



DisplayPort™ CTS Tools for UCD-400



Guide to Product Options

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GENERAL

Reference Standards

High-bandwidth Digital Content Protection, Revision 2.3 on DisplayPort, Compliance Test Specification, Revision 1.1, 4 March 2019

VESA DisplayPort v1.4a Link Layer Compliance Test Specification (Link CTS), Revision 1.0, June 12, 2019

VESA® DisplayPort® DSC Link Layer Compliance Test Specification, Version 1.4a, Revision 1.0, June 24, 2019

Released Versions

This document explains features found in the following versions of the software:

Tool	Version
HDCP 2.3 CTS: UCD Console	1.7
DP 1.4a CTS: UCD Console	1.7

DP 1.4 LINK LAYER CTS

DP 1.4 Reference Hardware Products

Product	P/N	Description
UCD-400 DP 1.4 Test Device	<i>066600</i>	DP1.4a / HBR3 capable test unit for DisplayPort Sink, Source and Repeater. USB 3.0 Interface to Host PC.

DP 1.4 Link CTS Test Software Product Options

Product	P/N	Tests included
DP 1.4 LL CTS for testing Source DUT	<i>MT6637</i>	DP 1.4a Link Layer compliance tests (HBR3) for testing Source DUT.
DP 1.4 LL CTS for testing Sink DUT	<i>MT6635</i>	DP 1.4a Link Layer compliance tests (HBR3) for testing Sink DUT.

Description of DP 1.4 Link CTS

DP 1.4a LL CTS for testing Source DUT

Test Reference	Test Name
4.2.1.1	Source DUT Retry on No-Reply During AUX Read after HPD Plug Event
4.2.1.2	Source Retry on Invalid Reply During AUX Read after HPD Plug Event
4.2.1.3	Source Device HPD Event Pulse Length Test
4.2.1.4	Source Device IRQ_HPDPulse Length Test
4.2.1.5	Source Device Inactive HPD / Inactive AUX Test
4.2.2.1	DPCD Receiver Capability and EDID Read upon HPD Plug Event
4.2.2.2	DPCD Receiver Capability Read upon HPD Plug Event
4.2.2.3	EDID Read
(4.2.2.4)	(EDID Read Failure #1: I2C-Over-AUX NACK) Informative
(4.2.2.5)	(EDID Read Failure #2: I2C-Over-AUX DEFER) Informative
4.2.2.6	Source Device Inactive HPD / Inactive AUX test
4.2.2.7	Branch Device Detection upon HPD Plug Event
4.2.2.8	EDID Read on IRQ HPD Event after Branch Device Detection
4.2.2.9	E-DDC Four Block EDID Read
4.2.2.10	Link Status-Adjust Request AUX read interval during Link Training
4.3.1.1	Successful Link Training at All Supported Lane Counts and Link Speeds
4.3.1.2	Successful Link Training Upon HPD Plug Event
4.3.1.3	Successful Link Training with Request of Higher Differential Voltage Swing During Clock Recovery Sequence
4.3.1.4	Successful Link Training to a Lower Link Rate #1: Iterate at Maximum Voltage Swing
4.3.1.5	Successful Link Training to a Lower Link Rate #2: Iterate at Minimum Voltage Swing
4.3.1.6	Successful Link Training with Request of a Higher Pre-emphasis Setting During Channel Equalization Sequence
4.3.1.7	Successful Link Training at Lower Link Rate Due to Loss of Symbol Lock During Channel Equalization Sequence
4.3.1.8	Unsuccessful Link Training at Lower Link Rate #1: Iterate at Maximum Voltage Swing
4.3.1.9	Unsuccessful Link Training at Lower Link Rate #2: Iterate at Minimum Voltage Swing
4.3.1.10	Unsuccessful Link Training due to Failure in Channel Equalization Sequence (loop count > 5)
4.3.1.11	Successful LT with Simultaneous Request for Differential Voltage Swing and Pre-emphasis during Clock Recovery Sequence
4.3.1.12	Source Device Link Training CR Fallback Test
4.3.1.13	Source Device Link Training EQ Fallback Test

