



USB-IF 2.0 Compliance Test Report for Embedded Host

Company Name: NXP Semiconductors

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

Model Name: i.MXRT685

Product Type: Embedded Host

Report Date: 02/12/2020

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)
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E-Mail: dezheng.tang@nxp.com
FAX Number: N/A

Product Picture:



Overall Test Result Summary

Test Category	Result
Electrical	
High Speed	Pass
Full Speed	Pass
Low Speed	Pass
BC 1.2	
Downstream Port	Pass
IOP	
HS Automated EH Tests	Pass
HS Interoperability Tests	Pass

Product Information:

Information Obtained From Checklist or Vendor			
Input	Type	Purpose	Checklist Ref
Uses Micro-AB	<input checked="" type="checkbox"/>	Check this box for an EH which uses a Micro-AB receptacle instead of a Standard-A receptacle. It will be automatically selected for OTG devices.	P15a
Supports Sessions	<input type="checkbox"/>	Check this box if the OTG A-UUT or EH with Micro-AB receptacle does not keep V BUS enabled all the time that the ID pin is held low. Check this box for an EH with Standard-A receptacle which does not keep V BUS high all the time it is powered up. In either case it is assumed that SRP or ADP is available to detect the presence of a device.	P110
SRP as A-device	<input type="checkbox"/>	Check this box if the UUT, as an A-device, supports detecting, and acting on, an SRP pulse generated by a connected device.	P113
HNP as A-device	<input type="checkbox"/>	Check this box if the UUT, as an A-device, supports HNP to enable the connected B-device to become host if it so requires.	P113
HNP Polling as A-device	<input type="checkbox"/>	Check this box if the UUT, as an A-device, supports HNP polling. If it does it is allowed to remain as host, for as long as the other device does not set its Host Request Flag.	P113
ADP as A-device	<input type="checkbox"/>	Check this box if the UUT, as an A-device, supports ADP probing to detect the presence or otherwise of a connected device.	P113

Input	Type	Purpose	Checklist Ref
SRP as B-device	<input type="checkbox"/>	Check this box if the UUT, as a B-device, supports generating an SRP pulse in order to start a session (cause the connected A-device to turn on V BUS).	PI20
HNP as B-device	<input type="checkbox"/>	Check this box if the UUT, as a B-device, supports HNP to allow it to become host if it so requires.	PI20
ADP as B-device	<input type="checkbox"/>	Check this box if the UUT, as a B-device, supports ADP sensing and probing to detect the presence or otherwise of a connected device.	PI20
FS Not Available	<input type="checkbox"/>	Check this box if UUT does not fully support full-speed operation. This is not permitted for an OTG device, but may be for an Embedded Host.	PI11, PI18
IA_VBUS_RATED	100 mA	The rated output current of an A-device in mA units.	PI8
bMaxPower	100 mA	bMaxPower (sic) is the highest current, in mA, declared in any of the device's Configuration Descriptors. This value ignores current drawn under the Battery Charging provisions.	PI17
TPWRUP_RDY	30 S	Maximum time, in seconds, specified by vendor from powering on the UUT until it is ready to perform USB functionality. By default this is set to 30 seconds, but a vendor is permitted to specify a longer time.	PI24

Input	Type	Purpose	Checklist Ref
TA_WAIT_BCON max	30 S	The maximum time, in seconds, that V BUS is left on for by an A-device, in the absence of a B-device connecting. The default value is thirty seconds. A vendor is permitted to specify a longer time, but should be aware that this will have an impact on the time taken for, and therefore possibly the cost of, compliance testing.	PI10
Unknown Dev (No HNP)	VID: 1A0A PID: 0201	The test will use the VID/PID combination specified during tests for error messages, when an unknown B-device, not capable of HNP, is connected. A default value (1A0A/0201) is used, but any other device not on the UUT's TPL may be defined here.	-
Unknown Dev (HNP)	VID: 1A0A PID: 0202	The test will use the VID/PID combination specified during tests for error messages, when an unknown B-device, capable of HNP, is connected. A default value (1A0A/0202) is used, but any other device not on the UUT's TPL may be defined here.	-

Test Cable Information:

Information Obtained From MQP USB-PET Test Cables			
Input	Type	Purpose	Checklist Ref
Cable A	<u>175</u> mΩ	Test Cable A loop resistance in mΩ.	Cable A
Cable B	<u>587</u> mΩ	Test Cable B loop resistance in mΩ.	Cable B

USB 2.0 Electrical Compliance Tests

Host 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.

