0	HDRX EDID: RD 0x01: 0xFF		0x20:TMDS CONFIG
		656	2039559.031	INFO	0	HDRX EDID: RD 0x02: 0xFF		0x02
		657	2039559.218	INFO	0	HDRX EDID: RD 0x03: 0xFF		
		658	2039559.406	INFO	0	HDRX EDID: RD 0x04: 0xFF		
		659	2039559.599	INFO	0	HDRX EDID: RD 0x05: 0xFF		
		660	2039559.786	INFO	0	HDRX EDID: RD 0x06: 0xFF		
		661	2039559.976	INFO	0	HDRX EDID: RD 0x07: 0x00		
		662	2039560.107	INFO	0	HDRX EDID: RD 0x08: 0x54		
		663	2039560.211	INFO	0	HDRX EDID: RD 0x09: 0xC7		
		664	2039560.314	INFO	0	HDRX EDID: RD 0x0A: 0x36		
		665	2039560.418	INFO	0	HDRX EDID: RD 0x0B: 0x40		
		666	2039560.528	INFO	0	HDRX EDID: RD 0x0C: 0x4C		
		667	2039560.632	INFO	0	HDRX EDID: RD 0x0D: 0x34		
		668	2039560.735	INFO	0	HDRX EDID: RD 0x0E: 0x32		
		669	2039560.839	INFO	0	HDRX EDID: RD 0x0F: 0x30		
		670	2039560.941	INFO	0	HDRX EDID: RD 0x10: 0x34		
		671	2039561.042	INFO	0	HDRX EDID: RD 0x11: 0x18	Ψ.	
Presets		•				•		

Event Log dialog is divided into three panels: *Data sources and filters* panel on the left enables selection of the items to be logged. The selection of data sources is dependent on the role selected: DP Input, DP Output, HDMI Input, HDMI Output.

Data Source	HDMI Input	DP Input	HDMI Output	DP Output
HPD status	•	•	•	•
I2C transactions	•		•	
AUX transaction		٠		•
HDMI InfoFrames	•			
DP SDP messages		٠		
Changes in MSA		•		
Changes in VB-ID		•		

Transaction list in the center panel lists all transactions captured, and the right panel shows the parsed transaction data for the line selected in the center panel.

The transactions are with Time stamps, Type indications, Message source, and raw message data. The right panel lists the content of one message. Messages belonging together with the selected one are shown in red color.

- Start event logging by clicking Start Capture and stop it by clicking Stop Capture.
- You can save transactions in binary *.evt Event Log files by clicking Save. You can recall saved Event Log files by clicking Open.
- ▶ By clicking **Report** you can store event logs as html reports to be shared and viewed with any web browser. You are first asked to indicate the file name and location, then you can add detailed information about the DUT and the test in free-text *Report information*.

DP AUX Analyzer

DP AUX Analyzer functionality is enabled with UCD Pro for DP Sink and UCD Pro for DP Source license.

Start Capture		Stop Cap	ture					
Data sources and filters:		-						
⊿ · DisplayPort Input		/Even	t Log DP AUX			<u> </u>		
HPD			<u>S</u> ave	Repor	t 🛛 🤇	Open		
AUX		Line	Timestamp	From	Type	Details	Data	Message details:
🔽 SDP		178	3025048.97		Native	AUX ACK - 16 bytes	00 3a 19 19 ca 2c	
MSA changes		179	3025049.17		Native	Reg RD 16 bytes fro		3025050,24ms
VB-ID changes		180	3025049.29	Sink	Native	AUX_ACK - 16 bytes		CERT(rx) - DPCD
		181	3025049.48		Native	Reg RD 16 bytes fro		Address range trace
		182	3025049.61		Native	AUX_ACK - 16 bytes		, and end in the light of the
		183	3025049.80		Native	Req RD 16 bytes fro		0x6900b - 0x69214
		184	3025049.93		Native	AUX_ACK - 16 bytes		No extended trace
		185	3025050.12		Native	Reg RD 10 bytes fro		decoding available.
		186	3025050.24 3025050.24		Native	AUX_ACK - 10 bytes CERT(rx) - DPCD Ad		
		188	3025050.38		Native	Reg RD 8 bytes fro		Block dump
		189	3025050.51		Native	AUX ACK - 8 bytes	00 ff ed 4b 92 c9	0x000 : 7b bc 90 4d c2 ca 16 74 4c dc 25 ba
		190	3025050.51		Trace	R(rx) - DPCD Addres		ca 16 /4 4c dc 25 ba 51 33 91 fe
	<	191	3025050.63		Native	Reg RD 3 bytes fro		0x010 : aa cc 24 2a e2
		192	3025050.75		Native	AUX ACK - 3 bytes	00 02 00 02	e0 7e 44 8b f1 01 c7
		193	3025050.75	HDCP 2.3	Trace	RxCaps - DPCD Add		44 8b ae 91
		194	3025106.61		Native	Reg WR 16 bytes to	86 92 20 Of 94 84	0x020 : 31 5d ba 75 e
		195	3025106.87		Native	AUX_ACK - 0 bytes	00	b0 d4 c8 db 6d ad 96
		196	3025106.93		Native	Req WR 16 bytes to		2a 37 c7 be
		197	3025107.19		Native	AUX_ACK - 0 bytes	00	0x030 : bf 32 ed b7 ee
		198	3025107.26		Native	Req WR 16 bytes to		2c 63 87 d7 5a 14 99
		199	3025107.52 3025107.58		Native Native	AUX_ACK - 0 bytes Reg WR 16 bytes to	00 96 02 50 05 27 15	b4 a1 7a 16
		200	3025107.58		Native	AUX ACK - 0 bytes to	00	0,010, 30, 60, 60, 61, 60, 61, 60, 61, 60, 61, 61, 61, 61, 61, 61, 61, 61, 61, 61
		201	3025107.84		Native	Reg WR 16 bytes to		35 e4 90 a1 f8 3d ee
		202	3025108.16		Native	AUX ACK - 0 bytes	00	b9 82 20 45 0x050 ; 61 72 50 5c bo
		204	3025108.23		Native	Reg WR 16 bytes to		6e fd 08 55 0b c8 d4 9
		205	3025108.48		Native	AUX ACK - 0 bytes	00	7e b 1 f0
		206	3025108.55	Source	Native	Reg WR 16 bytes to	86 92 80 0f 29 68	0x060 : fe 38 84 87 a4
		207	3025108.81	Sink	Native	AUX_ACK - 0 bytes	00	af 2f 54 5f 5a 39 42 8
		208	3025108.87	Source	Native	Req WR 16 bytes to	86 92 90 0f c8 c6	•
Presets	L L	1					•	DETAILED_CAP_INF
Presets								

The AUX Analyzer tabs collect AUX Channel Transactions from the Event Log in the *Transaction list*. The user can parse the content of each transaction by clicking the corresponding *transaction line*. The parsed content is in the *Message Details* panel on the right.

Please refer to chapter *Customizing the Main Window* below for details on how to modify the content and look of the *Transaction list*.

