DisplayPort™ CTS Tools for UCD-400

Guide to Product Options

UNIGRAF

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Table of Content

1. 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 1.1, Draft 6, Nov 18, 2019

VESA DisplayPort v1.4a DisplayID EDID Compliance Test Specification (DisplayID EDID CTS) Revision 1.3, 18 February 2021

2. DP 1.4 LINK LAYER CTS

DP 1.4 Reference Hardware Products

Product	P/N	Description
UCD-400 DP 1.4 Test Device *	066600	DP 1.4a / HBR3 capable test unit for DisplayPort Sink, Source and Repeater. USB 3.0 Interface to Host PC.
UCD-411 Tester	066606	DP 1.4 / HBR3/MST capable Pattern Generator. USB 3.0 interface to Host PC.

*) Approved for testing DP Link and DSC CTS on Sink, Source and Branch devices

DP 1.4 CTS Test Software Product Options

Product	P/N	Description
DP 1.4 LL CTS for testing Source DUT	MT6637	DP 1.4 Link Layer compliance tests (HBR3) for testing Source DUT. Audio and FEC CTS included
DP 1.4 LL CTS for testing Sink DUT	MT6635	DP 1.4 Link Layer compliance tests (HBR3) for testing Sink DUT. Audio and FEC CTS included
DP 1.4 DSC CTS Source DUT	MT6642	Display Stream Compression for testing Source DUT
DP 1.4 DSC CTS Sink DUT	MT6643	Display Stream Compression for testing Sink DUT
DP 1.4 DSC CTS Source and Sink DUT	MT6645	Combine for testing Sink, Source and Branch DUT (*
DP 2.1 DisplayID / EDID CTS for testing Source DUT (8b/10b)	MT6646	DisplayID CTS for testing Source DUT (*
DP 2.1 DisplayID / EDID CTS for testing Sink DUT (8b/10b)	MT6647	DisplayID CTS for testing Sink DUT (*
DP 2.1 Adaptive-Sync CTS for testing Source DUT (8b/10b)	MT6648	Adaptive-Sync CTS for testing Source DUT
DP 2.1 Adaptive-Sync CTS for testing Sink DUT (8b/10b)	MT6649	Adaptive-Sync CTS for testing Sink DUT.

*) DP 1.4 LL Branch CTS and DisplayID CTS for testing Source will be available in a future release

Test Software Content

Source DUT Testing		DP 1.4a LL CTS*	DP 1.4a DSC CTS*	DP 2.1 LL CTS*	DP 2.1 DSC CTS*	DisplayID/EDID CTS*	Adaptive-Sync CTS*	DP 2.1 LTTPR CTS*
DP 1.4a Link Layer CTS	• 4.2.1.1 – 4.2.1.5 • 4.2.2.1 – 4.2.2.10 • 4.3.1.1 – 4.3.1.13 • 4.3.2.1 – 4.3.2.5 • 4.3.3.1 • 4.4.1.1 – 4.4.1.3 • 4.4.2, 4.4.3 • 4.4.4.2 – 4.4.4.6 • 4.5.1.1 – 4.5.1.2	●						
DP 1.4a DSC CTS	• 4.6.1.1 – 4.6.1.9		●					
DP 2.1 DisplayID/EDID CTS**	• 4.7.1.1 – 4.7.1.4 • 4.7.2.1 – 4.7.2.2 • 4.7.3.1 – 4.7.3.3 • 4.7.4.1, 4.7.4.4 • 4.7.5.1 • 4.7.6.1 - 4.7.6.4 • 4.7.7.1 - 4.7.7.2					●		
DP 2.1 Adaptive-Sync LL CTS**	• 4.8.1.1 – 4.8.1.2 • 4.8.2.1 – 4.8.2.3						●	