Port	1
EL_2: Data Rate	Pass
EL_3: Eye Pattern	Pass
EL_6: Rise and Fall Time	Pass
EL_7: Monotonic	Pass

Host Controller Packet Parameters

Pass Fail N/A

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

Port	1
EL_21: (32bit)	Pass 32bit/ 32bit
EL_25: (8bit)	Pass 8bit
EL_23: (>=88bit and <=192bit)	Pass 120bit
EL_22: (>=8bit and <=192bit)	Pass 134bit
EL_55: (40bit)	Pass 40bit

Host 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)

Port	1
EL_33: ($\leq 100\mu\text{s}$)	Pass 50.003us
EL_34: ($\geq 40\mu\text{s}$ and $\leq 60\mu\text{s}$)	Pass 50.022us
EL_35: ($100\mu\text{s}$ and $\leq 500\mu\text{s}$)	Pass 360.670us

Host Suspend/Resume/Reset Timing

Pass Fail N/A

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

Port	1
EL_39:	Pass
EL_41: ($\leq 3\text{ms}$)	Pass 122us

Host 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 is 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:

Port	1
SE0_NAK D+	-1.4mV
SE0_NAK D-	-1.4mV
TEST_J D-	2.1mV
TEST_K D+	1.9mV

(-20mV to 20mV)

Full Speed Signal Quality Test Result

Pass Fail

Full Speed Downstream Signal Quality:

Pass Fail

Port 1
Pass

Low Speed Downstream Signal Quality:

Pass Fail N/A

Port 1
Pass

Drop/Droop Test Result

Pass

Fail

Load: 100mA

Port	1
V _{non-load} (>=4.75V and <=5.5V)	5.201V
V _{load} (>=4.75V and <=5.5V)	5.157V
V _{drop} (<=500mV)	44mV
V _{droop} (<=330mV)	N/A

BC 1.2 Implemented Check:

Supported Not Supported

If any one of exposed ports has BC 1.2 capability, all items of BC 1.2 specific category(s) should be tested under this port(s) for USB-IF certification.

Port 1
N/A

Battery Charging 1.2 Compliance Tests

Dedicated Charging Port (DCP)

Pass Fail N/A

Test Items	Port
	1
DCP Overshoot and Undershoot Voltage Test	N/A
DCP Handshaking Test	N/A
DCP Resistance and Capacitance Test	N/A
DCP Voltage and Current	N/A

Charging Downstream Port (CDP)

Pass Fail N/A

Test Items	Port
	1
CDP Overshoot and Undershoot Voltage Test	N/A
CDP Voltage and Current Test	N/A
CDP Handshaking Test	N/A
CDP Ground Offset Test – Full Speed	N/A
CDP Ground Offset Test – High Speed	N/A

Standard Downstream Port (SDP)

Pass

Fail

N/A

Port	1
Test Items	
SDP Handshaking Test	N/A

Multiple Role Port (MRP)

Pass

Fail

N/A

Port	1
Test Items	
MRP Functional Test	N/A

High Speed Interoperability Tests

High Speed Automated Tests (Ch 6)

Pass

Fail

MQP USB-PET

Only applicable when the Embedded Host has an A-Port.