Lines

The data is organized in lines, each numbered starting from 1 and marked with a timestamp. There are four kinds of lines:

1. Information lines

Identified by the text "INFO" in their Type column, they provide some useful information like the time acquisition has started and stopped or the logical state of the inputs, etc.

- 2. Transaction lines Identified by the text "Native" or "I2C" in their Type column, they report an AUX channel data transfer, either a data Request or a data Reply.
- **3.** Event lines Identified by the text "Event" in their Type column, they signal the state change in one or more of the monitored inputs.

4. Sideband Channel Messages The Isochronous Transport Service uses the sideband communications over sideband channel (AUX CH and HPD) for the management of topology/virtual channel connection/Main Link and performs Main Link symbol mapping.

5. Error lines

A line Type reading "Error" marks the detection of an illegal AUX channel data packet. An irregular start condition, an irregular stop condition or transfer of a number of bits which is not a multiple of 8 are all conditions that cause an error line.

6. Trace lines

Combines the data from several lines of a HDCP related message to one entry in *Message details* panel for easier readability.

Columns

The data on each line is ordered in columns. Each column provides additional information about the data line, facilitating its viewing and interpretation:

Line

This column displays the line number, starting from 1, and cannot be hidden.

Timestamp

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.

From

This column indicates the originator of the data line:

- "Source" and "Sink" for an AUX channel transaction, respectively a data Request and a data Reply.
- "Source Trace" and "Sink Trace" respectively for Sideband Message data Request and Reply.
- "UCD-300" for error and information lines.
- "Unknown" for signal state change events.

Туре

This column provides additional information about the type of the line:

- "Native" marks Native AUX channel Requests and Replies.
- "I2C" marks I2C AUX channel Requests and Replies.
- "Sideband Request" and "Sideband Reply" to mark the Sideband Channel messages
- "Event" is used for signal state change events.
- "**INFO**" is used with information lines.
- "Error" is used for illegal conditions detected on the AUX channel.

Details

This column contains an abbreviated description of the line content in textual form.

Data

The binary data exchanged during AUX channel transactions, in hexadecimal notation.

Find

To locate an access to a DPCD location right-click on the list and select Find... or select Ctrl+F from keyboard. To Find again select F3.

Search		X)
Search for	Any access 🔹	to addr. (Hex):	
	X Cancel	🔍 Search	ļ

Message Details

The *Message details* panel is used to provide a detailed explanation of the line currently selected in the *Transaction list*. For AUX channel transaction lines, for each of the DPCD memory locations affected, the panel lists:

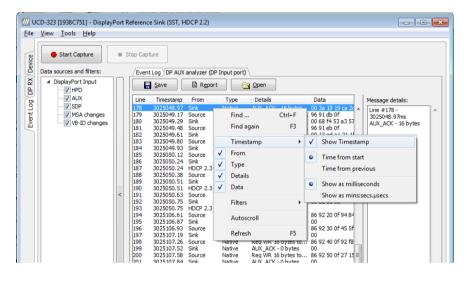
- All data bytes read or written.
- All DPCD memory locations affected.
- The name of the locations and of each of their bit fields.
- All bit field's numeric and binary values, together with their decoded value.
- The Replies outcome (AUX_ACK, AUX_NACK, I2C_DEFER, etc.).

Customizing the Main Window

Format of the data shown in the *Transaction list* and the *Message details* panels can be altered in order to highlight the details of your interest.

Selecting Data Columns

The *Transaction list* can be customized by right-clicking over the list. The pop-up menu allows choosing which columns to display, the style of the timestamp and switch between absolute and relative timestamps. *Filters* limit the transactions shown in the list. Please see *Filtering* later in this document.



Selecting Font and Colors

Select **Tools > Options > AUX Analyzer options** tab. Click **Select new font** and choose the font and size used for displaying the *Transaction list* and the *Message details*.

Options			×	
	IX Analyzer options			
Font Selection	Font			—
Select new font Current f	Eont: Tahoma	Font style: Regular	Size:	ОК
Transaction list color option	TeamViewer12	Bold	10 11 12 14	Cancel
Show / change color settings for Normal item colors	Tempus Sans ITC Times New Roman Trebuchet MS	Oblique Bold Oblique	14 16 18 20 ~	
Color exar		Sample AaBbYyZz	2	
Change text color		Script:		
Highlighted DPCD address r		Western	-	

Event Log

Transaction List Color Options

Select the colors for the font and background of various items.

Options
Video, Audio and Misc options AUX Analyzer options
Font Selection
Select new font Current font "Tahoma", size 10
Transaction list color options
Show / change color settings for:
Normal item colors
Normal item colors
Selected item colors Highlighted item colors
Sideband request message colors
Sideband reply message colors
Signal state change message colors HDCP 1.3 Trace colors
HDCP 1.3 Trace colors HDCP 2.2 Trace colors
Highlighted DPCD address ranges

Highlighted DPCD Address Ranges

In order to improve the readability of the *Transaction list*, you can mark the AUX channel transactions where a certain DPCD register address or address range is highlighted with a color of choice.

Click **Add...**, select the access type, start DPCD address and end DPCD address of the range in Hex. Click **Accept**.

Select the range you just created from the **Highlighted DPCD addresses ranges** list and click the **Change test color** and **Change background color** buttons to select the colors desired.

You can create multiple simultaneous coloring rules to help you get a better view of the data captured.

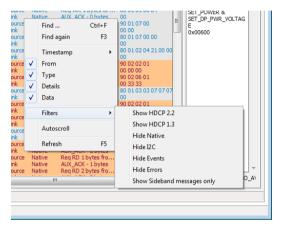
<u>F</u> ile	<u>View</u> <u>T</u> ools <u>H</u> elp							
Device	Start Capture	= 3	Stop Cap	ure			ĺ	Options
Event Log (DP RX) D	Data sources and filters:	<		Log) DP AUX Save Timestamp 3024881.49 3024881.56 3024881.56 3024881.63 3024881.63 3024882.06 3024882.06 3024882.07 3024882.37 3024882.37 3024882.45 3024882.45 3024882.45 3024882.45 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024882.81 3024883.00 3024882.80 3024883.00 3024882.80 3024883.00 3024882.80	Report From Sink Source S		Details Details AUX_ACX Req RD 1 AUX_ACX Req RD 1 AUX_ACX Req WR AUX_ACX Req WR AUX ACX Req WR AUX ACX Req WR AUX ACX AUX AUX ACX AUX AUX ACX AUX AUX AUX AUX AUX AUX AUX AU	Video, Audio and Misc options AUX Analyzer options Font Selection Select new font Current font "Tahoma", size 10 Transaction list color options Show / change color settings for: Normal item colors Color example for selected item Change text color Highlighted DPCD address ranges Rule # 0 - RD/WR from 00050 to 00050 Rule # 2 - RD/WR from 00020 to 00307 Rule # 2 - RD/WR from 00200 to 68100
	Presets		67 68 69 70 71 72 73 74 75 76 77 78 79 80	3024883.18 3024883.31 3024883.37	Source Sink Source Sink Source Sink Source Sink Source Sink Source Sink Source	Native Native Native Native Native Native Native Native Native Native Native Native	AUX_ACK Req WR AUX_ACK Req RD 2 AUX_ACK Req RD 2 AUX_ACK Req RD 2 AUX_ACK Req RD 2 AUX_ACK Req RD 2 AUX_ACK Req RD 2 AUX_ACK	Add Edit Remove Up Down Color example for selected range Change text color Change background color Edit Custom Filters ØV OK

Filtering

Transactions lines shown in the transaction list can be limited by *Filtering*. The shown lines can be selected by:

- The type of data line
- The origin of the message
- The DPCD address range

Right click > Filters drop down menu lists a set of pre-programmed filters.



