



USB-IF 2.0 Compliance Test Report for Peripheral

Company Name: NXP Semiconductors

VID (Dec): 8137 The VID for the company who apply the USB-IF logo.

Model Name: LPC55S16

Product Type: MSC

Report Date: 02/07/2020

Test Result: **PASS**

Tester: Sofiya Mayevskiy

Authorized Signature: Kayla Seliner

Company Information:

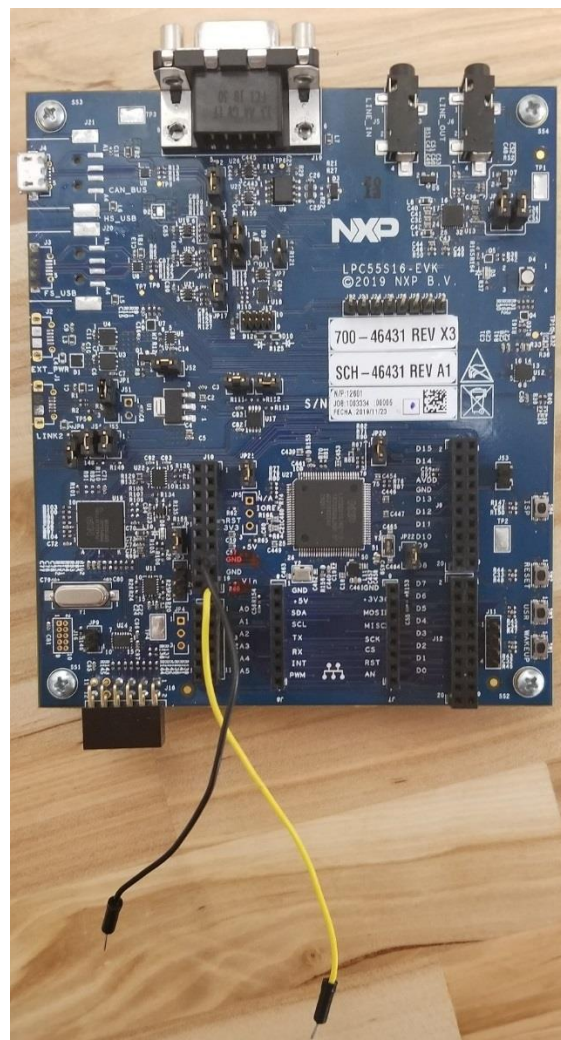
Company

Company Name: NXP Semiconductors
Company Address: 411 E Plumeria Dr. San Jose, CA 95134

Technical Contact

Name: Dezheng Tang (Tom)
Phone Number: N/A
E-Mail: dezheng.tang@nxp.com
FAX Number: N/A

Product Picture:



Overall Test Result Summary

Test Category	Result
PHY	
High Speed	Pass
Full Speed	Pass
BC 1.2	
Upstream Port	N/A
CV	
USB20CV	Pass
USB3xCV	Pass
IOP	
Average Power Current Draw	Pass
Interoperability Interim Tree	Pass

High Speed & Full Speed Compliance Tests

High-Speed Signal Quality

☒ Pass

☐ Fail

☐ N/A

These tests measure the ability of transmitters to do valid high speed signaling. High speed signal quality is measured on upstream ports. A high-speed scope with SMA cables is used. Signaling data is captured with the scope and then translated to an eye pattern. The signal quality eye patterns obtained from the measurements must agree with the transmit eye patterns in the USB 2.0 Specification.

Connector Type: Untethered (Tethered means no standard B or special B connector)

EL_2: Transmitter Data Rate	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_4: Eye Pattern (Template 1)	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_5: Eye Pattern (Template 2)	<input type="checkbox"/> Pass	<input checked="" type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_6: Rising and Falling Time	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_7: Monotonic Data Transition	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Device Packet Parameters

☒ Pass

☐ Fail

☐ N/A

This test measures the amount of time it takes hosts and devices to respond. It also verifies device generated SYNCs and EOPs.