Test Item	Port 1
6.7.2 A-UUT Initial Power-up Test	Pass
6.7.4 A-UUT V _{BUS} Voltage and Current Measurements	Pass
6.7.5 A-UUT Bypass Capacitance	N/A
6.7.6 A-UUT SRP	N/A
6.7.8 A-UUT ADP	N/A
6.7.9 A-UUT Leakage	N/A
6.7.14 EH, Capable of ADP and SRP, State Transition Test (Standard-A)	N/A
6.7.15 EH, Capable of ADP but not SRP, State Transition Test (Standard-A)	N/A
6.7.16 EH, Capable of SRP but not ADP, State Transition Test (Standard-A)	N/A
6.7.17 EH with no Session Support State Transition Test (Standard-A)	N/A
6.7.18 EH, Capable of ADP and SRP, (Micro-AB) or OTG-A, Capable of ADP and SRP but not HNP, State Transition Test	N/A
6.7.19 EH, Capable of ADP but not SRP, (Micro-AB) or OTG-A, Capable of ADP but not SRP or HNP, State Transition Test	N/A
6.7.20 EH, Capable of SRP but not ADP, (Micro-AB) or OTG-A, Capable of SRP but not ADP or HNP, State Transition Test	N/A
6.7.21 EH with no Session Support State Transition Test (Micro-AB), or OTG-A with no Session or HNP Support	Pass
6.7.22 A-UUT "Device No Response" for connection timeout	Pass
6.7.23 A-UUT "Unsupported Device" Message	Pass
6.7.24 A-UUT "Device No Response" for HNP enable	N/A
6.7.25 EH using Micro-AB "Incorrect Connection"	Pass

Only applicable when the Embedded Host has a B-Port.

Test Item	Port 1
6.8.1 B-UUT Initial Power-up Test	N/A
6.8.2 B-UUT V_{BUS} Voltage and Current Measurements	N/A
6.8.3 B-UUT Bypass Capacitance	N/A
6.8.4 B-UUT SRP	N/A
6.8.6 B-UUT ADP	N/A
6.8.7 B-UUT Leakage	N/A
6.8.13 ADP-Capable Peripheral Only B-device State Transition Test	N/A
6.8.14 SRP Only Capable Peripheral Only B-device State Transition Test	N/A
6.8.15 Peripheral Only B-device, Capable of No Protocols, State Transition Test	N/A
6.8.16 B-UUT “Device no response” for SRP	N/A

High Speed Manual Tests (Ch 7)

Pass

Fail

This section will perform DUT interoperability with peripherals that are on the vendor's Target Peripheral List.

Test Item	Port 1
7.3.1 A-UUT Functionality B-device	Pass
7.3.2 A-UUT Category Functionality B-device	Pass
7.3.3 A-UUT Boot test	Pass
7.3.4 A-UUT Legacy Speed test	N/A
7.3.5 A-UUT Concurrent and Independently test	N/A
7.3.6 A-UUT Unsupported device Message test	Pass
7.3.7 A-UUT Hub Error message test	Pass
7.3.8 A-UUT Hub Functionality test	N/A
7.3.9 A-UUT Hub maximum tier test	N/A
7.3.10 A-UUT Hub Concurrent and Independent test	N/A
7.3.11 A-UUT Bus powered hub power exceeded test	N/A
7.3.12 A-UUT Maximum concurrently device exceed message test	N/A
7.3.13 A-UUT Standby test	N/A
7.3.14 A-UUT Standby Disconnect test	N/A
7.3.15 A-UUT Standby Attach test	N/A
7.3.16 A-UUT Standby Topology Change test	N/A
7.3.17 A-UUT Standby Remote Wakeup test	N/A

More Detailed Test Results:

