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: i.MXRT685

Product Type: HID

Report Date: 06/03/2019

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

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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 differential probes 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: <u>Untethered</u> (Tethered means no standard B or special B connector)

	Pass	Fail	N/A
EL_2: Transmitter Data Rate	⊠ Pass	☐ Fail	☐ N/A
EL_4: Eye Pattern (Template 1)	⊠ Pass	☐ Fail	☐ N/A
EL_5: Eye Pattern (Template 2)	☐ Pass	☐ Fail	⊠ N/A
EL_6: Rising and Falling Time	⊠ Pass	☐ Fail	☐ N/A
EL_7: Monotonic Data Transition	⊠ Pass	☐ Fail	☐ 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.

		Pass	Fail	N/A
EL_21: (32bit)	32bit	⊠ Pass	☐ Fail	☐ N/A
EL_22-Step1: (>=8bit and <=192bit)	124bit	⊠ Pass	☐ Fail	☐ N/A
EL_22-Step2: (>=8bit and <=192bit)	103bit	⊠ Pass	☐ Fail	☐ N/A
EL_25: (8bit)	8bit	⊠ Pass	☐ Fail	☐ N/A

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

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

EL_28: (>=2.5us and <=6ms)	**128.415us**	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_29: (>=1ms and <=7ms)	**3.072ms**	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_31: (<=500us)	**128.236us**	☒ **Pass**	☐ **Fail**	☐ **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: (>=3ms and <=3.125ms)	**3.073ms**	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_39:		☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_40:		☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_27: (>=3.1ms and <=6ms)	**3.497ms**	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_28: (>=2.5us and <=6ms)	**128.568us**	☒ **Pass**	☐ **Fail**	☐ **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 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+	0.4
SE0_NAK D-	0.3
Test J D-	3.0
Test K D+	3.0

(-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: (<= +200mV)	+150.400mV	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_17 Negative: (>= -200mV)	-157.300mV	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_16 Positive: (>= +100mV)	+145.800mV	☒ **Pass**	☐ **Fail**	☐ **N/A**
EL_16 Negative: (<= -100mV)	-153.300mV	☒ **Pass**	☐ **Fail**	☐ **N/A**

Full Speed Signal Quality Test Result   ☒ **Pass**   ☐ **Fail**

Connector Type: <u>Untethered</u> (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+	0.6	0.7
D-	0.6	0.7
V$_{Bus}$	0.1	0.2

(All values <= 400mV)

Miscellaneous: ☒ **Pass**   ☐ **Fail**

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.

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: 0x00A2**

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: 0x00A2**

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 XPS8920 Platform

High-Speed:

VID: 0x1FC9   **PID: 0x00A2**

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: 0x00A2**

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**

Average Power Current Test Results ☒ Pass ☐ **Fail**

High-Speed: Low Powered Device ☒ Pass ☐ **Fail**

Unconfigured Power: 1.96 mA
(<= 100mA)

Configured Power: 1.96 mA
(<= Max Power <= 100mA for Low Power)
(<= Max Power <= 500mA for High Power)

Suspend Mode Power without Remote Wakeup: 1834 uA
Suspend Mode Power with Remote Wakeup Enabled: N/A uA
Suspend Mode Power with Remote Wakeup Disabled: N/A uA
(<= 2500uA for Self Power Hub or Non Compound Device)
(<= 12500uA for Bus Power Hub or Compound Device)

Powered State Suspend Mode Power: 1834 uA
(<= 2500uA for not Supporting USB Battery Charging)
(<= 100mA for Supporting USB Battery Charging)

Operating Power: 1.95 mA
(<= Max Power <= 100mA for Low Power)
(<= Max Power <= 100mA for Self Power)
(<= Max Power <= 500mA for High Power)

Full-Speed: Low Powered Device ☒ Pass ☐ **Fail**

Unconfigured Power: 1.96 mA
(<= 100mA)

Configured Power: 1.96 mA
(<= Max Power <= 100mA for Low Power)
(<= Max Power <= 500mA for High Power)