EL_21: (32bit)	32bit	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_22-Step1: (>=8bit and <=192bit)	130bit	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_22-Step2: (>=8bit and <=192bit)	110bit	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_25: (8bit)	8bit	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Device CHIRP Timing☒ **Pass**☐ **Fail**☐ **N/A**

This test examines the basic timings and voltages of the upstream port during the speed detection protocol. (Device reset from Full Speed)

EL_28: ($\geq 2.5\mu\text{s}$ and $\leq 6\text{ms}$)	128.431μs	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_29: ($\geq 1\text{ms}$ and $\leq 7\text{ms}$)	3.072ms	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_31: ($\leq 500\mu\text{s}$)	3.346μs	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Device Suspend/Resume/Reset timing☒ **Pass**☐ **Fail**☐ **N/A**

This test verifies that a device can be suspended and resumed while operating in high speed, and also that the device can be reset from the suspended state.

EL_38: ($\geq 3\text{ms}$ and $\leq 3.125\text{ms}$)	3.074ms	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_39:		<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_40:		<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_27: ($\geq 3.1\text{ms}$ and $\leq 6\text{ms}$)	3.497ms	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_28: ($\geq 2.5\mu\text{s}$ and $\leq 6\text{ms}$)	128.400μs	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Device Test J/K, SE0_NAK☒ **Pass**☐ **Fail**☐ **N/A**

The USB-IF no longer requires EL_8: TEST_J and TEST_K to be performed as a condition for USB Certification. Measurement of EL_9: TEST_J, TEST_K and SE0_NAK are still a requirement for certification. EL_9 is defined in the USB 2.0 Test Specification and measures the data line voltage when not driven.

EL_9

Test Mode	Voltage (mV)
SE0_NAK D+	0.3
SE0_NAK D-	0.4
TEST_J D-	1.7
TEST_K D+	1.6

(-20mV to 20mV)

Device Receiver Sensitivity☒ **Pass**☐ **Fail**☐ **N/A**

These tests check the receiver characteristics of the upstream port.

EL_18☒ **Pass**☐ **Fail**☐ **N/A**

EL_17 Positive: ($\leq +200\text{mV}$)	+123.000mV	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_17 Negative: ($\geq -200\text{mV}$)	-133.500mV	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_16 Positive: ($\geq +100\text{mV}$)	+120.200mV	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A
EL_16 Negative: ($\leq -100\text{mV}$)	-128.200mV	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input type="checkbox"/> N/A

Full Speed Signal Quality Test Result☒ **Pass**☐ **Fail**Connector Type: **Untethered** (Tethered means no standard B or special B connector)

Full Speed Upstream Signal Quality:

☒ **Pass**☐ **Fail**

Inrush Current Test:

☒ **Pass**☐ **Fail****Back Voltage Test Results**☒ **Pass**☐ **Fail****Before Enumeration / After Enumeration**

Pin	Voltage (mV)	
D+	1.0	1.0
D-	1.2	1.2
V _{Bus}	0	0.1

(All values <= 400mV)

Miscellaneous:☐ **Pass**☐ **Fail**☒ **N/A****BC 1.2 Implemented Check:**☐ **Supported**☒ **Not Supported**

If the upstream port has BC 1.2 capability, all items of BC 1.2 Portable Device category should be tested under this port for USB-IF certification.

Battery Charging 1.2 Compliance Test

<u>Portable Device (PD)</u>	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
B-UUT Initial Power-up Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Data Contact Detect Test – With Current Source	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Data Contact Detect Test – No Current Source	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
DCP Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
CDP Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
SDP Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
ACA-Dock Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
ACA-A Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
ACA-B Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
ACA-C Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
ACA-GND Detection Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Common Mode Test - Full Speed	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Common Mode Test - High Speed	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A
Dead Battery Provision Test	<input type="checkbox"/> Pass	<input type="checkbox"/> Fail	<input checked="" type="checkbox"/> N/A

Framework Test Results (USB 2 CV) ☒ **Pass** ☐ **Fail**

This test primarily covers USB-IF testing of devices and hubs for compliance with the standard commands in Chapters 9 and 11 of the USB 2.0 specification. This specification does not describe the full set of USB-IF tests and assertions for these devices.