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

Sink DUT Testing		DP 1.4a LL CTS*	DP 1.4a DSC CTS*	DP 2.1 LL CTS*	DP 2.1 DSC CTS*	DisplayID/EDID CTS*	Adaptive-Sync CTS*	DP 2.1 LTTPR CTS*
DP 1.4a Link Layer CTS	• 5.2.1.1 – 5.2.1.12 • 5.2.2.1 – 5.2.2.9 • 5.3.1.1 – 5.3.1.9 • 5.3.2.1 – 5.3.2.2 • 5.4.1.1 – 5.4.1.4 • 5.4.2, 5.4.3.1 – 5.4.3.2 • 5.4.4.1 – 5.4.4.6 • 5.5.1.1 – 5.5.1.7	●						
DP 1.4a DSC CTS	• 5.6.1.1 – 5.6.1.26 • 5.6.2.1 – 5.6.2.14		●					
DisplayID/EDID CTS**	• 5.7.1.1 – 5.7.1.2 • 5.7.1.3.1 – 5.7.1.3.4 • 5.7.1.4.1 – 5.7.1.4.9 • 5.7.1.5 – 5.7.1.6 • 5.7.2.1 – 5.7.2.2 • 5.7.2.3.1 – 5.7.2.3.5 • 5.7.2.4.1 – 5.7.2.4.2 • 5.7.2.5.1 – 5.7.2.5.2 • 5.7.2.6.1 – 5.7.2.6.2 • 5.7.2.7.1, 5.7.2.8 • 5.7.3.1 – 5.7.3.5 • 5.7.4.1 – 5.7.4.3 • 5.7.4.5, 5.7.5.1 • 5.7.6.1 – 5.7.6.5 • 5.7.7.1 – 5.7.7.6 • 5.7.8.1 – 5.7.8.6 • 5.7.9.1 – 5.7.9.3 • 5.7.10.1 – 5.7.10.3 • 5.7.11.1 – 5.7.11.5 • 5.7.12.1 – 5.7.12.4 • 5.7.13.1 – 5.7.13.2 • 5.7.14.1 – 5.7.14.8 • 5.7.15.1 – 5.7.15.11 • 5.7.16.1 – 5.7.16.7 • 5.7.16.9 – 5.7.16.10 • 5.7.17.1 – 5.7.17.5, 5.7.18.1 • 5.7.19.1 - 5.7.19.6 • 5.7.20.1 - 5.7.20.3 • 5.7.21.1 - 5.7.21.5 • 5.7.22.1 - 5.7.22.7					●		
Adaptive-Sync LL CTS**	• 5.8.1.1 – 5.8.1.3						●	

*) Separate licenses for testing Sink, Source, Branch DUT

3. LINK CTS FOR TESTING SOURCE DUT

DP 1.4a LL CTS for testing Source DUT (P/N: MT6637)

AUX Reads after HPD Plug Event

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_HPD Pulse Length Test
4.2.1.5	Source Device Inactive HPD / Inactive AUX Test

EDID and DPCD Reads

Test Reference	Test Name
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
4.2.2.5	EDID Read Failure #2: I2C-Over-AUX DEFER
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

Link Training

Test Reference	Test Name
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

Link Maintenance

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

Video Time Stamp Generation

Test Reference	Test Name
4.3.3.1	Video Time Stamp Generation

Main Stream Data Mapping

Test Reference	Test Name
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

Audio Stream Transmission over Secondary Packets

Test Reference	Test Name
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

Source FEC Protocol

Test Reference	Test Name
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 DSC 1.4a CTS for testing Sink DUT (P/N MT6642)

Source Device DSC Test Procedures

Test Reference	Test Name
4.6.1.1	DSC enable sequence verification
4.6.1.2	DSC PPS block prediction flag verification

4.6.1.3	DSC PPS convert RGB flag verification
4.6.1.4	DSC PPS YCbCr 4:4:4 convert RGB = 0) flag verification
4.6.1.5	DSC PPS Simple 4:2:2 flag verification
4.6.1.6	DSC PPS Native 4:2:2 flag verification
4.6.1.7	DSC PPS Native 4:2:0 flag verification
4.6.1.8	DSC PPS convert RGB flag verification for DSC Algorithm Revision 1.1
4.6.1.9	DSC PPS (YCbCr 4:4:4 convert RGB = 0) flag verification for DSC Algorithm Revision 1.1

DisplayID/EDID CTS for testing Source DUT (P/N: MT6646)

Video Tests

Test Reference	Test Name
4.7.1.1	Basic Supported Formats
4.7.1.2	Preferred Timing
4.7.1.3	Out-of-Range Request
4.7.1.4	Invalid EDID