Editing Filters

From *Custom Filter* dialog (Tools > Options > Edit Custom Filters ...) allows for adding and modifying filters. The pre-programmed filters are listed in the dialog. Their structure can be copied as bases of your custom filters. It is advisable not to modify the pre-programmed filters directly but make copies of them.

	m Filter					— ×
Stor	ed custor	n filter defini	tions			
	W HDCP 2					New definition
Hide	Native	.3				Rename selected
	I2C Events					Delete selected
	Errors	nd messages	anhu			Move Up
Sho	w Siuebar	iu messages	only			
						Move Down
Filte	r Rules					
Decu		by Desistence and		weeks on the second		
Requ	iest / Rep	ly Pairing mo	de Auto -	- Hilter item by request if	reply received within 40	Dµs of request 🔹
A	Rule	Type	Source	- Filter item by request it Range	Comment	0µs of request ▼
· ·						
A	Rule	Туре	Source	Range	Comment	
A	Rule	Туре	Source	Range	Comment	
A	Rule	Туре	Source	Range	Comment	
A	Rule	Туре	Source	Range	Comment	
A	Rule	Туре	Source	Range	Comment	
A	Rule	Туре	Source	Range	Comment	
A	Rule	Type Native	Source Src/Sink	Range 0x069000-0x069fff	Comment	

In the *Stored custom filter definitions* panel, lists currently defined Filters. On the right hand side buttons, you can define new Filters, rename or delete them. Their appearance in the *Filters* pull-down menu can also be altered.

In the *Filter Rules* panel lower in the dialog you can review and change the *Rules* in the selected *Filter*. Add... creates new rules, Edit... enables review and editing existing Filters and **Remove** deletes from the Filter definition.

When clicking Add... or Edit... *Edit Filter Rule* dialog opens. The dialog defines the action of the rule, events and event details.

Hide VEvent	From Any (*) Range: *	×
Filter by Data:		*
		-
Comment (Optional, max 120 chars):	Hide Events	

Click Help to show "Help" text also attached to Appendix F of this document.

Note	Please note that Filters are a very powerful tool. They can however unintentionally hide valuable data from you. Please be careful when applying custom filters. A good practice is to start from an existing filter and gradually add new rules while testing their performance.
Note	Filtering and selecting the columns for display do not affect the actual data acquisition. All transactions and their full data are always captured.

13. EDID EDITOR

The Main Window

Collection 1 Blocks in collection	^	Details of ":/0/Version/Vendor _Produc	t ID"
Block 0 [VESA EDID]		Key	Value
Checksum		ID Manufacturer Name	UFG
▲ Version		ID Product Code	0x4036
Extension flag	ш	ID Serial Number	0x3032344c
 Vendor & Product ID Basic Display Parameters and Feature 			
 Display x,y Chromacity coordinates 		Manufacture or Model year	Manufacture Year and Week
 Established timings I and II 			
Manufacturer's Timings	E	Week of manufacture	Week 20
Standard Timings		Year of manufacture	Year 2012
▲ 18-Byte data blocks			
▷ Descriptor 1			
 Descriptor 2 Descriptor 3 			
> Descriptor 4			
▲ Block 1 [CEA 861]			
Checksum			
 CEA Extensions Version 			
···· Sink Underscans IT video			
Basic audio			
YCbCr (4:4:4)	-		
• III			

The *EDID Editor* main window is divided into three logical areas. The bottom part of the window contains the command buttons, and the log view. The top-left portion shows the currently edited E-EDID blocks in a tree-form, and the top-right portion shows an edit control for the currently selected item, possibly a list of sub-keys and their names (The list is not shown for all values) and the HEX-view of the block collection.

Command Buttons

Load: Load an EDID block collection file from disk. Save: Save the current block collection to a disk file. Show Hex: Show or Hide the HEX view. Show Log: Show or Hide the Log view.

EDID Editor Features

The EDID Editor currently supports VESA E-EDID block versions 1.3 and 1.4. As the standard defines, the versions 1.0, 1.1 and 1.2 are supposed to be backward compatible, and therefore the VESA E-EDID decoder will also show their contents. However, in these cases it should be noted that the error checking is not compliant with restrictions given in these older versions of the standard. In addition to VESA E-EDID block, the CEA-861 versions 1, 2 and 3 EDID blocks are also fully supported as well as the VESA Block Map Extension blocks.

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 blocks contain a structure that is very similar to a tree-structure. The EDID Editor decodes each block into a tree-view of the block. The tree-view then contains all values contained within the EDID block. The contents can then be easily browsed, using only a few mouse clicks. The EDID Editor has a support for automatic variables, such as the block checksum. When the user changes a value in an EDID block, the tool will update the checksum accordingly. The automatic variables appear as read only values for the user. A log print will be made when an automatic variable is updated by the editor.

HEX View: An optional HEX data display of all blocks in the collection. The view also shows the latest changes highlighted.

LOG View: An optional LOG view, which will contain log prints generated by the editor. Mostly it will list values that have been automatically updated due to edits.

Editing Tips

Editing an EDID block is very straightforward, but there are some special cases where the user must know how to accomplish certain types of tasks.

- Enter key will apply text-edit values and combo-box selection.
- To apply new setting to *binary* values (ones that show a check-box), please click the **Set** button.
- When you see a **Quick Config** button appear below an editor, you can access a configuration menu that allows you to quickly select one of multiple pre-defined setup options.
- In CEA-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". Unfortunately re-arranging the descriptors and CEA data blocks is not supported yet, so you need to be careful when editing these.
- Enter hex values with prefix "**0x**" or "**\$**", no prefix means a decimal value.
- You can always enter HEX or DEC, even if the value is presented as HEX, and/or value range is given in HEX.
- Floating point values must be given with period "." as decimal separator, even if your localization setting defines decimal separator as comma (or other).
- Remember to click **Set** after changing a bit-value presented as a single check-box if you want the new value applied.

Note It is recommended that you back up the un-edited EDID contents to a file before editing and writing it to the card.

Saving EDID Data

When you are done with editing you can either save the EDID contents to a file in the PC or bring it in the *HEX Editor*.

For saving the data to a file in your PC click Save.

For bringing the data to the HEX Editor close the EDID Editor window by clicking the **Window Close** button in the top right hand corner of the window. You will be asked if you would like to copy and replace the EDID data in the HEX Editor. Click **Yes** to replace the data, click **No** to discard the modifications.