StarTech PEX400USB2 (add-in card)

High-Speed:

VID: 0x1FC9 PID: 0x0092

Chapter 9 Tests: ☒ **Pass** ☐ **Fail**

Interface: 1 Max Power: 100 mA Remote Wakeup: N/A

MSC Class Tests: ☒ **Pass** ☐ **Fail** ☐ **N/A**

UVC Class Tests: ☐ **Pass** ☐ **Fail** ☒ **N/A**

HID Class Tests: ☐ **Pass** ☐ **Fail** ☒ **N/A**

Full-Speed:

VID: 0x1FC9 PID: 0x0092

(HS device under Full-Speed)

Chapter 9 Tests: ☒ **Pass** ☐ **Fail**

Interface: 1 Max Power: 100 mA Remote Wakeup: N/A

MSC Class Tests: ☒ **Pass** ☐ **Fail** ☐ **N/A**

UVC Class Tests: ☐ **Pass** ☐ **Fail** ☒ **N/A**

HID Class Tests: ☐ **Pass** ☐ **Fail** ☒ **N/A**

Framework Test Results (USB 3 Gen X CV) ☒ Pass ☐ Fail

All USB peripherals are required to enumerate on a SuperSpeed host controller and pass all applicable tests within USB 3 Gen X CV. Failure framework test in USB 3 Gen X CV will prevent certification.

DELL XPS8700 Platform

High-Speed:

VID: 0x1FC9 PID: 0x0092

Chapter 9 Tests: ☒ Pass ☐ Fail

Connector Type Tests: ☒ Pass ☐ Fail

Interface: 1 Max Power: 100 mA Remote Wakeup: N/A

MSC Class Tests: ☒ Pass ☐ Fail ☐ N/A

UVC Class Tests: ☐ Pass ☐ Fail ☒ N/A

HID Class Tests: ☐ Pass ☐ Fail ☒ N/A

Full-Speed:

VID: 0x1FC9 PID: 0x0092

(HS device under Full-Speed)

Chapter 9 Tests: ☒ Pass ☐ Fail

Connector Type Tests: ☒ Pass ☐ Fail

Interface: 1 Max Power: 100 mA Remote Wakeup: N/A

MSC Class Tests: ☒ Pass ☐ Fail ☐ N/A

UVC Class Tests: ☐ Pass ☐ Fail ☒ N/A

HID Class Tests: ☐ Pass ☐ Fail ☒ N/A

Average Power Current Test Results ☒ Pass ☐ Fail

High-Speed: Low Powered Device ☒ Pass ☐ Fail

Unconfigured Power: 0.02 mA
($\leq 100\text{mA}$)

Configured Power: 0.02 mA
($\leq \text{Max Power} \leq 100\text{mA}$ for Low Power)
($\leq \text{Max Power} \leq 500\text{mA}$ for High Power)

Suspend Mode Power: 9.1 μA
($\leq 2500\mu\text{A}$ for Self Power Hub or Non Compound Device)
($\leq 12500\mu\text{A}$ for Bus Power Hub or Compound Device)

Powered State Suspend Mode Power: 9.0 μA
($\leq 2500\mu\text{A}$ for not Supporting USB Battery Charging)
($\leq 100\text{mA}$ for Supporting USB Battery Charging)

Operating Power: 0.02 mA
($\leq \text{Max Power} \leq 100\text{mA}$ for Low Power)
($\leq \text{Max Power} \leq 100\text{mA}$ for Self Power)
($\leq \text{Max Power} \leq 500\text{mA}$ for High Power)

Full-Speed: Low Powered Device ☒ Pass ☐ Fail

Unconfigured Power: 0.02 mA
($\leq 100\text{mA}$)

Configured Power: 0.02 mA
($\leq \text{Max Power} \leq 100\text{mA}$ for Low Power)
($\leq \text{Max Power} \leq 500\text{mA}$ for High Power)

Suspend Mode Power: 9.2 μA
($\leq 2500\mu\text{A}$ for Self Power Hub or Non Compound Device)
($\leq 12500\mu\text{A}$ for Bus Power Hub or Compound Device)

Powered State Suspend Mode Power: 9.2 μA
($\leq 2500\mu\text{A}$ for not Supporting USB Battery Charging)
($\leq 100\text{mA}$ for Supporting USB Battery Charging)

Operating Power: 0.02 mA
($\leq \text{Max Power} \leq 100\text{mA}$ for Low Power)
($\leq \text{Max Power} \leq 100\text{mA}$ for Self Power)
($\leq \text{Max Power} \leq 500\text{mA}$ for High Power)

