

# VESA Display Standards Updates

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# Agenda

- VESA Overview and Standards Updates: Jim Choate, VESA
- DP Alt Mode v 2.1 Overview and Updates: Tim Wei, Ellisys
- DisplayPort Link Layer CTS v 2.1, Presented by Alok Soni, Teledyne LeCroy
- ClearMR Testing Challenges, Presented by Lexus Lee, Allion Labs
- VESA Compliance Program Updates: Jim Choate
- Summary, Questions & Answers
- Demos



## About VESA

• A growing global industry alliance with more than 340 members. Strong growth in membership.



Mission to develop, promote and support ecosystem of vendors and certified interoperable products for the electronics industry.

# Develops OPEN standards, contribution is open to all companies at all stages of development



 Leading PC/computer, display, hardware, software, and component manufacturers worldwide

• VESA membership continues to grow the most in Asia





# **VESA Local Asian Support Capability**

- VESA has long had a dedicated Japan Task Group with charter to promote the development of design tools and reference guides, PlugTests, educational seminars, and other activities for the benefit of VESA member companies, particularly those in Japan.
- **NEW:** VESA has added to its local support to Asia to address growing regional membership needs
- China (Mainland) and Taiwan are the fastest growing areas for VESA's membership.
- Kellen is VESA's Representative for all Chinese speaking areas of Asia
- This partnership will provide members with a communication option in their native language. Kellen will handle membership related activities including, new membership requests, renewals, PlugTest and event support and translation of VESA member messaging, etc.



# VESA Standards Enable Many Market Segments...







Gaming consoles and headsets





Smartphones and tablets



Automotive



Digital projectors



Digital signage / kiosks



# ... As Well as Many Aspects of Display Technology

- DisplayPort
- Embedded DisplayPort (eDP)
- DisplayPort Alt Mode
- DisplayPort Tunneling (USB4 and Thunderbolt)
- DP Automotive Extensions (DP AE)



- Display Stream Compression (DSC)
- VESA Display Codec for Mobile (VDC-M)



Display

Interfaces

- Standardized Display Performance Measurement
- VESA DisplayHDR Certification (High Dynamic Range)
- VESA ClearMR
- VESA AdaptiveSync



- DisplayID
- Extended Display Identification Data (EDID)
- Multi-Display Interface
- Bulk Display Protocol



# DISPLAYPORT<sup>™</sup> 2.1



# **DisplayPort 2.1 Summary**

- DisplayPort v2.1 was released in October 2022
- DisplayPort 2.1 brings DisplayPort into convergence with USB4 PHY specifications to ensure the highest video performance across a broad range of consumer products
- Added DP40 (up to UHBR10) and DP80 (up to UHBR20) cable specifications and certification
- Enhanced DP connectors provide highest performance with full sized DP and mDP connectors

https://vesa.org/featured-articles/vesa-releases-displayport-2-1specification/



- DisplayPort 2.1 enables up to 3X increase in video bandwidth performance
- First standard to support 8K resolution (7680 x 4320) at 60 Hz refresh rate with full-color 4:4:4 resolution, including with 30 bits per pixel (bpp) for HDR-10 support
- Beyond 8K resolutions achieved with maximum link rate to up to 20 Gbps/lane and more efficient 128b/132b channel coding

### DisplayPort<sup>™</sup> EVOLUTION OF DISPLAYPORT DATA BANDWIDTH





## **DisplayPort 2.1 Resolution Capability** (Single Display Examples)

Port Configuration	DisplayPort 1.4a	DisplayPort 2.1			
No Compression					
4 Lanes, max link rate	5K (5120x2800)@60fps 24bpp	10K (10240x4320)@60fps 24bpp			
2 Lanes, max link rate	4K (3840x2160)@60fps 24bpp	8K (7680x4320)@30fps 30bpp			
With Compression (DSC)					
4 Lanes, max link rate	8K (7680x4320)@60fps 30bpp	16K (15360x8460)@60fps 30bpp			
2 Lanes, max link rate	5K (5120x2800)@60fps 24bpp	10K (10240x4320)@72fps 30bpp			

#### Notes:

- 2 Lane configuration is common for USB-C DP Alt Mode
- All above modes assume full 4:4:4 color encoding
- 30bpp is required for DisplayHDR operation

Key:

- DSC = Display Stream Compression
- fps = frames per second
- bpp = bits per pixel



# **Optimization for Shared Interface Use**

- Numerous specification enhancements to simplify the use of DisplayPort as an ingredient in the following interface examples:
  - The USB-C connector, using the DisplayPort Alt Mode (DP Alt Mode)
  - VESA Embedded DisplayPort Standard (eDP)
  - ThunderBolt
  - USB4
  - Wireless interfaces



# DP 40/DP 80 Cable Specification and Certification

- Developed as part of DP 2.1 specification update
- DP40 and DP80 Certified cables provide added assurance of smooth operation and full compliance at the UHBR data rates
- Dozens of DP40 and DP80 cables have been certified since launch of program





# VESA Technology Development Areas



# VESA technology development

- VESA members are collaborating on several key technology areas
- AR/VR Task Group
  - Specification is released. Work started on CTS
  - Focused on creating solutions roadmap to meet performance, power and implementation requirements for future AR/VR needs
- DP Automotive Extension Task Group
  - Working with automotive industry to address needs for high-resolution performance in this market segment
  - Working on DP AE specification and CTS
- Bulk Display Protocol
  - BDP specification and CTS nearing release
- Display Performance Metrics Task Group
  - DisplayHDR, ClearMR, AdaptiveSync



# **USB4** Overview

- Runs over USB Type-C<sup>®</sup> interconnect
- Tunnels USB3, PCIe and DP protocols
- Signaling rates of 10 or 20 Gbps (10 to 40Gbps aggregated b/w)
- Helps converge USB Type-C connector ecosystem to minimize enduser confusion



# VESA VESA Display Performance Metrics Standards Very Successful





# DP Alt Mode v 2.1 Overview and Updates

Presented by Tim Wei, Senior Application Engineer, Ellisys

# DP Alt Mode v 2.1 Overview and Updates

Tim Wei – Senior Application Engineer, Ellisys

VESA Seoul Workshop October 10, 2023



# **USB Test and Analysis Solutions**

## USB Explorer<sup>™</sup> 350



Multi-function USB Type-C<sup>®</sup>, USB 3.2, and Power Delivery Protocol Test Platform VESA-Approved Tester for DisplayPort ALT Mode





Protocol and Electrical Analysis Tool for USB Type-C<sup>®</sup> Standards Includes DP AUX and DP ALT Support







## **Example USB Type-C Configurations**

Either end can serve as USB Host, USB-PD Power Consumer, and DisplayPort Video Source (these services are independent of each other



## **DP Alt Mode over USB-C Ecosystem is Mainstream**





**USB-C** Tablets

USB-C Laptops





Multi Function Adapters

All types of certified adapters available

- C to DP adapters, Multifunction docks
- Type C protocol converters (HDMI, VGA, DVI) using DP Alt Mode

More are certified every week

- Major PC OEMs continue to launch new products with DP Alt Mode over USB-C
- Major Display OEMs continue to add USB-C inputs to their products

## USB-C Connector Functional Extension DP Alt Mode



- A passive Full Feature USB Type-C to Type-C cable can carry up to four DisplayPort lanes
  - Same performance and features as a standard DisplayPort connection
  - Allows DisplayPort data rates to increase in the future, since the USB Type-C connector has very high data rate capability
- DisplayPort can be combined with USB 3.2 operation over the same USB Type-C cable
- USB 2.0 and USB Power Delivery is available in all configurations

## 2xDisplayPort and USB 3.2 over a Standard USB-C Cable



- Uses a standard "Full Feature" USB-C to USB-C cable which is designed to include DisplayPort
- The above configuration uses two high-speed lanes each for DisplayPort and USB 3.2
  - Ideal for docking stations, or for displays or TVs that include USB 3.2 functions

### 4xDP Over a USB Type-C to USB Type-C Full Feature Passive Cable



- Utilizes optional DP Alt Mode capability of USB Type-C connector
- DisplayPort can use all four high speed lanes to deliver full DisplayPort performance
- The DisplayPort AUX Channel uses the SBU pins
- The DisplayPort HPD / IRQ is transmitted over the CC pin using the USB-PD protocol
- USB 2.0 and USB Power Delivery always available

