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Enabling the Electronics Revolution

Amphenol Interconnect and Sensor System(AISS)

AssembleTech(AST)

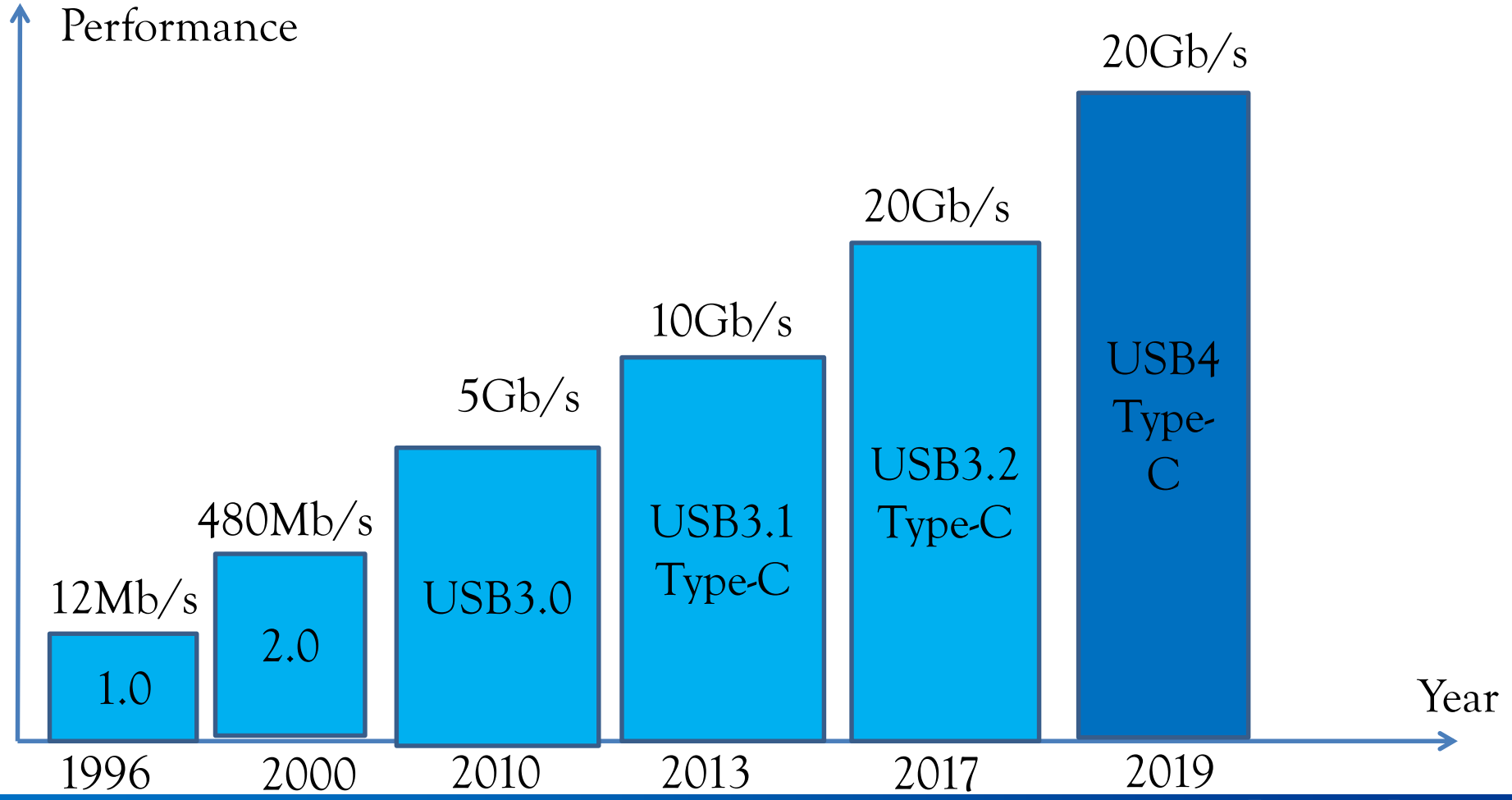
Nov. 4th, 2021

USB4 Type C

USB Technology Roadmap

Trend

- ✓ Higher speed
- ✓ Higher density
- ✓ Higher current/power
- ✓ Wider application



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USB4 Type C Cable

USB4 is the most recent update of the USB specification and supports a range of higher video resolutions, high data bandwidth, power, bandwidth capability is increased up to 40Gbps in two lanes.

Cable Samples	Cable assembly certification
Available	Passed the certification (USB4 Gen3 spec) The certified cable length is 1 meter TID number is 6595

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USB4 Type C Cable

Highlight:

First group to pass USB-IF certification，SI support 20Gbps/pair（bandwidth is 40Gbps), support 100W power and cable assembly are fully shielded.

- Certified by USB-IF committee, the TID number is 6595
- 20Gbps/channel, total bandwidth is 40Gbps
- Physical interface compatible with Type C and Thunderbolt3
- Certified cable length is 1m
- Symmetrical design for either direction plug
- Support 5A 100W power
- Support data, video, audio and power
- Fully shielded connector
- Small connector pitch: 0.5mm

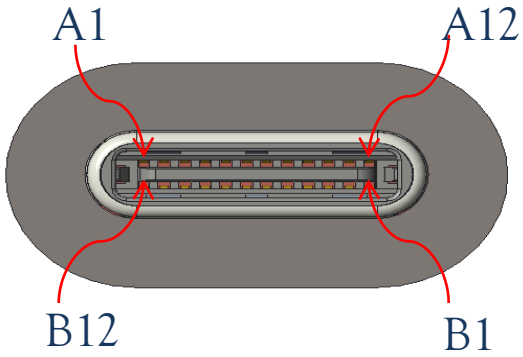
USB4 Type C Cable

Comparison between USB4 Gen3 and Gen2 performance

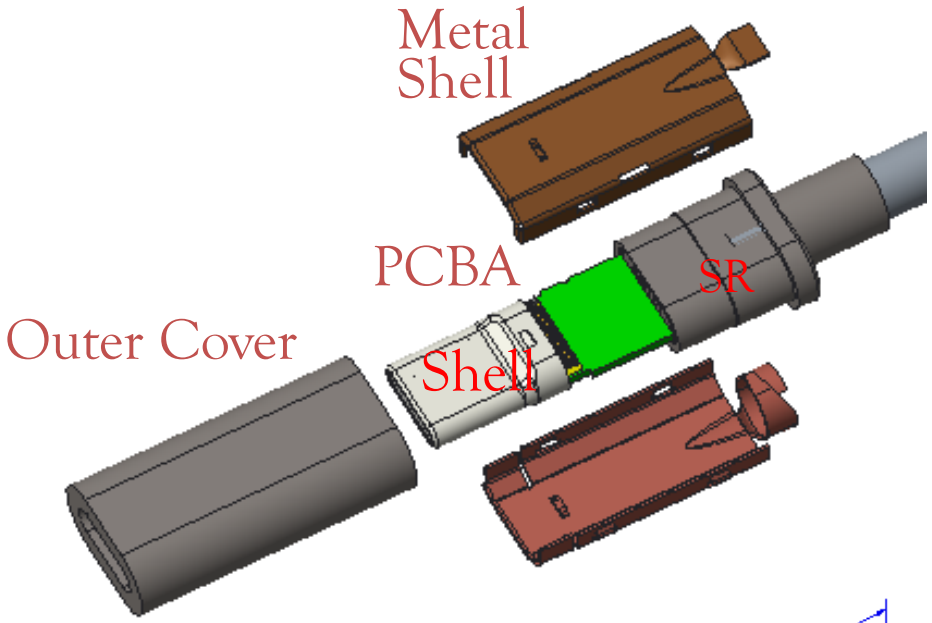
USB4 Type C Gen2	USB4 Type C Gen3
Spec defined cable Length≤ 2 m	Spec defined cable Length≤ 0.8 m
Bandwidth: 20Gbps	Bandwidth: 40Gbps
IMR is Normative	IMR is Informative
No need to test COM	Add COM requirement
no need to test IXT_USB and IXT_DP requirement	Add IXT_USB and IXT_DP requirement
	Support TBT3

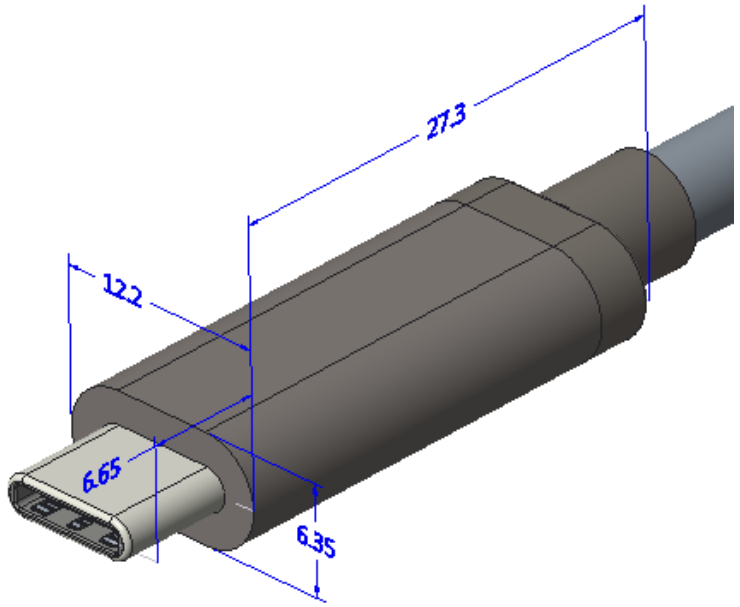
USB4 Type C Cable

Connector Configuration



P1			P2		
Pin	Signal Name	Wire color	Pin	Signal Name	
A1 B1 A12 B12	GND	Brain	A1 B1 A12 B12	GND	4PCS 10nF
A4 B4 A9 B9	VBUS	Blue	A4 B4 A9 B9	VBUS	4PCS 10nF
A5	CC	Green	A5	CC	
B5	VCONN	Yellow	B5	VCONN	
A6	Dp1	White	A6	Dp1	Pair
A7	Dn1	Green	A7	Dn1	Pair
A2	SSTXp1	Brown	B11	SSRXp1	Coaxial pair
A3	SSTXn1	Green	B10	SSRXn1	Coaxial pair
B11	SSRXp1	Yellow	A2	SSTXp1	Coaxial pair
B10	SSRXn1	White	A3	SSTXn1	Coaxial pair
B2	SSTXp2	Red	A11	SSRXp2	Coaxial pair
B3	SSTXn2	Black	A10	SSRXn2	Coaxial pair
A11	SSRXp2	Blue	B2	SSTXp2	Coaxial pair
A10	SSRXn2	Orange	B3	SSTXn2	Coaxial pair
A8	SBU1	Orange	B8	SBU2	
B8	SBU2	Gray	A8	SBU1	
Shell	Shield	Braid	Shell	Shield	





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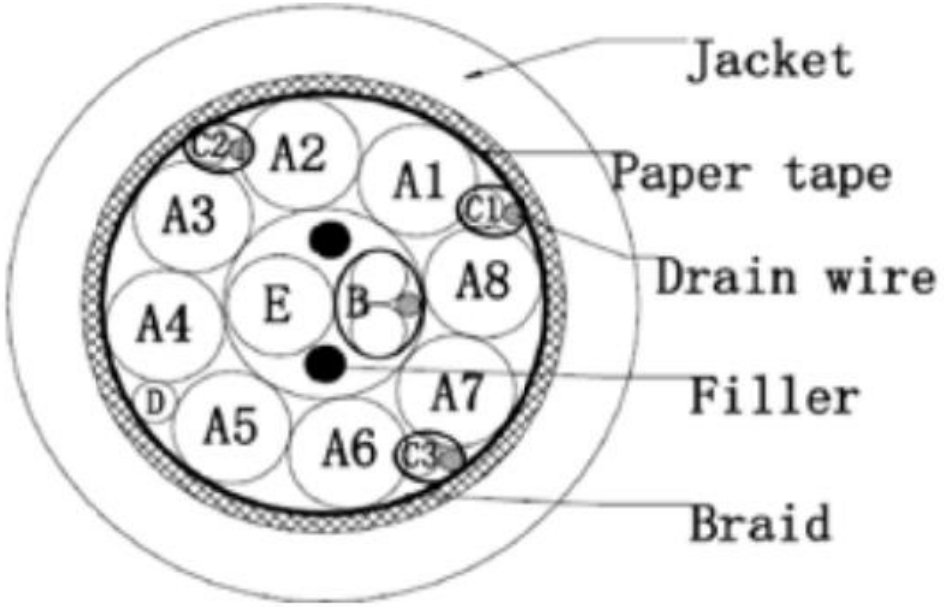
USB4 Type C Cable

Cable Configuration



Cross sectional view

Cores Color:

Cores A insulation: Nature

Cores Color:

A1 orange, A2 Blue, A3 Blue A4 Black

A5 White, A6 Yellow, A7 Brown, A8 Green,

B White-Green, C1 Green, C2 Gray, C3 Orange

D Yellow, E Blue.

8C 30awg coaxial wire for high speed signal transimission

1pair 34awg USB2.0 signal transimission

3C 34awg side band and CC

1C 34awg VCONN

1C 24awg power

We are using coaxial cable for current design, in the future, we will develop twisted pair solution for USB4.

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USB4 Type C Cable

Test Spec

Test Items	Test Method	Condition	Comments
Examination of Product	EIA-364-18	10x magnification	No detrimental condition
Dielectrical Withstanding Voltage	EIA-364-20	100V AC, 1minute	No disruptive discharge; Leakage current <2mA
Insulation Resistance	EIA-364-21	100V DC, 1minute	≥100MΩ
Low Level Contact Resistance	EIA-364-23	Test current: 100mA Open voltage: 20mV (max.)	Initial ≤40mΩ; Final ≤50mΩ;
Continuity	Per product spec.	/	No discontinuities or shorts allowed
Insertion Force	EIA-364-13	Speed: 12.5 mm/min (rate)	Insertion Force: 5~20N
Extraction Force	EIA-364-13	Speed: 12.5 mm/min (rate)	First 5cycles: 8~20N; After 30cycles: within 33% of initial reading and meet 8~20N; After 10000cycles: 6~20N;

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USB4 Type C Cable

Test Spec

Durability (preconditioning)	EIA-364-09	4cycles, 200cycles/hour	No evidence of physical damage
Durability	EIA-364-09	total 10000cycles, rotate 180° every 2500cycles, 500cycles/hour	No evidence of physical damage
Cable Pull Out	EIA-364-38	Pull the plug from board connector load 40N for 1 minute;	No discontinuity and cable no mechanical separation from connector
Cable Flex	EIA-364-41	±60°, 1000cycles, 20cycles/minute, 500g weight, roller OD=37mm	No loss of continuity during cycling
4-Axis Continuity	Product Standard	Force 8N at 15mm from receptacle shell mating edge, maintain 1minute each for 4 orientations	No discontinuity over 1us
Voltage Drop	EIA-364-06	5V, 3A rated current	250mV for GND; 500mV for VBUS
Wrenching Strength (50N)	Product Standard	Wrenching strength load 50N at 15mm from the edge of receptacle in each of four directions (left, right, up, down)	No physical damage

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USB4 Type C Cable

SI performance based on USB4 Gen3

Measured data based on 30awg 0.8meter cable, straight plug to straight plug.
spec is USB type C section 3.7.2

	TX1(L)	TX1(R)	RX1(L)	RX1(R)	TX2(L)	TX2(R)	RX2(L)	RX2(R)	Limit	Pass/Fail
ILfit@0.1GHz, dB	-0.54	-0.54	-0.52	-0.52	-0.53	-0.53	-0.52	-0.52	-1	Pass
ILfit@2.5GHz, dB	-2.92	-2.92	-2.9	-2.9	-2.9	-2.9	-2.92	-2.92	-4.2	Pass
ILfit@5GHz, dB	-4.17	-4.17	-4.15	-4.15	-4.16	-4.16	-4.2	-4.2	-6	Pass
ILfit@10GHz, dB	-6.18	-6.18	-6.16	-6.16	-6.27	-6.27	-6.21	-6.21	-7.5	Pass
ILfit@12.5GHz, dB	-7.13	-7.13	-7.06	-7.06	-7.28	-7.28	-7.14	-7.14	-9.3	Pass
ILfit@15GHz, dB	-8.1	-8.1	-7.92	-7.92	-8.27	-8.27	-8.07	-8.07	-11	Pass
IMR, dB	-40.86	-40.86	-41.57	-41.57	-39.38	-39.38	-39.62	-39.62	-35.9	Pass
IRL, dB	-20.09	-20.09	-20.34	-20.34	-19.94	-19.94	-19.83	-19.83	-18.21	Pass
C2D, dB	-26.83	-27.82	-23.28	-23.89	-19.79	-19.8	-29.48	-30	-17	Pass
D2C, dB	-26.68	-27.97	-23.46	-23.8	-19.85	-19.79	-29.75	-29.96	-17	Pass
IXT_DP, dB	-48.78	-48.76	-48.95	-49.43	-48.59	-47.94	-48.11	-48.39	-40.3	Pass
IXT_USB, dB	-50.11	-52.47	-51.04	-52.75	-50.06	-51.76	-49.75	-52.33	-40.26	Pass

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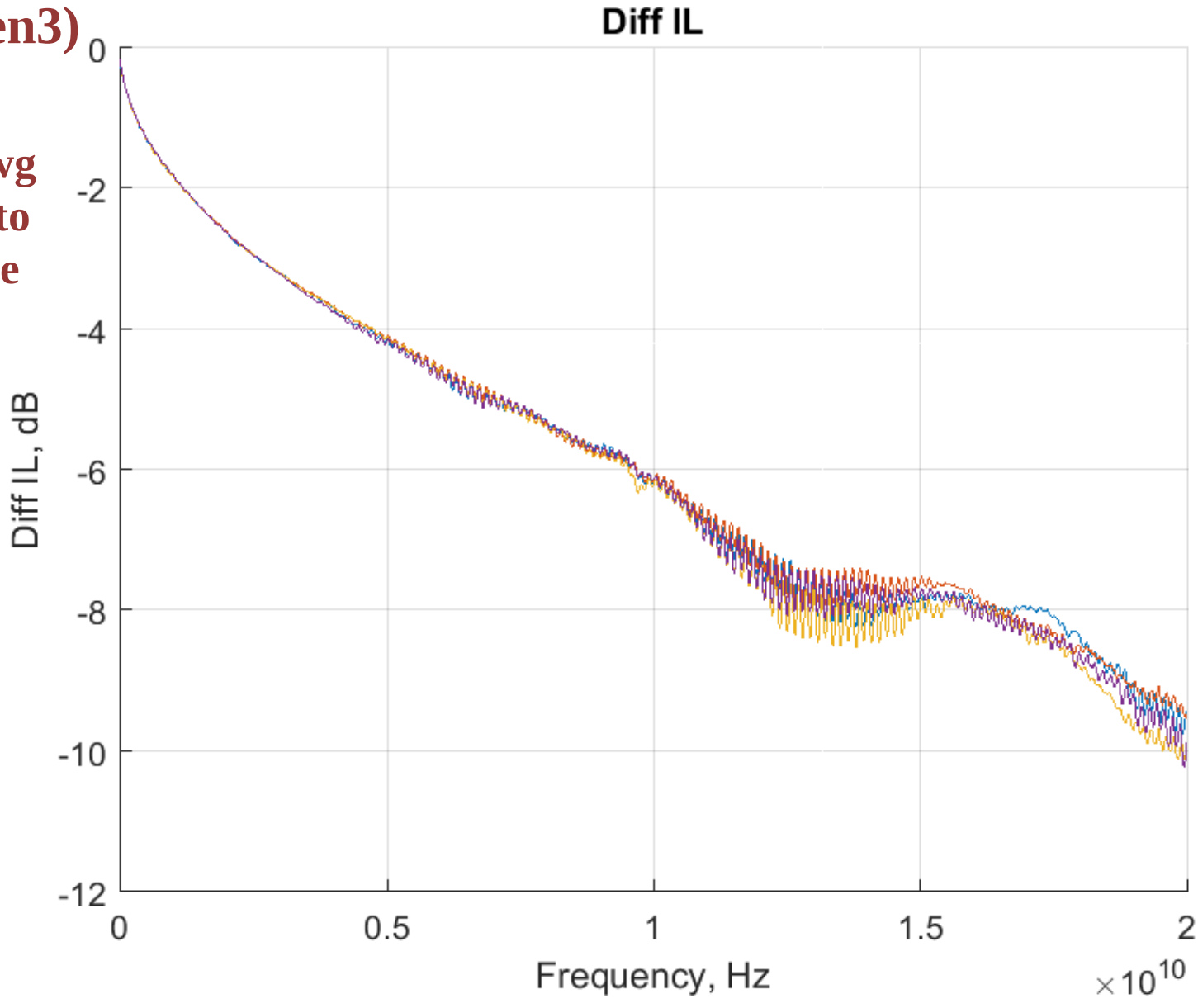
USB4 Type C Cable