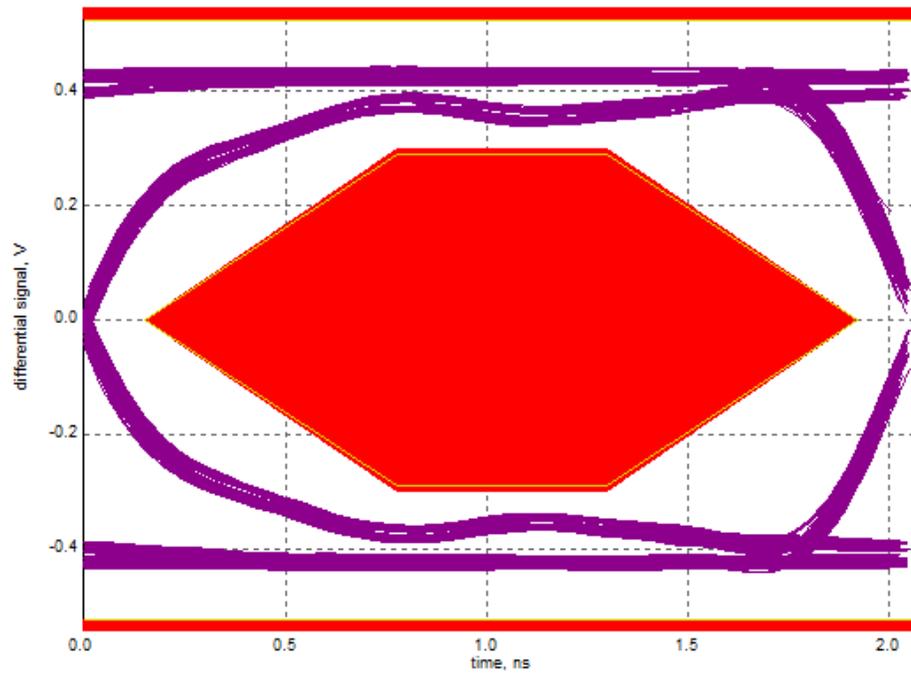
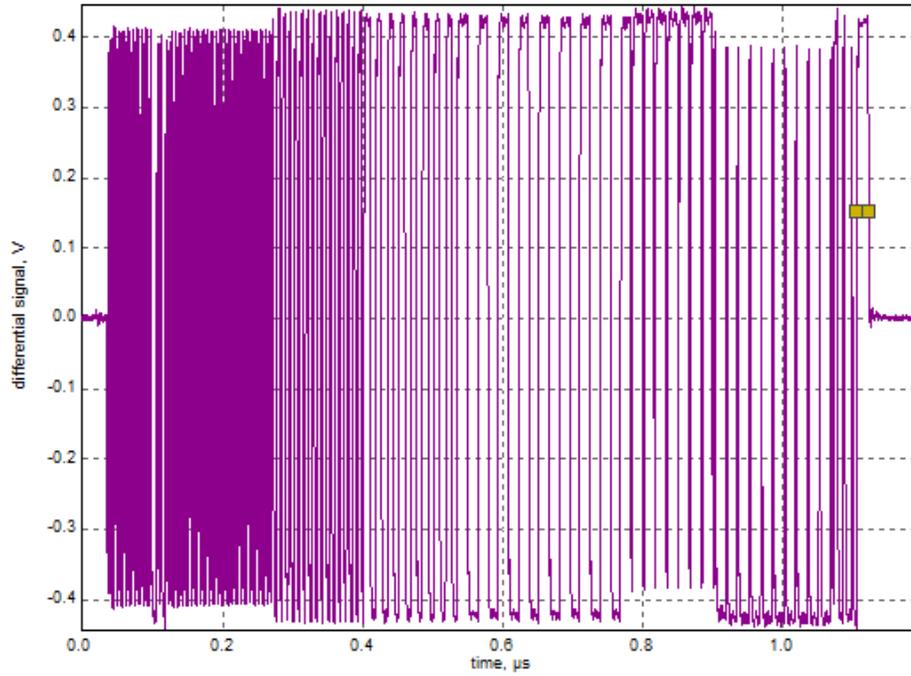
1. High Speed Downstream Signal Quality: Pass

- Overall result: pass!
- Sync result:
sync passes
- Signal eye:
eye passes
- EOP width: 7.93 bits
EOP width passes
- Measured signaling rate: 479.9832 MHz
signal rate passes
- Edge Monotonicity: 0 mV
Monotonic Edge passes
- Rising Edge Rate: 1512.55 V/us (423.13 ps equivalent risetime)
passes
- Falling Edge Rate: 1477.03 V/us (433.30 ps equivalent falltime)
passes