# **Typical DisplayPort Alternate Mode Flow**

Untitled.ctrt - Ellisys Type-C Tracker Analyzer

File View Lavout Search Record Tools Help			
🗄 🔟 🦾 🔄 👬 📔 Record 👻 🖬 Stop 🖾 Restart 🧑 號 🕶 🔤 🕼 Navigate 🔹 🖳 💭 Markers 🕶 🚑 🧠 🥳			
USB PD Overview			
📾 Grouping 👻 120 items displayed			
Item P T I v	Bit Rate 🗸 🗸	Direct $\vee$	5. V
Ber SOP' Discover Identity (x 4)	296.718 kbit/s	OUT	OK
⊕ → Source Capabilities (1=Fixed 5V 1.5A)	296.63 kbit/s, 3	OUT	OK
🕀 🚊 Request (1=Fixed 5V 1.5A, Requested 1.5A, Max 1.5A) > Accepted	300.553 kbit/s,	IN	OK
⊕ → PsRdy	296.674 kbit/s,	OUT	OK
🖃 🛄 DisplayPort Discover Modes > Ack (UFP_D Capable, CD)	296.63 kbit/s, 3	OUT	OK
🗄 🏓 DisplayPort Discover Modes	296.63 kbit/s, 3	OUT	OK
🕀 🄄 DisplayPort Discover Modes Ack (UFP_D Capable, CD)	300.553 kbit/s,	IN	OK
🖃 鵍 Apple Discover Modes > Ack (0x00000002, 0x00000001)	296.63 kbit/s, 3	OUT	OK
🕀 🏓 Apple Discover Modes	296.63 kbit/s, 3	OUT	OK
🗉 🍬 Apple Discover Modes Ack (0x00000002, 0x00000001)	300.481 kbit/s,	IN	OK
🖃 🜉 DisplayPort Enter Mode (Mode=1) > Adk	296.648 kbit/s,	OUT	OK
	296.648 kbit/s,	OUT	OK
🗉 🍬 DisplayPort Enter Mode Ack	300.598 kbit/s,	IN	OK
🖃 🔜 DisplayPort Status Update (DFP_D connected, Not Enabled) > Ack (UFP_D connected, Enabled, HPD Low)	296.648 kbit/s,	OUT	OK
🗉 🏓 DisplayPort Status Update (DFP_D connected, Not Enabled)	296.648 kbit/s,	OUT	OK
🗉 🍬 DisplayPort Status Update Ack (UFP_D connected, Enabled, HPD Low)	300.553 kbit/s,	IN	OK
= 🖳 DisplayPort Configure (Set Config as DP Sink, D) > Adk	296.648 kbit/s,	OUT	OK
	296.648 kbit/s,	OUT	OK
🗉 🍬 DisplayPort Configure Ack	300.418 kbit/s,	IN	OK

## **DisplayPort Alternate Mode 2.1 Update**

- SVDM Header Update (by USB PD Spec)
- Cable DP Capabilities VDO update to support UHBR20 and UHBR13.5
  - Both passive and active cables
- SOP' Active Cable DisplayPort Configurations VDO update
- DP Capabilities VDO Update (DPAM Version field)
- SOP DisplayPort Configurations VDO Update
  - Cable information
  - DPAM Version
- DisplayPort Status Update VDO Update

## SVDM Header Update

12:11	Structured VDM	Version number (Minor) of the SVDM (not the USB PD version			
	Version (Minor) <sup>a</sup>	number).			
		00b = Version 2.0  or earlier			
		01b = Version 2.1			
		All other values are RESERVED.			
14:13	Structured VDM	Version number (Major) of the SVDM (not the USB PD version			
	Version (Major) <sup>a</sup>	number).			
		00b = Version 2.0  or earlier.			
		01b = Version 2.x. (x indicates SVDM minor version)			
		All other values are RESERVED.			

12:11 was reserved

# **Cable DP Capabilities VDO update**

#### SOP' Cable DP Capabilities (VDO in the Responder USB PD Discover Modes Table 4-5:

11b = Optical.

00b = Version 2.0 or earlier.

01b = Version 2.1 or higher.

VDM) <sup>a</sup>			
Bit(s)	Description	Values	
1:0	RESERVED	RESERVED (always 00b).	Ī

5:2

7:6

15:8

23:16

25:24

26<sup>d</sup>

27

29:28<sup>d</sup>

31:30

DPAM Version

Description	Values	Bit(s)	Description	
RESERVED	RESERVED (always 00b).	1:0	RESERVED	RESERV
Signaling for Transport of DisplayPort Protocol <sup>b</sup>	XXX1b = Supports all defined <i>DP</i> bit rates up to HBR3. XX1Xb = Supports <i>DP</i> bit rate UHBR10. X1XXb = Supports <i>DP</i> bit rate of UHBR20 (e.g., 0111b supports all <i>DP</i> bit rates, including UHBR10 and UHBR20). All other values are RESERVED for higher bit rates. <sup>c</sup>	5:2	Signaling for Transport of DisplayPort Protocol <sup>a</sup>	XXX1b = from diag XX1Xb = X1XXb = 1XXXb =
RESERVED	RESERVED (always 00b).	7:6	RESERVED	RESERV
DP Source Device Pin Assignments Supported	OCh = Pin Assignments C and D are supported. 10h = USB-C and DP connector Pin Assignment E is supported. All other values are RESERVED.	15:8	DP Source Device Pin Assignments Supported	0Ch = Pin All other
DP Sink Device Pin Assignments Supported	OCh = Pin Assignments C and D are supported (USB-C-to-USB- C cable). 10h = USB-C and DP connector Pin Assignment E is supported.	23:16	DP Sink Device Pin Assignments Supported	0Ch = Pin (USB-C-1 All other
	All other values are RESERVED.	31:24	RESERVED	RESERV
RESERVED UHBR13.5	ERVED         RESERVED (always 00b).           3R13.5         0 = UHBR13.5 is not supported.           1 = UHBR13.5 is supported. <sup>e</sup>		alue indicates "Don't Care."	1
RESERVED	RESERVED (always 0).			
Active Component	00b = Passive.			
	UTD = ACTIVE re-timer. TOD = ACTIVE re-timer.			

#### Table 4-2: Active Cable DP Capabilities (VDO in the Responder USB PD Discover Modes VDM)

Bit(s)	Description	Values	
1:0	RESERVED	RESERVED (always 00b).	
5:2	Signaling for Transport of DisplayPort Protocol <sup>a</sup>	XXX1b = Supports $DP$ bit rates and electrical settings (shall always be set apart from diagnostic purposes).	
		XX1Xb = RESERVED.	
		X1XXb = RESERVED.	
		1XXXb = RESERVED.	
7:6	RESERVED	RESERVED (always 00b).	
15:8	DP Source Device Pin	0Ch = Pin Assignments C and D are supported.	
	Assignments Supported	All other values are RESERVED.	
23:16	DP Sink Device Pin	0Ch = Pin Assignments C and D are supported	
	Assignments Supported	(USB-C-to-USB-C cable).	
		All other values are RESERVED.	
31:24	RESERVED	RESERVED (always 00h).	

# Active Cable DisplayPort Configurations VDO update

#### Table 4-7: SOP' Active Cable DisplayPort Configurations

Bit(s)	Description	Values
1:0	Select Configuration	00b = Set configuration for USB. <sup>a</sup> 01b = Set configuration for active cable as a DP Source device(UFP_U is a DP Source device). <sup>b</sup> 10b = Set configuration for active cable as a DP Sink device(UFP_U is a DP Sink device). <sup>b</sup> 11b = RESERVED.
5:2	Signaling for Transport of DisplayPort Protocol	0h = Bit rate is unspecified (used only when the Select Configuration field is programmed for USB Configuration). 1h = Select <i>DP</i> bit rates and electrical settings. All other values are RESERVED.
7:6	RESERVED	RESERVED (always 00b).
15:8	Configure Active Cable Pin Assignment	00h = Deselect pin assignment. 04h = Select Pin Assignment C. <sup>e</sup> 08h = Select Pin Assignment D. <sup>d</sup> 10h = Select Pin Assignment E. <sup>e</sup> All other values are RESERVED.
31:16	RESERVED	RESERVED (always 0000h).

#### Table 4-3: Active Cable DisplayPort Status Update

Bit(s)	Description	Values		
2:0	RESERVED	RESERVED (always 00b).		
3	Enabled	0 = Active cable <i>DP</i> functionality is disabled.		
		1 = Active cable <i>DP</i> functionality is enabled and operational.		
31:4	RESERVED	RESERVED (always 0000000h).		