Audio Tests

Test Reference	Test Name
4.7.2.1	Basic Supported Formats
4.7.2.2	Out-of-Range Request

Source Device Test Procedures (E-DDC Protocol)

Test Reference	Test Name
4.7.3.1	EDID Read with More than 256 Bytes of Data Including DisplayID Block
4.7.3.2	EDID Read with Greater than 8 Blocks of Data Including DisplayID Block
4.7.3.3	EDID Read with Unknown Extensions and Unknown Data Blocks, Including DisplayID Block

Source Device Test Procedures (DisplayID)

Test Reference	Test Name
4.7.4.1	DisplayID Detailed Timing support
4.7.4.4	Dynamic Refresh Rate with Vertical Blank Stretch with MSA_TIMING_PAR_IGNORED

Source Device Test Procedures (Adaptive-Sync)

Test Reference	Test Name
4.7.5.1	DisplayID Adaptive-Sync CVT RB Timing v3 Support

Source Device Test Procedures (Native DisplayID Video Tests)

Test Reference	Test Name
4.7.6.1	Basic Supported Formats
4.7.6.2	Preferred Timing
4.7.6.3	Out-of-Range Request
4.7.6.4	Invalid DisplayID Structure

Source Device Test Procedures (Native DisplayID Audio Tests)

Test Reference	Test Name
4.7.7.1	Basic Supported Formats
4.7.7.2	Out-of-Range Request

Adaptive-Sync CTS for testing Source DUT (P/N: MT6648)

Fixed-Average VTotal Mode Support Validation

Test Reference	Test Name
4.8.1.1	EDID - Fixed-Average VTotal Mode Support over the Declared Frame Rate Range
4.8.1.2	EDID - Fixed-Average VTotal Mode Duration Increase and Decrease Constraint Value Support

Adaptive VTotal Mode Support Validation

Test Reference	Test Name
4.8.2.1	EDID - Adaptive VTotal Mode Support with Duration Increase and Decrease Constraint Values
4.8.2.2	EDID - Adaptive VTotal Mode Support with Unconstrained Duration Increase and Decrease
4.8.2.3	EDID – Adaptive VTotal Mode Support in Gaming Environment

4. LINK CTS FOR TESTING SINK DUT

DP 1.4a LL CTS for testing Sink DUT (P/N MT6635)

AUX Channel Protocol

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

Sink Device DPCD Field Implementation Addendum

Test Reference	Test Name
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

Link Training

Test Reference	Test Name
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

Link Maintenance

Test Reference	Test Name
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

Main Video Stream Reconstruction

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

Main Audio Stream Reconstruction

Test Reference	Test Name
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

Sink FEC Protocol

Test Reference	Test Name
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

DP 1.4a DSC CTS For testing Sink DUT (P/N: MT6643)

Sink Device DSC Test Procedures

Test Reference	Test Name
5.6.1.1	DSC capability verification
5.6.1.2	DSC RGB Color Depth Test
5.6.1.3	DSC RGB Block Prediction Test
5.6.1.4	DSC RGB bits-per-pixel test
5.6.1.5	DSC RGB slice test
5.6.1.6	DSC RGB lane test
5.6.1.7	DSC YcbCr 4:4:4 Color Depth Test
5.6.1.8	DSC YcbCr 4:4:4 Block Prediction Test
5.6.1.9	DSC YcbCr 4:4:4 bits-per-pixel test
5.6.1.10	DSC YcbCr 4:4:4 slice test
5.6.1.11	DSC YcbCr 4:4:4 lane test
5.6.1.12	DSC Simple 4:2:2 Color Depth Test
5.6.1.13	DSC Simple 4:2:2 Block Prediction Test
5.6.1.14	DSC Simple 4:2:2 bits-per-pixel test
5.6.1.15	DSC Simple 4:2:2 slice test
5.6.1.16	DSC Simple 4:2:2 lane test
5.6.1.17	DSC Native 4:2:2 Color Depth Test
5.6.1.18	DSC Native 4:2:2 Block Prediction Test
5.6.1.19	DSC Native 4:2:2 bits-per-pixel test
5.6.1.20	DSC Native 4:2:2 slice test
5.6.1.21	DSC Native 4:2:2 lane test
5.6.1.22	DSC Native 4:2:0 Color Depth Test
5.6.1.23	DSC Native 4:2:0 Block Prediction Test
5.6.1.24	DSC Native 4:2:0 bits-per-pixel test
5.6.1.25	DSC Native 4:2:0 slice test
5.6.1.26	DSC Native 4:2:0 lane test