Suspend Mode Power without Remote Wakeup: 1876 uA
Suspend Mode Power with Remote Wakeup Enabled: N/A uA
Suspend Mode Power with Remote Wakeup Disabled: N/A uA
(<= 2500uA for Self Power Hub or Non Compound Device)
(<= 12500uA for Bus Power Hub or Compound Device)

Powered State Suspend Mode Power: 1876 uA
(<= 2500uA for not Supporting USB Battery Charging)
(<= 100mA for Supporting USB Battery Charging)

Operating Power: 1.95 mA
(<= Max Power <= 100mA for Low Power)
(<= Max Power <= 100mA for Self Power)
(<= Max Power <= 500mA for High Power)

Interoperability Test Overall Results   ☒ **Pass** ☐ **Fail**

DELL XPS8700 Platform

Operating System: Win10

XHCI Host Controller:

Root Port

Enumeration and Driver installation	☒ **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 1 (SS 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 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	
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	

Battery Charging 1.2 Compliance Test

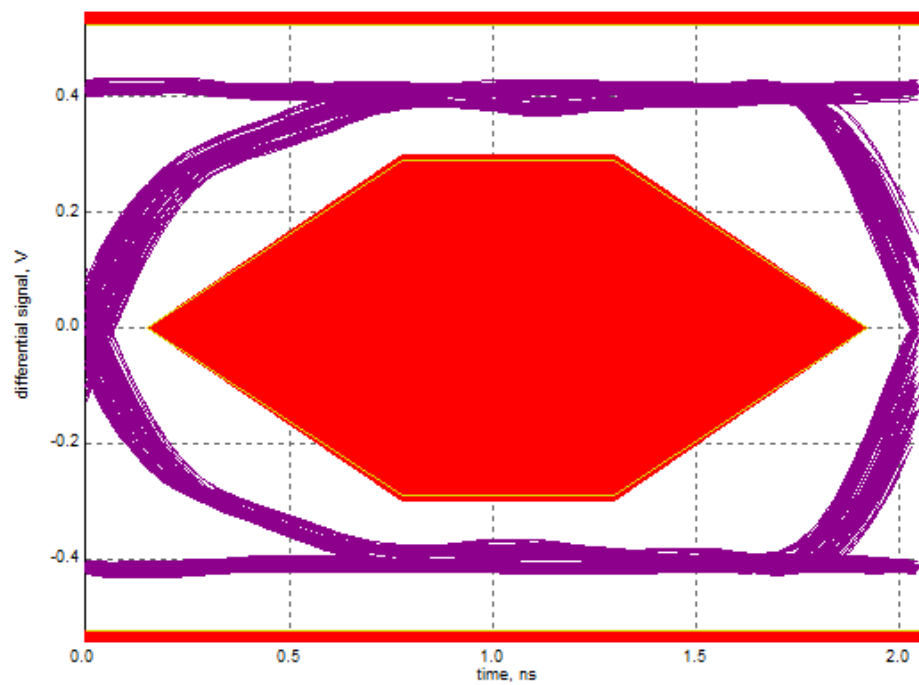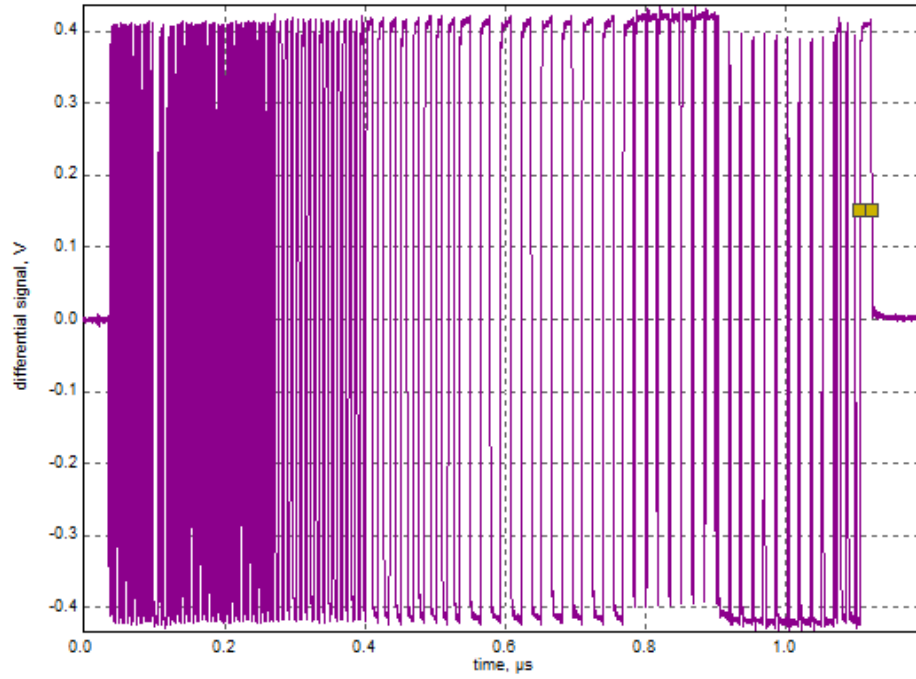| **Portable Device (PD)**	☐ Pass	☐ **Fail**	☒ N/A
B-UUT Initial Power-up Test	☐ Pass	☐ **Fail**	☒ N/A
Data Contact Detect Test – With Current Source	☐ Pass	☐ **Fail**	☒ N/A
Data Contact Detect Test – No Current Source	☐ Pass	☐ **Fail**	☒ N/A
DCP Detection Test	☐ Pass	☐ **Fail**	☒ N/A
CDP Detection Test	☐ Pass	☐ **Fail**	☒ N/A
SDP Detection Test	☐ Pass	☐ **Fail**	☒ N/A
ACA-Dock Detection Test	☐ Pass	☐ **Fail**	☒ N/A
ACA-A Detection Test	☐ Pass	☐ **Fail**	☒ N/A
ACA-B Detection Test	☐ Pass	☐ **Fail**	☒ N/A
ACA-C Detection Test	☐ Pass	☐ **Fail**	☒ N/A
ACA-GND Detection Test	☐ Pass	☐ **Fail**	☒ N/A
Common Mode Test - Full Speed	☐ Pass	☐ **Fail**	☒ N/A
Common Mode Test - High Speed	☐ Pass	☐ **Fail**	☒ N/A
Dead Battery Provision Test	☐ Pass	☐ **Fail**	☒ N/A