SI performance

Insertion Loss(USB4 Gen3)

Measured data based on 30awg 0.8meter cable, straight plug to straight plug. spec is USB type C section 3.7.2



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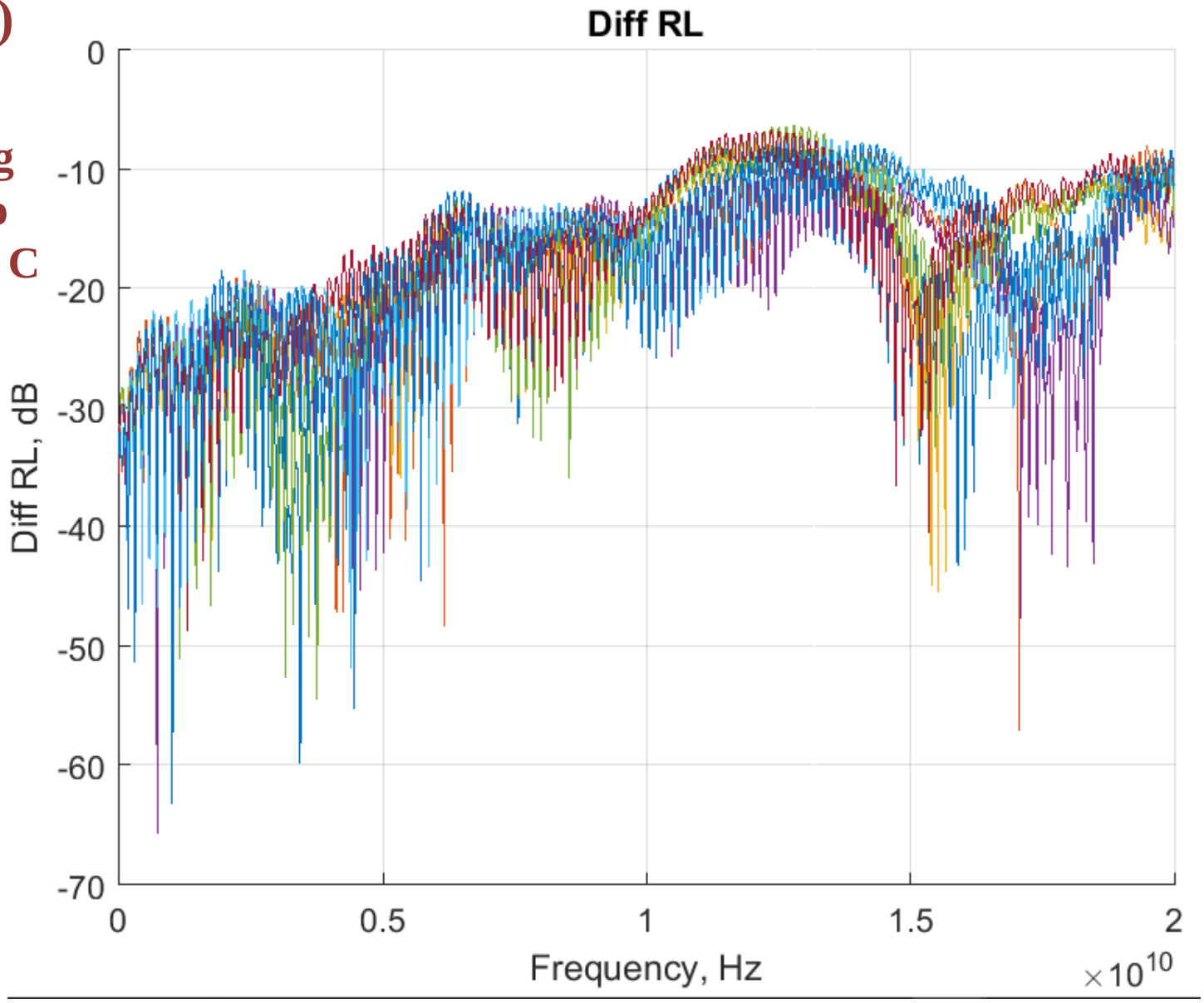
USB4 Type C Cable

SI performance

Return Loss(USB4 Gen3)

Measured data based on 30awg 0.8meter cable, straight plug to straight plug. spec is USB type C section 3.7.2



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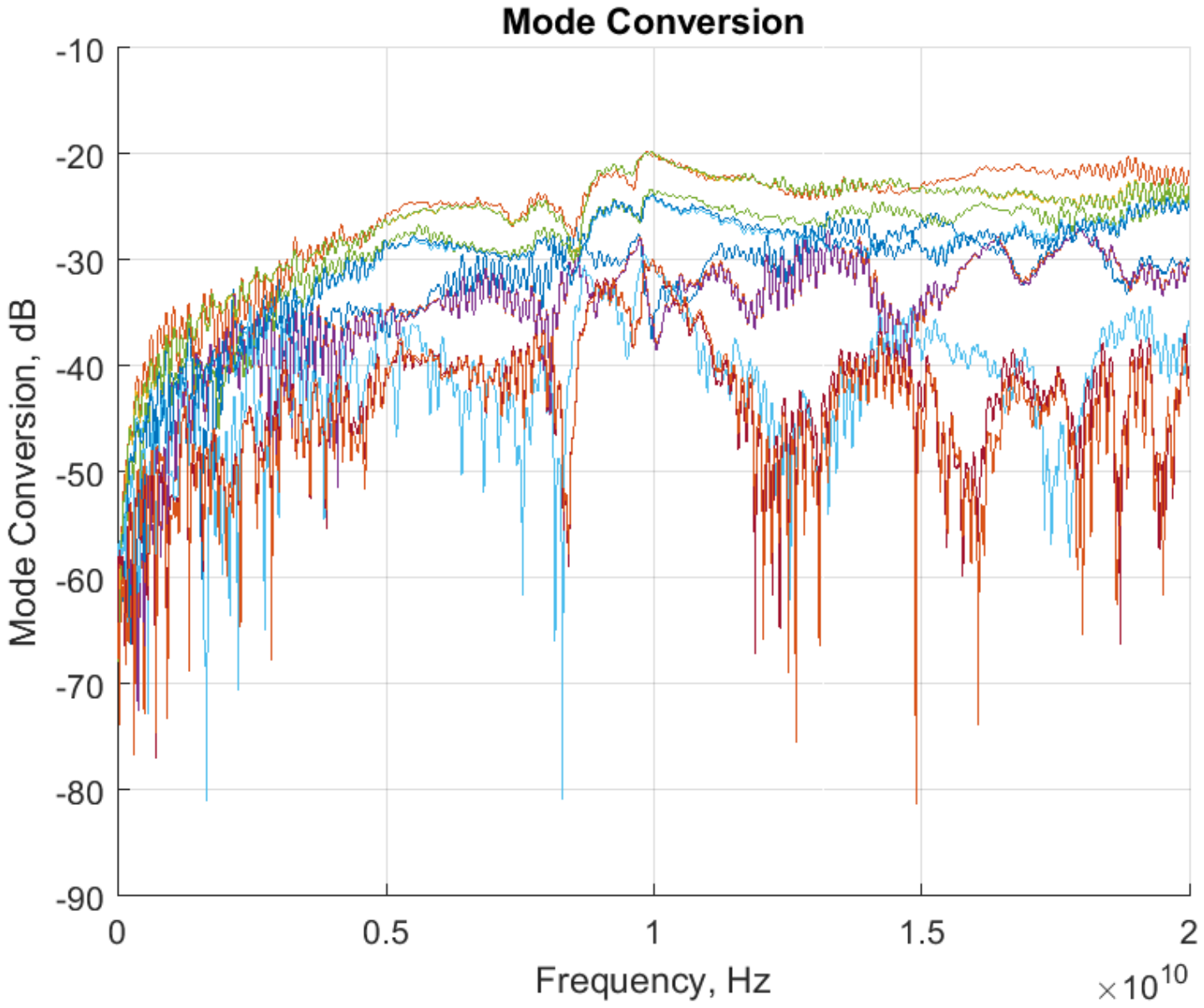
USB4 Type C Cable

SI performance

Scd21 (USB4 Gen3)

Measured data based on 30awg 0.8meter cable, straight plug to straight plug. spec is USB type C section 3.7.2



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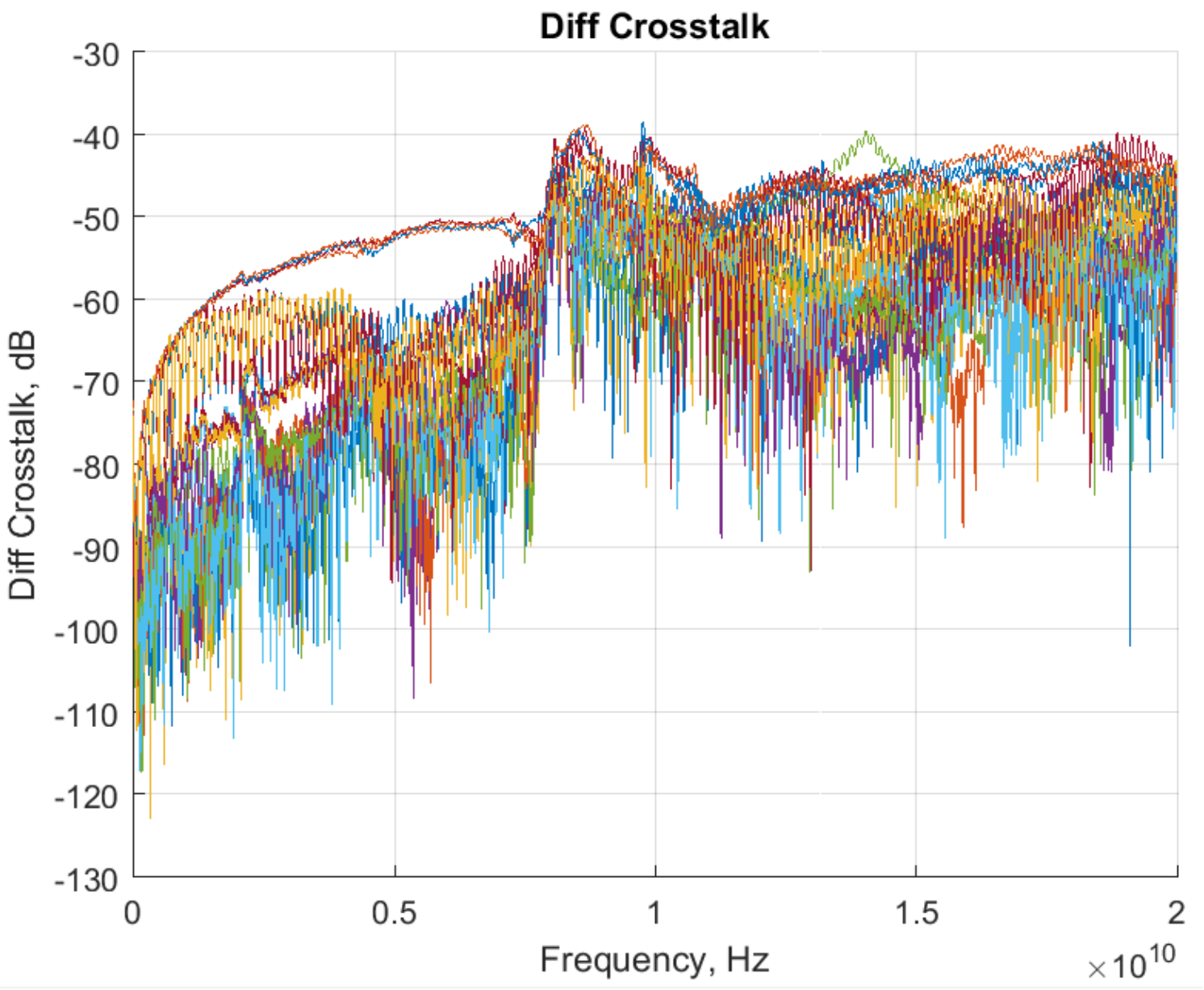
USB4 Type C Cable

SI performance

Crosstalk between high speed pair (USB4 Gen3)

Measured data based on 30awg 0.8meter cable, straigh plug to straight plug. spec is USB type C section 3.7.2



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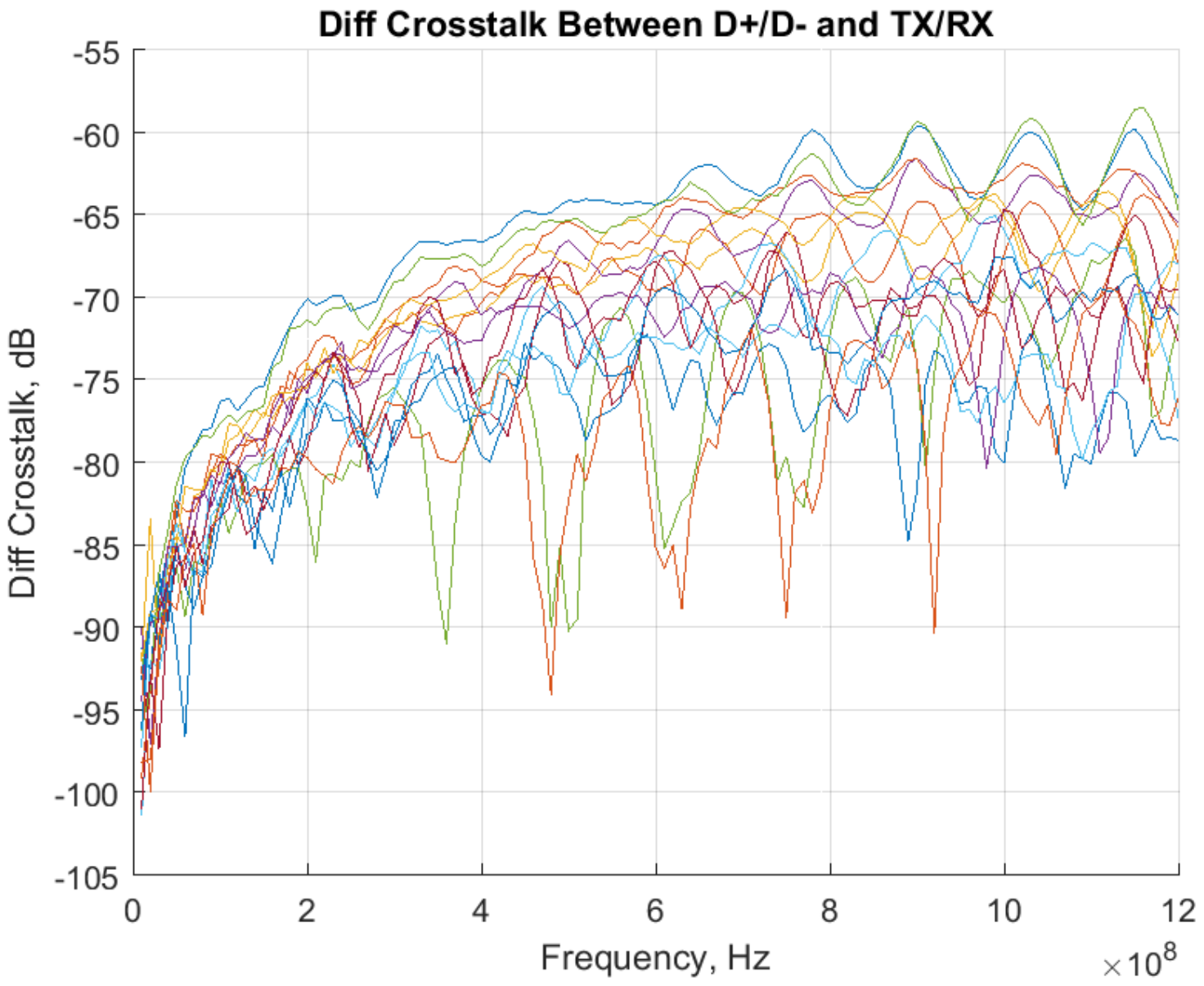
USB4 Type C Cable

SI performance

Crosstalk between high speed pair and low speed pair(USB4 Gen3)

Measured data based on 30awg 0.8meter cable, straight plug to straight plug. spec is USB type C section 3.7.2



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HDMI2.1

HDMI 2.1

HDMI 2.1 is the most recent update of the HDMI specification and supports a range of higher video resolutions and refresh rates including 8K@60 HZ and 4K@120HZ. Dynamic HDR formats are also supported, and bandwidth capability is increased up to 48Gbps.

Cable Samples	Connector Certification	Cable assembly certification
Available	Available	Available

The certified cable length is 2 meter

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Highlight

Cable assembly passed HDMI committee certification, bandwidth is 48Gbps with 12Gbps/pair, support 8K@60Hz resolution display, the cable assembly are fully shielded.