Additional Information

- Consecutive jitter range: -31.537 ps to 24.214 ps, RMS jitter 10.857 ps
- Paired JK jitter range: -37.755 ps to 16.084 ps, RMS jitter 8.933 ps
- Paired KJ jitter range: -25.125 ps to 28.404 ps, RMS jitter 9.085 ps
- Margin Above eye: 0.0403 V
- Margin Below eye: 0.0386 V
- Maximum Voltage: 0.4426 V
- Margin Below Top: 0.0824 V
- Minimum Voltage: -0.4398 V
- Margin Above Bottom: 0.0852 V

Signal Data and Eye



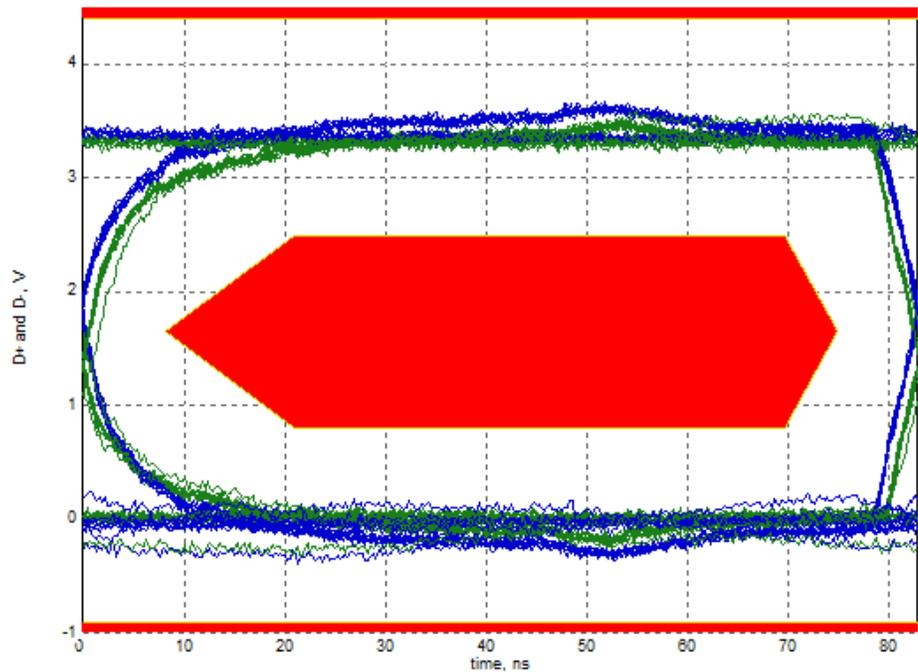
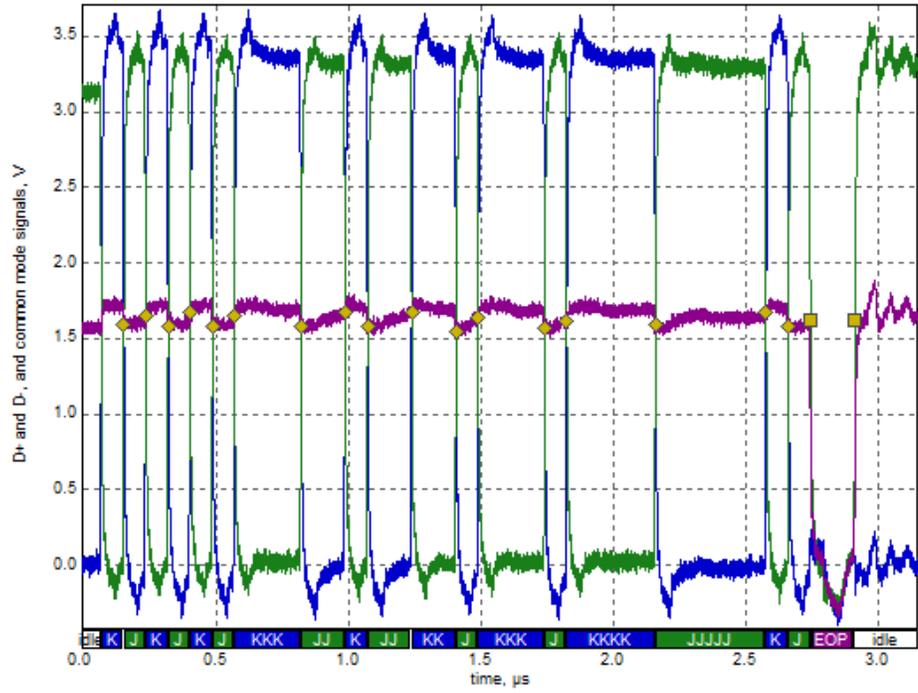
2. Full Speed Downstream Signal Quality: Pass