# **DP Capabilities VDO Update**

#### Table 5-6: DP Capabilities (VDO in the Responder USB PD Discover Modes VDM)

Bit(s)	Description	Values <sup>a</sup>			
1:0 F	Port Capability	00b = RESERVED.			
		01b = DP Sink Device Capable (including DP Branch device).			
		10b = DP Source Device Capable (including DP Branch device).			
		11b = Both DP Source and Sink Device Capable.			
5:2 S	Signaling for Transport of DisplayPort Protocol	XXX1b = Supports DP bit rates and electrical settings (shall always be set apart from diagnostic purposes).			
		XX1Xb = RESERVED.			
		X1XXb = RESERVED.			
		1XXXb = RESERVED.			
6 F	Receptacle Indication	0 = DP interface is presented on a USB-C plug.			
		1 = DP interface is presented on a USB-C receptacle.			
7 <b>t</b>	USB 2.0 Signaling Not Used	0 = USB 2.0 may be needed on A6 – A7 –or– B6 – B7 while in DisplayPort Configuration.			
		1 = USB 2.0 is not needed on A6 – A7 –or– B6 – B7 while in DisplayPort Configuration.			
15:8 I	DP Source Device Pin	00000000b = DP Source device pin assignments are not supported.			
A	Assignments Supported	XXXXXXX1b = RESERVED.			
(	reported by a DP Source device recentacle or	XXXXXX1Xb = RESERVED.			
I	DP Sink device	XXXXX1XXb = Pin Assignment C is supported. <sup>b</sup>			
e	(un ect-attach) plug)	XXXX1XXXb = Pin Assignment D is supported. <sup>c d</sup>			
		XXX1XXXXb = Pin Assignment E is supported. <sup>e</sup>			
		XX1XXXXXb = RESERVED.			
		X1XXXXXXb = RESERVED.			
		1XXXXXXXb = RESERVED.			
23:16 I	DP Sink Device Pin	00000000b = DP Sink device pin assignments are not supported.			
A	Assignments Supported	XXXXXXX1b = RESERVED.			
a	reported by a DP Sink device receptacle	XXXXXX1Xb = RESERVED.			
0	or DP Source device	XXXXX1XXb = Pin Assignment C is supported. <sup>f</sup>			
6	(direct-attach) plug)	XXXX1XXXb = Pin Assignment D is supported. c g			
		XXX1XXXXb = Pin Assignment E is supported.h			
		XX1XXXXXb = RESERVED.			
		X1XXXXXXb = RESERVED.			
		1XXXXXXXb = RESERVED.			
29:24 F	RESERVED	RESERVED (always 00h).			
31:30 I	DPAM Version <sup>j</sup>	00b = Version 2.0 or earlier.			
		01b = Version 2.1 or higher.			

#### Table 5-5: DP Capabilities (VDO in the Responder USB PD Discover Modes VDM)

Bit(s)	Description	Values <sup>a</sup>		
1:0	Port Capability	00b = RESERVED.		
		01b = DP Sink device-capable (including $DP$ Branch device).		
		10b = DP Source device-capable (including DP Branch device).		
		11b = Both DP Source and Sink device-capable.		
5:2	Signaling for Transport of DisplayPort Protocol	XXX1b = Supports <i>DP</i> bit rates and electrical settings (shall always be set apart from diagnostic purposes).		
		XX1Xb = RESERVED.		
		X1XXb = RESERVED.		
		1XXXb = RESERVED.		
6	Receptacle Indication	0 = DP interface is presented on a USB-C plug.		
		1 = DP interface is presented on a USB-C receptacle.		
7 USB 2.0 Signaling Not Used	USB 2.0 Signaling Not Used	0 = USB 2.0 may be needed on A6 – A7 –or–B6 – B7 while in DisplayPort Configuration.		
		1 = USB 2.0 is not needed on A6 – A7 –or– B6 – B7 while in DisplayPort Configuration.		
15:8 DP Source Device Pin	00000000b = DP Source device pin assignments are not supported.			
	Assignments Supported (reported by a <i>DP</i> Source device receptacle or <i>DP</i> Sink device	XXXXXXX1b = RESERVED.		
		XXXXXX1Xb = RESERVED.		
		XXXXX1XXb = Pin Assignment C is supported. <sup>b</sup>		
	(direct-attach) plug)	XXXX1XXXb = Pin Assignment D is supported. <sup>c d</sup>		
		XXX1XXXXb = Pin Assignment E is supported. <sup>e</sup>		
		XX1XXXXXb = RESERVED.		
		X1XXXXXXb = RESERVED.		
		1XXXXXXXb = RESERVED.		
23:16	DP Sink Device Pin Assignments	00000000b = DP Sink device pin assignments are not supported.		
	Supported (reported by	XXXXXXX1b = RESERVED.		
	or DP Source device	XXXXXX1Xb = RESERVED.		
	(direct-attach) plug)	$XXXXX1XXb = Pin Assignment C is supported.^f$		
	.0	XXXX1XXXb = Pin Assignment D is supported. <sup>c g</sup>		
		XXX1XXXXb = Pin Assignment E is supported.h		
	÷	XX1XXXXXb = RESERVED.		
		X1XXXXXXb = RESERVED.		
		1XXXXXXXb = RESERVED.		
31:24	RESERVED	RESERVED (always 00h).		

If SVDM Version is 2.1 or higher, DPAM Version field is applicable else this field shall be set to 00b.

# A Bit More Background

## From DisplayPort Alt Mode 2.0 Spec

Future versions of this Standard may describe other modes associated with the DP\_SID. Such modes shall be identified by having a non-zero value in bits 31:24 of the VDO. The DFP\_U shall examine the list of modes returned until it finds 0s in bits 31:24 of the VDO and a non-zero value in bits 23:0 of the VDO (i.e., DP Capabilities). The DFP\_U and UFP\_U shall use the corresponding offset (indexed from 1) as the Object Position in the following commands:

# **SOP DisplayPort Configurations VDO Update**

#### Table 5-13: SOP DisplayPort Configurations

Bit(s)	Description	Values		Bit(s)	Description	Values
1:0	Select Configuration	00b = Set configuration for USB. <sup>a</sup>	]	1:0	Select Configuration	00b = Set configuration for USB. <sup>a</sup>
		01b = Set configuration for UFP_U as a <i>DP</i> Source device. <sup>b</sup>				01b = Set configuration for UFP U as a DP Source device.b
		10b = Set configuration for UFP_U as a <i>DP</i> Sink device. <sup>b</sup>				
		11b = RESERVED.				$100 = \text{Set configuration for } \cup \text{FP}_{\cup} \text{ as a } DP \text{ Sink device.}^{\circ}$
5:2 <sup>c</sup>	Signaling for Cable	XXX1b = Supports all defined DP bit rates up to HBR3 -or-	1			11b = RESERVED.
	Information Transport of DisplayPort Protocol	capability is unknown		5:2	Signaling for Transport	0h = Bit rate is unspecified (used only when the Select Configuration field is
	or Display roll roll of	XX1Xb = Supports DP bit rate UHBR10.			of DisplayPort Protocol	programmed for USB Configuration).
		X1XXb = Supports DP bit rate of UHBR20 (e.g., 0111b supports all DP bit rates,				1h = Select <i>DP</i> bit rates and electrical settings.
		including UHBR10 and UHBR20).				All other values are RESERVED.
	DECEDITED	All other values are RESERVED for higher bit rates. <sup>d</sup>	_	7:6	RESERVED	RESERVED (always 00b).
/:0	RESERVED	RESERVED (always 000).	-	15:8	Configure UFP U	00h = De-select pin assignment.
15:6	15:8 Configure UFP_U Pin Assignment	oon = Deserect pin assignment.			Pin Assignment	oth Calast Dir Assistant C.S.
		04h = Select Pin Assignment C. <sup>e</sup>			-	04n = Select Pin Assignment C.*
		08h = Select Pin Assignment D. <sup>1</sup>				08h = Select Pin Assignment D. <sup>d</sup>
		10h = Select Pin Assignment E. <sup>g</sup>				10h = Select Pin Assignment E. <sup>e</sup>
		All other values are RESERVED.				All other values are RESERVED
25:16	RESERVED	RESERVED (always 000000000b).		21.16	DECEDVED	DESERVED (always 0000k)
26 <sup>h</sup>	Cable UHBR13.5	0 = Not supported. <sup>i</sup> -or- capability is unknown		51.10	RESERVED	RESERVED (always 00001).
	заррога	1 = Supported.				
27	RESERVED	RESERVED (always 0).				
29:28 <sup>h</sup>	Cable Active	00b = Passive -or- cable type is unknown				
	Component	01b = Active re-timer.				
		10b = Active re-driver.				
		11b = Optical.	_			
31:30	DPAM Version	00b = Version 2.0 or earlier.				
		01b = Version 2.1 or higher	1			

• This is the most challenging part for DPAM 2.1 DFP\_U

Table 5-8: DisplayPort Configurations

Values

# **DisplayPort Status Update VDO Update**

#### Table 5-7: DisplayPort Status Update

Bit(s)	Description	Values		
1:0	DP Source/Sink Device Connected	00b = Neither a <i>DP</i> Source device nor <i>DP</i> Sink device is connected, -or- the adapter is disabled.		
		01b = DP Source device is connected. $10b = DP$ Sink device is		
		connected. <sup>a</sup>		
		11b = Both a <i>DP</i> Source and Sink device are connected.		
2 <sup>b</sup>	Power Low	0 = Adapter is not in low power state is functioning normally or is disabled.		
		1 = Adapter has detected low power and disabled <i>DP</i> support.		
3 <sup>b</sup>	Enabled	0 = Adapter <i>DP</i> functionality is disabled.		
		1 = Adapter <i>DP</i> functionality is enabled and operational.		
4 <sup>d</sup>	Multifunction	0 = No preference for multifunction.		
	Preferred	1 = Multifunction is preferred.		
5 <sup>c</sup>	DisplayPort/ USB	0 = Request change to DisplayPort Configuration (if currently in USB Configuration).		
	Configuration Request	1 = Request change to USB Configuration (if currently in DisplayPort Configuration).		
6 <sup>c</sup>	Exit DisplayPort	0 = Maintain the current mode.		
	Alt Mode Request	1 = Request exit from DisplayPort Alt Mode (if currently in DisplayPort Alt Mode).		
$7^{d}$	HPD State	$0 = HPD_Low.$		
		$1 = HPD_High.^e$		
8 <sup>d</sup>	IRQ_HPD	0 = IRQ_HPD has not been issued since the last status Message.		
		$1 = IRQ\_HPD.^{f}$		
9g	NO_DPAM_SUSP	0 = UFP_U/ DP Sink device has no preference for entry into low		
	END	power state.		
		1 = UFP_U/ DP Sink device prefers not to enter low power state.		
31:10	RESERVED	RESERVED (always 0000000h).		