More Detailed Test Results:

1. **High Speed Upstream Signal Quality: Pass**

- Overall result: pass!
- Signal eye:
  eye passes
- EOP width: 7.93 bits
  EOP width passes
- Measured signaling rate: 480.0297 MHz
  signal rate passes
- Edge Monotonicity: 0 mV
  Monotonic Edge passes
- Rising Edge Rate: 1547.79 V/us (413.49 ps equivalent risetime)
  passes
- Falling Edge Rate: 1521.46 V/us (420.65 ps equivalent falltime)
  passes

Additional Information

- Consecutive jitter range: -54.568 ps to 74.039 ps, RMS jitter 31.185 ps
- Paired JK jitter range: -16.746 ps to 27.087 ps, RMS jitter 6.926 ps
- Paired KJ jitter range: -15.773 ps to 17.156 ps, RMS jitter 6.696 ps
- Margin Above eye: 0.0675 V
- Margin Below eye: 0.0658 V
- Maximum Voltage: 0.4287 V
- Margin Below Top: 0.0963 V
- Minimum Voltage: -0.4271 V
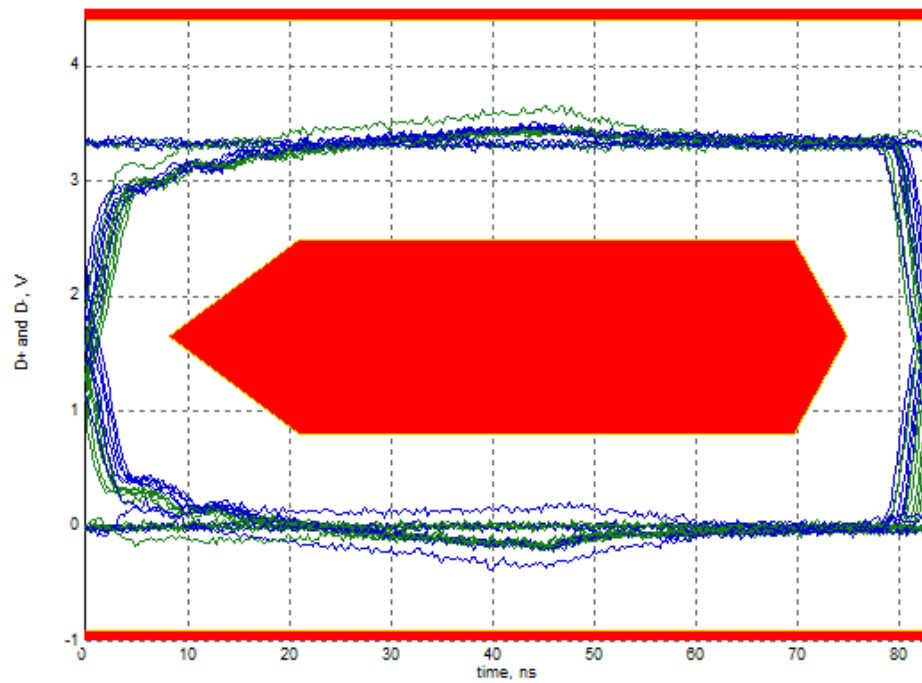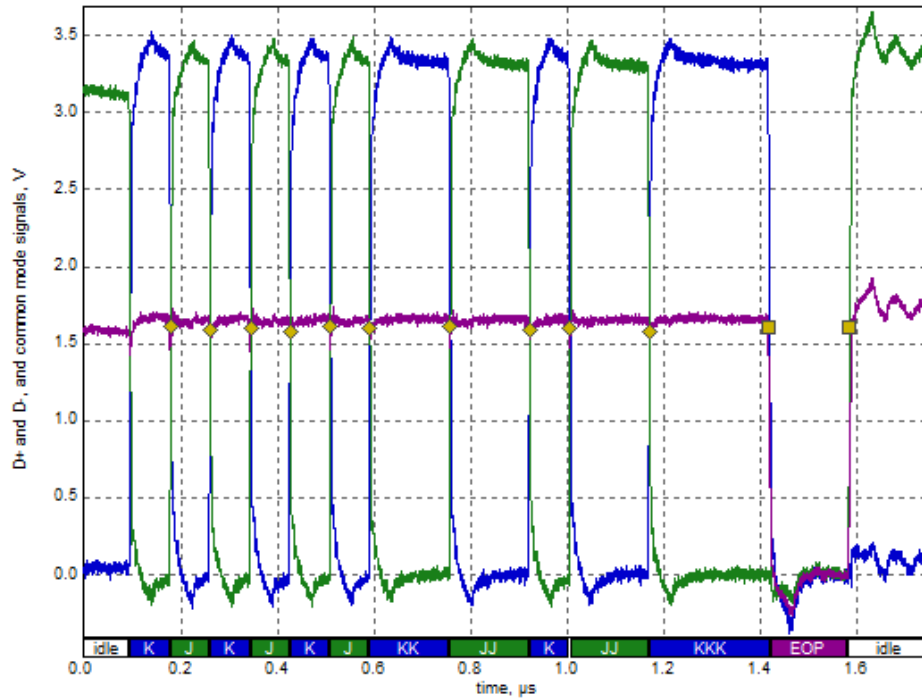- Margin Above Bottom: 0.0979 V