- Certified by HDMI committee, the certified cable length is 2m
- 12Gbps/channel, total bandwidth is 48Gbps
- Physical interface compatible with HDMI2.0 and HDMI1.4
- Support high resolution 8K@ 60Hz
- Fully shielded connector

HDMI Technology Roadmap

Spec release date	2005	2006	2009	2013	2017

HDMI Spec. Rev.	1.0–1.2	1.3	1.4	2.0	2.1
Max signal each lane bandwidth (Gbps)	1.65	3.4	3.4	6	12
Max signal total bandwidth (Gbps)	4.95	10.2	10.2	18	48
Max resolution	1920 X 1080 60 Hz 1080P	2560 X 1600 75Hz	3840 X 2160 30 Hz 4K	3840 X 2160 60 Hz 4K	7680 X 4320p 60Hz, 8K

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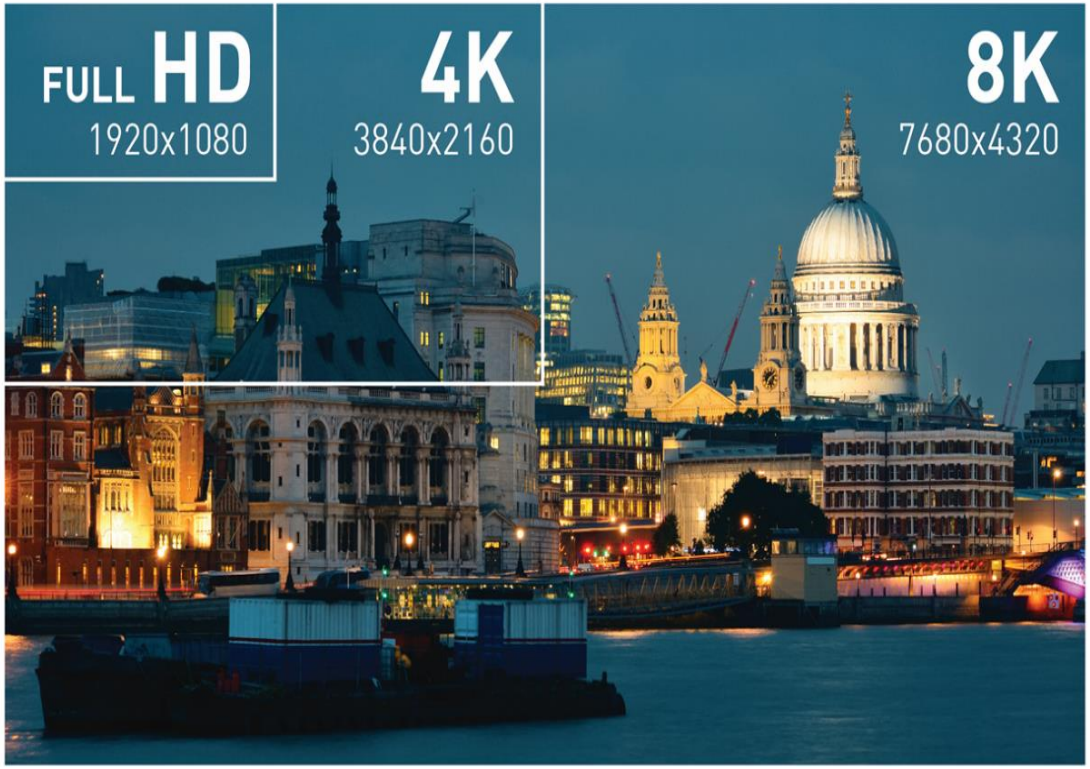
HDMI2.1

Application

- ✓ Higher Resolutions
- ✓ Faster Refresh rates
- ✓ Dynamic HDR
- ✓ eARC



- ✓ 8K60
- ✓ 8K delivers a super-immersive viewing experience
- ✓ 60Hz enables smooth and sharp viewing of content with high-speed action

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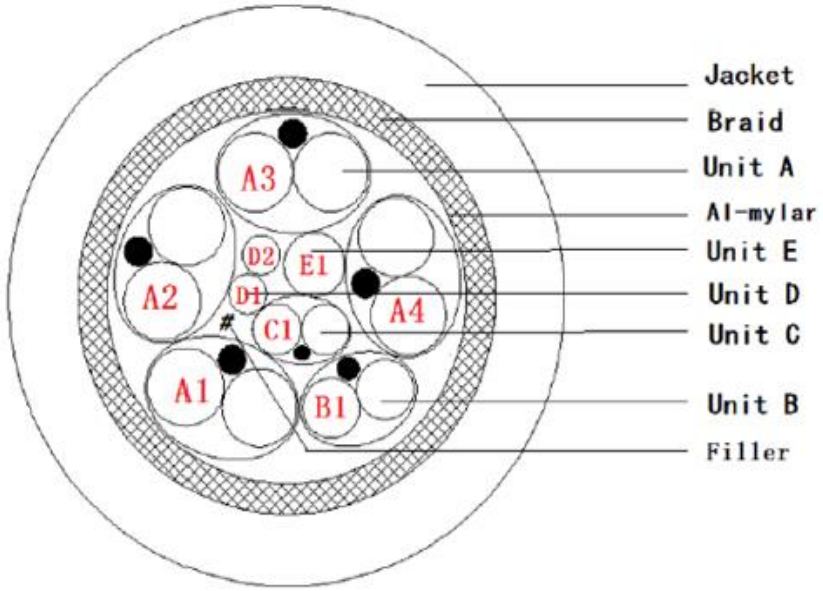
HDMI 2.1 Cable Assembly

Cable cross section



Colour code:

Unit A:
A1:White&Brwon
A2:White&Red
A3:White&Orange
A4:White&Blue

Unit D:
D1.Gray D2.White

Unit E:
E1. Red

Unit B:
B1:White&Green

Unit C:
C1.Green&Orange

4pairs 30awg for high speed signal transimission
1pair 32awg for SCL&SDA
1pair 34awg for reserve and hot plug detect
1C 28awg for power
2C control signal

HDMI2.1 compatible to both
Coaxial cable and twisted pair cable

Bend Radius	2.5x cable OD
Cable Dimensions 100Ω	Jacket OD : 6.0+/-0.2MM

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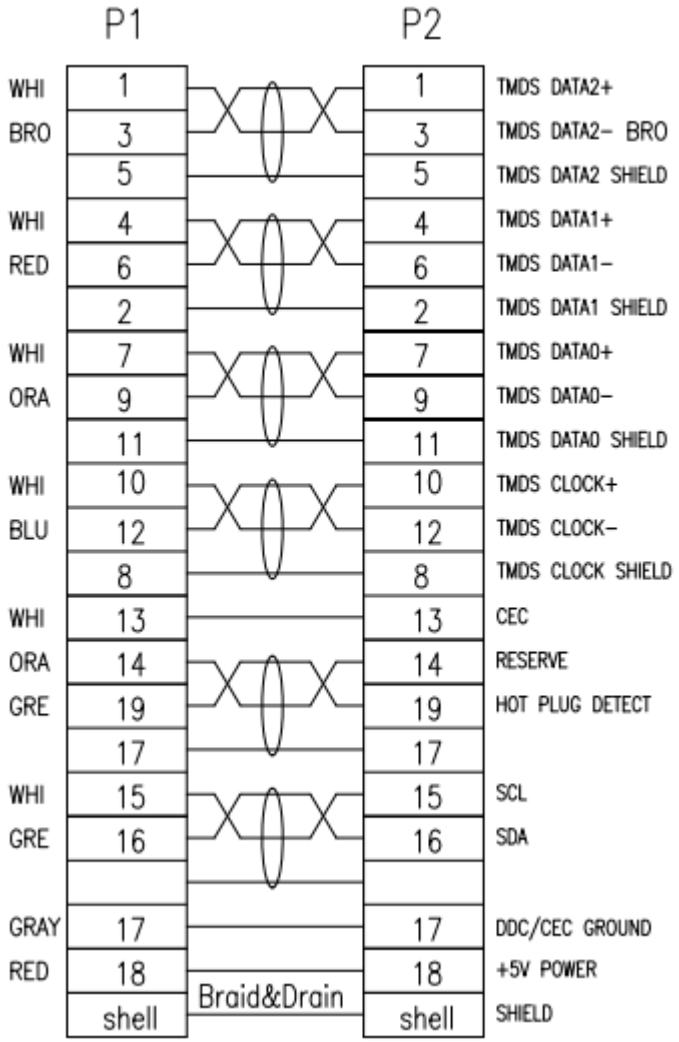
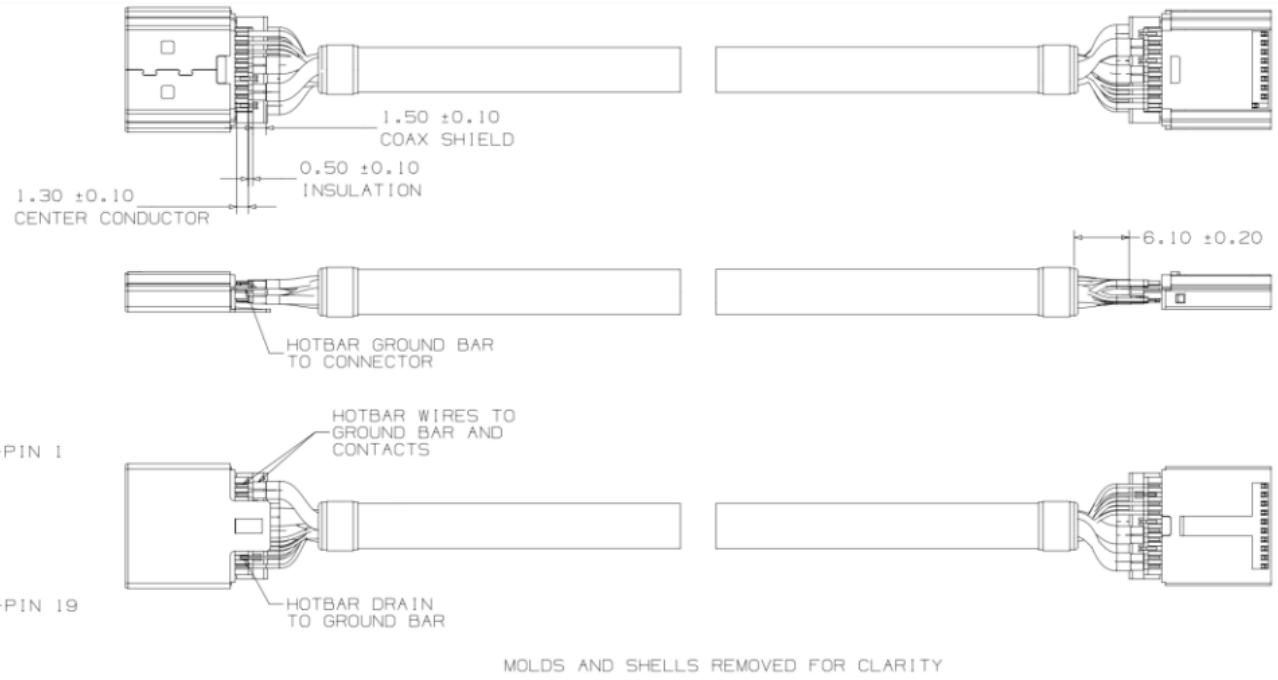
HDMI 2.1 Cable Assembly

Typical wire diagram





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HDMI 2.1 Cable Assembly

Mechanical reliability test

Vibration test

Item	Test Condition	Requirement	
Vibration	Amplitude : 1.52mm P-P or 147m/s^2 {15G} Sweep time: 50-2000-50Hz in 20 minutes. Duration : 12 times in each (total of 36 Times) X, Y, Z axes. Electrical load : DC100mA current shall be Flowed during the test. (ANSI/EIA-364-28 Condition III)	Appearance	No Damage
		Contact Resistance	Contact : Change from initial value: 30 milliohms maximum. Shell Part : Change from initial value: 50 milliohms maximum.
		Discontinuity	1 μsec maximum.

Cable pull-out test

Cable Pull-Out	Axial load to the cable for 1 minute. (ANSI/EIA-364-38c)	Discontinuity	Type D: 40N minimum

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Mechanical reliability test

Mechanical shock test

Shock	Pulse width: 11 msec., Waveform : half sine, 490m/s^2{50G}, 3 strokes in each X.Y.Z. axes (ANSI/EIA-364-27, Condition A)	Appearance	No Damage
		Contact Resistance	Contact : Change from initial value: 30 milliohms maximum. Shell : Change from initial value: 50 milliohms maximum.
		Discontinuity	1 μsec maximum.

HDMI 2.1 Cable Assembly

Mechanical reliability test

Mechanical durability test

Durability	Measure contact and shell resistance after Following. Automatic cycling : Type A: 10,000 cycles at 100 ± 50 cycles per hour Type C and Type D: 5,000 cycles at 100 ± 50 cycles per hour	Contact Resistance	Contact : Change from initial value: 30 milliohms maximum. Shell : Change from initial value: 50 milliohms maximum.

Wrenching test

Wrenching strength	Mated connectors, apply perpendicular forces to plug at a 15 mm distance from the edge of the receptacle covered by test fixture. Perform this test using virgin parts. Forces are to 4 directions (left, right, up, down).	appearance	Type D: 0-20N: No plug or receptacle damage. 20-40N: No receptacle damage.

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Mechanical reliability test

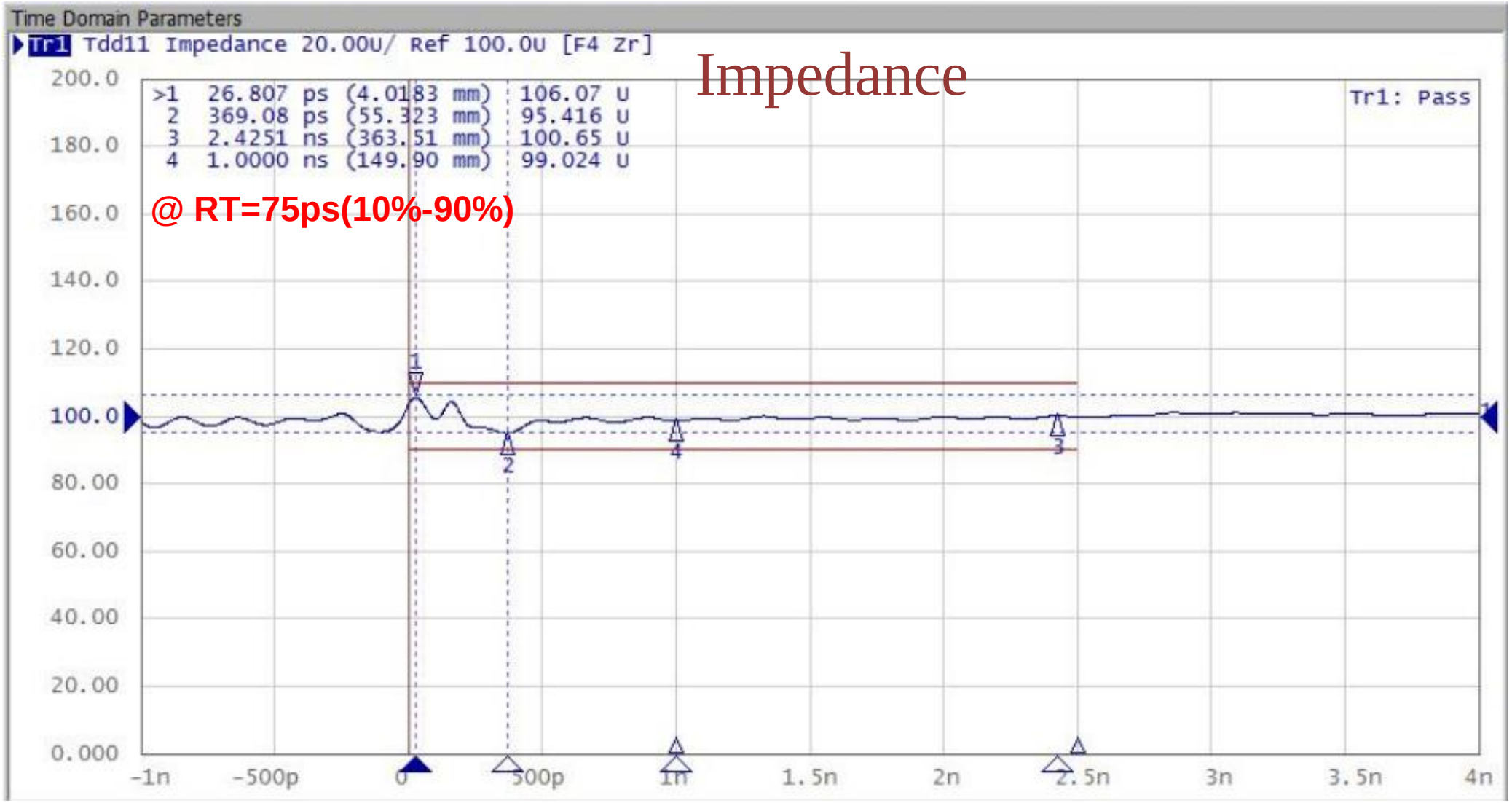
Mechanical mating force and unmating force test

Insertion / Withdrawal Force	Insertion and withdrawal speed : 25mm/minute. (ANSI/EIA-364-13)	Withdrawal force	Type A: 9.8N {1.0kgf} minimum 39.2N {4.0kgf} maximum Type C: 7N minimum 25N maximum Type D: 5N minimum 25N maximum and after 5,000 cycles mating, 3N minimum 25N maximum
		Insertion force	44.1N {4.5kgf} maximum

HDMI 2.1 Cable Assembly

SI performance

Measured data based on 30awg 2meter cable, straight plug to straight plug. spec is HDMI2.1 section 5 (used category3 cable, and downward compatible with Category 1&2)



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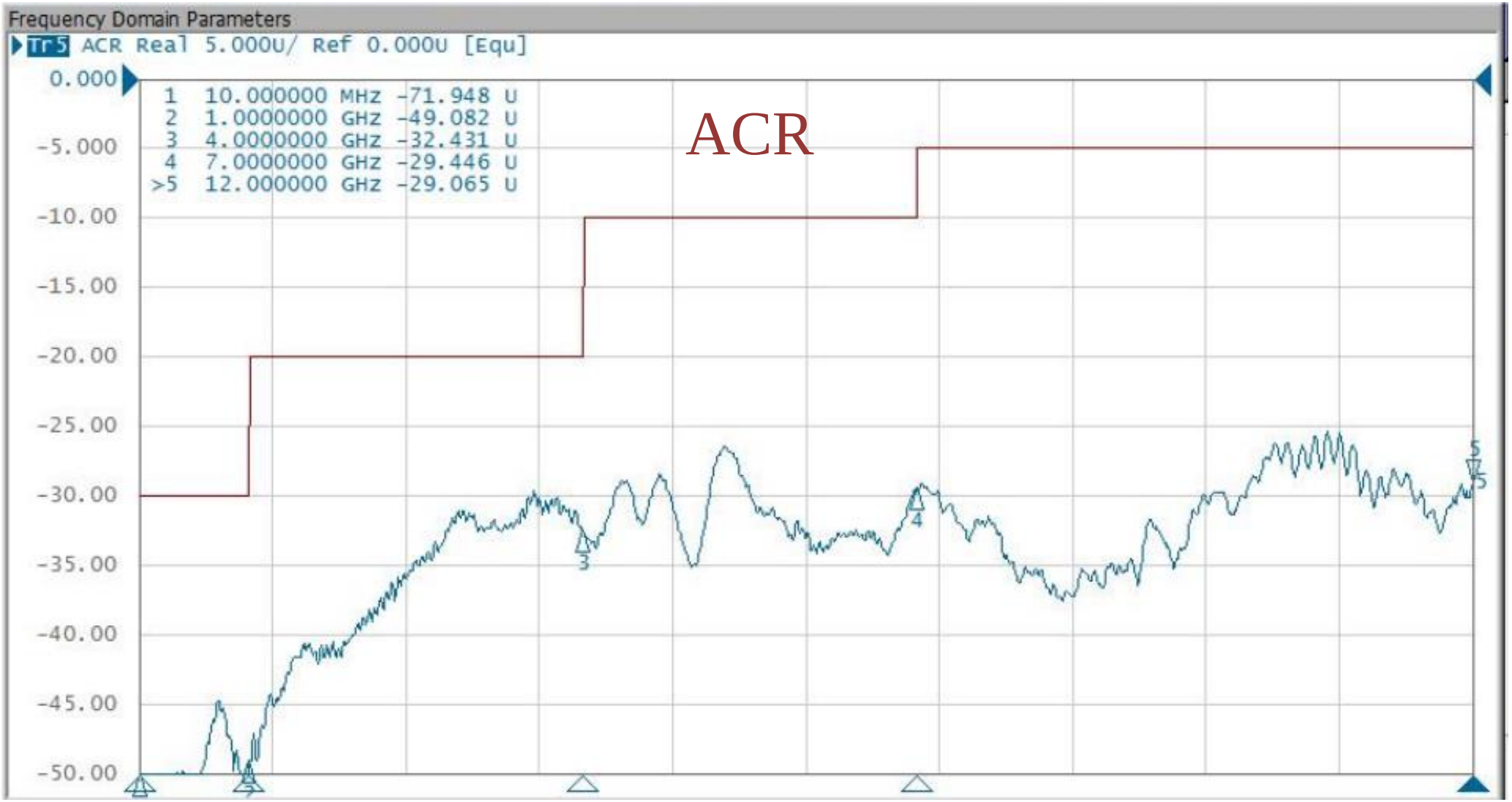