Sink DSC Protocol Extension

Test Reference	Test Name
5.6.2.1	DSC Height test
5.6.2.2	DSC Padding test
5.6.2.3	DSC RGB min and max bits-per-pixel test
5.6.2.4	DSC YcbCr 4:4:4 min and max bits-per-pixel test
5.6.2.5	DSC Simple 4:2:2 min and max bits-per-pixel test
5.6.2.6	DSC Native 4:2:2 min and max bits-per-pixel test
5.6.2.7	DSC Native 4:2:0 min and max bits-per-pixel test
5.6.2.8	DSC RGB most pack test
5.6.2.9	DSC Native 4:2:2 most pack test
5.6.2.10	DSC Native 4:2:0 most pack test
5.6.2.11	DSC one corrupt slice test
5.6.2.12	DSC interrupt test for Chunk Length error
5.6.2.13	DSC interrupt test for RC buffer under-run error
5.6.2.14	DSC interrupt test for RC buffer overflow error

DisplayID/EDID CTS for testing Sink DUT (P/N MT6647)

EDID Block 0

Test Reference	Test Name
5.7.1.1	VESA E-EDID Verification Guide (Syntax Verification Only)
5.7.1.2	Physical Display Characteristics

EDID Block 0 (Basic Display Parameters and Features)

Test Reference	Test Name
5.7.1.3.1	Test for a Valid Video Input Definition
5.7.1.3.2	Test for a Valid Feature Support Byte
5.7.1.3.3	Test For Valid Established Timings I & II
5.7.1.3.4	Test For Valid Standard Timings

18-Byte Descriptor Test Cases

Test Reference	Test Name
5.7.1.4.1	Test for Detailed Timing Descriptors
5.7.1.4.2	Test for Valid Display Descriptor Structure
5.7.1.4.3	Test for Valid Display Range Limits (tag #FDh)
5.7.1.4.4	Test for Valid Standard Timing Identifier Descriptor (tag #FAh)
5.7.1.4.5	Test for Valid CVT 3 Byte Code Descriptor (tag #F8h)
5.7.1.4.6	Test for Valid Established Timings III Descriptor (tag #F7h)
5.7.1.4.7	Test for Valid String Descriptors (tags #FFh, #FEh, #FCh)
5.7.1.4.8	Unused – Reserved Data Tag Number (Tags #11h to #F6h)
5.7.1.4.9	Test for Valid Dummy Descriptors (tag #10h)

5.7.1.5	Test for Valid Extension Flag and Checksum
5.7.1.6	EDID Address A0h and A1h Handling

CTA Block Validation (CTA Extension Format)

Test Reference	Test Name
5.7.2.1	CEA Extension Version Number
5.7.2.2	Byte #2 (18-byte Descriptor Offset 'd')

Byte #3 (For CTA Extension Version 3 Only)

Test Reference	Test Name
5.7.2.3.1	Byte #3 - Underscan support
5.7.2.3.2	Byte #3 - Basic audio support
5.7.2.3.3	Byte #3 - YCbCr Support
5.7.2.3.4	Byte #3 - Native DTD Count
5.7.2.3.5	Byte #3 - Byte 3 Consistency

Data Block Collection (Type Validation)

Test Reference	Test Name
5.7.2.4.1	Duplicate Data Block Validation
5.7.2.4.2	Validity of Data Block Types

Short Video Descriptors (SVDs)

Test Reference	Test Name
5.7.2.5.1	Validity of SVDs
5.7.2.5.2	SVD/DTD Ordering

Audio Data Block

Test Reference	Test Name
5.7.2.6.1	Duplicate Audio Format Codes
5.7.2.6.2	Audio Output Validation

Speaker Allocation Data Block

Test Reference	Test Name
5.7.2.7.1	Verify Max Number of Channels

5.7.2.8	Test for Detailed Timing Descriptors

DisplayID Extension Block Framework Validation

Test Reference	Test Name
5.7.3.1	DisplayID EDID Extension Block Tag (Byte#0) and extension version (Byte#1)
5.7.3.2	DisplayID Section Size, Byte#2
5.7.3.3	DisplayID Product Identifier/ Primary Use Case, Byte#3