#### Table 5-6: DisplayPort Status Update

Bit(s)	Description	Values	
1:0	DP Source/Sink Device Connected	00b = Neither a <i>DP</i> Source device nor <i>DP</i> Sink device is connected, -or- the adapter is disabled.	
		01b = DP Source device is connected.	
		10b = DP Sink device is connected. <sup>a</sup>	
		11b = Both a DP Source and Sink device are connected.	
2 <sup>b</sup>	Power Low	<ul> <li>Adapter is functioning normally or is disabled.</li> </ul>	
		1 = Adapter has detected low power and disabled <i>DP</i> support.	
3 <sup>b</sup>	Enabled	0 = Adapter DP functionality is disabled.	
		1 = Adapter <i>DP</i> functionality is enabled and operational.	
4 <sup>b</sup>	Multi-function Preferred	0 = No preference for multi-function.	
		1 = Multi-function is preferred.	
5 <sup>b</sup>	DisplayPort/	0 = Request change to DisplayPort Configuration (if currently	
	USB Configuration	in USB Configuration).	
	Request	1 = Request change to USB Configuration (if currently	
		in DisplayPort Configuration).	
6 <sup>b</sup>	Exit DisplayPort Alt	0 = Maintain the current mode.	
	Mode Request	1 = Request exit from DisplayPort Alt Mode (if currently in DisplayPort Alt Mode).	
7 <sup>c</sup>	HPD State	0 = HPD_Low.	
		1 = HPD_High. <sup>d</sup>	
8 <sup>c</sup>	IRQ_HPD	0 = IRQ_HPD has not been issued since the last status Message.	
		$1 = IRQ\_HPD.^{e}$	
31:9	RESERVED	RESERVED (always 000000h).	

#### Three New timers:

- tAttentionSpacing min 10ms
- tHpdConvertPd max 5ms
- tAttentionToDPConfigure max 500ms

# **DPAM Version Resolution**

Table 5-5: DPAM Version Resolution						
DFP U, Cable and UFP_U with DP SID	DFP_U	Cable	UFP_U	DPAM Version Resolution		
DPAM Version	2.0 or earlier	2.0 or earlier	2.0 or earlier	2.0 or earlier <sup>ab</sup>		
	2.1 or higher	2.0 or earlier	2.0 or earlier	2.0 or earlier <sup>ab</sup>		
	2.0 or earlier	2.1 or higher	2.0 or earlier	2.0 or earlier <sup>ab</sup>		
	2.0 or earlier	2.0 or earlier	2.1 or higher	2.0 or earlier <sup>ab</sup>		
	2.1 or higher	2.1 or higher	2.0 or earlier	2.0 or earlier <sup>ab</sup>		
	2.0 or earlier	2.1 or higher	2.1 or higher	2.0 or earlier <sup>ab</sup>		
	2.1 or higher	2.0 or earlier	2.1 or higher	DPAM 2.1 or higher <sup>c</sup>		
	2.1 or higher	2.1 or higher	2.1 or higher	2.1 or higher <sup>d</sup>		
				(Shall support		
				DPAM 2.1 or higher)		

- a. If Initiator and Responder support SVDM Version 2.0 or earlier and if DisplayPort Alternate Mode is supported all DP Capabilities exchange shall follow DisplayPort Alt Mode on USB Type-C specification 2.0 or earlier.
- b. If Initiator and Responder both support SVDM Version 2.1 or higher and if either Initiator or Responder supports DPAM Version 2.0 or earlier, then all DP Capabilities exchange shall follow DisplayPort Alt Mode on USB Type-C specification 2.0 or earlier.
- c. When DPAM 2.1 or higher DFP\_U and DPAM 2.1 or higher UFP\_U are connected with a legacy active DPAM 2.0 cable, then the system shall exchange all DP Capabilities as per DisplayPort Alt Mode on USB Type-C specification 2.1 or higher but support HBR3 rates.
- d. If Initiator and Responder both support SVDM Version 2.1 or higher and DPAM Version 2.1 all DP Capabilities exchange shall follow DisplayPort Alt Mode on USB Type-C specification 2.1 or higher.

# **Typical DPAM 2.1 Flow**

	USB PD Overview USB 2.0 Overview USB 3.x Overview	
201	Grouping 👻 32 items displayed	
	Item 🕂 🗸	Structured VDM Version
	🗷 🚉 SOP' Discover Identity > Ack (Type-C to Type-C 3A)	Version 2.1
	Source Capabilities (1=Fixed 5V 0.5A)     Source Capabilities (1=Fixed 5V 0.5A)	
	📧 🚉 Request (1=Fixed 5V 0.5A, Requested 0.5A, Max 0.5A) > Accepted	
	🗷 🏓 PsRdy	
	🗷 🚉 Discover Identity > Ack (PDUSB Peripheral, PDUSB Host)	Version 2.1
	🖃 🚉 Discover SVIDs > Ack (DisplayPort)	Version 2.1
	🗟 🏓 Discover SVIDs	Version 2.1
	🗟 🍖 Discover SVIDs Ack (DisplayPort)	Version 2.1
	🗈 📃 DisplayPort Discover Modes > Ack (UFP_D Capable, CDE)	Version 2.1
	🗄 🚉 SOP' Discover SVIDs > Ack (Intel, DisplayPort)	Version 2.1
	SOP' DisplayPort Discover Modes > Ack (DFP_D=CD, UFP_D=CD)	Version 2.1
	🗟 🏓 SOP' DisplayPort Discover Modes	Version 2.1
	🗃 🍖 SOP' DisplayPort Discover Modes Ack (DFP_D=CD, UFP_D=CD)	Version 2.1
	🖃 😋 SOP' Intel Discover Modes > Ack (Thunderbolt Cable, No retimer, 20Gb/s)	Version 2.1
	🗟 🏓 SOP' Intel Discover Modes	Version 2.1
	🗃 🈓 SOP' Intel Discover Modes Ack (Thunderbolt Cable, No retimer, 20Gb/s)	Version 2.1
	SOP' DisplayPort Enter Mode (Mode=1) > Ack	Version 2.1
	🗟 🏓 SOP' DisplayPort Enter Mode (Mode=1)	Version 2.1
	🗟 🍖 SOP' DisplayPort Enter Mode Ack	Version 2.1
	🖃 📃 DisplayPort Enter Mode (Mode=1) > Ack	Version 2.1
	🗟 🏓 DisplayPort Enter Mode (Mode=1)	Version 2.1
	🗃 🍬 DisplayPort Enter Mode Ack	Version 2.1
	🖃 📃 DisplayPort Status Update (DFP_D connected, Not Enabled) > Ack (UFP_D connected, Not Enabled, HPD High)	Version 2.1
	B      B      B      DisplayPort Status Update (DFP_D connected, Not Enabled)	Version 2.1
	📧 🍬 DisplayPort Status Update Ack (UFP_D connected, Not Enabled, HPD High)	Version 2.1
	SOP' DisplayPort Configure (Set Config as DP Sink, C) > Ack	Version 2.1
	SOP' DisplayPort Configure (Set Config as DP Sink, C)	Version 2.1
	🗷 😓 SOP' DisplayPort Configure Ack	Version 2.1
	□ 💭 DisplayPort Configure (Set Config as DP Sink, C) > No Response	Version 2.1
	■	Version 2.1
<		
# DPAM 2.1 CTS Update (1)