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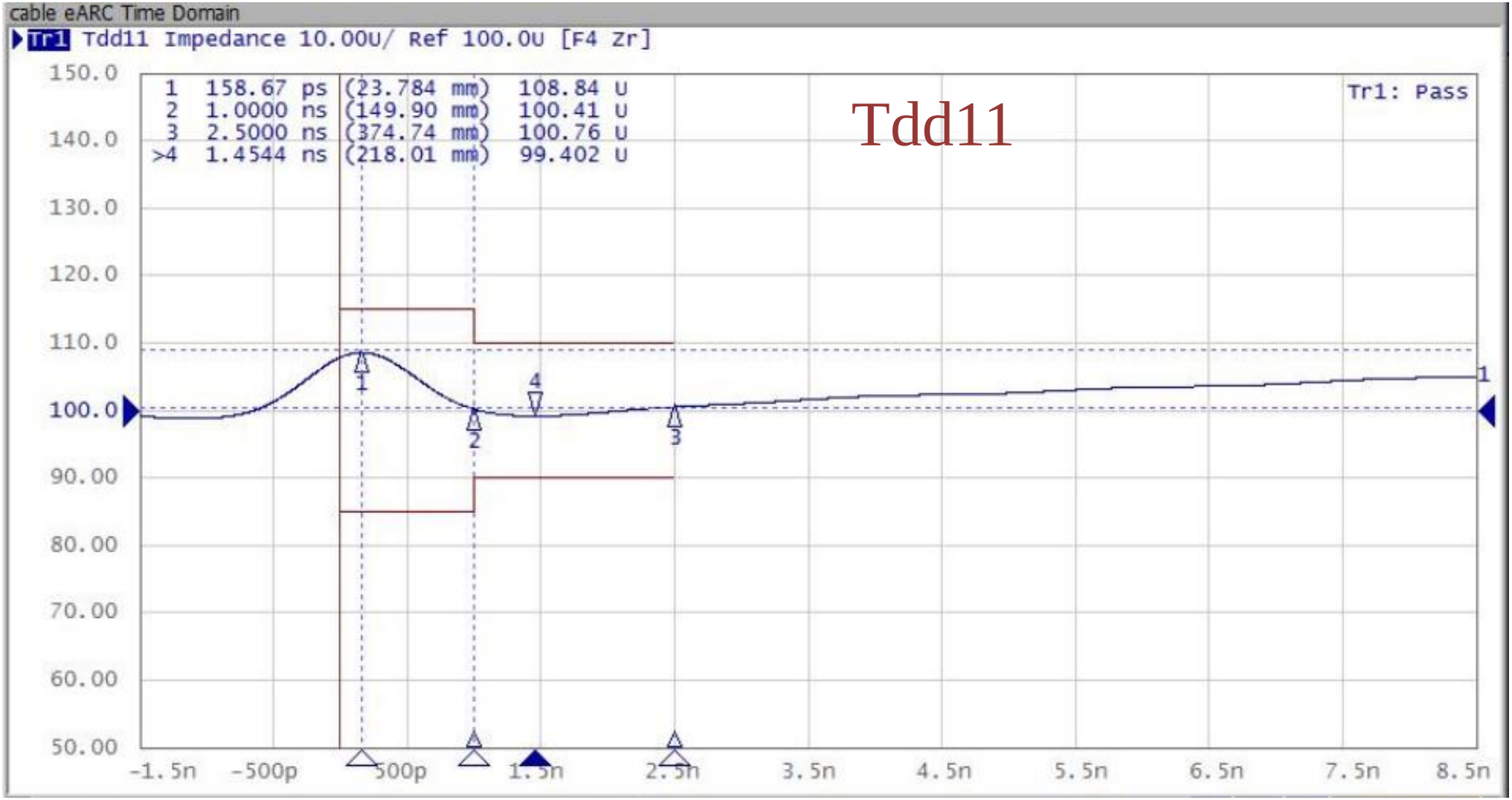

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SI performance based

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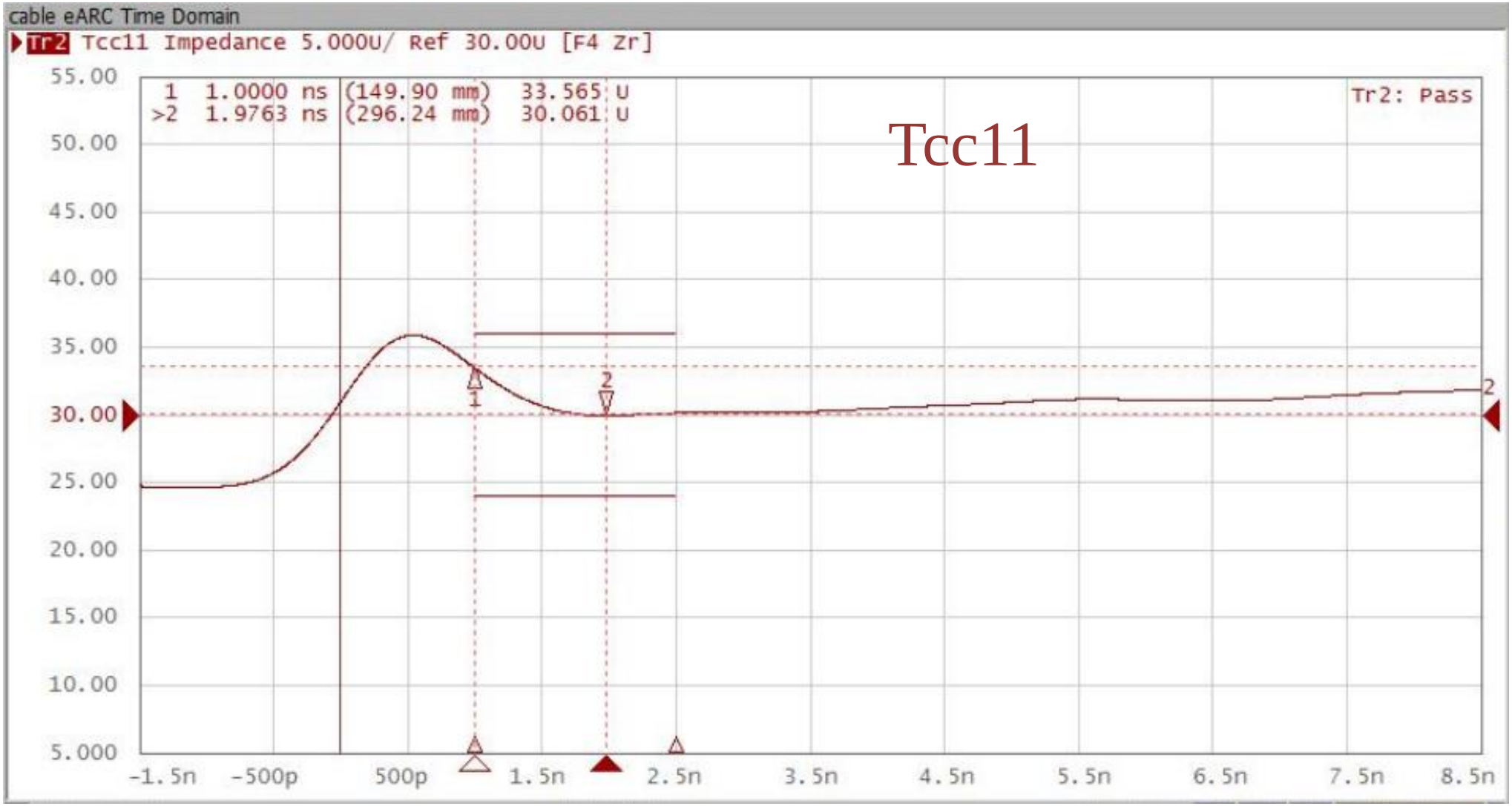

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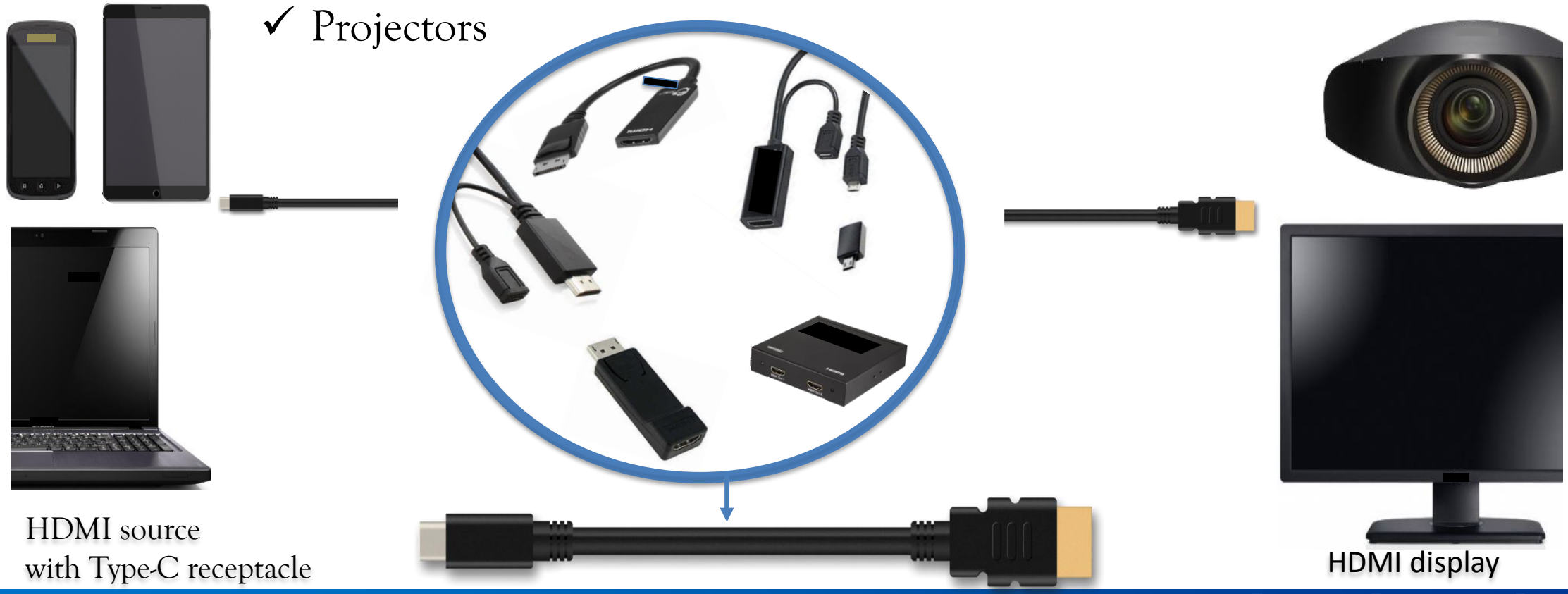
HDMI Alt mode on Type C

HDMI Alt Mode on Type-C

Applications

- ✓ Mobile devices including Mobile phone, tablets and notebook
- ✓ Digital TVs
- ✓ Monitors
- ✓ Multimedia players
- ✓ Projectors



HDMI source
with Type-C receptacle

HDMI display

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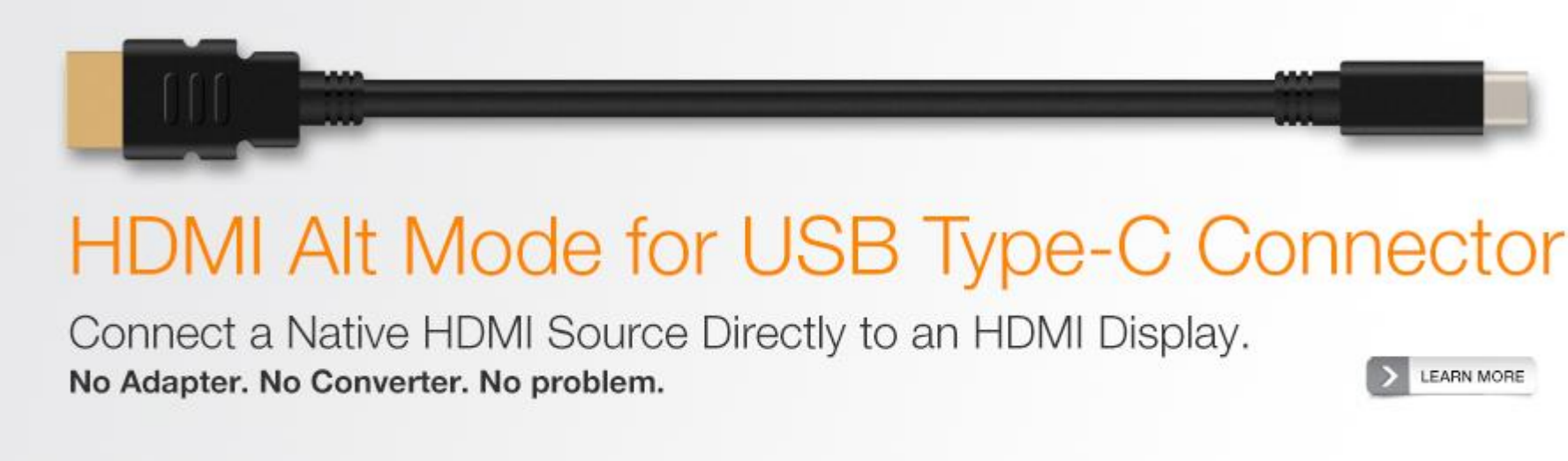
HDMI Alt Mode on Type-C

The HDMI Alt Mode for USB Type-C connector will allow HDMI-enabled source devices to utilize a USB Type-C connector to directly connect to HDMI-enabled displays, and deliver native HDMI signals over a simple cable without the need for protocol and connector adapters or dongles.



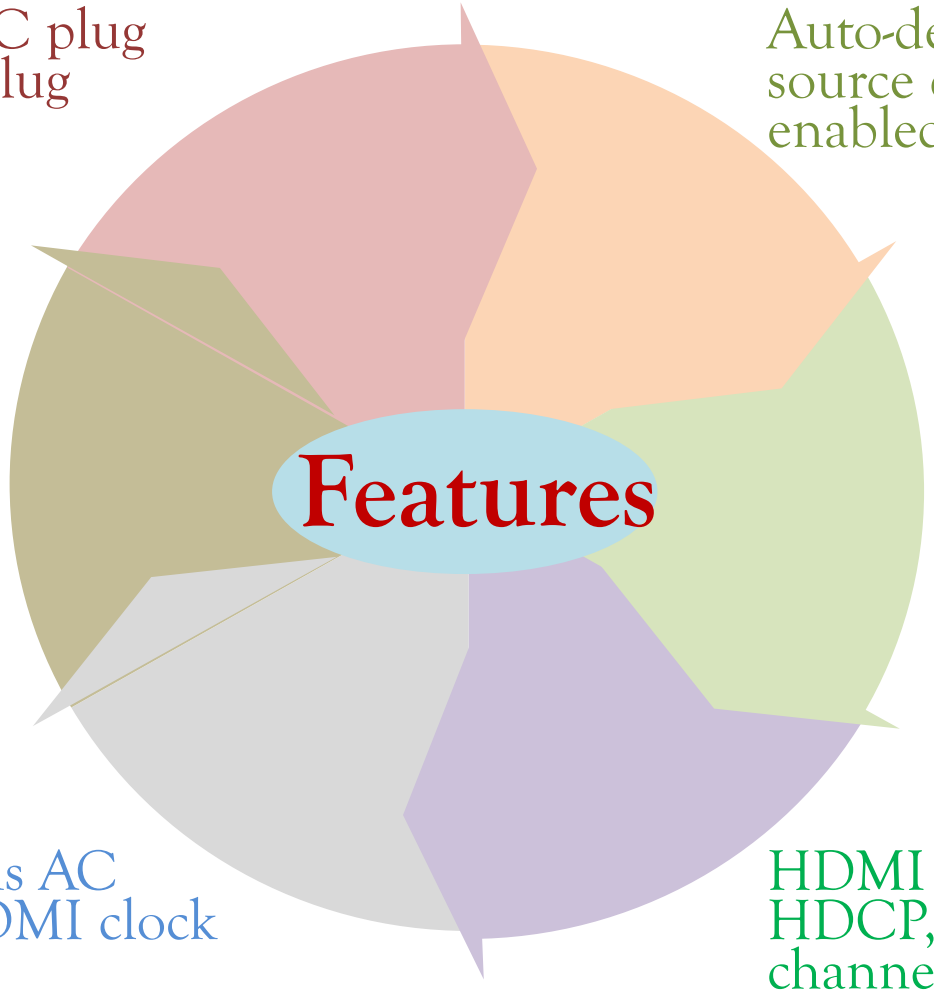
Status: sample available, passed HDMI certification

HDMI Alt Mode on Type-C

Standard USB Type-C plug and HDMI Type-A plug

Auto-detects HDMI Alt Mode source devices and HDMI-enabled displays

30-34AWG raw cable is optional



Support all HDMI 1.4b features

Source output is AC coupled for HDMI clock and data lanes

HDMI Ethernet Channel and HDCP, Audio return channel(ARC) and consumer electronic control(CEC)

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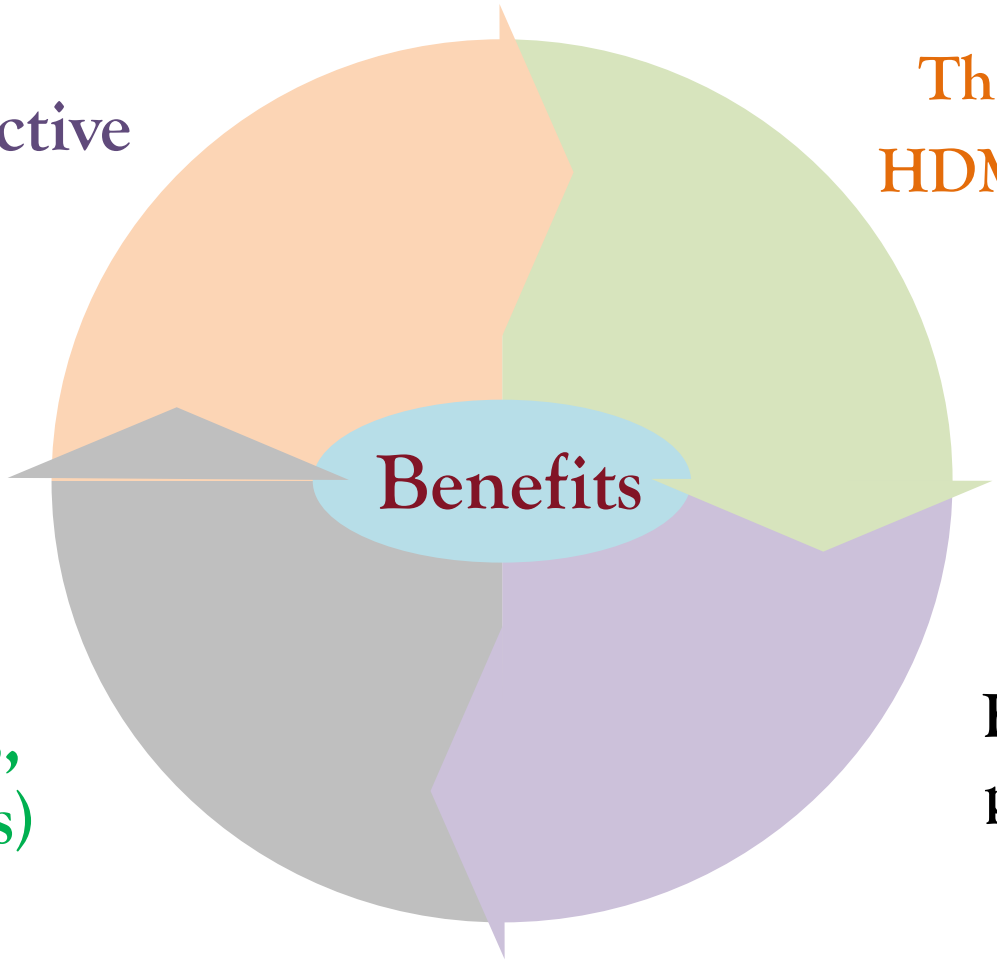
HDMI Alt Mode on Type-C



Cost effective

The 1st batch certified HDMI Alt Mode product

Easy to use (No adapters, no converters)

Excellent SI and EMI performance support high resolution

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HDMI Alt Mode on Type-C

Certificate and Test Report (2m cable assembly)

CONFIRMATION OF

HDMI® ATC TESTING

This Tested Product identified below has successfully completed testing at the HDMI® Authorized Test Center in accordance with the HDMI® Compliance Test Specification listed below.