When you are back in the *HEX Editor*, the bytes that the *EDID Editor* changed are highlighted with **BLUE BACKGROUND**.

APPENDIX A. PRODUCT SPECIFICATION

UCD-323 HDDP Dual

Inputs	DisplayPort™ 1.2 compliant (DP in) HDMI 2.0 compliant (HDMI in)
Outputs	DisplayPort™ 1.2 compliant (DP out) HDMI 2.0 compliant (HDMI out)
Max video mode	4096 × 2160 p60 input and output
Audio	LPCM, 2 – 8 channels, 44.1 to 192 kHz
Features	DisplayPort Tx supports Link Training with LT-Tunable PHY Repeaters
Computer interface	USB 3.0 and USB 2.0
Software	Windows 10, 8 and 7 compatible software driver UCD Console application for Windows Compatible with Unigraf TSI
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
Mechanical Size	281 × 128 × 62 mm
Weight	0.9 kg w/o power supply

UCD-301 Digital

Inputs	DP 1.2 compliant HDMI 2.0 compliant
	Dual-DVI (currently not supported) S/PDIF audio (192 kHz max)
Max video mode	4096 × 2160 p60 input
Audio	LPCM, 2 – 8 channels, 44.1 to 192 kHz
Electrical Test	Verify electrical continuity of input signals
Computer interface	USB 3.0 and USB 2.0
Software	Windows 10, 8 and 7 compatible software driver UCD Console application for Windows Compatible with Unigraf TSI
Power supply	AC/DC Power supply (100 to 240 Vac 50/60 Hz input, +12 Vdc output)
Mechanical Size	281 × 128 × 62 mm
Weight	0.9 kg w/o power supply

All specifications are subject to change without notice.

APPENDIX B. LICENSING

The table below lists all functions in UFG-323 and UCD-301 devices and their licensing.

Overview

Input / Output Role	Tab	Default	Pro License	HDCP 2.3	HDCP 2.3 CTS	TSI Basic (default)	TSI Advanced	Electrical Test
HDMI Reference Sink (HDMI RX)	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information of the upstream link (Link). EDID editor (EDID). HDCP status monitor and control (HDCP) InfoFrames Source DUT Testing Electrical Test	•	• • • •	•				
DisplayPort Reference Sink (DPRX)	Video preview and saving (Video). Audio monitoring and saving (Audio). Status information of the upstream link (Link). Video mode and control of the upstream link (Link). EDID editor (EDID). DPCD editor (DPCD). HDCP status monitor and control (HDCP) Source DUT Testing Event Log, DP AUX Analyzer	•	•	•				
HDMI Reference Source (HDMI TX)	Video pattern generator (Pattern Generator). Audio generator Status information of the downstream link (Link). Control of the downstream link (Link) EDID editor (EDID). HDCP status monitor and control (HDCP)	•	• • • • • • • •	•				
DisplayPort Reference Source (DPTX)	Video pattern generator (Pattern Generator). Audio generator Status information of the downstream link (Link). Control of the downstream link (Link) EDID editor (EDID). HDCP status monitor and control (HDCP) Sink DUT Testing Event Log, DP AUX Analyzer	•	•	•			A	
SPDIF Reference Sink (SPDIF)	Audio monitoring and saving (Audio).	•	-					

In the following pages, please find detailed explanation of the functions and the licensing. Please refer to TSI documentation on detailed description of TSI features.

Features in UCD-323 and UCD-301

	Video pattern generator (fixed patterns and timings)	Custom video patterns and timings
	Audio generator	
	Link status and configuration	HDCP 1.4 status and control HDCP 2.3 status and control
HDMI Reference Source	HPD status	HDCP 2.5 Status and control
HDMI Reference Sink	Video status, preview and saving	Video mode and control of the upstream link
	Audio monitoring, graphical preview and saving	HDCP 1.4 status and control
	Link status, HPD status and control	HDCP 2.3 status and control
	Electrical Test	Infoframe status
		EDID read and write, EDID Editor
		Built-in Source DUT tests
		Video mode and control of the upstream link
		HDCP 1.3 status and control
		HDCP 2.3 status and control
	Video status, preview and saving	DPCD read and write, DPCD editor
	Audio monitoring, graphical preview and saving	SDP status
	Link status, HPD status and control	EDID read and write, EDID Editor
	Electrical Test	Built-in Source DUT tests
DP Reference Sink	HDCP 2.3 CTS	Event Log, DP AUX Analyzer
DP Reference Source	Video pattern generator (fixed patterns and timings)	Custom video patterns and timings
	Audio generator	HDCP 1.4 status and control
	Link status and configuration	HDCP 2.3 status and control
	HPD status	Event Log, DP AUX Analyzer
	HDCP 2.3 CTS	

Electrical Test	Available in UCD-301 Digital (P/N 066510) with TSI Electrical Test Set (P/N MT6502) license
HDCP 2.3 status and control	Available with HDCP 2.3 support (P/N MT6504) license
	Available with HDCP 2.3 CTS for testing Source on DP DUT (P/N MT6634) or HDCP 2.3 CTS for testing Sink on DP DUT (P/N MT6636) license

Features Available in UCD-323 and UCD-301 with **Default Feature Set**

		Console Basic	Basic TSI API
HDMI Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	Electrical Test*		0
DP Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	Electrical Test*		Ø
	HDCP 2.3 CTS **		Ø
HDMI Reference Source	Video pattern generator (fixed patterns and timings)		•
	Audio generator		
	Link status and configuration		
	HPD status		
DP Reference Source	Video pattern generator (fixed patterns and timings)		•
	Audio generator		
	Link status and configuration		•
	HPD status		
	HDCP 2.3 CTS **		0
SPDIF Reference Sink	Audio monitoring, graphical preview and saving		

*) Available in UCD-301 Digital (P/N 066510) with TSI Electrical Test Set (P/N MT6502) license

**) Available with HDCP 2.3 CTS for testing Source on DP DUT (P/N MT6634) or HDCP 2.3 CTS for testing Sink on DP DUT (P/N MT6636) license

_		

Feature available in UCD Console



Feature available in TSI SDK and API

Features Available in UCD-323 and UCD-301 with Console Pro Feature Set *

		Console Pro *	TSI Advanced *
HDMI Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	HDCP 1.4 status and control		•
	HDCP 2.3 status and control ***		(
	Infoframe status		•
	EDID read and write, EDID Editor		•
	Built-in Source DUT tests (ARC, CEC, CRC tests)		•
	Electrical Test **		0
DP Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	Video mode and control of the upstream link		•
	HDCP 1.3 status and control		•
	HDCP 2.3 status and control ***		(
	DPCD read and write, DPCD editor		•
	Infoframe status		•
	EDID read and write, EDID Editor		•
	Built-in Source DUT tests (LT test, CRC tests)		•
	Electrical Test **		Ø
	HDCP 2.3 CTS ****		Ø
	Event Log, AUX Analyzer		
HDMI Reference Source	Video pattern generator (fixed patterns and timings)		•
	Custom video patterns and timings		•
	Audio generator		
	Link status and configuration		•
	HPD status		Ф
	HDCP 1.4 status and control		•
	HDCP 2.3 status and control ***		Ø

contd. ...