Interoperability Test Overall Results

☒ Pass ☐ Fail

DELL XPS8700 Platform

Operating System: Win10

XHCI Host Controller:

Root Port

Enumeration and Driver installation
Check operation of device
Interoperability – Operate all devices
Hot plug test – A Plug
Hot plug test – B Plug
S3 Active Standby Test
Remote Wake-up Test
S3 Active Standby Resume Test
S4 Active Hibernate Test
S4 Active Hibernate Resume Test
Warm Boot Test
Hybrid Boot Test
Cold Boot Test

☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail ☐ N/A
☒ Pass ☐ Fail
☐ Pass ☐ Fail ☒ N/A
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail

Topology Change 1 (SS Tree)

Enumeration
Check operation of device
Interoperability – Operate all devices
Hot plug test – A Plug
Hot plug test – B Plug
S3 Active Standby Test
Remote Wake-up Test
S3 Active Standby Resume Test
S4 Active Hibernate Test
S4 Active Hibernate Resume Test
Warm Boot Test
Hybrid Boot Test
Cold Boot Test

☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail ☐ N/A
☒ Pass ☐ Fail
☐ Pass ☐ Fail ☒ N/A
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail
☒ Pass ☐ Fail

Topology Change 2 (HS Tree)

Enumeration

☒ Pass ☐ Fail

Check operation of device

☒ Pass ☐ Fail

Interoperability – Operate all devices

☒ Pass ☐ Fail

Hot plug test – A Plug

☒ Pass ☐ Fail

Hot plug test – B Plug

☒ Pass ☐ Fail ☐ N/A

S3 Active Standby Test

☒ Pass ☐ Fail

Remote Wake-up Test

☐ Pass ☐ Fail ☒ N/A

S3 Active Standby Resume Test

☒ Pass ☐ Fail

S4 Active Hibernate Test

☒ Pass ☐ Fail

S4 Active Hibernate Resume Test

☒ Pass ☐ Fail

Warm Boot Test

☒ Pass ☐ Fail

Hybrid Boot Test

☒ Pass ☐ Fail

Cold Boot Test

☒ Pass ☐ Fail

Topology Change 3 (FS Tree)

Enumeration

☒ Pass ☐ Fail

Check operation of device

☒ Pass ☐ Fail

Interoperability – Operate all devices

☒ Pass ☐ Fail

Interoperability without Driver Verifier:

Run Only if Saw Poor Video or Audio Quality

☒ Pass ☐ Fail ☐ N/A

*Tested without Driver Verifier due to Poor Audio Quality

More Detailed Test Results:

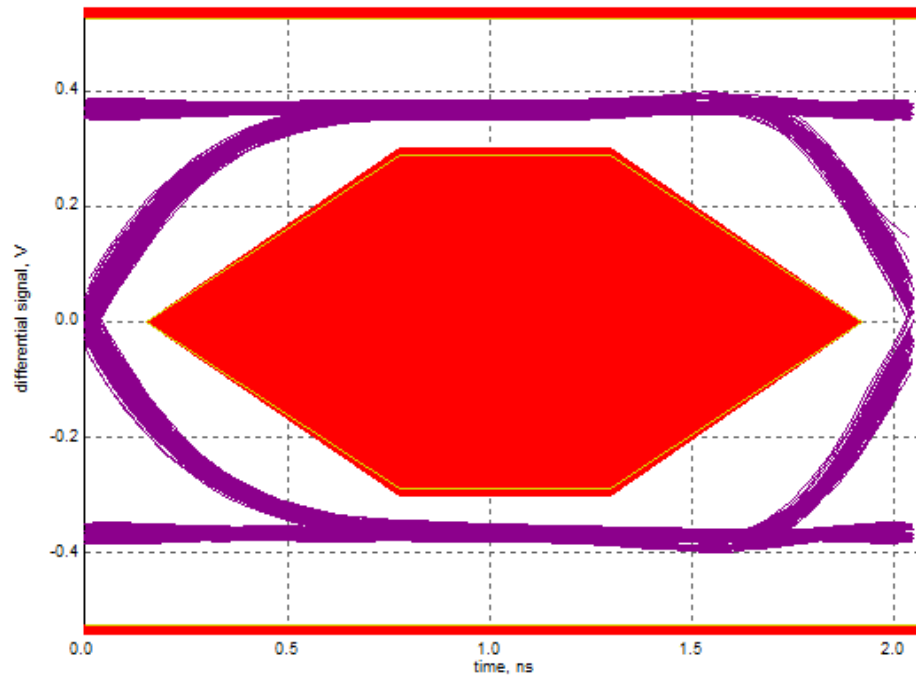
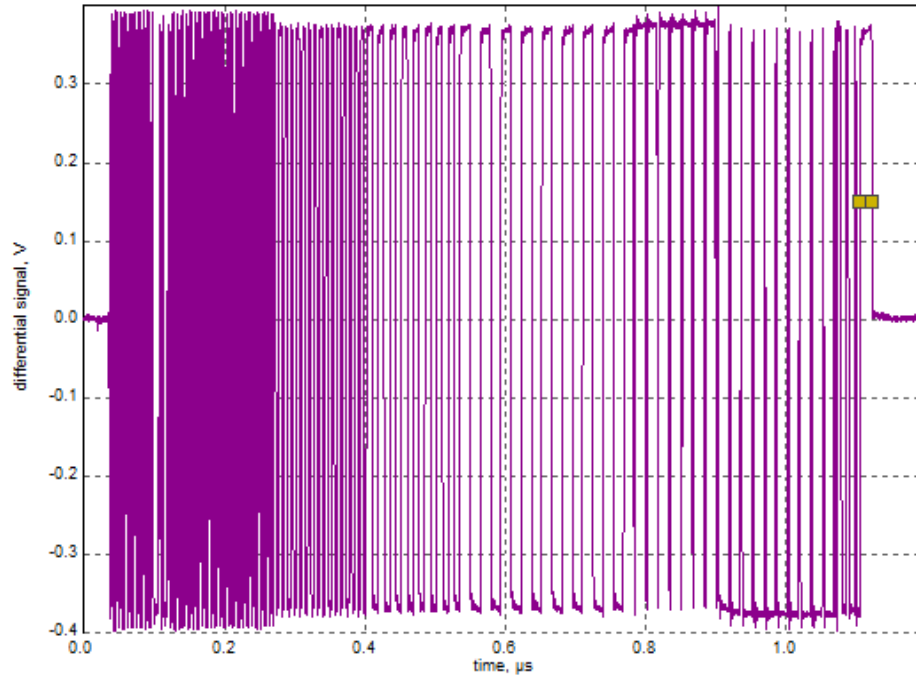
1. High Speed Upstream Signal Quality: Pass

- Overall result: pass!
- Sync result:
sync passes
- Signal eye:
eye passes
- EOP width: 7.90 bits
EOP width passes
- Measured signaling rate: 479.9715 MHz
signal rate passes
- Edge Monotonicity: 0 mV
Monotonic Edge passes
- Rising Edge Rate: 1154.59 V/us (554.31 ps equivalent risetime)
passes
- Falling Edge Rate: 1121.81 V/us (570.50 ps equivalent falltime)
passes

Additional Information

- Consecutive jitter range: -48.714 ps to 46.132 ps, RMS jitter 18.853 ps
- Paired JK jitter range: -60.363 ps to 33.441 ps, RMS jitter 15.270 ps
- Paired KJ jitter range: -65.048 ps to 44.262 ps, RMS jitter 18.879 ps
- Margin Above eye: 0.0498 V
- Margin Below eye: 0.0444 V
- Maximum Voltage: 0.3859 V
- Margin Below Top: 0.1391 V
- Minimum Voltage: -0.3866 V
- Margin Above Bottom: 0.1384 V