5.7.3.4	DisplayID Extension Count, Byte#4
5.7.3.5	DisplayID Section Checksums

DisplayID Extension Block Tiled Display Topology Block

Test Reference	Test Name
5.7.4.1	EDID – Tiled Display Block Revision (Byte#1)
5.7.4.2	EDID – Tiled Display Number of Payload Bytes in Block (Byte#2)
5.7.4.3	EDID - Tiled Display Capabilities (Byte#3, bit 6 and bit 7)
5.7.4.5	EDID - Tile Size (Byte#7 to Byte#10)

DisplayID Extension with Stereo Display Interface Data Blocks

Test Reference	Test Name
5.7.5.1	EDID – Stereo Display Interface Block Revision and Other Data (Byte #1)

DisplayID Extension with Type VII Detailed Timing Block

Test Reference	Test Name
5.7.6.1	EDID – DTD Type VII Block Revision (Byte #1)
5.7.6.2	EDID – DTD Type VII Block Number of Payload Bytes in Block (Byte #2)
5.7.6.3	EDID – DTD Type VII Block Pixel Clock (Bytes #0 through #2 of Each Descriptor)
5.7.6.4	EDID – DTD Type VII Block Descriptor Payload Verification (Bytes #3 through #19)
5.7.6.5	EDID – DTD Type VII Block Timing Support Validation

DisplayID Extension with Type VIII Detailed Timing Block

Test Reference	Test Name
5.7.7.1	EDID – DTD Type VIII Block Revision and Other Data (Byte #1)
5.7.7.2	EDID – DTD Type VIII Block Number of Payload Bytes in Block (Byte #2)
5.7.7.3	EDID – DTD Type VIII Block DMT Timing Codes
5.7.7.4	EDID – DTD Type VIII Block CTA Timing Codes
5.7.7.5	EDID – DTD Type VIII Block HDMI Timing Codes
5.7.7.6	EDID – DTD Type VIII Block Timing Support Validation

DisplayID Extension with Type IX Detailed Timing Block

Test Reference	Test Name
5.7.8.1	EDID – DTD Type IX Block Revision (Byte #1)
5.7.8.2	EDID – DTD Type IX Block Number of Payload Bytes in Block (Byte #2)
5.7.8.3	EDID – DTD Type IX Block Timing Options (Byte #0 of Each Descriptor)
5.7.8.4	EDID – DTD Type IX Block Horizontal Active Image Pixels and Vertical Active Image Lines (Bytes #1-4 of Each Descriptor)
5.7.8.5	EDID – DTD Type IX Block Refresh Rate and Pixel Clock (Byte #5 of Each Descriptor)
5.7.8.6	EDID – DTD Type IX Block Timing Support Validation

CTA Data Blocks in a DisplayID Extension

Test Reference	Test Name
5.7.9.1	Block Revision (Byte#1)
5.7.9.2	Block Number of Payload Bytes in Block (Byte#2)
5.7.9.3	Validity of Data Block Types

DisplayID Vendor-Specific Data Blocks

Test Reference	Test Name
5.7.10.1	EDID – Vendor-specific Data Block Revision (Byte #1)
5.7.10.2	EDID – Vendor-specific Data Block Number of Payload Bytes in Block (Byte #2)
5.7.10.3	EDID – Vendor-specific Data Block Manufacturer/Vendor ID Field

Dynamic Video Timing Range Limits Data Block

Test Reference	Test Name
5.7.11.1	EDID – Dynamic Video Timing Range Limits Block Revision (Byte #1)
5.7.11.2	EDID – Dynamic Video Timing Range Limits Data Block Number of Payload Bytes in Block (Byte #2)
5.7.11.3	EDID – Dynamic Video Timing Range Limits Minimum and Maximum Pixel Clocks (Bytes #3 through #8)
5.7.11.4	EDID – Dynamic Video Timing Range Limits Minimum and Maximum Vertical Refresh Rates (Bytes #9 through #11)
5.7.11.5	EDID – Dynamic Video Timing Range Limits Dynamic Video Timing Range Support Flags (Byte #11)