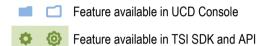
DP Reference Source	Video pattern generator (fixed patterns and timings)	.
	Custom video patterns and timings	.
	Audio generator	
	Link status and configuration	.
	HPD status	.
	HDCP 1.4 status and control	•
	HDCP 2.3 status and control ***	Ô
	HDCP 2.3 CTS ****	Ø
	Event Log, AUX Analyzer	
SPDIF Reference Sink	Audio monitoring, graphical preview and saving	

*) *Console Pro* can be enabled with each interface (DP / HDMI; Sink / Source) separately. *TSI Advanced* feature is delivered with *Console Pro* feature.

**) Available in UCD-301 Digital (P/N 066510) with TSI Electrical Test Set (P/N MT6502) license

***) Available with HDCP 2.3 support (P/N MT6504) license

****) Available with *HDCP 2.3 CTS for testing Source on DP DUT* (P/N MT6634) or *HDCP 2.3 CTS for testing Sink on DP DUT* (P/N MT6636) license



HDCP

TSI API Features in UCD-323 and UCD-301

U	ICD-323 & UCD-30	01 Defaul	t TSI API Features		TSI Advanced Feature Set
					Custom video patterns and timings
					HDCP 1.4 status and control
HD	OMI Reference Source	Video patte	ern generator (fixed patterns and timings)		HDCP 2.3 status and control
HD	MI Reference Sink	Video statu	is, preview and saving		Video mode and control of the upstream link
		Audio mon	itoring, graphical preview and saving		HDCP 1.4 status and control
		Link status	, HPD status and control		HDCP 2.3 status and control
		Electrical 1	- Fest		Infoframe status
					EDID read and write, EDID Editor
					Built-in Source DUT tests
					Video mode and control of the upstream link
					HDCP 1.3 status and control
-		Video statu	s, preview and saving		HDCP 2.3 status and control
		Audio moni	toring, graphical preview and saving		DPCD read and write, DPCD editor
		Link status,	HPD status and control		Infoframe status
		Electrical Te	est		EDID read and write, EDID Editor
DP	Reference Sink	HDCP 2.3 C	TS		Built-in Source DUT tests
DP	Reference Source	Video patte	rn generator (fixed patterns and timings)		Custom video patterns and timings
		Link status a	and configuration		HDCP 1.4 status and control
		HDCP 2.3 C	TS		HDCP 2.3 status and control
Electr	rical Test		Available in UCD-301 Digital (P/N 066510)	with TS	I Electrical Test Set (P/N MT6502) license
HDCP	HDCP 2.3 status and control Available with HDCP 2.3 support (P/N MT6504) license				ense

P 2.3 status and control	Available with HDCP 2.3 support (P/N MT6504) license
273(15	Available with HDCP 2.3 CTS for testing Source on DP DUT (P/N MT6634) or HDCP 2.3 CTS for testing Sink on DP DUT (P/N MT6636) license

Features Available in UCD-323 and UCD-301 with TSI Advanced Test Set (P/N MT6501)

		Console Basic	TSI Advanced
HDMI Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	Video mode and control of the upstream link		•
	HDCP 1.4 status and control		•
	HDCP 2.3 status and control **		Ø
	Infoframe status (ARC, CEC, CRC tests)		\$
	EDID read and write, EDID Editor		\$
	Built-in Source DUT tests (ARC, CEC, CRC tests)		\$
	Electrical Test *		Ø
DP Reference Sink	Video status, preview and saving		•
	Audio monitoring, graphical preview and saving		•
	Link status, HPD status and control		•
	Video mode and control of the upstream link		•
	HDCP 1.3 status and control		\$
	HDCP 2.3 status and control **		Ø
	DPCD read and write, DPCD editor		•
	SDP status		•
	EDID read and write, EDID Editor		•
	Built-in Source DUT tests (LT test, CRC tests)		•
	Electrical Test *		Ø
	HDCP 2.3 CTS ***		Ø
HDMI Reference Source	Video pattern generator (fixed patterns and timings)		•
	Custom video patterns and timings		•
	Link status and configuration		•
	HPD status		ð
DP Reference Source	Video pattern generator (fixed patterns and timings)		•
	Custom video patterns and timings		•
	Link status and configuration		•
	HPD status		•
	HDCP 2.3 CTS ***		Ø
SPDIF Reference Sink	Audio monitoring, graphical preview and saving		

*) Available in UCD-301 Digital (P/N 066510) with TSI Electrical Test Set (P/N MT6502) license **) Available with TSI SDK Advanced Test Set with HDCP 2.3 support (P/N MT6516) license ***) Available with HDCP 2.3 CTS for testing Source on DP DUT (P/N MT6634) or HDCP 2.3 CTS for testing Sink on DP DUT (P/N MT6636) license

Feature available in UCD Console

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Feature available in TSI SDK and API