- Overall result: pass!
- Sync result:
sync passes
- Signal eye:
eye passes
- EOP width: 168.20 ns
EOP width passes
- Measured signaling rate: 12.0019 MHz
signal rate passes
- Edge Monotonicity: 22 mV
Monotonic Edge passes
- Crossover voltage range: 1.54 V to 1.68 V, mean crossover 1.62 V
(first crossover at 1.59 V, 16 other differential crossovers checked)
crossover voltages pass
- Consecutive jitter range: -604.213 ps to 543.640 ps, RMS jitter 522.327 ps
- Paired JK jitter range: -18.923 ps to 137.258 ps, RMS jitter 68.080 ps
- Paired KJ jitter range: -84.944 ps to 92.237 ps, RMS jitter 53.849 ps
jitter passes

Additional Information

- Rising Edge Rate: 344.28 V/us (Equivalent risetime = 7.67 ns)
- Falling Edge Rate: 372.16 V/us (Equivalent falltime = 7.09 ns)
- Edge Rate Match: 7.78% (limit +/-10%)
- Margin Above eye: 0.6788 V
- Margin Below eye: 0.6114 V
- Maximum Voltage: 3.6760 V
- Margin Below Top: 0.7240 V
- Minimum Voltage: -0.3959 V
- Margin Above Bottom: 0.5041 V

Signal Data and Eye



3. Low Speed Downstream Signal Quality: Pass

- Overall result: pass!
- Sync result:
sync passes
- Signal eye:
eye passes
- EOP width: 1.33 us
EOP width passes
- Measured signaling rate: 1.5000 MHz
signal rate passes
- Edge Monotonicity: 96 mV
Monotonic Edge passes
- Crossover voltage range: 1.47 V to 1.56 V, mean crossover 1.52 V
(first crossover at 1.54 V, 24 other differential crossovers checked)
crossover voltages pass
- Consecutive jitter range: -1.971 ns to 1.676 ns, RMS jitter 1.007 ns
- Paired JK jitter range: -0.879 ns to 1.133 ns, RMS jitter 0.673 ns
- Paired KJ jitter range: -0.969 ns to 1.020 ns, RMS jitter 0.515 ns
jitter passes

Additional Information

- Rising Edge Rate: 22.90 V/us (Equivalent risetime = 115.30 ns)
- Falling Edge Rate: 23.70 V/us (Equivalent falltime = 111.41 ns)
- Edge Rate Match: 3.43% (limit +/-20%)
- Margin Above eye: 0.4009 V
- Margin Below eye: 0.2555 V
- Maximum Voltage: 3.4317 V
- Margin Below Top: 0.2683 V
- Minimum Voltage: -0.1254 V
- Margin Above Bottom: 0.0746 V

Signal Data and Eye

Test Procedure Reference:

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. USB Battery Charging 1.2 Compliance Plan, Revision: 1.1
4. USB On-The-Go and Embedded Host Automated Compliance Plan for the On-The-Go & Embedded Host Supplement Revision 2.0, Version 1.2

Notice: Test result is valid only to the original tested device model.