DisplayID Data Block Version Validation

Test Reference	Test Name
5.7.12.1	EDID - DisplayID Version 1.x Blocks
5.7.12.2	EDID - DisplayID Version 2.x Blocks
5.7.12.3	EDID - DisplayID Version 2.x Multiple Instances of Data Blocks
5.7.12.4	EDID – YCbCr 4:2:0 Consistency Validation

EDID Dynamic Refresh Rate Support with Vertical Blank Stretch with MSA_TIMING_PAR_IGNORED Option

Test Reference	Test Name
5.7.13.1	EDID – Validation
5.7.13.2	EDID – Timing Support Validation

DisplayID Extension with Type X Formula-based Timing Data Block

Test Reference	Test Name
5.7.14.1	EDID – DTD Type X Block Revision (Byte #1)
5.7.14.2	EDID – DTD Type X Block Number of Payload Bytes in Block (Byte #2)
5.7.14.3	EDID – DTD Type X Block Timing Options (Byte #0 of Each Descriptor)
5.7.14.4	EDID – DTD Type X Block Horizontal Active Image Pixels and Vertical Active Image Lines (Bytes #1-4 of Each Descriptor)
5.7.14.5	EDID – DTD Type X Block Refresh Rate and Pixel Clock (Byte #5 of Each Descriptor)

5.7.14.6	EDID – DTD Type X Block Timing Support Validation
5.7.14.7	EDID – HBlank and VBlank Validation
5.7.14.8	EDID – Alternate Minimum VBlank (Byte #7 of Each 8-byte Descriptor)

DisplayID Structure with ARVR_HMD Data Block

Test Reference	Test Name
5.7.15.1	Native DisplayID – ARVR_HMD Data Block Revision (Byte #01h)
5.7.15.2	Native DisplayID – ARVR_HMD Data Block Number of Payload Bytes in Block (Byte #02h)
5.7.15.3	Native DisplayID – ARVR_HMD Data Block Dual Layer SST Support (Byte #03h)
5.7.15.4	Native DisplayID – ARVR_HMD Data Block Number of Displays and Streams (Byte #04h)
5.7.15.5	Native DisplayID – ARVR_HMD Data Block Layers (Byte #05h)
5.7.15.6	Native DisplayID – ARVR_HMD Data Block Area of Low Distortion (Bytes #06h through #12h)
5.7.15.7	Native DisplayID – ARVR_HMD Data Block Lenses (Byte #19h)
5.7.15.8	Native DisplayID – ARVR_HMD Data Block Lens Adjustments Available in HMD and Foveated Rendering Support (Bytes #24h and #25h)
5.7.15.9	Native DisplayID – ARVR_HMD Data Block Center of Projection (Bytes #40h through #4Fh)
5.7.15.10	Native DisplayID – ARVR_HMD Data Block Streams_per_Layer (Bytes #50h and #51h)
5.7.15.11	Native DisplayID – HMD Mandate for ARVR_HMD Data Block

DisplayID Structure with ARVR_Layer Data Block

Test Reference	Test Name
5.7.16.1	Native DisplayID – ARVR_Layer Data Block Revision (Byte #01h)
5.7.16.2	Native DisplayID – ARVR_Layer Data Block Number of Payload Bytes in Block (Byte #02h)
5.7.16.3	Native DisplayID – ARVR_Layer Data Block Consistency
5.7.16.4	Native DisplayID – ARVR_Layer Data Block Layers (Byte #0Ch)
5.7.16.5	Native DisplayID – ARVR_Layer Data Block RESERVED (For Tile Location) (Byte #0Dh)
5.7.16.6	Native DisplayID – ARVR_Layer Data Block Lens Distortion (Byte #0Eh)
5.7.16.7	Native DisplayID – ARVR_Layer Data Block Asynchronous Reprojection (Byte #10h)
5.7.16.9	Native DisplayID – ARVR_Layer Data Block Multiple Stream Stereo Modes (Byte #16h)
5.7.16.10	Native DisplayID – HMD Mandate for ARVR_Layer Data Block