ADOPTER

Name: Lino Liu
Company name: AMPHENOL CORPORATION

Company address:

Street 39-B QianPu Industrial Estate,

City, Xiamen/Fujian
State/Province
Country China
Postal code 361009
Telephone: 86-593 7316; Ext 5216
Fax: 86-592-5931111
Email: Lino.liu@amphenol-ast.com

TESTED PRODUCT

Category: Cable
Product Type: USB Type-C HDMI Alt Mode Cable Adaptor
Product Brand Name: Amphenol

Model: USB Type-C TO HDMI Alt mode cable assembly (2m/34AWG)

Family model(s) of tested product (supplied by Adopter, not tested)
Number of model(s) included in the family:
Family model(s): No family defined

TEST CONFIRMATION

Date of issue: June 21st,2017
Test center: Simplay Labs - Shanghai

Test Specification: 1.4b
Confirmed by: Dat.Tran.

Notes:

1. The information in this document is subject to the HDMI® Specification Adopter Agreement.
2. This confirmation document does not guarantee the quality or functionality of any product, compliance with any specification, or interoperability with other HDMI® products. Adopter is solely responsible for the quality, functionality, interoperability and specification conformance of Adopter's products.
5. This confirmation is based upon the information Adopter has supplied and Adopter's representation that the products listed under "Family Model Number(s)" have the same hardware and software as the Tested Product and would successfully pass the entire HDMI® Compliance test.

HDMI
HIGH-DEFINITION MULTIMEDIA INTERFACE

Confirmation # :
308021

HDMI certification report

Please double click the report for detail

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HDMI A, C and D Type Solution

Configuration

- ✓ HDMI A Type to A Type
- ✓ HDMI A Type to C Type
- ✓ HDMI A Type to D Type
- ✓ Screw lock HDMI A Type to A Type
- ✓ Long HDMI Cable(>5M)

HDMI A type to D type
(D Type: Micro HDMI)

HDMI A type to D type
(D Type: Micro HDMI)

HDMI A type to C Type
(C Type: Mini HDMI)

Long HDMI cable

HDMI with lock

HDMI with retail sales design

HDMI AOC Hybrid cable

HDMI AOC hybrid cable support long distance high definition video transmission through optical fiber, copper wires are integrated to supply power to device chipset module for HDMI AOC hybrid cable solution.

- ✓ Copper cable with EQ: OD is10mm, support 4K*2K @60Hz at 19meter Max.
- ✓ AOC cable with O/E: OD is 4.5mm, support 4K*2K @60Hz at 100meter Max.

Note: the pictures are only for reference.

HDMI AOC

HDMI AOC Hybrid cable

Applications

- ✓ Digital Signage
- ✓ LED signboards in streets and in stadiums
- ✓ Medical Imaging Equipment
- ✓ Airplane On-board Video System
- ✓ Projector
- ✓ Blue-ray, 3D video, Set-up box
- ✓ DVR, Game Consoles and Computer
- ✓ TV Broadcast Station
- ✓ Conference Room Video Equipment
- ✓ Security systems

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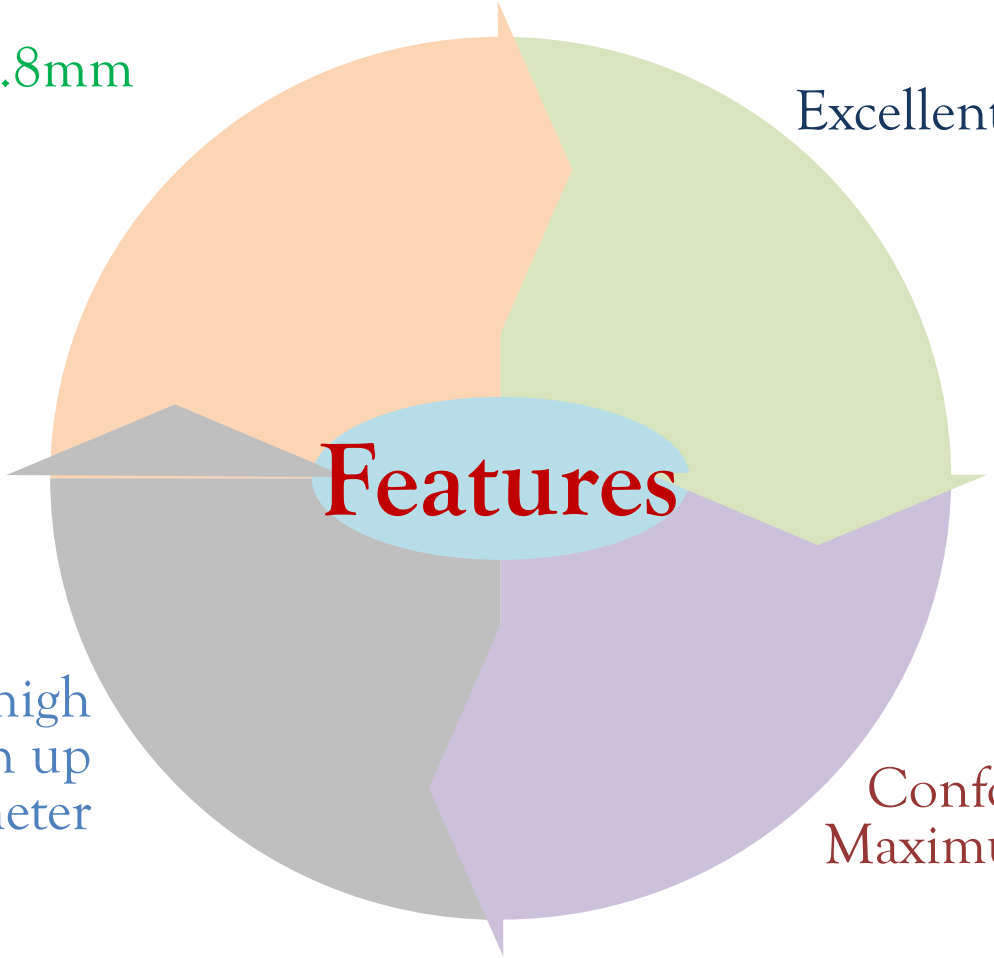
HDMI Alt Mode on Type-C

Cable OD is 4.8mm

Excellent EMI/EMC performance



Support long distant high speed signal transmission up to 150 meter

Conform to HDMI 2.0 spec Maximum support 4K@60HZ resolution

Amphenol

Internal Thunderbolt 3(TBT3)

Internal Thunderbolt 3(TBT3)

Mechanical Requirements

- ✓ Insertion and extraction force: 14.55N max. for 30pin
- ✓ Durability: 30 cycles
- ✓ Cable retention force: 14.7N min. for 30pin

Electrical Requirements

- ✓ Contact resistance≤ 275mΩ max. for 36AWG
- ✓ Insulation resistance: 1000 Mohm at 250V DC
- ✓ Withstand voltage: 250V AC
- ✓ SI performance fully compliant to Intel Internal Thunderbolt Interconnect Specification

Environment Requirements

- ✓ High temperature: 250 hours for 85 °C
- ✓ Thermal shock: -55 °C to 85 °C, 5 cycles
- ✓ Humidity: 90-95%RH, 40+/-2 °C, 240 hours
- ✓ Salt spray: 48 hours

Internal Thunderbolt 3 (TBT3)

30(signal) and
40(signal + power)

36AWG micro-coaxial signal cable and 30AWG power wire are typical

Pitch0.5mm
,
max24 pin

Features

Active latch

Mated height: 1.1mm

EMI shielding

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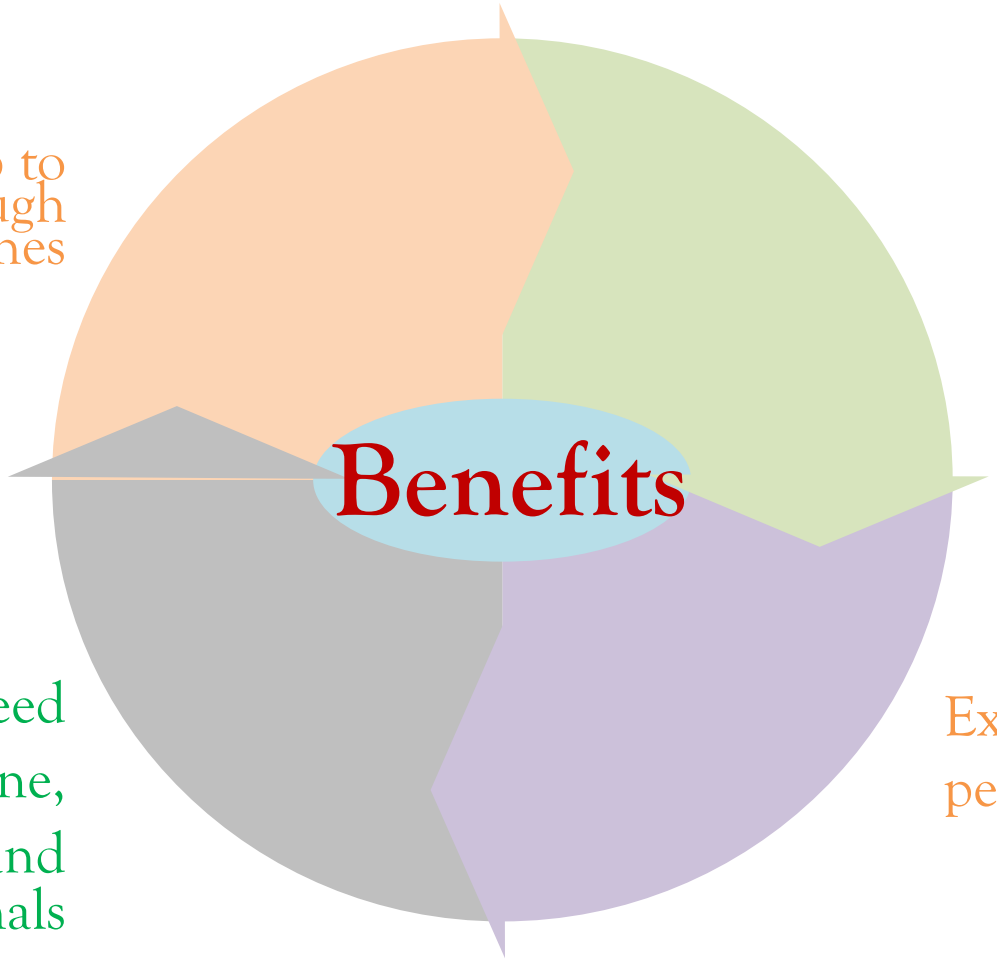
Internal Thunderbolt 3 (TBT3)



Speed up to 40Gbps through two lanes

Amphenol AST is Contributor inIntel Internal Thunderbolt 3 Spec

High speed TBT3 20Gbps/lane, USB 3.1 10 Gbps and DisplayPort signals

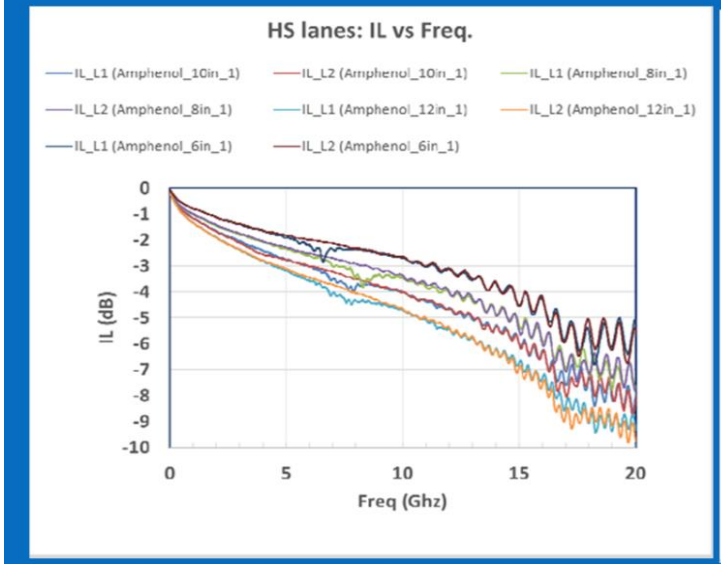
Excellent SI performance

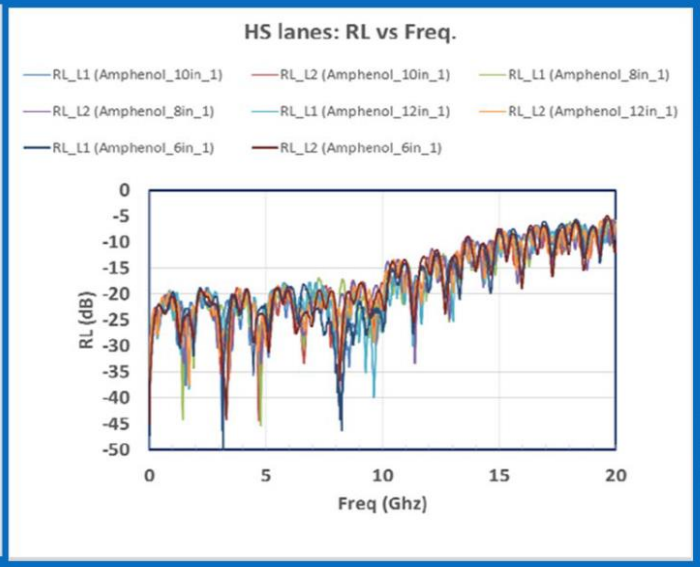
Amphenol

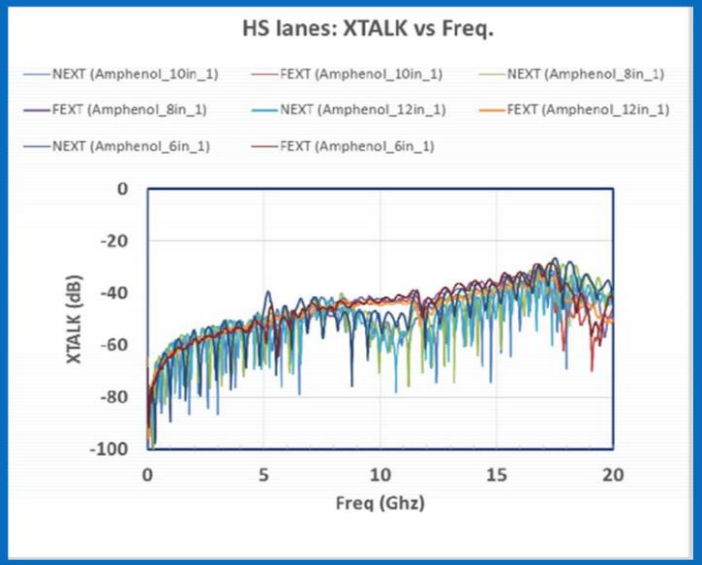
Internal Thunderbolt 3(TBT3)

SI test report for 10 inches cable assembly

Testing Results – Amphenol cable (36 AWG Wire)







IL

RL

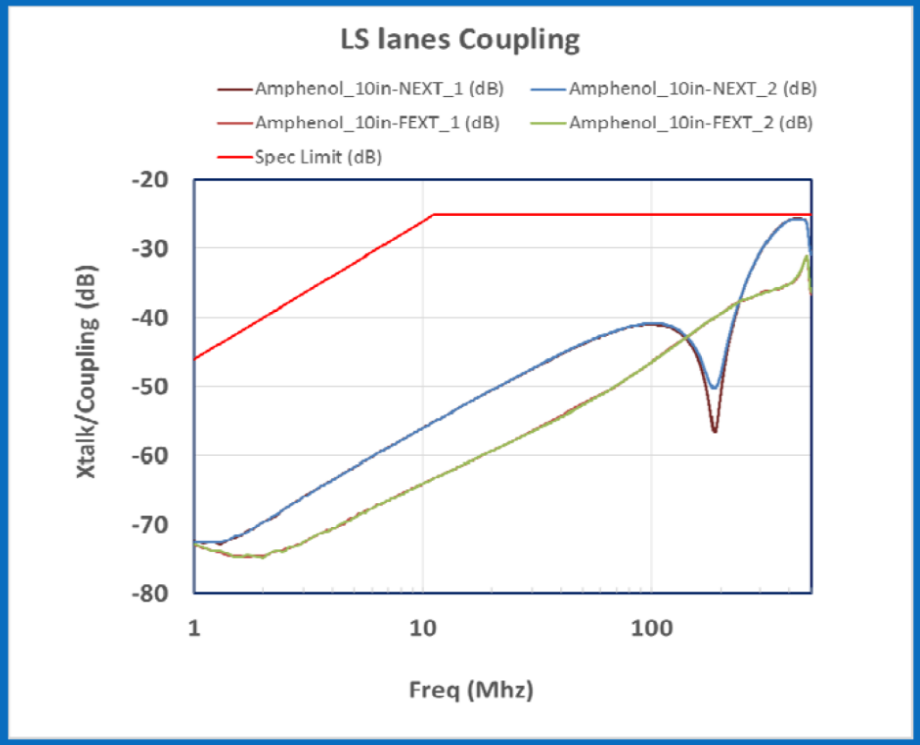
Xtalk

Amphenol

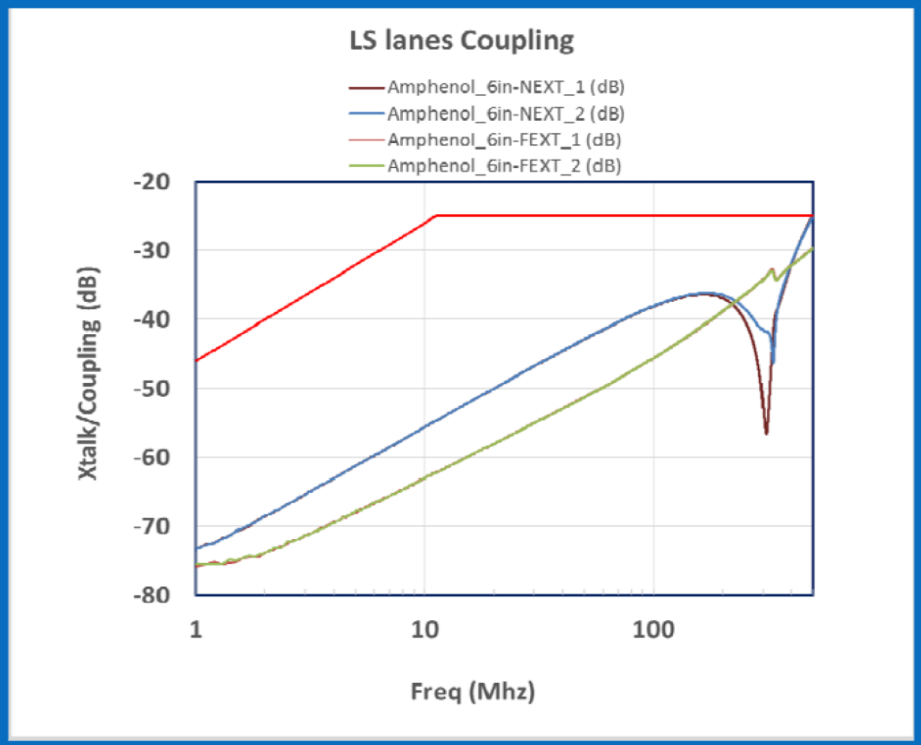
Internal Thunderbolt 3(TBT3)