- 10.3.2 DPAM2.1 Entry with USB-C to USB-C non-emarked cable
- 10.3.3 DPAM2.1 Entry with USB-C to USB-C Passive TBT3 cable
- 10.3.4 DPAM2.1 Entry with Passive E-Marked USB-C to USB-C
- 10.3.5 DPAM2.1 Entry with USB-C to USB-C DP2.0 LRD Cable
- 10.3.6 DPAM2.1 Entry with USB-C to USB-C DP2.0 Active Retimer cable
- 10.3.7 DPAM2.1 Entry with USB-C to USB-C DP2.1 LRD cable
- 10.3.8 DPAM2.1 Entry with USB-C to USB-C Active Non-DP cable
- 10.3.9 DPAM2.1 Entry with USB-C to USB-C USB2.0 cable
- 10.3.10 DPAM2.1 Entry with USB-C to DP2.1 cable
- All these tests were added to make sure the DFP\_U set correct cable information in DisplayPort Configurations VDO

## DPAM 2.1 CTS Update (2)

#### DPAM Version Resolution Tests

> 10.3.23 DPAM Version 2.1 DFP\_U Connected to DPAM Version 2.0 or 2.1 UFP\_U

> 10.4.3 DPAM Version 2.1 Cable Connected to DPAM Version 2.0 or 2.1 DFP\_U

> 10.2.8 DPAM Version 2.1 UFP\_U Connected to DPAM Version 2.0 or 2.1 DFP\_U

### > 10.6.3 DPAM Discovery Interoperability Flow for USB-C to DP Adapters



# **Questions?**

### **DisplayPort over USB-C**

The most advanced display connection now uses the most versatile connector.

Learn More

Go to www.displayport.org

55- D -





## DisplayPort Link Layer CTS v 2.1

## Presented by Alok Soni, Teledyne LeCroy

## DP v2.1 Link Layer Compliance Tests

- Test Setup Details
- DP Source Compliance Tests
- DP Sink Compliance Tests
- LTTPR and DP Tunnel Compliance Tests
- DP Link Layer Test Equipment from Teledyne LeCroy
- Q/A

Presenter: Alok K. Soni Teledyne LeCroy Alok.Soni@Teledyne.com

## **Test Setup Details:**



- How to Tests
  - CDF Entries to provide supported capabilities of Source DUT.
    - Fill out information about what DUT support for example:
      - Lane count, Link Rate, Colors, BPC, Test Automation, Video format Supported, FEC, DSC, Adaptive Sync etc.
  - Select group of tests to run
  - Execute the tests (may require operator interaction during the tests).
  - End of the test, generate reports and logs for certification.

- AUX Tests
- HPD Tests
- EDID Protocol Tests
- DPCD Read Tests
- AUX read interval testing for Link Training
- Link Training Tests HBR rates
- Link Training Tests UHBR rates
- Link Maintenance Tests

- Video Timestamp generation tests (HBR and UHBR)
- Video Tests (HBR and UHBR)
  - All color and bit per components tests
  - Least pack tests
  - Most pack tests
- Power Management tests
- \*Audio Tests (new version for UHBR rate under development)
- FEC Tests
- DSC Tests

- EDID/Display ID and/or Native Display ID tests
  - Video tests
  - Audio tests
  - EDDC tests
  - Display ID tests
  - Adaptive Sync tests
- Adaptive Sync Tests
  - Fix average vtotal tests
  - Adaptive vtotal tests
- LTTPR tests
  - Tests Source DUT handling of LTTPR.

- **DP Sink Device Tests:**
- How to Tests
  - No CDF needed Reference Source (TE) will read the capabilities and run/skip the tests accordingly.
  - Select group of tests to run
  - Execute the tests (may require operator interaction during the tests).
  - End of the test generate reports and logs.

### **DP Sink Device Tests:**

- AUX Tests (syntax and procedure tests)
- DPCD Declaration Tests
  - Certain DPCD values for various state setup by Ref Source.
  - Symbol error tests
- Link Training Tests HBR rates
- Link Training Tests UHBR rates
- Link Maintenance Tests
- Video Tests based on EDID and fallback capability
- Power management tests
- Audio tests (UHBR rate tests are under development)

### **DP Sink Device Tests:**

- Split SDP tests
- FEC tests including error counter validation
- DSC tests
- EDID, embedded Display ID tests
  - EDID Base block tests
  - CTS block tests
  - Embedded Display ID (rev 1.x and 2.x) tests
- \*Native Display ID tests
  - Many tests under development.
- Adaptive Sync tests
- Embedded LTTPR tests (Capability and Link Training)

### LTTPR and DP Tunnel Tests:

Note: DP Tunnel here is discrete DP Tunnel treated as pseudo LTTPR.

- How to Tests
  - No CDF needed Reference Source (TE) will read the capabilities and run/skip the tests accordingly.
  - Select group of tests to run
  - Execute the tests (may require operator interaction during the tests).
  - End of the test generate reports and logs.

### LTTPR and DP Tunnel Tests:

- Capability tests and DPCD values via LTTPR.
- HBR Link Training Tests
  - Non-LTTPR
  - Transparent mode
  - Non-Transparent mode
- UHBR Link Training Tests
- Link Maintenance tests
- Symbol and FEC error counter tests.
- Split SDP handling tests
- Video/DSC tests with and without HDCP in SST or MST mode.

**Teledyne LeCroy DP Test Equipment:** 

- M42D
  - Supports DP2.1 link layer CTS
  - Supports DP1.4 link layer CTS
  - EDID/Display ID CTS and Adaptive Sync CTS
  - Verity of Functional Tests
  - Passive Monitoring
- M21 (handheld device)
  - Supports DP2.1 analyzer capability for functional testing.
  - Supports other protocol for video generation and analyzer.

**Teledyne LeCroy DP Test Equipment:** 

- M41D
  - Supports DP1.2 link layer CTS
  - Supports DP1.4 link layer CTS
  - EDID CTS
- 980 with DP1.4 and DP 1.2 card
  - Supports DP1.2 link layer CTS
  - Supports DP1.4 link layer CTS
  - EDID CTS

**DP V2.1 Link Layer CTS** 

# **Question/Answer**



## ClearMR Testing Challenges

## Presented by Lexus Lee, Allion Labs



### **VESA ClearMR Testing Challenges**

Program Manager, Lexus Lee 09/2023



• VESA ClearMR Testing Challenges

### **OVERVIEW**

VESA AdaptiveSync Testing Challenges

Allion Test Tool Solution



## **VESA ClearMR Testing Challenges**



# VESA

### Note: Dependency of VESA Program













### What is VESA ClearMR(Clear Motion Ratio)?

Motion artifacts

Test purpose:

It is to ensure the quality of moving picture on display devices



Note: It does not require DP logo

### **Test Concept**



### 10000fps is used by High Speed Camera.



### Source: the above picture is from VESA

### **Test Concept Cont'**



Leading Edge

### Test Combination.

		Luminance after a Transition						
Luminance		0%	25%	33%	67%	75%	100%	Leading
before a Transition	0%						0	Not Tested
	25%						с. С.	Trailing
	33%					A		
	67%							
	75%				.0	0		
	100%				.6			

Source: the pictures here are from VESA



### **Test Concept Cont'**





**ClearMR Logo Tiers** 



Logo: 11 tiers

- Bigger number means better quality
- Ratio of Clear pixels to Blurry pixels

ALLIE	

ClearMR		
ClearMR™ TIER		CMR RANGE
ClearMR 3000	••••••	··· 2500 ≤ CMR < 3500
ClearMR <b>4000</b>	••••••	··· 3500 ≤ CMR < 4500
ClearMR <b>5000</b>	••••••	··· 4500 ≤ CMR < 5500
ClearMR 6000	••••••	·· 5500 ≤ CMR < 6500
ClearMR <b>7000</b>		··· 6500 ≤ CMR < 7500
ClearMR <b>8000</b>	••••••	··· <b>7500</b> ≤ CMR < <b>8500</b>
ClearMR <i>9000</i>	••••••	··· 8500 ≤ CMR < 9500
ClearMR <b>10000</b>		··· 9500 ≤ CMR < 10500
ClearMR <b>11000</b>	••••••	·· 10500 ≤ CMR < 11500
ClearMR <b>12000</b>		··· 11500 ≤ CMR < 12500
ClearMR <b>13000</b>	••••••	· · <b>12500</b> ≤ CMR



**Here Comes The First Challenges** 

Now, you can guess What they are?

• Challenge1: How Clear is Clear according to the Log Tiers?

Challenge2: Which Log Tier Should I target for our products?











Source: the above picture is from VESA



### **ClearMR Performance Tier Cont'**



Source: the above picture is from VESA



Here Comes The Second Challenges



Now, you can guess What they are?

Challenge3: Our panel suppliers do NOT know their panels' capability against the logo tiers.

Challenge4: What if my product fails to meet the criteria of the desired tier?

(Over driving vs CMR value , which takes some time to find a suitable OD setting.)