Signal Data and Eye



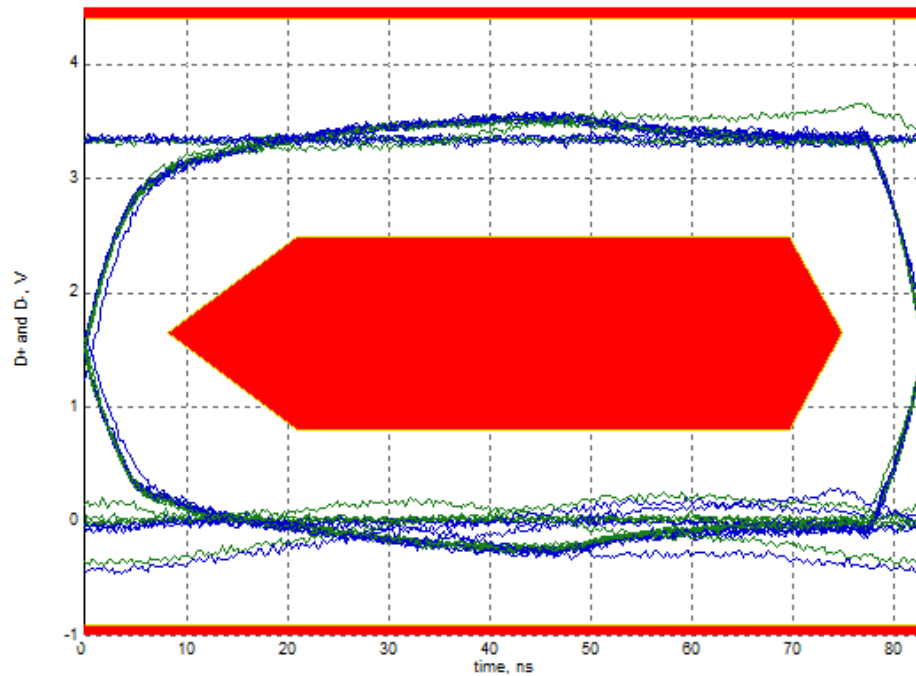
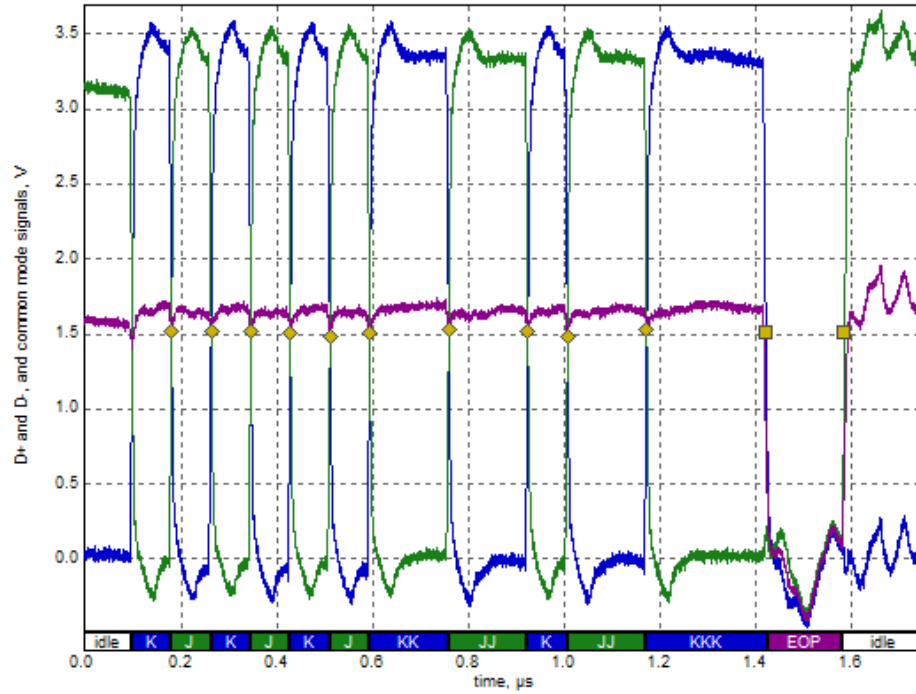
2. Full Speed Upstream Signal Quality: Pass

- Overall result: pass!
- Sync result:
sync passes
- Signal eye:
eye passes
- EOP width: 166.02 ns
EOP width passes
- Measured signaling rate: 11.9986 MHz
signal rate passes
- Edge Monotonicity: 0 mV
Monotonic Edge passes
- Crossover voltage range: 1.48 V to 1.53 V, mean crossover 1.51 V
(first crossover at 1.51 V, 9 other differential crossovers checked)
crossover voltages pass
- Consecutive jitter range: -62.506 ps to 69.914 ps, RMS jitter 43.073 ps
- Paired JK jitter range: -86.352 ps to 68.272 ps, RMS jitter 72.986 ps
- Paired KJ jitter range: -44.396 ps to 83.160 ps, RMS jitter 61.496 ps
jitter passes