SI test report for 10 inches cable assembly

Testing Results – Amphenol cable (36 AWG Wire)



Low Speed Signal Coupling 10 inch



Low Speed Signal Coupling 6 inch

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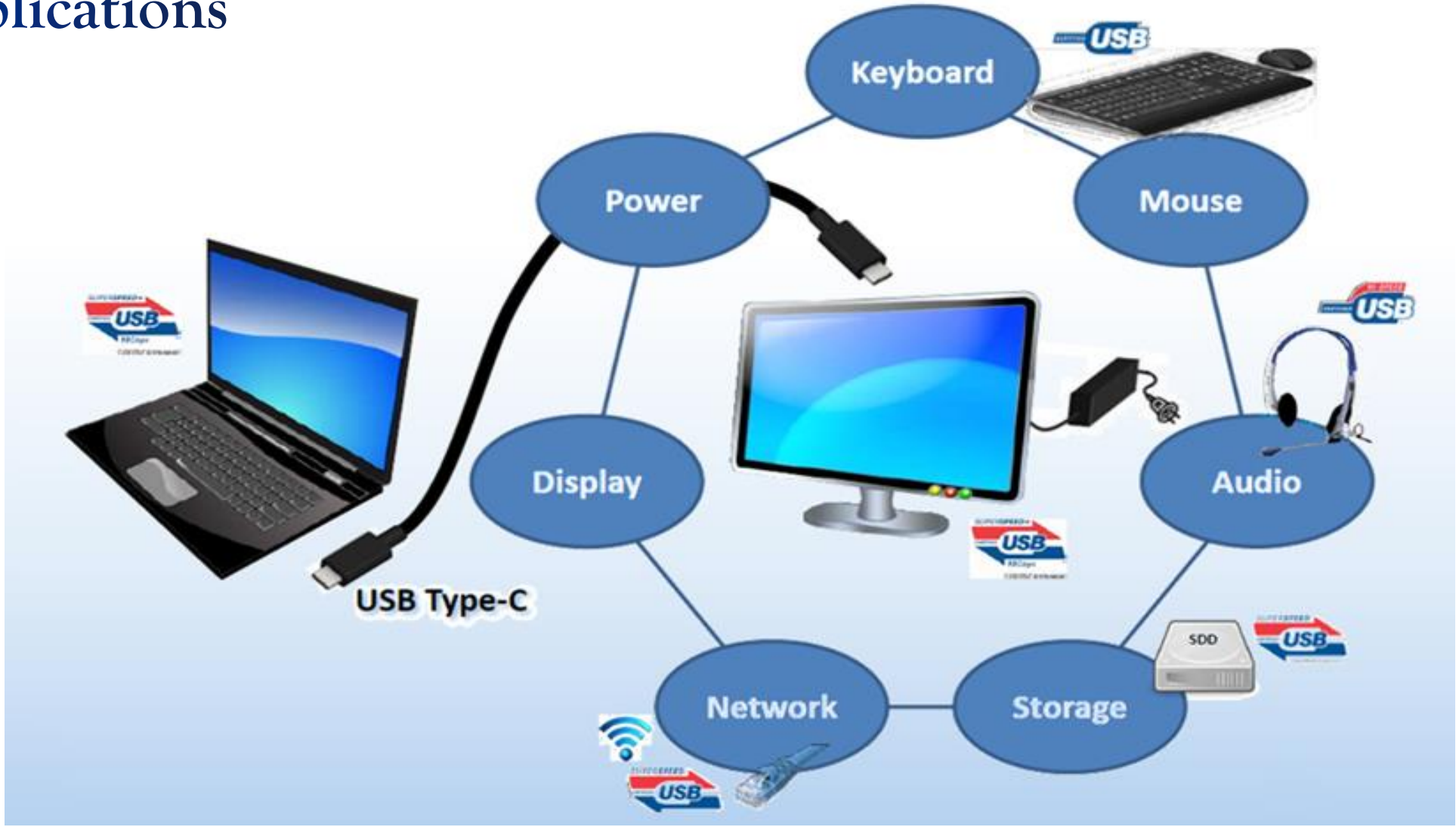
USB Type C

Type-C

Applications



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Type-C Cable Configuration

1. Full-featured Type-C to Full-featured Type-C cable assembly

- ✓ Support 5G&10G/lane data transmission
- ✓ Support 3A&5A current rating with E-Mark chipset
- ✓ Coaxial or Twisted cable for super speed signals

2. USB2.0 Type-C to Type-C cable assembly

- ✓ Support USB2.0 data transmission
- ✓ Support 3A current rating with E-Mark chipset optional
- ✓ Support 5A current rating with E-Mark chipset
- ✓ Twisted cable for USB2.0 signals

3. Power only cable assembly

- ✓ Not support data transmission
- ✓ Support 3A current rating with E-Mark chipset optional
- ✓ Support 5A current rating with E-Mark chipset

Type-C Cable Configuration

1. Full-featured Type-C to Type-C cable assembly

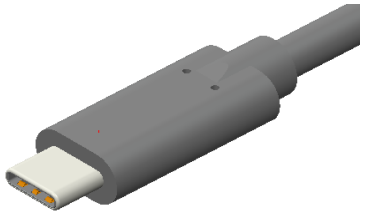
Cable: 36AWG ~ 30AWG, PVC or TPE Jacket ,OD 3.7 ~ 4.8, 85% braid coverage
EMI Shielding: Sheet metal embedded

2. USB2.0 Type-C to Type-C cable assembly

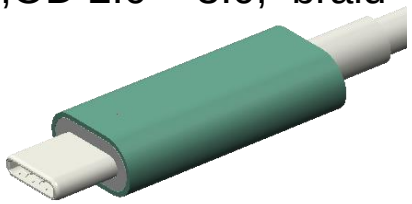
Cable: 32AWG ~ 30AWG, PVC or TPE Jacket ,OD 3.0 ~ 3.5, 60% braid coverage
EMI Shielding: Sheet metal embedded

3. Power only cable assembly

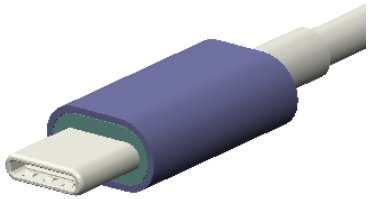
Cable: 26AWG ~ 22AWG, PVC or TPE Jacket ,OD 2.0 ~ 3.0, braid coverage



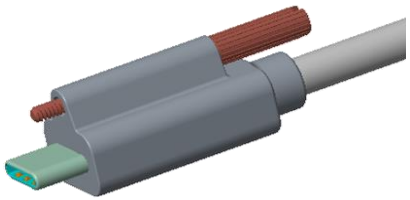
Over-molding



High Cosmetic

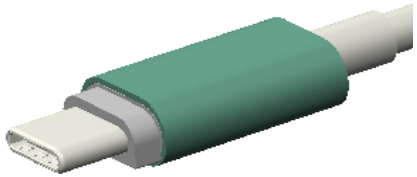


High Cosmetic



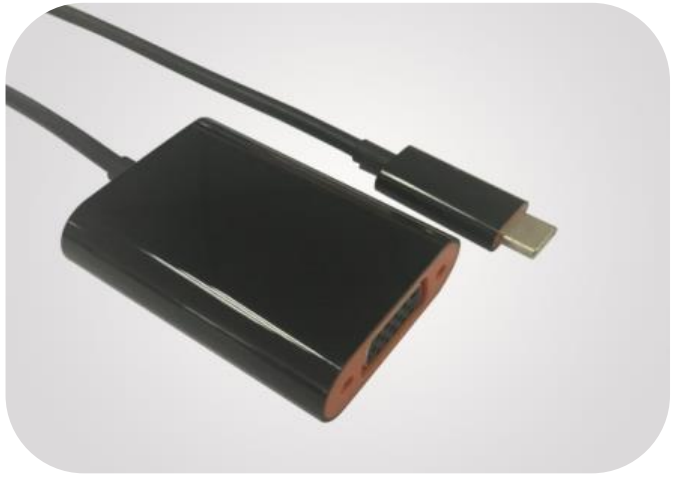
Over-molding with 1 screw

Over-molding with 2 screws



Customized

Type-C to Dongle



Type-C to VGA

Type-C to HDMI Female

Type-C plug to DP receptacle
(4k x 2k resolution)

Type-C to
RJ45(Ethernet)

Type-C to RJ45 +
2 USB3.0 Female Hub

Type-C Dongles

Typical Type-C Dongles(To be customized for EMI shielding)

USB3.1 Type C to 2*USB3.0+
2*USB2.0+PD+RJ45 Hub Adapter

USB3.1 Type C to 2*USB3.0+
PD Hub Adapter

Type-C to Type-C+HDMI+VGA-
I+RJ45+USB3.0 receptacle Adapter

Type C / USB3.0 A M to
Cfast2.0+ SD3.0+TF3.0

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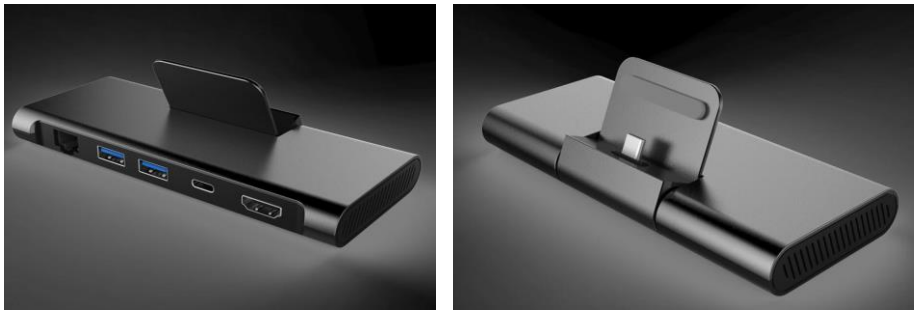
Type-C Dongles

Typical Type-C Dongles(To be customized for EMI shielding)

Type-C, USB3.0 and HDMI



Type-C, USB3.0, HDMI and RJ45

Type-C to HDMI+RJ45 +
2* USB3.0+SD+PD docking

Type-C to VGA+HDMI+DP+
2* USB3.0+2*Type-C docking

Type-C to HDMI+VGA+RJ45 +
2* USB3.0+SD+Audio+PD docking

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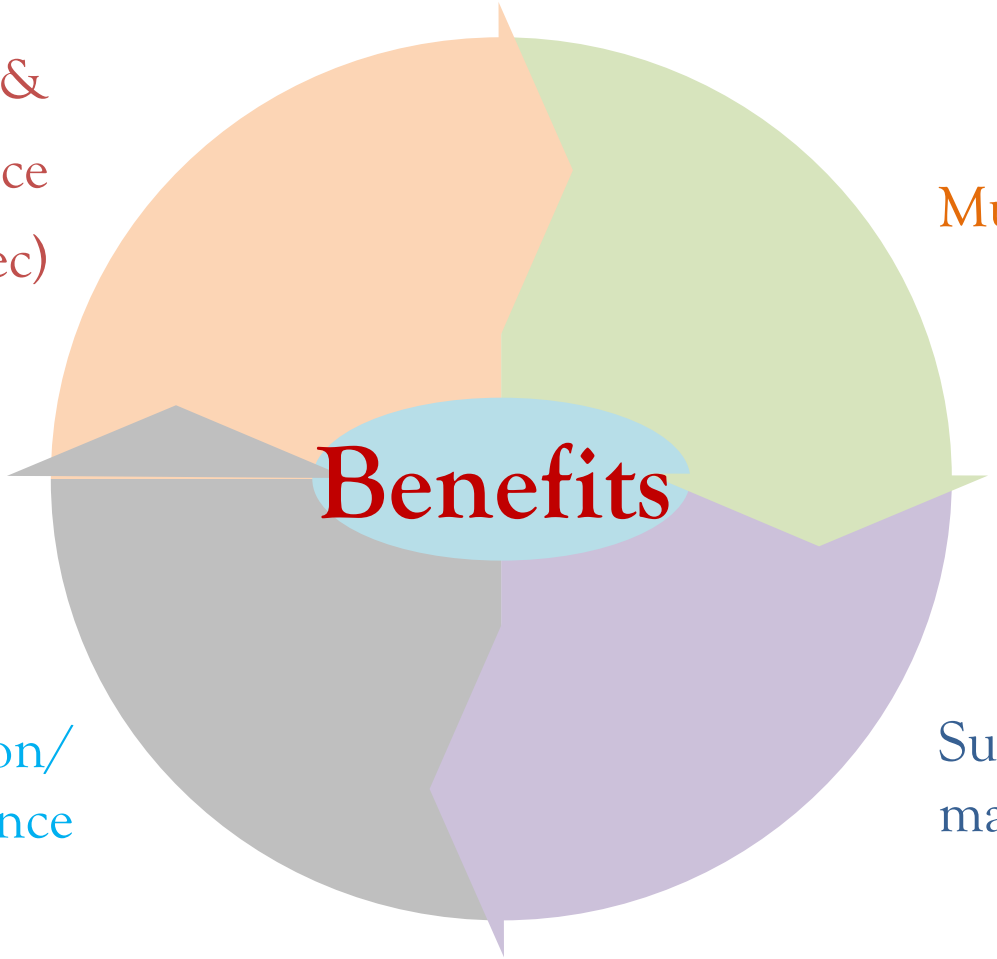
Type-C

Good SI, EMI & mechanic performance (USB3.1 Gen2 Spec)

Multiple cables and dongles



USB certification/ engineering experience

Support 20Gbps, 5A max and 100W

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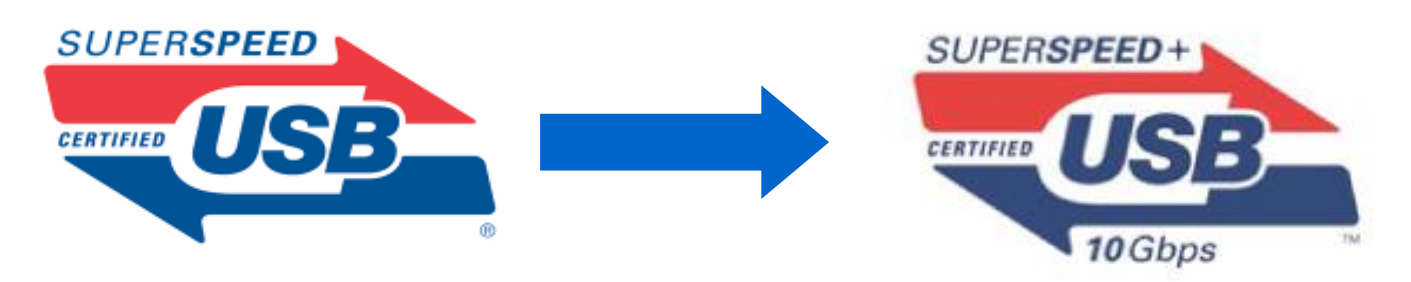
USB 3.1

USB 3.1

The SuperSpeed USB 10Gbps (USB 3.1) cable assembly is a higher speed and power solution that deliver more than twice the effective data through-put performance of existing SuperSpeed USB over enhanced, fully backward compatible USB connectors and cables.

- ✓ Delivers 10 Gbps USB data rate, twice SuperSpeed USB 5 Gbps data rate
- ✓ Improved data encoding for more efficient data
- ✓ Compatible with USB 3.0 software stacks and device protocols
- ✓ Backward compatible with both USB3.0 and USB 2.0 products



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Configuration

USB3.1 Standard-A

USB3.1 Standard-B

USB 3.1 Micro-B over-mold

USB3.1 Standard Cable Assemblies
USB3.1 Standard A plug to Standard B Plug
USB3.1 Standard A plug to Micro B Plug
USB3.1 Standard A plug to Standard A plug

Internal USB3.1

Internal USB Technology Roadmap

Release date	Before 2010	2010 Aug	2017 Jan
Intel internal USB Spec.	**2.0**	**3.0**	**3.1**
Connector pitch	2.54	2.0	0.8
Connector pin no.	1x5 and 2x5	2x10	2x10 and 2x20
USB2.0 signal pairs	1 and 2	2	1 or 2 and 2
USB3.0 signal pairs	No	4	4(20pin), 8(40pin)
Power pins	1 and 2	2	3(20pin), 6(40pin)
Total Current (A)	0.5 and 1	3	3(20pin), 6(40pin)
Signal speed (Gbps/lane)	0.48	5	10

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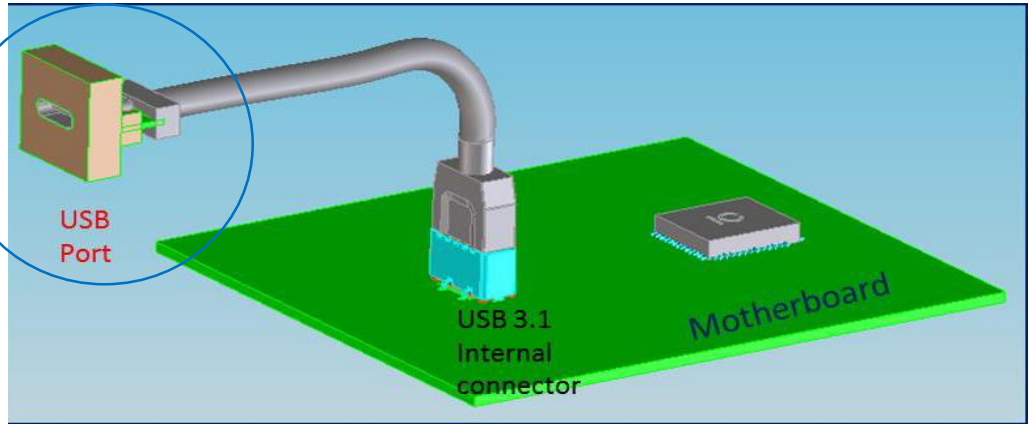
Internal USB3.1

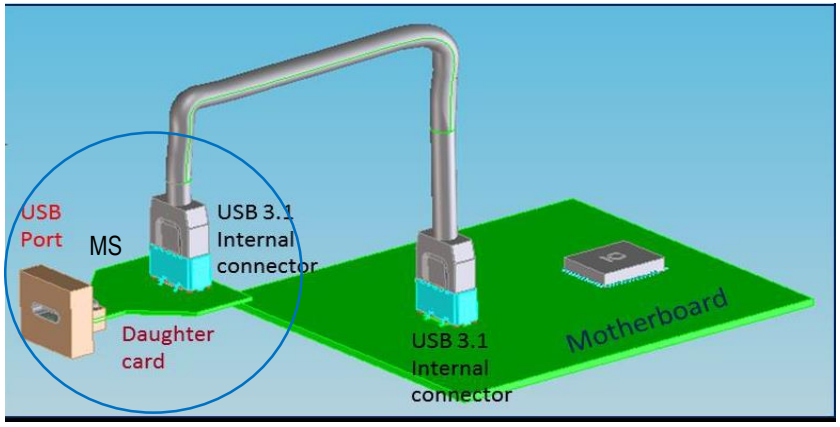
Desktop PC's usually have USB ports on the front-panel of the enclosure and internal cable assemblies are typically used to connect the external USB ports on the front panel to the motherboard.