Test Reference	Test Name
4.3.2.1	Successful Link Re-training After IRQ HPD Pulse Due to Loss of Symbol Lock
4.3.2.2	Successful Link Re-training After IRQ HPD Pulse Due to Loss of Clock Recovery Lock
4.3.2.3	Successful Link Re-training After IRQ HPD Pulse Due to Loss of Inter-lane Alignment Lock
4.3.2.4	Handling of IRQ HPD Pulse with No Error Status Bits Set
4.3.2.5	Lane Count Reduction
4.3.3.1	Video Time Stamp Generation
4.4.1.1	Pixel Data Packing and Steering
4.4.1.2	Main Stream Data Packing and Stuffing – Least Packed TU
4.4.1.3	Main Stream Data Packing and Stuffing – Most Packed TU
4.4.2	Main Video Stream Format Change Handling
4.4.3	Power Management
4.4.4.1	Configuring Video and Audio Parameters
4.4.4.2	Audio Stream Header Synchronization
4.4.4.3	Audio Time Stamp Generation
4.4.4.4	Audio InfoFrame Packet
4.4.4.6	Audio Start Sequence
4.5.1.1	FEC enable verification for all supported Lane count and Link Speed
4.5.1.2	FEC ready verification for non FEC capable sink

DP 1.4a LL CTS for testing Sink DUT

Test Reference	Test Name
5.2.1.1	Read One Byte from Valid DPCD Address
5.2.1.2	DPCD Receiver Capability Read (Read 12 Bytes from Valid DPCD Address)
5.2.1.3	Write One Byte to Valid DPCD Address
5.2.1.4	Write Nine Bytes to Valid DPCD Addresses
5.2.1.5	Write EDID Offset (One Byte I2C-Over-AUX Write)
5.2.1.6	Read One EDID Byte (One Byte I2C-Over-AUX Read)
5.2.1.7	EDID Read (1 Byte I2C -Over-AUX Segment Write, 1 Byte I2C-Over-AUX Offset Write, 128 Byte I2C-Over-AUX Read)
5.2.1.8	Illegal AUX Request Syntax
5.2.1.9	Glitch Rejection
5.2.1.10	Interleaved EDID and DPCD Receiver Capability Read
5.2.1.11	Downstream Stop on MOT Reset
5.2.1.12	Downstream Stop on Timeout
5.2.2.1	Sink Organizationally Unique Identifier (OUI)
5.2.2.2	Sink Count
5.2.2.3	Sink Status
5.2.2.4	Sink Error Count
5.2.2.5	DPCD Address Range
5.2.2.6	Number of Receiver Ports
5.2.2.7	Main Link Channel Coding
5.2.2.8	ESI Field Mapping
5.2.2.9	Sink Device Symbol Error Count
5.3.1.1	Successful Link Training at All Supported Lane Counts and Link Speeds
5.3.1.2	Successful Link Training with Request of Higher Differential Voltage Swing During Clock Recovery Sequence
5.3.1.3	Successful Link Training to a Lower Link Rate Due to Clock Recovery Lock Failure During Clock Recovery Sequence
5.3.1.4	Successful Link Training with Request of a Change to Pre-Emphasis and/or Voltage Swing Setting During Channel Equalization Sequence
5.3.1.5	Successful Link Training at Lower Link Rate Due to Loss of Symbol Lock During Channel Equalization Sequence
5.3.1.6	Lane Count Reduction
5.3.1.7	Lane Count Increase
5.3.1.8	2-Lane Link Training CR/EQ Fallback Test
5.3.1.9	1-Lane Link Training CR/EQ Fallback Test
5.3.2.1	IRQ HPD Pulse Due to Loss of Symbol Lock and Clock Recovery Lock
5.3.2.2	IRQ HPD Pulse Due to Loss of Inter-lane Alignment Lock

Test Reference	Test Name
5.4.1.1	Pixel Data Reconstruction
5.4.1.2	Main Stream Data Unpacking and Unstuffing – Least Packed TU
5.4.1.3	Main Stream Data Unpacking and Unstuffing – Most Packed TU
5.4.1.4	Pixel ClockRecovery
5.4.2	Main Video Stream Format Change Handling
5.4.3.1	Entering and Exiting Power Save Mode
5.4.3.2	Resumption of Main Link Activity After Extended Idle
5.4.4.1	Audio Test Patterns
5.4.4.2	Audio Startup and Format Change
5.4.4.3	RS Error Correction
5.4.4.4	Audio InfoFrame Packet
5.4.4.5	Audio Clock Recovery
5.4.4.6	Audio Stream Reception
5.5.1.1	Sink Device FEC capability verification
5.5.1.2	Successful Link Training at All Supported Lane Counts and Link Rates with FEC Enable
5.5.1.3	Uncorrectable Block error count
5.5.1.4	Correctable Block error count
5.5.1.5	Correctable Bit error count
5.5.1.6	Correctable Parity Block error count
5.5.1.7	Correctable Parity Bit error count