Signal Data and Eye

2. Full Speed Upstream Signal Quality: Pass

- Overall result: pass!
- Signal eye:
  eye passes
- EOP width: 167.22 ns
  EOP width passes
- Measured signaling rate: 11.9788 MHz
  signal rate passes
- Edge Monotonicity: 1 mV
  Monotonic Edge passes
- Crossover voltage range: 1.58 V to 1.61 V, mean crossover 1.60 V
  (first crossover at 1.61 V, 9 other differential crossovers checked)
  crossover voltages pass
- Consecutive jitter range: -1092.694 ps to 1054.488 ps, RMS jitter 637.176 ps
- Paired JK jitter range: 335.690 ps to 411.992 ps, RMS jitter 366.141 ps
- Paired KJ jitter range: 213.795 ps to 558.700 ps, RMS jitter 381.570 ps
  jitter passes

Additional Information

- Rising Edge Rate: 461.15 V/us (Equivalent risetime = 5.72 ns)
- Falling Edge Rate: 472.63 V/us (Equivalent falltime = 5.59 ns)
- Edge Rate Match: 2.46% (limit +/-10%)
- Margin Above eye: 0.6964 V
- Margin Below eye: 0.5926 V
- Maximum Voltage: 3.6557 V
- Margin Below Top: 0.7443 V
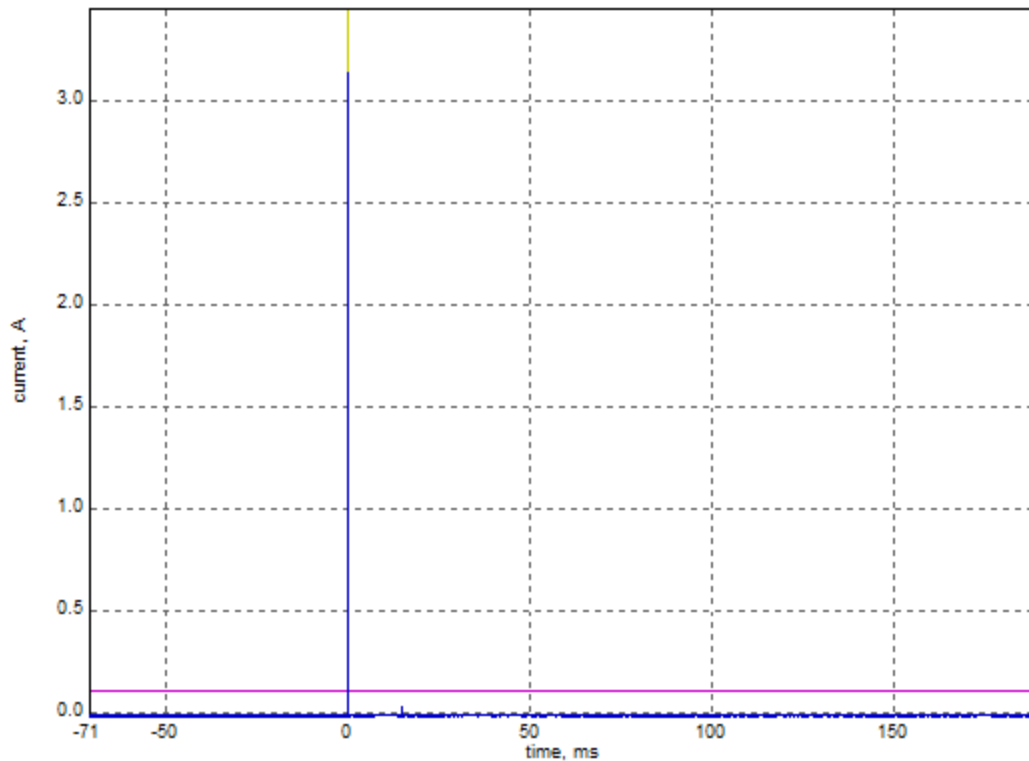- Minimum Voltage: -0.3834 V
- Margin Above Bottom: 0.5166 V

Signal Data and Eye

3. Inrush Current: Pass

- Overall result: pass!
- Inrush at 5.239 V: 39.2832 μC
  Inrush passes
- **Region 1 Start: -0.00049 ms - End: 0.128 ms = 39.28 μC**

Hot Plug (Attach) Current Draw

Testing Procedure Documents:

1. Keysight N5416A/N5416B USB 2.0 Compliance Test Application, Version 3.96
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.