DisplayID Extension with Adaptive-Sync Data Block

Test Reference	Test Name
5.7.17.1	EDID – Adaptive-Sync Data Block Revision and Descriptor Size (Byte #1)
5.7.17.2	EDID – Adaptive-Sync Data Block Number of Payload Bytes in Block (Byte #2)
5.7.17.3	EDID – Adaptive-Sync Data Block Adaptive-Sync Operation Mode and Range Descriptor RESERVED Values (Bytes #0 and #4 of Each Descriptor)
5.7.17.4	EDID – Adaptive-Sync Data Block Minimum and Maximum Refresh Rates (Bytes #2 through #4 of Each Descriptor)
5.7.17.5	EDID – Adaptive-Sync/CVT Timing Match Validation

Sink Device Native DisplayID Test Procedures

Test Reference	Test Name
5.7.18.1	Block Revision and Descriptor Size (Byte #1)

Native DisplayID Framework Validation

Test Reference	Test Name
5.7.19.1	Native DisplayID – Structure Version/Revision (Byte 00h)
5.7.19.2	Native DisplayID – Bytes in Section (Byte 01h)
5.7.19.3	Native DisplayID – Product Identifier / Display Product Primary Use Case (Byte 02h)
5.7.19.4	Native DisplayID – Extension Count (Byte 03h)
5.7.19.5	Native DisplayID – Section Checksums
5.7.19.6	Native DisplayID – Mandatory Blocks

Product Identification Data Block

Test Reference	Test Name
5.7.20.1	Native DisplayID – Product Identification Data Block Revision (Byte 1)
5.7.20.2	Native DisplayID – Product Identification Data Block Number of Payload Bytes in Block (Byte 2)
5.7.20.3	Native DisplayID – Product Identification Data Block Week of Manufacture/Model Tag and Year of Manufacture/Model Year (Bytes 12 and 13)

Display Parameters Data Block

Test Reference	Test Name
5.7.21.1	Native DisplayID – Display Parameters Data Block Revision (Byte 1)
5.7.21.2	Native DisplayID – Display Parameters Data Block Number of Payload Bytes in Block (Byte 2)
5.7.21.3	Native DisplayID – Display Parameters Data Block Feature Support Flags Field (Byte 0Bh)
5.7.21.4	Native DisplayID – Display Parameters Data Block Native Luminance-related Fields (Bytes 18h to 1Dh)
5.7.21.5	Native DisplayID – Display Parameters Data Block Native Color Depth and Display Device Technology Fields (Byte 1Eh)

Display Interface Data Block

Test Reference	Test Name
5.7.22.1	Native DisplayID – Display Interface Features Data Block Revision (Byte 1)
5.7.22.2	Native DisplayID – Display Interface Features Data Block Number of Payload Bytes in Block (Byte 2)
5.7.22.3	Native DisplayID – Display Interface Features Data Block Supported Interface Color Depth-related Fields
5.7.22.4	Native DisplayID – Display Interface Features Data Block Minimum Pixel Rate at Which YCbCr 4:2:0 Encoding Is Supported (Byte 7)
5.7.22.5	Native DisplayID – Display Interface Features Data Block Supported Interface Audio Capability and Feature Flags (Byte 8)
5.7.22.6	Native DisplayID – Display Interface Features Data Block Supported Interface Color Space and EOTF-related Fields
5.7.22.7	Native DisplayID – Display Interface Features Data Block Additional Supported Interface Color Space and EOTF-related Fields (Bytes 0Bh to 12h)

Adaptive-Sync CTS for testing Sink DUT (P/N: MT6649)

Adaptive-Sync Operation Validation

Test Reference	Test Name
5.8.1.1	Fixed-Average VTotal Mode Support over the Declared Frame Rate Range
5.8.1.2	Duration Increase and Decrease Constraint Value Support in Adaptive VTotal Mode
5.8.1.3	Adaptive VTotal Mode Support

5. HDCP 2.3 CTS FOR DISPLAYPORT

DP HDCP 2.3 CTS Capable Hardware Products

Product	P/N	Description
UCD-400 DP 1.4 Test Device	066600	DP1.4 / HBR3/MST capable test unit for DisplayPort Sink, Source and Repeater. USB 3.0 Interface to Host PC.
UCD-411 Tester	066606	DP1.4 / HBR3/MST capable Pattern Generator. USB 3.0 interface to Host PC.