HDCP 2.3 CTS FOR DISPLAYPORT SINK, SOURCE AND REPEATER DUT

DP HDCP 2.3 CTS Capable Hardware Products

Product	P/N	Description
UCD-323 HDDP *	066512	4K capable test unit for digital video inputs and outputs. USB 3.0 Interface to Host PC.
UCD-400 DP 1.4 Test Device *	066600	DP1.4a / HBR3 capable test unit for DisplayPort Sink, Source and Repeater. USB 3.0 Interface to Host PC.
UCD-340 USB-C DP Alt Mode Tester **	066514	4K capable test unit for USB-C DP Alt Mode Sinks or Sources. USB 3.0 Interface to Host PC. TSI SDK Basic Test Set included
UCD-340 USB-C DP Alt Mode Tester with Electrical Test **	066515	4K capable test unit for USB-C DP Alt Mode Sinks or Sources with Electrical Test. USB 3.0 Interface to Host PC. TSI SDK Basic Test Set included.
UCD-301 Digital **	066510	4K capable test unit for digital video outputs. USB 3.0 Interface to Host PC.

*) Approved as Authorized Test Tool for DP Sinks and Sources

***) Approved as Authorized Test Tool for DP Sources

DP HDCP 2.3 CTS Test Software Product Options

Product	P/N	Tests included
HDCP 2.3 CTS for testing Source DUT on DP	MT6634	HDCP 2.3 on DisplayPort compliance tests for testing Source DUT. (Sets 1A + 1B)
HDCP 2.3 CTS for testing Sink DUT on DP	MT6636	HDCP 2.3 on DisplayPort compliance tests for testing Sink DUT. (Set 2C)
HDCP 2.3 CTS for testing Sink, Source and Repeater DUT on DP	MT6638	HDCP 2.3 on DisplayPort CTS for testing Sink, Source and Repeater DUT. (Sets 2C + 1A + 1B + 3A + 3B + 3C)

Description of HDCP 2.3 CTS Transmitter Tests

1A. Downstream procedure with Receiver

Test Reference	Test Name
HDCP2.3 CTS 1A-01	Regular Procedure – With previously connected Receiver (With stored km)
HDCP2.3 CTS 1A-02	Regular Procedure – With newly connected Receiver (Without stored km)
HDCP2.3 CTS 1A-03	Regular Procedure – Receiver disconnect after AKE_Init
HDCP2.3 CTS 1A-04	Regular Procedure – Receiver disconnect after km
HDCP2.3 CTS 1A-05	Regular Procedure – Receiver disconnect after locality check
HDCP2.3 CTS 1A-06	Regular Procedure – Receiver disconnect after ks
HDCP2.3 CTS 1A-07	Regular Procedure – Receiver sends REAUTH_REQ after ks
HDCP2.3 CTS 1A-08	Irregular Procedure – Verify Receiver Certificate
HDCP2.3 CTS 1A-09	Irregular Procedure – SRM
HDCP2.3 CTS 1A-10	Irregular Procedure – Invalid H'
HDCP2.3 CTS 1A-11	Irregular Procedure – Pairing Failure
HDCP2.3 CTS 1A-12	Irregular Procedure – Locality Failure
HDCP2.3 CTS 1A-13	Regular Procedure – Encryption Disable Bootstrapping

1B. Downstream procedure with Repeater

HDCP2.3 CTS 1B-01	Regular Procedure – With Repeater
HDCP2.3 CTS 1B-02	Irregular Procedure – Timeout of Receiver ID list
HDCP2.3 CTS 1B-03	Irregular Procedure – Verify V'
HDCP2.3 CTS 1B-04	Irregular Procedure – MAX_DEVS_EXCEEDED
HDCP2.3 CTS 1B-05	Irregular Procedure – MAX_CASCADE_EXCEEDED
HDCP2.3 CTS 1B-06	Irregular Procedure – Incorrect seq_num_V
HDCP2.3 CTS 1B-07	Regular Procedure – Re-authentication on HPD
HDCP2.3 CTS 1B-08	Regular Procedure – Re-authentication on REAUTH_REQ
HDCP2.3 CTS 1B-09	Irregular Procedure – Rollover of seq_num_V
HDCP2.3 CTS 1B-10	Irregular Procedure – Failure of Content Stream Management