## **Suitable Products for certification**



Laptop

### Focusing on panels

### Monitor/TV

## **CTS download and product listing**



### CLEARMR CTS

NEW ClearMR CTS Ver 1.0 VESA-2022-8 – Download

ADAPTIVE-SYNC DISPLAY CTS

• NEW Adaptive-Sync Display CTS Ver 1.0 VESA-2022-3 - Download

https://vesa.org/join-vesamemberships/member-downloads/

• Product listing

**CTS** Download

https://www.clearmr.org/certified-products/



### **ClearMR Certified Products**

Product/Model Number	Screen Size	Resolution	Frame Rate	ClearMR <sup>TM</sup> Tier
48GQ900 48GQ90B	48"	UHD	120Hz	7000
32GQ850				) I



### **VESA AdaptiveSync Testing Challenges**

### AdaptiveSync



## What is AdaptiveSync? Example: 1920x1080p60



### Note: It requires DP Logo.




For Maximum Gaming Experience

For Video Production and Playback





AdaptiveSync Display guarantees higher refresh rates and low latency, optimized for gaming, plus a lab-certified max refresh rate so you know your display's full potential.

**MediaSync Display** is designed for jitter-free media playback supporting all international broadcast video formats.

Minimum requirement of refresh rate: 60-144Hz Minimum requirement of refresh rate: 48-60Hz



### **Test Methodology**



48

### • Flicker at Fixed fps and 4 Dynamic waveforms

- 23.976/24/25/29.97/30/47.952/48/50/59.94/60
- Zigzag/Sine/Square/Random

v0.923 Test 3 - Flicker at Varying Refresh Rate: -Square Wave -Target: 50.000fps 20.00000ms Current: 49.982fps 20.00710ms Average: 82.581fps 12.10939ms 7.95729ms Monitor: 118.536Hz 2.4X Adjust luminance to 40nits using UI slider or OSD Select zigzag vs square wave etc using Up/Down arrows Press SPACE to hide this text.



165

### **Test Methodology**



### • Frame Drop and Frame Jitter



• G2G, Overshoot ,and Undershoot



# **Suitable Products for certification**



Laptop

## Focusing on Panels

### Monitor/TV

### **Test Issue**



### • The most frequently failed test items.

- G2G (Gray to Gray)
  - » 20 tests as shown on the right table



LUON	Rise/Fall		101	a pr
Test case	time(ms)	Mo.	overshoot	undershoot
0-63	29.89	0.00	2.24%	0.00%
0-127	3.16	0.00	5.39%	0.00%
0-191	10.67	0.00	1.86%	0.00%
0-255	6.40	0.00	2.73%	0.00%
63-127	3.12	0.00	27.67%	0.00%
63-191	3.75	0.00	7.58%	0.00%
63-255	4.51	0.00	3.43%	0.00%
127-191	2.18	0.00	34.13%	0.00%
127-255	4.40	0.00	1.96%	0.00%
191-255	3.40	0.00	2.13%	0.00%
255-63	4.50	0.00	0.00%	3.19%
255-127	2.97	0.00	0.00%	33.02%
255-191	3.74	0.00	0.00%	11.56%
127-63	2.81	0.00	0.00%	31.57%
191-63	3.16	0.00	0.00%	20.15%
191-127	3.59	0.00	0.00%	14.76%
255-0	7.31	0.00	0.00%	2.58%
191-0	7.00	0.00	0.00%	1.43%
127-0	6.85	0.00	0.00%	1.78%
63-0	6.91	0.00	0.00%	2.65%
AVG	6.02	MAX	34.13%	33.02%

Code value: 0->black, 63->Dark gray, 127-> Mid gray, 191-> Light Gray, 255->White

### **Test Issue Cont'**



# • The most frequently failed test items.

- Flicker
  - » Worst pattern
    - Square wave

How to Fix the failure
 » Can't be fixed by firmware only.
 » Always replaced with an another panel

Refresh rates	flicker(dB)	Judge
Min :	-52.53	Pass
23.976	-52.52	Pass
24	-52.49	Pass
25	-54.57	Pass
29.97	-80.90	Pass
30	-80.86	Pass
47.952	-52.88	Pass
48	-52.49	Pass
50	-54.57	Pass
59.94	-80.55	Pass
60	-80.48	Pass
Туре	flicker(dB)	Judge
Zigzag 🔊	-62.29	Pass
sine wave	-63.60	Pass
Random	-52.64	Pass
Square	-51.17	Pass

# Test Issue Cont'



Panel

## • A monitor that uses frame buffer exists.

### DP RX (Scaler )

A Dynamic waveform(frame rate) sent out by a DP TX

### A Constant waveform (frame rate) sent out



The Major Change in AdaptiveSync CTS 1.1 certification



### G2G: Percentage(1.0,5x5) VS Delta-PQ(1.1,9x9)

rom/Start



#### Table 2-2: Delta-PQ Tolerance Table

End	0	31	63	95	127	159	191	223	255
0			18	18	18	18	18	18	15
31			15	15	18	18	18	18	10
63				13	15	15	15	18	10
95			20		10	15	15	15	10
127			20	20		10	10	10	10
159			20	20	15		8	10	10
191			30	20	20	13		8	10
223			30	20	20	20	12		5
255			30	30	20	20	10	10	

### The Major Change in AdaptiveSync CTS 1.1 certification Cont'



Table A-1: EOTF SMPTE ST 2084 PQ Code to Luminance Level Lookup Table (Informative)

EOTF SMPTE ST 2084 10-bit PQ Code Value	Luminance Level <sup>a</sup> (cd/m <sup>2</sup> )	EOTF SMPTE ST 2084 10-bit PQ Code Value	Luminance Level <sup>a</sup> (cd/m <sup>2</sup> )
0	0	450	49.79 <sub>.</sub>
8	0.0015	452	50.83
16	0.0054	515	95.50
24	0.0119	520	100.23
36	0.0277	592	199.15
48	0.0520	616	249.03
56	0.0738	636	299.55
64	0.101	668	401.51
120	0.498	692	499.33
153	0.992	712	598.33
156	1.051	728	691.16
193	2.015	768	990.02
206	2.483	769	998.93
253	4.962	807	1404
254	5.031	846	2000
256	5.172	884	2803
307	10.05	892	3013
340	14.96	924	4024
384	24.70	1023	10000

PQ relationship with Luminance

# **CTS download and product listing**



### CLEARMR CTS

NEW ClearMR CTS Ver 1.0 VESA-2022-8 – Download

ADAPTIVE-SYNC DISPLAY CTS

• NEW Adaptive-Sync Display CTS Ver 1.0 VESA-2022-3 - Download

https://vesa.org/join-vesamemberships/member-downloads/

• Product listing

**CTS Download** 

https://www.adaptivesync.org/certified-products/



#### AdaptiveSync Display Certified Products

Mfr	Model	Screen Size	Native Resolution	Max Rate @ Native Resolution
Dell	AW2523HF	25"	FHD	360Hz
Dell	AW2723DF	27"	QHD	240Hz
LGE	27GP850 27GP83B	27"	QHD	165Hz



### **Allion Test Tool solution**

### **Test Tools & Fixtures**



### **Customizable Fixtures for Efficient Validation**

Allion has developed a wide range of exclusive tests and prides itself on topquality test fixtures. Our fixtures have been approved by leading international associations and can be tailored to different standards and specifications. With over 100 projects in high-frequency and other fixture designs, we offer customizable solutions that enhance the efficiency and cost-effectiveness of your product validation process.

Auto Switch **PCI** Express HDMI / DP Cable Connector **USB USB** Active Cable JSB4 Golden 86 © Allion Labs, Inc. All rights reserved USB A High Speed Signal Quality Test

### **USB Test Fixtures**

#### **USB-A 2.0 HSSQ TF Sets**

- High-Speed Device Signal Quality Test (EL 2, 4, 5, 6, and 7)
- · Eve Pattern Test

Brandnew design AUT20132 for USB-A Host in 2020, which reduce the risk of the SMA damage(easy to change the SMA Connecot), improve the quality of the USB 2.0 Signals, redesign the jumper to be a switch, Self Power connector changed to USB Type-C®

- High-Speed Host Quality Test (EL 2, 3, 6, and 7)
- Eve Pattern Test

Allion design a brandnew Product AUT20038 in 2020, which reduce the risk of the SMA damage(easy to change the SMA Connecot), improve the quality of the USB 2.0 Signals.

#### USB-C<sup>®</sup> 3.2 Electrical TF Sets

#### Application

#### USB-C® 3.1 Tx Signals Integrity Test

AUT20044 is a substitute for Host 1C & Device 1C in USB31CET Kits. In order to perform the integrity test, you must have the rest of UAB31CET Kits test fixtures.

#### Key Features

- Up to 40GHz Design for Next Gen Combine UFP/DFP testing in one Fixture
- · Better Signals quality than orignal Test Fixture



Application

original Design

 Type-C Connector for Delivery +5V Power instead of DC Jack

Setting

USB-C<sup>®</sup> 3.1 Tx/Rx Signals Integrity Test

AUT20098 is a substitute for Full Type-C<sup>®</sup> Breakout in

USB31CET Kits. In order to perform the integrity test, you

must have the rest of UAB31CET Kits test fixtures.