Applications

Desktop, workstation and server



Direct connect to USB port
(picture is only for reference)

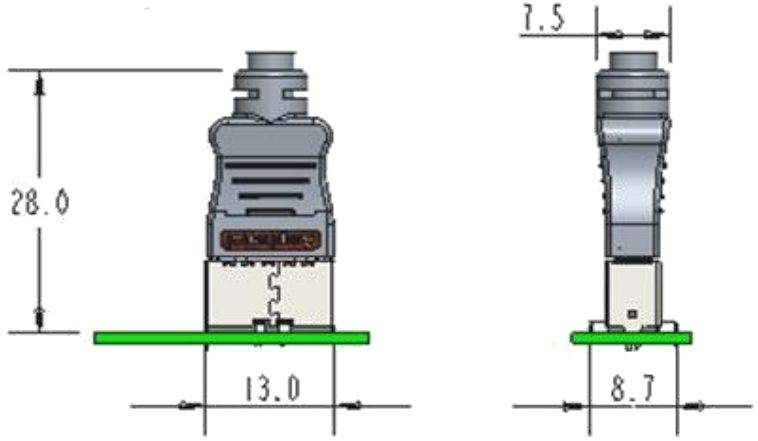


Through a daughter card
(picture is only for reference)

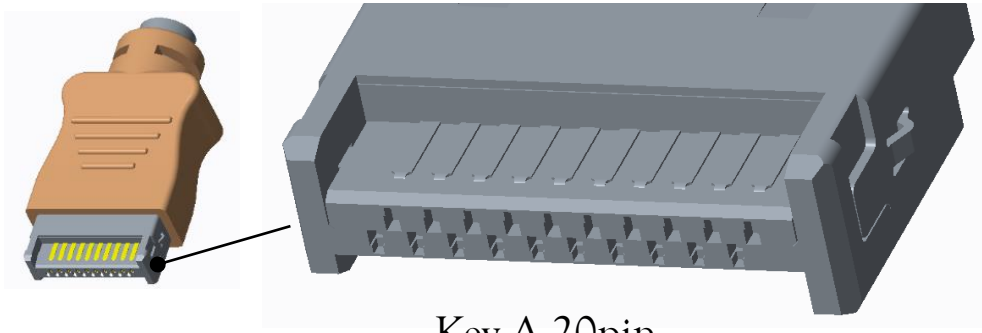
Internal USB3.1

Connector Configuration

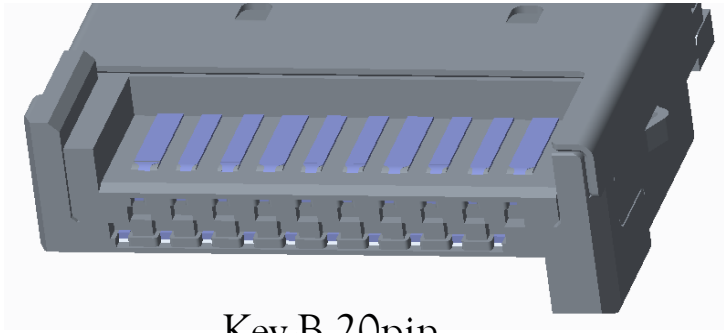
- ✓ Internal USB3.1 Key-A plug (to 1 Type-C port or 1 standard A port)
- ✓ Internal USB3.1 Key-B plug (to 2 standard A ports)



Internal USB3.1 20pin



Key-A 20pin



Key-B 20pin

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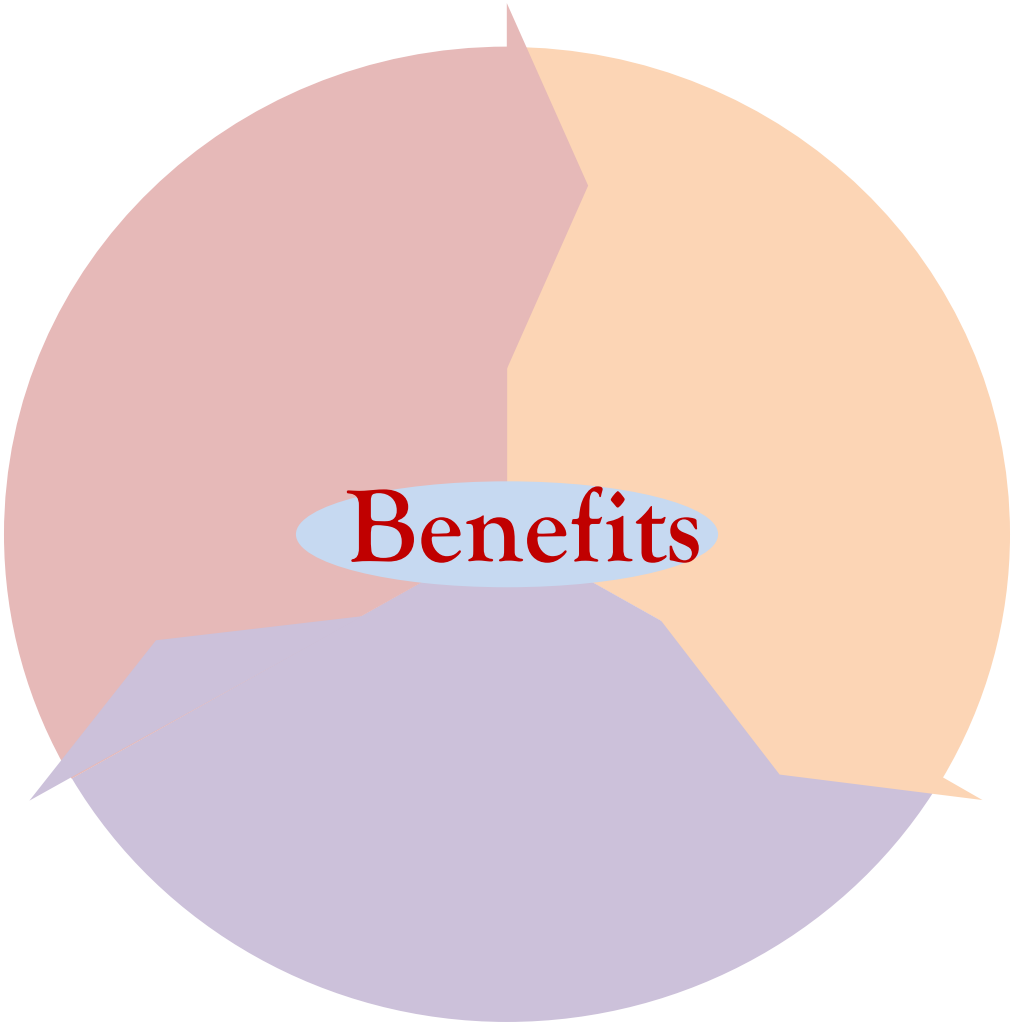
Internal USB3.1

Smaller size
pitch 0.80mm



Higher current
3A/6A

Higher Speed 10Gbps/lane

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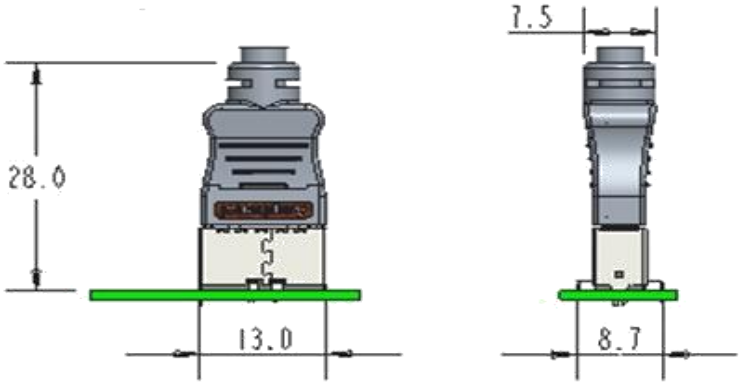
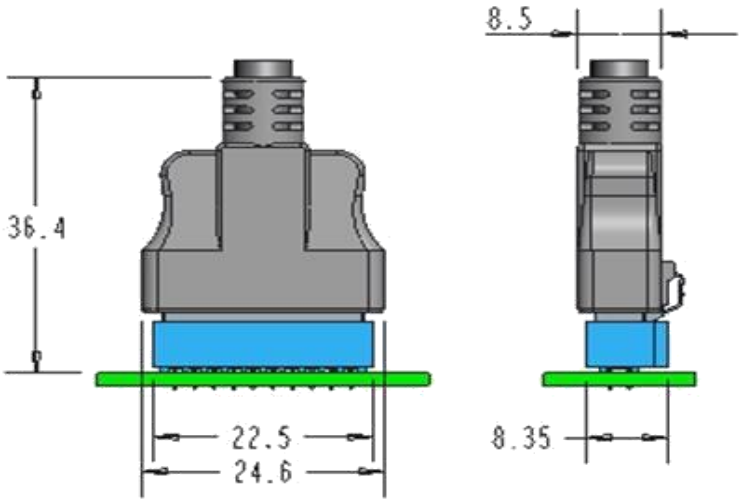
Internal USB3.1

Benefits

Internal USB Spec.	Ver. 3.0	Ver. 3.1
Connector pitch	2.0	0.8
Connector pin no.	2x10	2x10 and 2x20
USB3.0 signal pairs	4	4 and 8
Total Current (A)	3	3 and 6
Speed (Gbps/lane)	5	10



Internal USB3.1 Key-A 20pin



Internal USB3.0 20pin

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Configuration

USB3.0 A To A

USB3.0 A receptacle
to internal USB3.0 20P

Internal USB3.0
R/A type

USB3.0 A To B

USB3.0 Micro-B plug
to A receptacle

Internal USB3.0
STR type

USB3.0 A To Micro-B

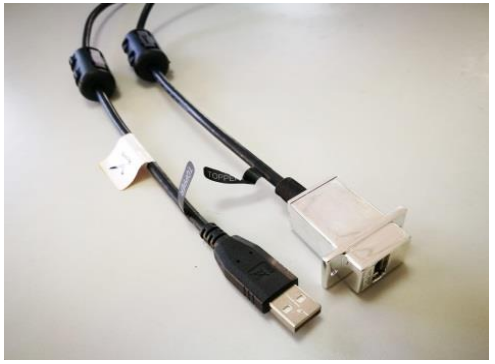
Internal USB3.0
Right S/E type

Internal USB3.0
STR with latch

Configuration

USB A to B

USB A to B with ferrite core



USB A plug to receptacle with ferrite core

USB A plug to receptacle without ferrite core

USB A to Micro-B with excellent cosmetic

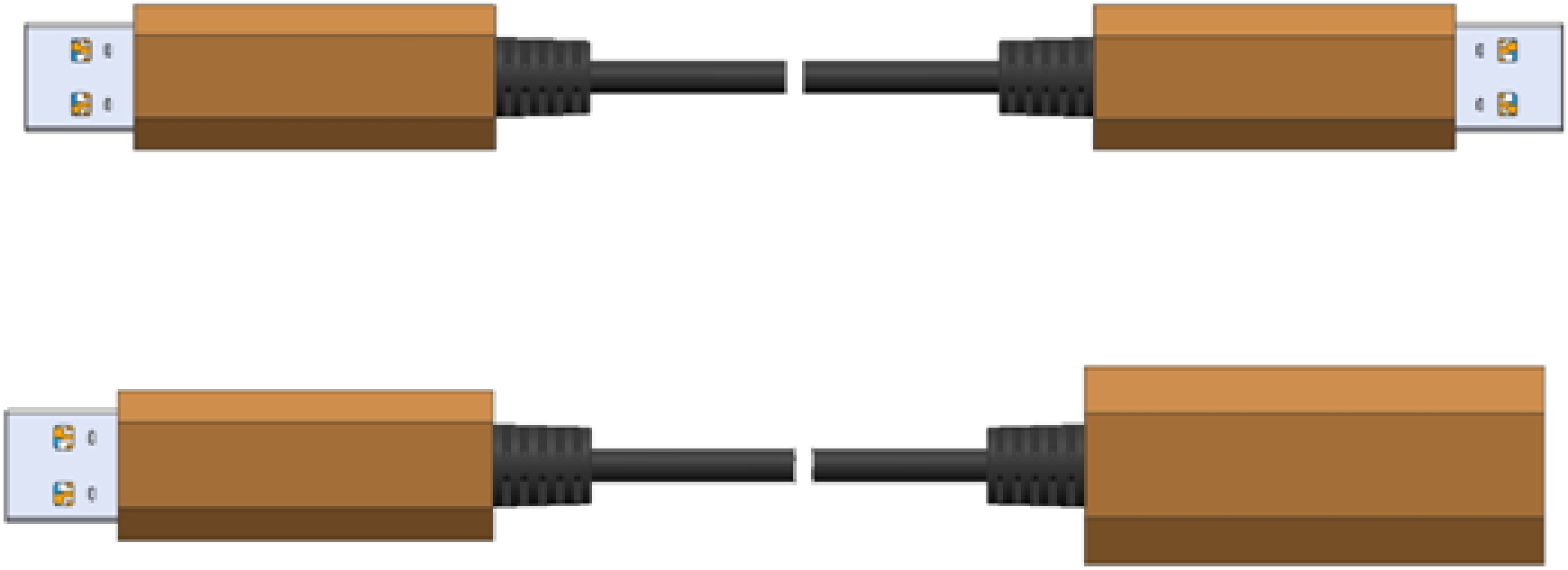
Micro-B plug to USB A receptacle

USB A to Mini-USB RA

USB A to Mini-USB STR

USB3.0 AOC Hybrid Cable

USB3.0 AOC hybrid cable support long distance and high speed signal transmission. The solution is integrated copper wires for AOC hybrid cable solution.

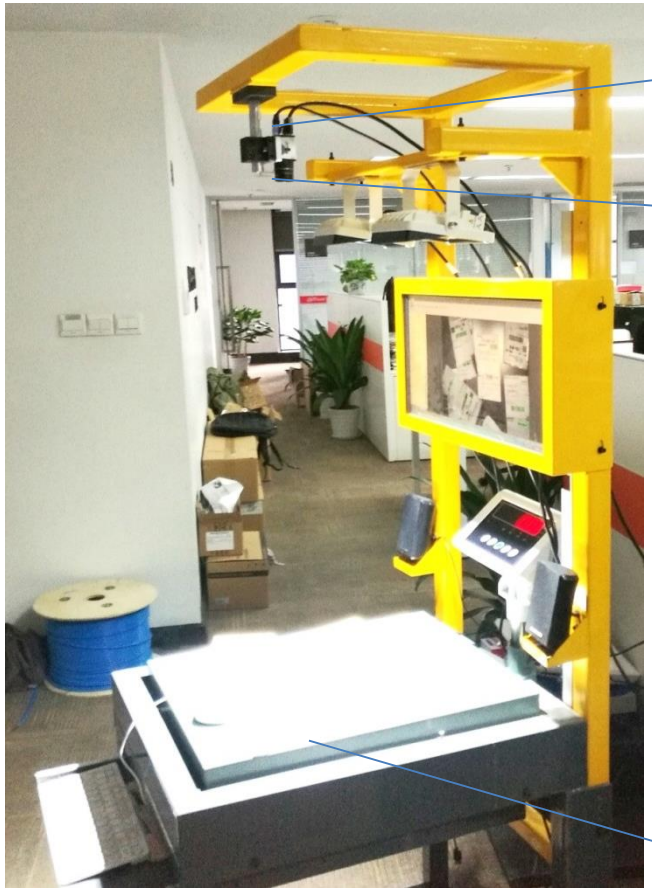


Note: the pictures are only for reference.

USB3.0 AOC Hybrid Cable

Applications

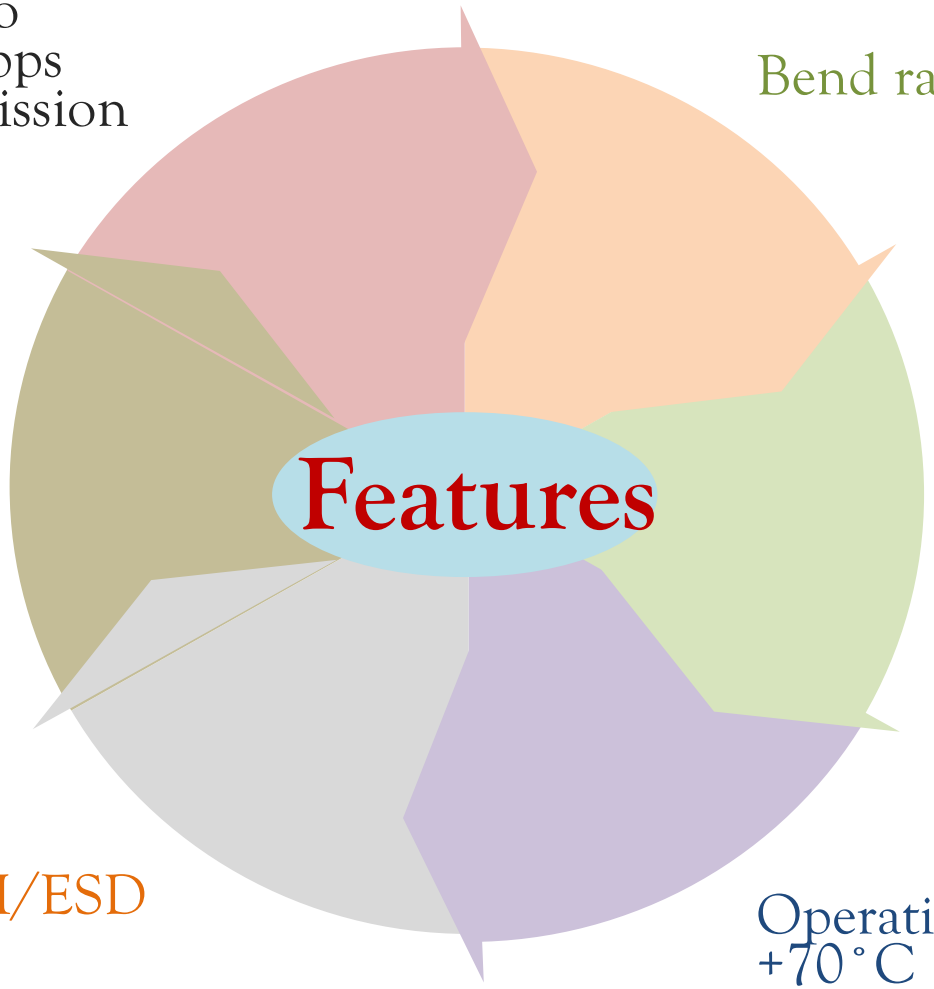
- ✓ Machine Vision
- ✓ Security surveillance
- ✓ Industry print system
- ✓ Digital signage
- ✓ Industry camera
- ✓ Multimedia classroom
- ✓ Internet bar



Machine Vision Camera

Amphenol

USB3.0 AOC Hybrid Cable



Upgradable to USB3.1 10Gbps signal transmission

Bend radius 20mm Max.