APPENDIX C: PREDEFINED TIMINGS

Description	H active	V active	H total	V total	Frame rate	RGB 6 bpc	RGB 8 bpc	RGB 10 bpc	RGB 12 bpc	RGB 16 bpc
VESA 800 x 600 @ 60Hz	800	600	1056	628	60	•	••	••	••	••
VESA 848 x 480 @ 60Hz	848	480	1088	517	60	•	••	••	••	••
VESA 1024 x 768 @ 60Hz	1024	768	1344	806	60	•	••	••	••	••
CTA 1280 x 720 @ 60Hz	1280	720	1650	750	60	•	••	••	••	••
VESA 1280 x 768 @ 60Hz	1280	768	1664	798	60	•	••	••	••	••
VESA 1280 x 960 @ 60Hz	1280	960	1800	1000	60	•	••	••	••	••
VESA 1280 x 800 @ 60Hz [RB]	1280	800	1440	823	60	•	••	••	••	••
VESA 1280 x 800 @ 60Hz	1280	800	1680	831	60	•	••	••	••	••
VESA 1280 x 768 @ 60Hz	1280	768	1440	790	60	•	••	••	••	••
VESA 1280 x 1024 @ 60Hz	1280	1024	1688	1066	60	•	••	••	••	••
VESA 1360 x 768 @ 60Hz	1360	768	1792	795	60	•	••	••	••	••
VESA 1400 x 1050 @ 60Hz	1400	1050	1560	1080	60	•	••	••	••	••
VESA 1600 x 1200 @ 60Hz [RB]	1600	1200	1760	1235	60	•	••	••	••	••
VESA 1600 x 1200 @ 60Hz	1600	1200	2160	1250	60	•	••	••	••	••
VESA 1680 x 1050 @ 60Hz	1680	1050	2240	1089	60	•	••	••	••	••
VESA 1680 x 1050 @ 60Hz [RB]	1680	1050	1840	1080	60	•	••	••	••	••
VESA 1792 x 1344 @ 60Hz	1792	1344	2448	1394	60	•	••	••	••	••
VESA 1920 x 1080 @ 30Hz [RB1]	1920	1080	2080	1096	30	•	••	••	••	••
VESA 1920 x 1080 @ 30Hz [RB2]	1920	1080	2000	1096	30	•	••	••	••	••
CTA 1920 x 1080 @ 30Hz	1920	1080	2200	1125	30	•	••	••	••	••
VESA 1920 x 1080 @ 60Hz [RB1]	1920	1080	2080	1111	60	•	••	••	••	••
VESA 1920 x 1080 @ 60Hz [RB2]	1920	1080	2000	1111	60	•	••	••	••	••
CTA 1920 x 1080 @ 60Hz	1920	1080	2200	1125	60	•	••	••	••	••
VESA 1920 x 1080 @ 120Hz [RB1]	1920	1080	2080	1144	120	•	••	••	••	••
VESA 1920 x 1080 @ 120Hz [RB2]	1920	1080	2000	1144	120	•	••	••	••	••
CTA 1920 x 1080 @ 120Hz	1920	1080	2200	1125	120	•	••	••	••	••
VESA 1920 x 1440 @ 60Hz	1920	1440	2600	1500	60	•	••	••	••	••
VESA 2048 x 1536 @ 60Hz	2048	1536	2208	1580	60	•	••	••	••	••
VESA 2560 x 1440 @ 60Hz	2560	1440	2720	1481	60	•	••	••	••	••
VESA 2560 x 1080 @ 60Hz	2560	1080	3424	1120	60	•	••	••	••	••
VESA 2560 x 1080 @ 60Hz [RB]	2560	1080	2720	1111	60	•	••	••	••	••
VESA 2560 x 1600 @ 60Hz	2560	1600	3504	1658	60	•	••	••	••	•
VESA 2560 x 1600 @ 60Hz [RB]	2560	1600	2720	1646	60	•	••	••	••	••
Other 2880 x 1440 @ 60Hz	2880	1440	2976	1456	60	•	••	••	••	••
VESA 4096 x 2160 @ 60Hz	4096	2160	4176	2222	60	•	••	•		
VESA 3840 x 2160 @ 30Hz [RB1]	3840	2160	4000	2191	30	•	••	••	••	••
VESA 3840 x 2160 @ 30Hz [RB2]	3840	2160	3920	2191	30	•	••	••	••	••
CTA 3840 x 2160 @ 30Hz	3840	2160	4400	2250	30	•	••	••	••	••
CTA 3840 x 2160 @ 50Hz	3840	2160	5280	2250	50	•	••			
CTA 4096 x 2160 @ 50Hz	4096	2160	5280	2250	50	•	••			
VESA 3840 x 2160 @ 60Hz [RB1]	3840	2160	4000	2222	60	•	••	•		
VESA 3840 x 2160 @ 60Hz [RB2]	3840	2160	3920	2222	60	•	••	•		
CTA 3840 x 2160 @ 60Hz	3840	2160	4400	2250	60	•	••			
CTA 3840 x 2160 @ 60Hz	4096	2160	4400	2250	60	•	••			

Supported video mode and color depth (• DisplayPort, • HDMI)

APPENDIX D: PREDEFINED PATTERNS

Selection	Pattern	Description
Disabled	N/A	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 Black		0% luminance
Solid White		100% white
Solid Red		100% red
Solid Green		100% green
Solid Blue		100% blue
White Vertical Stripes		Vertical stripes of black (0%) and white (100%). Parameters set the widths of the black and white stripes in pixels respectively. Default black / white = 20 / 20 pixels. Parameter range 0 to 5000.
Gradient Vertical Stripes		16 pixels high horizontal red green, blue and white stripes. Intensity is increased from 0 to 100% with steps defined by the given parameter (n). (step = $n*color_depth/256$). "n" range 0 to 5000 (default 120).
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)
Custom Image		Bitmap image uploaded by the user. Click on the Custom Images panel to browse.

More test patterns can be downloaded e.g. from <u>www.icdm-sid.org/downloads/testpatterns.html</u>.

APPENDIX E: SINK AND SOURCE DUT TESTS

The tables below list the Unigraf TSI SDK Test Cases that you can run in Sink DUT Testing / Source DUT Testing tabs of UCD Console, their definition in TSI Reference Manual and the licensing needed.

လံ

Source DUT Testing		Pro License	DP HDCP 2.3 CTS	Electrical Testing
Electrical Test Set (UCD-301) HDMI RX				
	Power test (TSI_TEST_HDMI_EL_POWER_LINE) TMDS test (TSI_TEST_HDMI_EL_TMDS_LINES) HPD test (TSI_TEST_HDMI_EL_HPD_LINE) DDC and CEC test (TSI_TEST_HDMI_EL_DDC_CEC_LINES)			 ✓ ✓ ✓ ✓
Electrical Test Set (UCD-301) DP RX				
	HPD test (TSI_TEST_DP_EL_HPD_LINE) Main Link test (TSI_TEST_DP_EL_MAIN_LINK) AUX test (TSI_TEST_DP_EL_AUX_LINE)			 ✓ ✓ ✓
CEC functional Test Set HDMI RX				
	CEC functional test (TSI_TEST_HDMI_CEC)	✓		
CRC based Video Test Set	CRC based single frame reference video test (TSI_TEST_VIDEO_CRC_SINGLE_REF) CRC based single frame stability test (TSI_TEST_CRC_VIDEO_STABILITY)	 ✓ ✓ 		
	CRC based sequence of frames reference video test (TSI_TEST_CRC_VIDEO_SEQUENCE)	√		
Link Test Set DP RX				
	Link Training at All Supported Lane Counts and Link Rates (TSI_TEST_DP_SIMPLE_LINK)	✓		
HDCP 2.3 CTS 1A Test Set DP RX	HCDP2.3 CTS 1A-01 – HCDP2.3 CTS 1A-13		✓	
HDCP 2.3 CTS 1B Test Set DP RX	HCDP2.3 CTS 1B-01 – HCDP2.3 CTS 1B-10		✓	
Sink DUT Testing		DP HDCP 2.3 CTS*		
HDCP 2.3 CTS 2C Test Set DP TX		DF		
	HCDP2.3 CTS 2C-01 – HCDP2.3 CTS 2C-06	✓		

*) Separate licenses for testing Sink and Source DUT

Electrical Test Set – HDMI Rx

Electrical Tests verify the continuity of the interface signals and the voltage levels applied by the driving electronics.