DP HDCP 2.3 CTS Test Software Product Options

Product	P/N	Description
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 1A + 1B + 2C + 3A + 3B + 3C)

Test Software Content

Source DUT Testing		DP HDCP 2.3 CTS*
DP HDCP 2.3 CTS 1A Test Set (UCD-400, UCD-424)	HDCP2.3 CTS 1A-01 – HDCP2.3 CTS 1A-12	●
DP HDCP 2.3 CTS 1B Test Set (UCD-400, UCD-424)	HDCP2.3 CTS 1B-01 – HDCP2.3 CTS 1B-10	●

*) Separate licenses for testing Sink, Source, Branch DUT

Sink DUT Testing		DP HDCP 2.3 CTS*
DP HDCP 2.3 CTS 2C Test Set (UCD-400, UCD-411, UCD-424)	HDCP2.3 CTS 2C-01 – HDCP2.3 CTS 2C-06	●

*) Separate licenses for testing Sink, Source, Branch DUT

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

*) Separate licenses for testing Sink, Source, Branch DUT

Description of HDCP 2.3 CTS Tests

DP HDCP 2.3 CTS for testing Source DUT (P/N MT6634)

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

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

DP HDCP 2.3 CTS for testing Sink DUT (P/N MT6636)

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

DP HDCP 2.3 CTS for testing Sink, Source and Repeater DUT (P/N MT6638)

1A. Downstream procedure with Receiver

Please see above

1B. Downstream procedure with Repeater

Please see above

2C. Upstream procedure with Transmitter

Please see above

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

3B. 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

Test Reference	Test Name
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
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 km
HDCP2.3 CTS 3C-14	Regular Procedure - Receiver disconnect after locality check
HDCP2.3 CTS 3C-15	Regular Procedure - Receiver disconnect after Ks
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

Version History

Rev.	Date	Author	Description
3	20.07.2018	JSa	Released
4	20.08.2018	JSa	Added source test product on page 5
5	28.09.2018	JE	
6	08.10.2018	JSa	Updated VESA LL CTS version references Moved Informative tests in the main list with label "**Informative**", Removed 5.4.4.2 – 5.4.4.6 (Not released)
7	27.11.2018		Added 5.4.4.1 to 5.4.4.6 with label "**Informative**",
8	25.04.2019	JSa	Added FEC tests 4.5.1.1, 4.5.1.2, 5.5.1.1 – 5.5.1.7
9	09.05.2019	JSa	Converted tests 5.4.1.X, 5.4.2.X, 5.4.3.X, 5.4.4.X from "Informative" to "Released"
10	24.06.2019	JSa	Converted Tests 4.4.1.1 – 4.4.1.3, 4.4.4.1 – 4.4.4.6 from "Informative" to "Released" Added 5.4.4.1
11	22.08.2019	JSa	Updated *Reference Standards* Changed DP 1.4 >> DP 1.4a (not in product names) Changed HDCP 2.2 >> HDCP 2.3
12	12.12.2019	JSa	Changed 4.2.2.4 and 4.2.2.5 to Normative Added 4.6.1.1 to 4.6.1.9 as Informative Added 5.6.1.3 to 5.6.1.26 as Informative Added 5.6.2.3 to 5.6.2.14 as Informative Added test category headings per document *Link CTS Implementation and VESA Approval Status*
13	30.01.2020	JSa	DSC Tests (4.6.1.1 – 4.6.1.9, 5.6.1.1 – 5.6.1.26, 5.6.2.1 – 5.6.2.14) now Normative Updated DSC CTS standard reference
14	26.07.2021	JSa	Adopted new User manual layout Added EDID / DisplayID tests Updated TE and CTS products to match price lists Reformatted listing to reference license products Added reference to DisplayID / EDID CTS Spec
15	11.10.2021	JSa	Corrected document Title
16	06.06.2020	JSa	Removed LL CTS test 4.4.4.1 Added *Test Software Content* to LL CTS and to HDCP CTS Updated SW version reference to 1.12
17	27.06.2022	JSa	Corrected: Added 5.8.1.1 - 5.8.1.3 with note about VESA approval status to the list of tests
18	30.06.2022	JSa	Removed HDCP2.3 CTS 1A-13
20	16.12.2024	Juha Eskola	Updating