Additional Information

- Rising Edge Rate: 335.03 V/us (Equivalent risetime = 7.88 ns)
- Falling Edge Rate: 351.92 V/us (Equivalent falltime = 7.50 ns)
- Edge Rate Match: 4.92% (limit +/-10%)
- Margin Above eye: 0.7378 V
- Margin Below eye: 0.5460 V
- Maximum Voltage: 3.5954 V
- Margin Below Top: 0.8046 V
- Minimum Voltage: -0.3478 V
- Margin Above Bottom: 0.5522 V

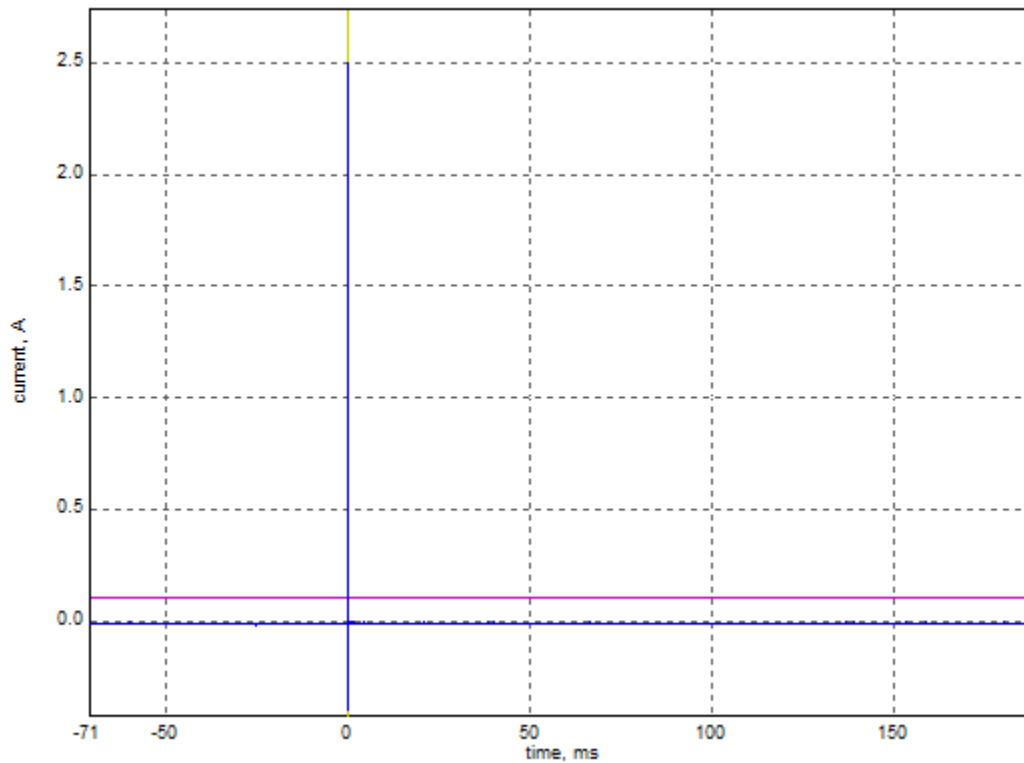
Signal Data and Eye



3. Inrush Current: Pass

- Overall result: pass!
- Inrush at 5.242 V: 6.0857 μC
Inrush passes
- Region 1 Start: -0.00376 ms - End: 0.100 ms = 6.086 μC

Hot Plug (Attach) Current Draw



Testing Procedure Documents:

1. Keysight D9010USBC USB 2.0 Compliance Test Application, Version 4.1
2. Universal Serial Bus Implementers Forum Full and Low Speed Electrical and Interoperability Compliance Test Procedure, Version: 1.3
3. xHCI Interoperability Test Procedures For Peripherals, Hubs and Hosts (Legacy, USB Type-C and Power Delivery), Version 0.95
4. USB Battery Charging 1.2 Compliance Plan, Revision: 1.1

Notice: The test results are only valid for the original tested device model.