<i>///</i> U	CD-301 [1642C158] - HDMI, DisplayPort (SST), SPDIF Re	ference Sink	
<u>F</u> ile	<u>V</u> iew <u>T</u> ools <u>H</u> elp		
	$\label{eq:link_eq} $$ \sqrt{Video} \\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	DUT Testing	
Device	Electrical Test Set	Test timeout, milliseconds	5000
) S	Power test	Power line low voltage limit, mV	4700
	···· TMDS test	Power line high voltage limit, mV	5300
DP RX	HPD test	Main link low voltage limit, mV	2600
	DDC and CEC test	Main link high voltage limit, mV	3100
HDMI RX	CRC based Video Test Set	HPD line logical zero low voltage limit, mV	-50
Ξ	> CRC based video Test Set	HPD line logical zero high voltage limit, mV	400
모		HPD line logical one low voltage limit, mV	2400
SPDIF RX		HPD line logical one high voltage limit, mV	5300
L L		DDC lines low voltage limit, mV	4500
D		DDC lines high voltage limit, mV	5500
S		CEC line logical zero low voltage limit, mV	-50
		CEC line logical zero high voltage limit, mV	600
		CEC line logical one low voltage limit, mV	2500
		CEC line logical one high voltage limit, mV	3600
		Load Save Configure	Reset
		Load Save Conligure	Reset
	Run Test runs 1 Time be	tween tests, sec 1	Report Clear
	<	*	

Power Test

Power Test verifies the voltage level on the +5 V power line (Pin 18) of the DUT source. The accepted value in HDMI specification is 4.7 V to 5.3 V on the sink side connector. (Called "TP2" in the HDMI specification).

The test will measure the power line voltage using two loads: 0 mA and 55 mA. The latter is the test setup in HDMI CTS specification (HDMI CTS 1.4b: Test ID 7-11: +5V Power). The test will fail if voltage level on the power line is below or above the voltage range set by the parameters.

- Test Timeout (default 5 000 ms)
- Power line low voltage limit (default 4 700 mV)
- Power line high voltage limit (default 5 300 mV)

TMDS Test

TMDS Test verifies average voltage levels on TMDS signal lines (8 lines: CLK+/-, D0+/-D1+/- and D2+/-). The positive and negative lines of the TMDS differential pair are measured separately.

TMDS uses DC balanced signaling. Sink pulls the lines up to 3.3 V (AVcc) and source applies the TMDS signal by pulling the line down to ground. On an active TMDS line average voltage level is half of the voltage swing below AVcc (AVcc – Vswing/2). By default, 2.6 V to 3.1 V.

TMDS line voltages outside of the above range might indicate an abnormal situation like short circuit of two TMDS lines, short to ground, open circuit or a broken output driver.

If the measured values fall outside the criteria set by the parameters, test result is FAIL.

Note: Fail criteria for each test set-up should be considered separately depending on the source DUT and test cable configuration.

Parameters in use

- Test Timeout (default 5 000 ms)
- Main link low voltage limit (default 2 600 mV)
- Main link high voltage limit (default 3 100 mV)

HPD Test

HPD Test verifies HPD line (pin 19) for short circuits to power or ground.

The test runs in two steps:

Step 1. HPD line is driven to logical low state and after a delay voltage level is measured. If the measured value is outside the limits set by the parameters for "zero" voltage minimum and maximum the test result is FAIL. The judgement is "Short to ground" or "Short to power" depending if the measured value is below the allowed window, or above it.

Step 2. HPD line is driven to logical high state and after a delay voltage level is measured. If the measured value is outside the limits set by the parameters for "one" voltage minimum and maximum the test result is FAIL. The judgement is "Short to ground" or "Short to power" depending if the measured value is below the allowed window, or above it.

- Test Timeout (default 5 000 ms)
- HPD line logical zero low voltage limit (default -50 mV)
- HPD line logical zero high voltage limit (default 400 mV)
- HPD line logical one low voltage limit (default 2 400 mV)
- HPD line logical one high voltage limit (default 5 300 mV)

DDC and CEC Test

DDC and CEC Test verifies voltage level of SCL (pin 15), SDA (pin 15) and CEC (pin 13) lines. HPD signal is driven low to de-activate any transmission in the tested lines. After a delay of 100 ms voltage level is measured in the three signal lines.

If the measured voltage levels are outside the limits set by the parameters, the test result is FAIL.

- Test Timeout (default 5 000 ms)
- DDC lines low voltage limit (default 4 500 mV)
- DDC lines high voltage limit (default 5 500 mV)
- CEC line logical zero low voltage limit (default -50 mV)
- CEC line logical zero high voltage limit (default 600 mV)
- CEC line logical one low voltage limit (default 2 500 mV)
- CEC line logical one low voltage limit (default 3 600 mV)

Electrical Test Set – DP Rx

Electrical Tests verify the continuity of the interface signals and the voltage levels applied by the driving electronics.

💯 UCD-301 [1636C147] - HDMI, DisplayPort (SST), SPDIF Re	ference Sink			
<u>File View Tools H</u> elp				
/Video \Audio \Link \EDID \DPCD \HDCP \SDP \Source	DUT Testing			
	Test timeout in milliseconds Main link low voltage limit, mV Main link high voltage limit, mV HPD line logical zero low voltage limit, mV HPD line logical zero high voltage limit, mV HPD line logical ore nigh voltage limit, mV HPD line logical one high voltage limit, mV HPD line logical one high voltage limit, mV AUX + line idle low voltage level limit, mV AUX + line idle high voltage level limit, mV AUX - line idle low voltage level limit, mV AUX - line idle low voltage level limit, mV AUX + line signal trigger low level, mV AUX + line signal trigger ligh level, mV	5000 2600 4000 -100 799 2000 3600 2400 3600 2400 3600 2400 3600 2400 3600 2400 3600 2400 3600 2400 3600		
	AUX - line signal trigger low level, mV AUX - line signal trigger high level, mV AUX signal capture timeout, milliseronds Load Save Configure	200 5 4 Reset		
Run Test runs 1 Time bet	tween tests, sec 1 Capture failed frames	Report Clear		
	× •			

HPD Test

HPD Test verifies HPD line for short circuits to power or ground.

The test runs in two steps:

Step 1. HPD line is asserted to logical high state and after a delay voltage level is measured. If the measured value is outside the limits set by the parameters for "one" voltage minimum and maximum the test result is FAIL. The judgement is "Short to ground" or "Short to power" depending if the measured value is below the allowed window, or above it.

Step 2. HPD line is de-asserted to logical low state and after a delay voltage level is measured. If the measured value is outside the limits set by the parameters for "zero" voltage minimum and maximum the test result is FAIL. The judgement is "Short to ground" or "Short to power" depending if the measured value is below the allowed window, or above it.

- Test Timeout (default 5 000 ms)
- HPD line logical zero low voltage limit (default -100 mV)
- HPD line logical zero high voltage limit (default 799 mV)
- HPD line logical one low voltage limit (default 2 000 mV)
- HPD line logical one high voltage limit (default 3 600 mV)

Main Link Test

The test utilizes a dedicated microchip to determine the power of DP Main Link input signal. The test verifies that the measured values lies within the window defined by provided parameters.

The measured values provide a relative voltage value that depends on the signal waveform and selected pre-emphasis and voltage swing. The values do not represent any absolute value, e.g. input signal voltage level.

"No signal" level is initially set to 2.3V. Note that even a disconnected line will give a relatively high value. Good signal levels are expected to be within range 2.6 V to 4.0 V. The allowed voltage window should be set separately for each device model after testing of several units.