Description of HDCP 2.3 CTS Receiver Tests

2C. Upstream procedure with Transmitter

Test Reference	Test Name
HDCP2.3 CTS 2C-01	Regular Procedure – With transmitter
HDCP2.3 CTS 2C-02	Irregular Procedure – New Authentication after AKE_Init
HDCP2.3 CTS 2C-03	Irregular Procedure – New Authentication during Locality Check
HDCP2.3 CTS 2C-04	Irregular Procedure – New Authentication after SKE_Send_Eks
HDCP2.3 CTS 2C-05	Irregular Procedure – New Authentication during Link Synchronization
HDCP2.3 CTS 2C-06	Regular Procedure – Encryption Disable Bootstrapping

Description of HDCP 2.3 CTS Repeater Tests

3A. Downstream Procedure with Receiver

Test Reference	Test Name
HDCP2.3 CTS 3A-01	Regular Procedure - With previously connected Receiver (With stored k_m)
HDCP2.3 CTS 3A -02	Regular Procedure - With newly connected Receiver (Without stored k_m)
HDCP2.3 CTS 3A -03	Irregular Procedure - Verify Receiver Certificate
HDCP2.3 CTS 3A -04	Irregular Procedure - invalid H'
HDCP2.3 CTS 3A -05	Irregular Procedure - Pairing Failure
HDCP2.3 CTS 3A -06	Irregular Procedure - Locality Failure

3A. Downstream Procedure with Repeater

HDCP2.3 CTS 3B-01	Regular Procedure - With Repeater
HDCP2.3 CTS 3B -02	Irregular Procedure - Timeout of Receiver ID list
HDCP2.3 CTS 3B -03	Irregular Procedure - Verify V'
HDCP2.3 CTS 3B -04	Irregular Procedure - MAX_DEVS_EXCEEDED
HDCP2.3 CTS 3B -05	Irregular Procedure - MAX_CASCADE_EXCEEDED
HDCP2.3 CTS 3B -06	Irregular Procedure - Rollover of seq_num_V
HDCP2.3 CTS 3B -07	Irregular Procedure - Failure of Content Stream Management

3C. Downstream Procedure with Transmitter

Repeater (DUT) Connected to Transmitter (TE pseudo-Source) and Receiver (TE pseudo-Sink)

HDCP2.3 CTS 3C-01	Regular Procedure - Transmitter - DUT - Receiver
HDCP2.3 CTS 3C -02	Regular Procedure - Receiver Disconnect Propagation when an Active Receiver is Disconnected Downstream
HDCP2.3 CTS 3C -03	Regular Procedure - Receiver Connected when an Active Receiver is Connected Downstream
HDCP2.3 CTS 3C -04	Irregular Procedure - New Authentication after AKE_init
HDCP2.3 CTS 3C -05	Irregular Procedure - New Authentication during Locality Check
HDCP2.3 CTS 3C -06	Irregular Procedure - New Authentication after SKE_Send_Eks
HDCP2.3 CTS 3C -07	Irregular Procedure - New Authentication during Link Synchronization
HDCP2.3 CTS 3C -08	Irregular Procedure - Rx Certificate invalid
HDCP2.3 CTS 3C -09	Irregular Procedure - invalid H'
HDCP2.3 CTS 3C -10	Irregular Procedure - Locality Failure

Repeater (DUT) Connected to Transmitter (TE pseudo-Source) and Receiver (TE pseudo-Repeater)

Test Reference	Test Name
HDCP2.3 CTS 3C-11	Regular Procedure - Transmitter - DUT - Repeater (With stored km)
HDCP2.3 CTS 3C-12	Regular Procedure - Receiver disconnect after AKE_Init
HDCP2.3 CTS 3C-13	Regular Procedure - Receiver disconnect after k_m
HDCP2.3 CTS 3C-14	Regular Procedure - Receiver disconnect after locality check
HDCP2.3 CTS 3C-15	Regular Procedure - Receiver disconnect after K_s
HDCP2.3 CTS 3C-16	Irregular Procedure - Timeout of Receiver ID list
HDCP2.3 CTS 3C-17	Irregular Procedure - Verify V'
HDCP2.3 CTS 3C-18	Irregular Procedure - DEVICE_COUNT
HDCP2.3 CTS 3C-19	Irregular Procedure - DEPTH
HDCP2.3 CTS 3C-20	Irregular Procedure - MAX_DEVS_EXCEEDED
HDCP2.3 CTS 3C-21	Irregular Procedure - MAX_CASCADE_EXCEEDED
HDCP2.3 CTS 3C-22	Regular Procedure - Repeater with zero downstream device
HDCP2.3 CTS 3C-23	Regular Procedure - Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag
HDCP2.3 CTS 3C-24	Regular Procedure - Propagation of HDCP1_DEVICE_DOWNSTREAM flag
HDCP2.3 CTS 3C-25	Regular Procedure - Content Stream Management