#### USB 5Gbps Electrical Testing



- Up to USB 5 Gbps Data Transfer
- · Standard A Plug Test Fixture
- Downstream Facing Port Tx/ Rx Long Channel Tests

#### Key Features

- Standard A Plug Test Fixture
- Channel Test



#### Key Features

- Up to USB 5 Gbps Data Transfer
- Standard B Receptable 5" Host Test Fixture/ Device Calibration Fixture
- Upstream Facing Port Calibration
- Downstream Facing Port Rx Long Channel Test



#### Key Features

- Up to USB 5 Gbps Data Transfer
- Standard A Receptable 11" Device Test Fixture
- · Upstream Facing Port Rx Long Channel Test



Upstream Facing Port Tx/ Rx Long Channel Tests



#### Key Features

- Up to USB 5 Gbps Data Transfer
- 5V Input from USB-C<sup>®</sup> Connector
- Standard A Receptacle Test Fixture
- · Upstream Facing Port Rx Short Channel Test



• Up to USB 5 Gbps Data Transfer



Downstream Facing Port Rx Short







#### Key Features

- Up to USB 5 Gbps Data Transfer
- 5V Input from USB-C<sup>®</sup> Connector
- Standard A Receptacle Test Fixture

### **USB Test Fixtures**



#### USB-C<sup>®</sup> 2.0 Host/Device HSSQ TF

#### USB Type-C<sup>®</sup> 2.0 Device HSSQ TF (AUT17037)

Application

#### Host

- Packet Parameters ( EL\_21, EL\_25, EL\_23, EL\_22, EL\_55)
- Chirp Timing (EL\_33, EL\_34, EL\_35)
- Suspend/Resume Timing (EL\_39, EL\_41) As for the High-Speed Signal Quality Test (EL\_2, EL\_3, EL\_6, EL\_7), we recommend AUT17094 to you

#### Device

- High-Speed Signal Quality Test (EL\_2, EL\_4, EL\_5, EL\_6, EL\_7)
- Packet Parameters ( EL\_21, EL\_22, EL\_25)
- Chirp Timing (EL\_28, EL\_29, EL\_31)
- Suspend/Resume Timing (EL\_38, EL\_39, EL\_40, EL\_27, EL\_28)
- Test J/K, SE0\_NAK (EL\_9)

#### USB Type-C<sup>®</sup> 2.0 Host HSSQ TF (AUT17094)

#### Application

High-Speed Signal Quality Test (EL\_2, EL\_3, EL\_6; EL\_7)

#### Key Features

Convert USB 2.0 Signal from Type-C Plug to SMA Connector



- Combine UFP/DFP testing in one Fixture
- · Better Signals quality than orignal Test Fixture

AIUI CAPERI



#### USB-C<sup>®</sup> 40Gbps TF

#### USB-C® Plug & Receptacle RX TF (AUT20159



#### Key Features

- Up to USB 40Gbps Data Transfer
- 5V Input from both USB-C<sup>®</sup> Connectors
- USB4<sup>®</sup>/ Thunderbolt<sup>™</sup>4 Rx Test

#### ISB-C<sup>®</sup> Receptacle TX/RX TF (AUT21112)



#### Key Features

- Up to USB 40Gbps Data Transfer
- 5V Input from both USB-C<sup>®</sup> Connectors
- USB4<sup>®</sup>/ Thunderbolt™4 Tx/ Rx Tests

#### USB 40Gbps Electrical Testing

#### USB-C<sup>®</sup> Plug & Receptacle TX TF (AUT21060)



#### Key Features

- Up to USB 40Gbps Data Transfer
- 5V Input from both USB-C<sup>®</sup> Connectors
- USB4<sup>®</sup>/ Thunderbolt<sup>™</sup>4 Tx Test

#### USB-C<sup>®</sup> Plug TX/RX TF (AUT21113)



#### Key Features

- Up to USB 40Gbps Data Transfer
- 5V Input from both USB-C<sup>®</sup> Connectors
- USB4<sup>®</sup>/ Thunderbolt<sup>™</sup>4 Tx/ Rx Tests

## **HDMI & DisplayPort Test Fixtures**

#### HDMI Type-A Test Fixture

HDMI Type-A Test Fixture

AHT20136-P/R-DS



- Application
- HDMI CTS 1.4b Compliance Electrical Testing
- HDMI Directly Attach Device Electrical Compliance Testing
- Features
- · No twisted wire, reducing signal loss
- Compatible with Electrical test for TX
  & RX devices
- Compatible with Electrical test for Cable & Directly Attach device

HDMI Type-A Test Fixture

AHT20136-HEAC-AR



- Application
- HDMI HEAC device Electrical Compliance Testing
- HDMI Cable Cat.1&2 Electrical Compliance testing
- Features
- No twisted wire, reducing signal loss
- FeaturesShort and strong cable reducing

HDMI 2.1 Compliance Electrical

HDMI 1.4b Compliance Electrical

HDMI Type A High

**Frequency Test Fixture** 

signal lossReduced Human factors

= mm

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Application

Testing

Testing

- Up to 48Gb/s data rate supported
- · Wire Modularization, easy Setup
- Supports FRL testing
- Calibration Board for De-embedding

#### **DisplayPort Test Fixture**

ADT2105



#### Application

#### VESA DisplayPort v1.4a PHY Layer Common Tests

- AUX\_CH (Manchester-II) EYE Test
- AUX\_CH\_n/p Termination DC Test
- AUX\_CH Slew Rate Test
- DP\_PWR DC Level Test / DP\_PWR Current Test

#### Features

- Measure AD and DC voltage
- Measure DP\_PWR voltage
- · No twisted wire, reducing signal loss

### **PCle Gen5 Test Fixtures**



#### M.2 CLB5.0 Test Fixtures



#### Key Features

- Worldwide First PCIe Gen5 M.2 Test Fixture
- Durable SMPM Connectors, supporting up to 40GHz
- · Flexible Cable Assembly to simplify installation & exchange
- One for M.2 Lane0/Lane1, the other for M.2 Lane2/Lane3
- 2X Thru Calibration Board

#### **CEM CLB5.0 Test Fixtures**



E1/E3 CLB5.0 Test Fixtures

#### Kev Features

- · Durable SMPM Connectors, supporting up to 40GHz
- · Flexible Cable Assembly to simplify installation & exchange
- One for L0/L3/L4/L7/L8/L11/L12/L15, the other for L1/L2/L5/L6/L9/L10/L13/L14
- 2X Thru Calibration Board
- Ready for Allion Automation

#### U.2/U.3 CLB5.0 Test Fixture



#### Kev Features

- Worldwide First PCIe Gen5 U.2/U.3 Test Fixture
- Durable SMPM Connectors, supporting up to 40GHz
- Flexible Cable Assembly to simplify installation & exchange
- · General support U.2/U.3 PCIe & SAS in one Board
- · 2X Thru Calibration Board



#### Key Features

- · Durable SMPM Connectors, supporting up to 40GHz
- · Flexible Cable Assembly to simplify installation & exchange
- One for E1 Lanes 0/1/2/3, the other for E3 Lanes 4/5/6/7
- · 2X Calibration Board

#### OCP NIC3.0 CLB5.0 Test Fixtures



#### Key Features

- Durable SMPM Connectors, supporting up to 40GHz
- · Flexible Cable Assembly to simplify installation & exchange
- One for Lanes L0/1/2/3 & L8/9/10/11, the other for Lanes 4/5/6/7 & L12/13/14/15
- 2X Calibration Board

### **PCIe Gen5 Test Fixtures**



#### M.2 CBB5.0 Test Fixture



#### Key Features

- Up to 40GHz Design for Next Gen.
- Worldwide First PCIe M.2 Test Fixture
- Power Source from USB-C Port
- Adjustable Voltage for 3.3V

#### U.2/U.3 CBB5.0 Test Fixture



#### Key Features

- Up to 40GHz Design for Next Gen
- 12V Power Source from AC/DC Adaptor or ATX Power Connector

#### CEM CBB5.0 Test Fixture



#### Key Features

- Up to 40GHz Design for Next Gen
- Power Source from ATX Power Connector

#### OCP NIC3.0 CBB5.0 Test Fixture



#### Key Features

- Up to 40GHz Design for Next Gen
- Backward Compatible for E1/E3
- Power Source from ATX Power Connector

## AI/ Automation Solutions: Allion PCIe Automation Measurement System (APMS)



- Control Switch Box to switch lanes automatically
- Control CMTS to toggle test patterns automatically
- Control instrument to load setup file and acquire/save wave automatically
- Flexible configuration selection for Spec. Generation, Lane No. and Preset mode
- One quick button to test all configuration (All generation, all 8 lanes with all preset)
- Conversion SW can be executed simultaneously or independently
- Conversion SW can be executed with human unattended



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## AI/ Automation Solutions: Cable-Connector Allion Multiport Switch (CAMS)

CAMS can help RD members verify the high-frequency cable and connector design. At the same time to accomplish 100% measured high-frequency cables in the production line.