Measured values are expected to be close to each other within a differential pair. Also, all main link differential pair measurements should produce a value close to each other if link training result is the same for all pairs.

Measurement results are given in volt, but this is only the voltage level of power measurement circuitry output and does not relate to the actual input signal. The positive and negative lines of main link differential pairs are measured separately.

Note

The measured values provide a relative voltage value that depends on the signal waveform and selected pre-emphasis and voltage swing. The values do not represent any absolute value, e.g. input signal voltage level.

- Test Timeout (default 5 000 ms)
- Main link low voltage limit (default 2 600 mV)
- Main link high voltage limit (default 4 000 mV)
- Maximum lanes count supported by DUT (default 0)
- Maximum data rate supported by DUT in 0.27 Gbps (default 0)

AUX Test

The test verifies voltage levels on AUX lines, and AUX connectivity to DUT.

The test verifies two issues:

1. The idle AUX voltage level is measured and compared to provided parameters. The voltages are expected to match values defined by resistor dividers set by connected DisplayPort sink and source devices.

2. The TE creates a short HPD pulse to have the DUT to generate an AUX request. The DUT is expected to read DPCD register address range 0x200 - 0x205. Test captures the sync sequence of the AUX transaction and verifies the unit interval timings.

The test is first done to AUX- line and then to AUX+ line.

- Test Timeout (default 5 000 ms)
- AUX+ line idle low voltage limit (default 2 400 mV)
- AUX+ line idle high voltage limit (default 3 600 mV)
- AUX- line idle low voltage limit (default 2 400 mV)
- AUX– line idle high voltage limit (default 3 600 mV)
- AUX+ line signal trigger low level (default 150 mV)
- AUX+ line signal trigger high level (default 200 mV)
- AUX- line signal trigger low level (default 200 mV)
- AUX– line signal trigger high level (default 5 mV)
- AUX signal capture timeout (default 4 ms)
- AUX signal capture attempts (default 20 times)

CEC Functional Test Set – HDMI Rx

<i>]]]</i> U	CD-301	[1642C1	58] - HDMI,	Display	yPort (SS	r), spdi	F Reference	Sink								
<u>F</u> ile	View	Tools	<u>H</u> elp													
	/Vide	o Audio		HDCP	InfoFran	nes / Sou	urce DUT Test	ting \								
8	▶ .	Electrical T	est Set						Те	st timeou	ut, mill	iseconds		5000		
Device	⊿ [ional Test Se									al address.		4.0.0.0		
x x			unctional test d Video Test													
Å	D .	URC Daset	a video rest	Set												
X																
Ψ																
모																
SX :																
SPDIF RX HDMI RX DP RX																
S																
											_			_		
										Load		Save	Configure			Reset
		Run	Test	runs 1	L	Tim	e between te	sts, sec	1	×		Capt	ure failed frames	Report		Clear
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CEC Functional Test

TE verifies that source DUT correctly handles an HPD event, reads the sink EDID and broadcasts a CEC "Report physical address" message.

First, the TE allocates the physical address provided as a parameter and issues an HPD pulse simulating cable detach/attach. After that the TE waits for DUT to broadcast the CEC "Report physical address" message.

The test is considered passed if DUT sends a correct "Report physical address" message.

Note:	The default physical address in UCD-300 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.

- Test Timeout (default 5 000 ms)
- Local CEC physical address (default 4.0.0.0)

CRC Based Video Test Set – HDMI & DP Rx

_	D-301 [1642C158] - HDMI, DisplayPort (SST), SPDIF Refe	rence Sink									
<u>F</u> ile	Eile View Iools Help										
	Video (Audio (Link (EDID (HDCP (InfoFrames) Source DUT Testing)										
Device	▷ · Electrical Test Set	Test timeout, milliseconds	100000								
Devi	▷ · CEC functional Test Set	Total number of frames	2000								
RX	CRC based Video Test Set	Number of frames to be tested	20								
2	···· CRC based single reference frame video test	Number of bad frames allowed	2								
В	···· CRC based single frame video stability test	Reference width	1920								
X	CRC based sequence of reference frames video to CRC based continuous sequence of reference frames.	Reference height	1080								
IWOH	····· CRC based continuous sequence of reference frai	Reference bpp	24								
모		Frame rate, mHz	0								
B		Frame rate tolerance, mHz	0								
Ľ.		CRC [1] (Red)	46750								
SPDIFRX		CRC [1] (Green)	45886								
lo lo		CRC [1] (Blue)	6835								
		Number of motion test iterations Color format	0								
		Color format	0								
		Load Save Configure	Reset								
	Run Test runs 1 Time betw	een tests, sec 1 📄 Capture failed frames	Report Clear								
		A									
	4	T									
		4									

CRC Based Single Reference Frame Video Test

The test compares captured frames to a provided reference.

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.

- Test Timeout (default 100 000 ms)
- Total number of frames (default 2 000 ms)
- Number of bad frames allowed (default 2)
- Reference width (default 1920)
- Reference height (default 1080)
- Reference BPP (default 24)
- Expected frame rate (mHz)
- Frame rate tolerance (mHz)
- 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 100 000 ms)
- Total number of frames (default 2 000 ms)
- Number of bad frames allowed (default 2)

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 100 000 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)
- Frame rate tolerance (mHz)
- 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 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 100 000 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)
- Frame rate tolerance (mHz)
- Expected color format
- Reference CRCs (R, G, B)

Note: Please note that in order for the TE to maintain the sequence, all CRCs in the reference frame list should be different.

Link Test Set – DP Rx

UCD-301 [1636C147] - HDMI, DisplayPort (SST), SPDIF Reference Sink											
ile View Tools Help											
Video (Audio (Link (EDID (DPCD (HDCP (SDP) Source D	/Video \Audio \Link \EDID \DPCD \HDCP \SDP \Source DUT Testing										
O • Electrical Test Set • CRC based Video Test Set • Inde Test Set	Test timeout, milliseconds	5000									
ORC based Video Test Set	Max lanes count supported by DUT	4									
Link Test Set	Max lane rate supported by DUT in 0.27Gbps	20									
Link Training at All Supported Lane Counts and Lin	Reserved for DUT Capabilities flags	0									
	Reserved for DUT Test automation capabilities flags	0									
SPDIF RX HDMI RX	Long HPD pulse duration, milliseconds	1000									
- W	Link training start timeout, milliseconds	5000									
무미	Delay between test cycles, milliseconds	3000									
< <u> </u>	Load Save Configure	Reset									
Run Test runs 1 Time betw	een tests, sec 1 Capture failed frames	Report Clear									
	A										
	-										
•	4										

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.

- Test Timeout (default 5 000 ms)
- Max lane count supported by DUT (default 4)
- Max lane rate supported by DUT as multiple of 0.27 Gbps. (valid settings 6, 10 and 20; default 20)
- Long HPD pulse duration (default 1 000 ms)
- Link training start timeout (default 5 000 ms)
- Delay between test cycles (default 3 000 ms)