Transmission distance up to 50 meters

Auxiliary power supply in host side

Excellent EMI/ESD performance

Operation Temp.: 0°C to +70°C

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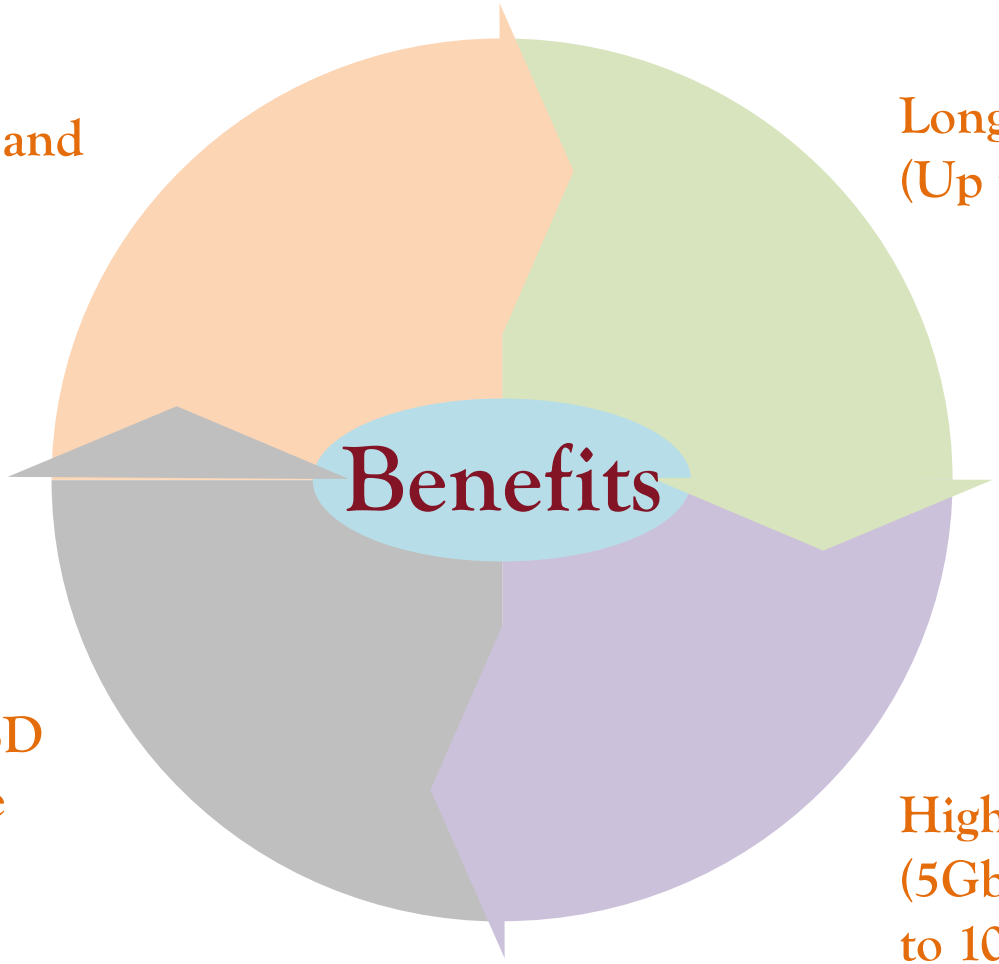
USB3.0 AOC Hybrid Cable

Small cable OD and low weight

Long distance for signal and power (Up to 50 meter, 5V 0.9A power)



Good EMI/ESD performance

High Speed (5Gbps USB3.1 Gen1 and scalable to 10Gbps USB3.1)

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DisplayPort

DisplayPort

DisplayPort is an industry standard to accommodate audio and digital display technology within the PC and CE industries.
It consolidates internal and external connection methods to reduce device complexity and provides performance scalability to enable the next generation of displays featuring higher color depths, refresh rates, and display resolutions.

Application

- ✓ PC
- ✓ Workstation
- ✓ Notebook
- ✓ Tablet
- ✓ LCDs
- ✓ High Definition Monitor
- ✓ Projector



Display Technology Roadmap

Spec release date: 2007 → 2012 → 2014 → 2019

Display Spec. Rev.	1.1	1.2	1.3	1.4	2.0
Max signal each lane bandwidth (Gbps)	2.7	5.4	8.1	8.1	20
Max signal total bandwidth (Gbps)	10.8	21.6	32.4	32.4	80
Max resolution	1920 X 1080 120 Hz	4096 X 2160 60 Hz 4K	5120×2880 60HZ 5K	7680 X 4320 60Hz 8K	>7680 X 4320 60Hz >8K

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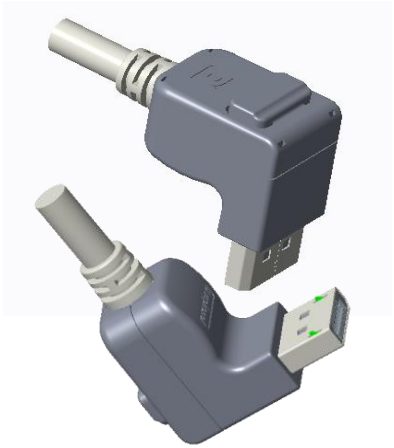
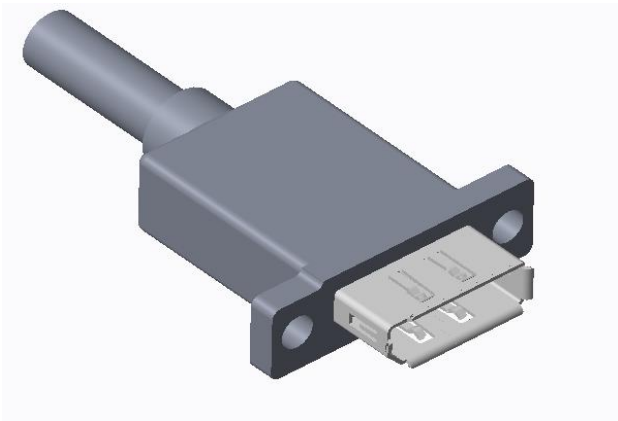
DisplayPort

Configuration

DP plug to DP plug



Right Angle DP plug with latch



DP receptacle
with mounting holes

Type-C plug to DP plug
(4k x 2k resolution)

Mini DP plug to Mini DP plug

DP Alt mode over Type-C

Amphenol

Dongle Configuration

DP to VGA & Mini DP to VGA

(1920 x 1200 resolution)

DP to DVI-SL & Mini DP to DVI-SL (1920 x 1200 resolution)

DP to HDMI & Mini DP to HDMI (4k x 2k resolution)

DP to DVI Adapter

DP to HDMI adapter

Type-C plug to DP receptacle

(4k x 2k resolution)

Mini DP to HDMI + VGA receptacle (1080P resolution,

No EMI shielding)

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DisplayPort

Features

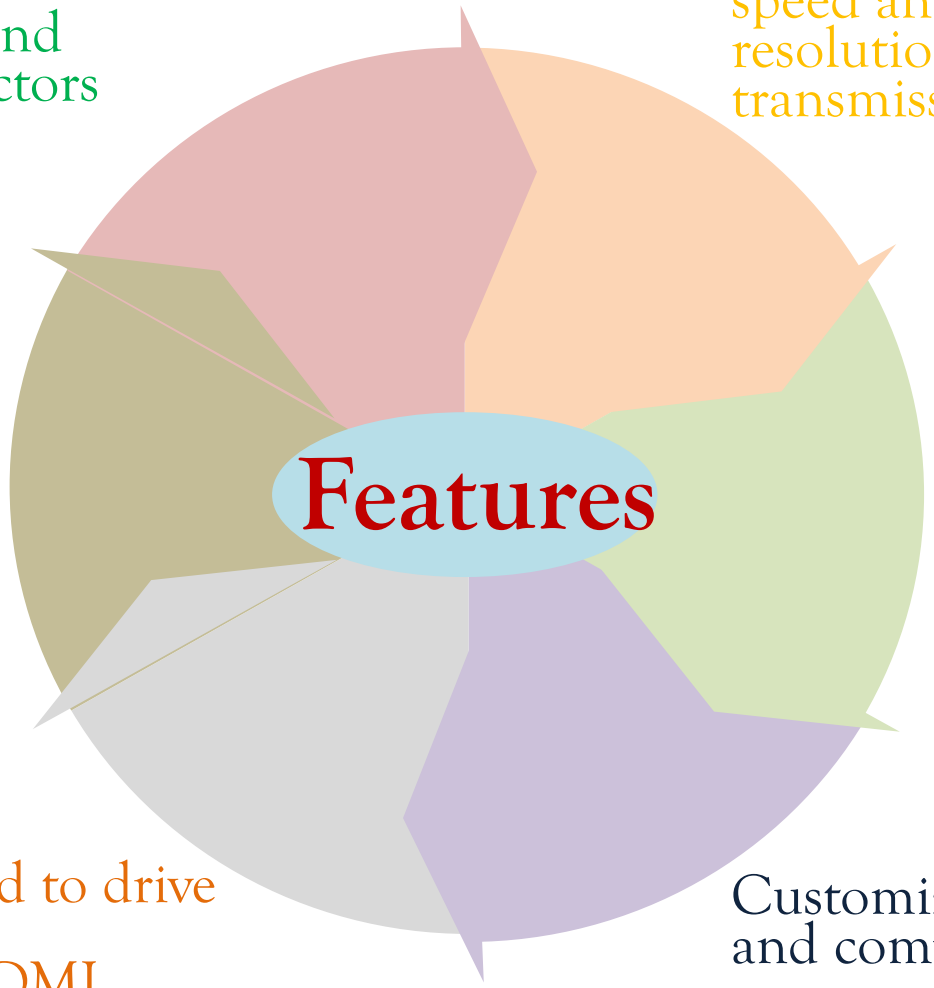
- ✓ Mini Display Port and Display Port connectors are optional:
- ✓ DP 20pin pitch 1.0mm, Mini DP 20pin pitch 0.6mm,
- ✓ DP can be used to drive displays with a VGA/DVI/HDMI interface thru a dongle
- ✓ Support 8.1Gbps signal speed and 4Kx2K resolution video & audio transmission
- ✓ Compliant to VESA industry spec
- ✓ Customized design and compatibility test

DisplayPort

Mini Display Port and Display Port connectors are optional

Support 8.1Gbps signal speed and 4Kx2K resolution video & audio transmission

DP 20pin pitch 1.0mm, Mini DP 20pin pitch 0.6mm



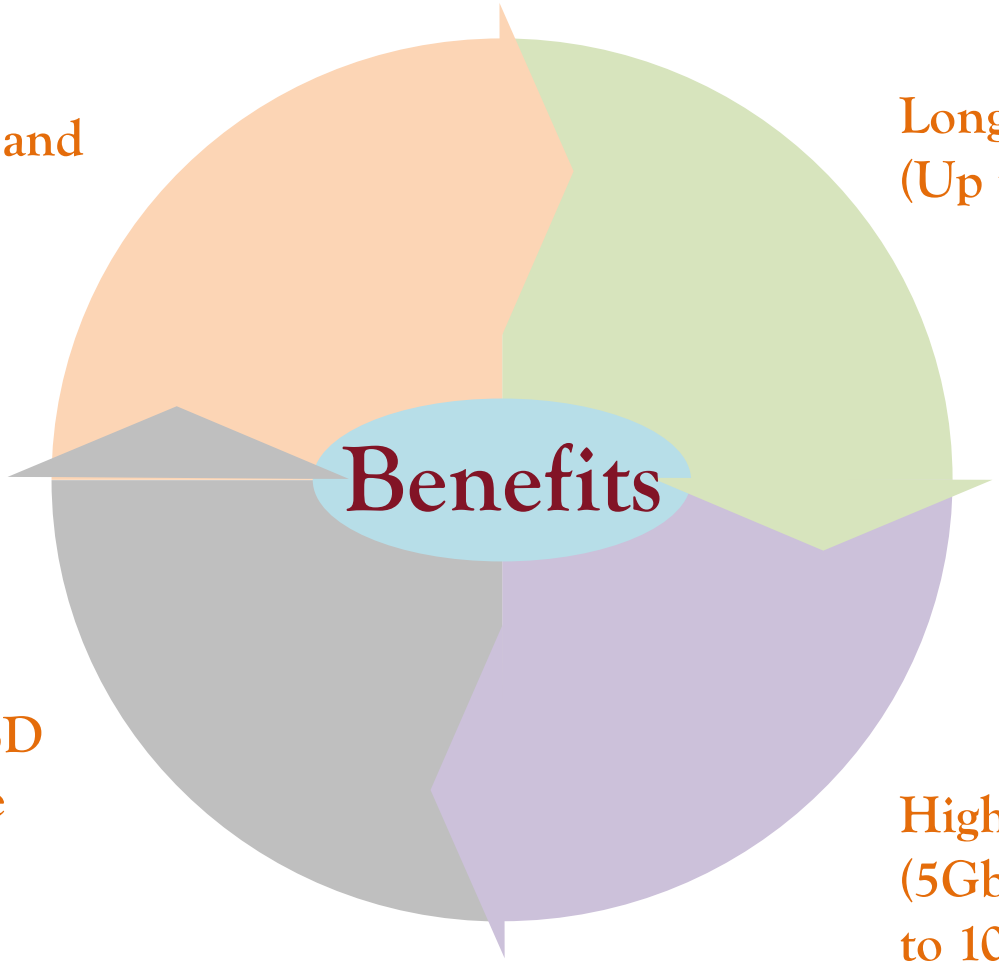
Compliant to VESA industry spec

DP can be used to drive displays with a VGA/DVI/HDMI interface thru a dongle

Customized design and compatibility test

Amphenol

DisplayPort



Small cable OD and low weight

Long distance for signal and power (Up to 50 meter, 5V 0.9A power)

Good EMI/ESD performance

High Speed (5Gbps USB3.1 Gen1 and scalable to 10Gbps USB3.1)

Amphenol

DisplayPort AOC

DisplayPort(DP) active optical cable(AOC) assemblies with high bandwidth and low power consumption uses optical fiber to replace copper wires to transmit DP1.4 high speed signal and support 8k 60Hz high resolution video up to 50 meters.
The product has long, small, soft and excellent signal quality advantages and is free from EMI.
It can be used conveniently with good compatibility without external power.

Applications

- ✓ Computers
- ✓ Monitors
- ✓ Airplane On-board Video System
- ✓ Conference Room Video Equipment
- ✓ Digital signage
- ✓ LED signboards
- ✓ Security systems

DisplayPort AOC

Configuration

Copper+fiber
hybrid cable

DP plug
(photoelectrical conversion inside)

DisplayPort AOC

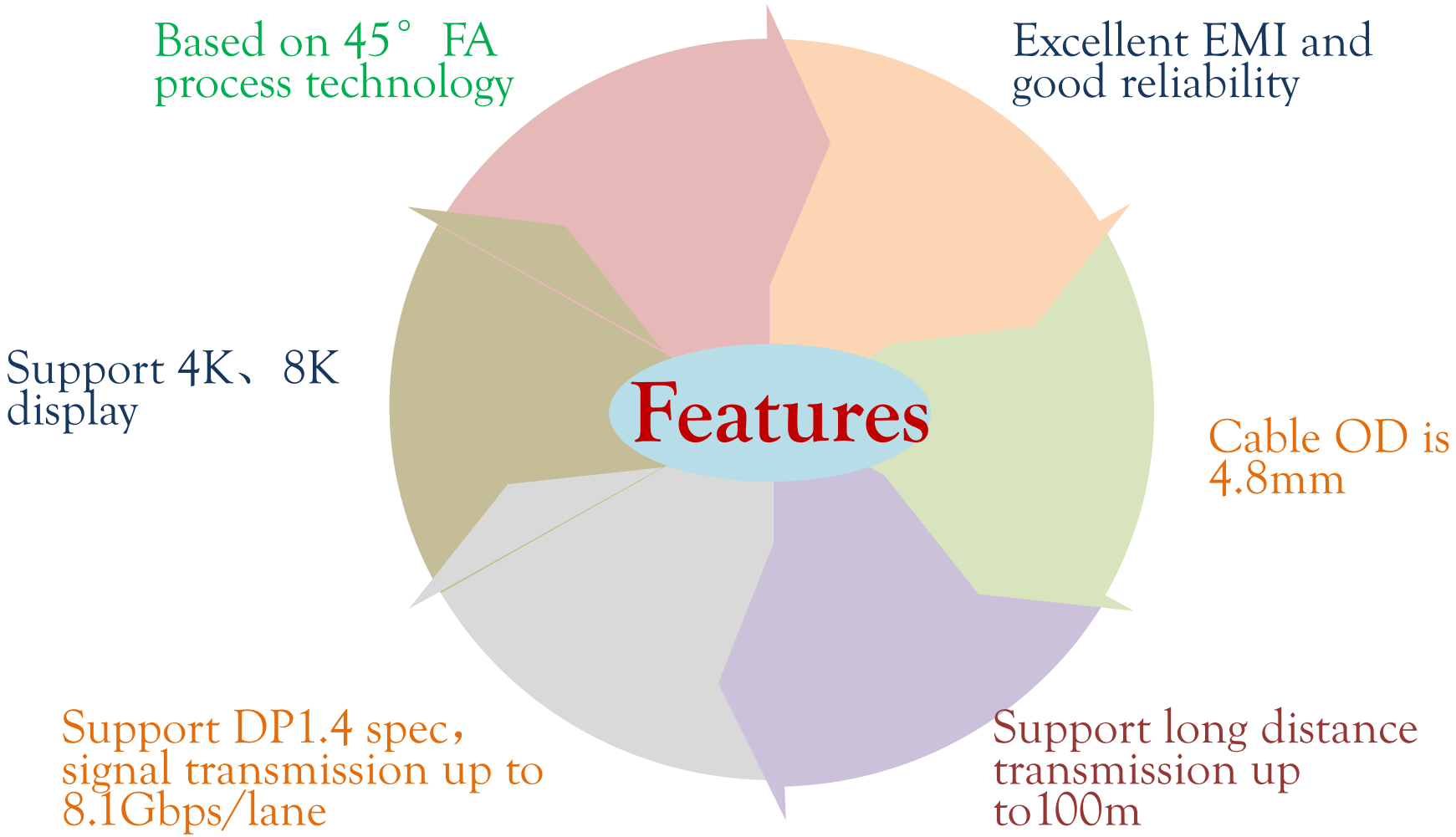
Features

- ✓ Based on 45° FA process technology
- ✓ Support 4K、8K display
- ✓ Support DP1.4 spec, signal transmission up to 8.1Gbps/lane
- ✓ Support long distance transmission up to100m
- ✓ Cable including 4 fiber wire and seven copper wires
- ✓ Cable OD is 4.8mm
- ✓ Excellent EMI and good reliability

Main Application

- ➢ Outdoor/Indoor display in convention and exhibition center, stadium

DisplayPort AOC



Amphenol

Thank You

Contact window for more information

- Website: www.amphenol-ast.com
- Email : Sales@amphenol-ast.com
- Tel.: +1-281-340-6500 ext. 141 (USA)

  +886-3-2647-278 (Taiwan)

  +86-592-5936666 ext. 5203 (China Mainland)