# Q&A



Allion is the premier resource for all of your third party testing needs. Our services bring products to market more quickly, reliably, and cost effectively to protect your brand quality and that of your suppliers.



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# VESA Compliance Program Updates

# Presented by Jim Choate



# **VESA PlugTest Events**

- Provide significant value to member companies, particularly as new capabilities and products are deployed.
- Demonstrate and improve Traditional Interoperability
- Test Native DP and DP Alt Mode over USB Type-C products
  - UHBR20/13.5/10, DSC, FEC and other new capabilities
  - Verify Test Equipment Correlation (DP 2.1 LL CTS and PHY CTS)
- VESA hosted two successful PlugTests in 2022 (Taiwan and US)
- VESA will host two PlugTests in 2023
  - Taipei, Taiwan: October 2023 (Next week)
  - Burlingame, CA: May 2023 (done)



# **Product certifications 2022/2023**

Products	2022	2023
DP Sources	141	99
DP Sinks	339	277
DP Cables	42	59
DisplayHDR	388	397
ClearMR	14	45
AdaptiveSync	25	80



# Summary



# Summary

- Product shipments and certifications on DP 2.1 based products continue to grow
- DisplayPort over USB-C is now the defacto standard for laptops, tablets and handheld devices
- DP 2.1 Link Layer CTS is major update and improvement of testing coverage for new capabilities introduced in DP v2.1 specification
- Momentum continues to grow for DisplayHDR, ClearMR and VESA AdaptiveSync product certification
- Development and adoption of new technologies continues to drive increases in VESA membership growth



THANK YOU DisplayPort.org DisplayHDR.org Adaptivesync.org Clearmr.org VESA.org



# Questions?



# Demos

# quantumdata M42de Video Analyzer/Generator





- Protocol Analysis and Video Generator for DisplayPort 2.1 source & sink testing
- Supports DP80, DP40 and USB-C (Alt Mode) compatible devices
- Full support for DP 2.1 10Gb/s,13.5Gb/s & 20Gb/s lane rates

### M21 Video Analyzer 8K UHBR DP/USB-C

Everywhere**you**look



### Voyager M4x: USB4 Protocol Analyzer



### Complete Solution

Evervwhere**vou**look

Analyzer, Exerciser, & Compliance Tester

## Accurate Capture at 40Gb/s

 T.A.P.4<sup>™</sup> front-end captures link training without distorting equalization process

# Comprehensive Decoding

View Tunneled PCIe, DisplayPort<sup>™</sup>, & USB Protocols

106

# T3RapidWave4000: Advanced modular and automated cable tester



### Production Configuration

- Continuity
- DC Resistance
- DC Resistance Pins
- EMarker read
- SVID Protocol
- Quiescent Current
- Insertion Loss

✓ PRODUCTION MODULE wiring and resistance measurements



- ✓ >13 K\$ +pay-per-test
- ✓ High Volume Factory Production

# Failure Analysis and Signal Integrity testing





- Eye diagram
- Insertion loss
- Cross-talk
- Impedance profile
- Inter-pair skew
- Intra-pair skew
- ADVANCED SIGNAL INTEGRITY MODULE accurate and rapid signal integrity measurements

- $\checkmark$  > 43 K\$ (unlimited testing)
- ✓ Factory QC labs, Compliance Lab, Standard Organization, OEM Brand



# Powerful Oscilloscope for USB-C® Testing

### WaveMaster 8000HD Oscilloscope

- PHY Compliance Testing
  - 12 Bits all the time; Best in Class Jitter and Eye Measurements
  - 'Unified' Test Fixture Approach for DP2.1 and USB4 Version 2.0
  - Source and Sink (Anritsu MP1900A)
     PHY Compliance Testing using QualiPHY Software
- Serial Data Analysis

TELEDYNE LECRO¥ Everywhere**you**look<sup>™</sup>

- Built-In SDA Expert DisplayPort PHY CTS Measurements
- Unique Cross Layer Analysis
  - DP-AUX Sideband Trigger and Decode
  - CrossSync® PHY for DisplayPort Tunneling using M4X


## **Allion Demo Booth**



#### **Customizable Fixtures for Efficient Electrical Signal Validation**



### Cybertek VESA DSC Decoder IP Core Demo



#### **DSC Decoder IP Core Feature**

- ✓ Compliant with VESA DSC 1.2a and 1.2b standards
- ✓ Support MMAP, BP, MPP and ICH encoding mechanisms
- ✓ YCbCr and RGB video input format
- ✓ 4:4:4, 4:2:2, and 4:2:0 native coding
- ✓ Support 8/10/12 bits per component
- ✓ Support 3 pixels per clock decoding
- ✓ Configurable features for gate count and speed



## DisplayPort Protocol Analyzer In Action!

## FuturePlus Systems



- Connects between ANY Source and ANY Sink
  - Supports 8b/10b, eDP, FEC/DSC,
    DP1.2b DP 1.4b, DP2.1
  - Supports 128b/132b DP2.1
  - Probe, Decode, and Time Correlate
    High Speed Main Link and Aux Channel
  - Snooper and Repeater Probing

Solutions Available See our Rep in Taiwan









USB Type C Repeater



Regular DP Snooper

Advancing Technology Development





graniteriverlabs.com

# GRL DisplayPort 2.1 Solution



#### **GRL Solutions**



## DisplayPort 2.1 Transmitter Test Automation Solution

A quick and straightforward way to test and debug your DisplayPort 2.1 transmitter products efficiently (GRL-DP21-TX)

#### Overview

- Provides full compliance automation to the DisplayPort 2.1 standard.
- Compatible with Tektronix and Keysight oscilloscopes.
- Flexible selection on test items and data rates (UHBR10, UHBR13.5, and UHBR20).
- DP 2.1 according to current CTS.
- Support AUX Controller automation.





#### **GRL Solutions**



DisplayPort 2.1 Receiver Calibration and Test Automation

#### Overview

- Provides full compliance automation to test Sink products to the DisplayPort 2.1 standards
- Automatically calibrates BERT and Scope to create stressed eye for Sink Jitter Tolerance testing
- Compatible with Tektronix and Keysight oscilloscopes paired with the Anritsu MP1900A BERT
- Fully integrated with high-speed test fixtures and AUX controller available from Wilder Technologies (sold separately)







## **Measurement Disaggregation**

**Keysight Technologies** 

#### **Challenge: Test Run Time Optimization**

#### Solution: Measurement Disaggregation



#### What is it costing you?

- Extensive test plan requires long test time
- 75% of test time is spent processing data

#### What is an ideal solution?

- Significant test time improvement using Measurement Disaggregation
- · Re-use of your invested solution
  - Saves \$\$\$
  - Builds on your present equipment and knowledge





## Tektronix DisplayPort Tx Compliance Testing Solution





### /// UNIGRAF

UCD-500 Gen2 16K DP 2.1 Generator & Analyzer



- DP 2.1 Sinks and Sources up to 10K@60Hz (16K@60Hz with DSC up to UHBR 20 Bit Rate)
- Supports DP and USB-C connectors

- UHBR 20 Gb max link rate for DP and USB-C connectors

- Adaptive-Sync, DSC, FEC and LTTPR support
- DP 1.4a Link Layer CTS Tool
- DP 2.1 Link Layer CTS Tool including
  - LTTPR CTS
  - DisplayID/EDID CTS
  - Adaptive-Sync CTS
- HDCP 2.3 Compliance Test Device for Transmitters, Receivers and Repeaters
- Color depth 6 to 16bpc
- Capture memory 16GB



#### USB Explorer<sup>™</sup> 350

Multi-function USB Type-C®, USB 3.2 x1, and Power Delivery Protocol Test Platform



- Broad Specifications Support: USB 2.0 (1.5, 12, 480 Mbps), USB 3.2 x1 Gen 1 (5 Gbps) and Gen 2 (10 Gbps), USB Power Delivery 3.1 and USB Type-C 1.3
- Multi-function: Same unit can operate as protocol analyzer, host/device/sink/source emulator, as well as compliance tester
- Perfect Accuracy: High precision clocking components coupled to Ellisys' protocol analysis engine provides industry's unmatched accuracy
- Unequaled Software: Ellisys powerful yet easy to use multi-protocol analysis software offers the most complete feature set in the industry, including essential features such as Instant Timing for precise timing analysis and Instant Throughput for performance characterization
- Integrated Logic Analysis: Logic signals analysis concurrently to traffic capture opens a new debugging dimension to development engineers by visualizing outputs of their FPGA or ASIC

#### CAPTURING THE WORLD