Compliance Plan for USB On-The-Go and Embedded Host 3.0

Release 1.0

USB-IF OTG & EH 3.0 Working Group

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Revision History

Revision	Issue Date	Comment
1.0	May 10, 2013	Initial release.

Universal Serial Bus Specification Supplement

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1 Introduction

This document provides the compliance criteria and test descriptions (TDs) for SuperSpeed ***[OTG&EH3.0]*** implementations. It is relevant for anyone building a SuperSpeed On-the-Go (OTG) device, Embedded Host (EH), or peripheral-only B-device.

Compliance criteria are provided as a list of assertions that describe specific characteristics or behaviors that must be met. Each assertion provides a reference to ***[OTG&EH3.0]*** or other documents from which the assertion was derived. In addition, assertions deemed as testable are referenced to a specific TD(s), where the assertion is tested.

TDs provide a high-level overview of the tests that are performed to check the compliance criteria. The descriptions are provided with enough detail so that a reader can understand what the test does. Additional certification requirements not covered herein shall apply, including the requirement to pass ***[OTG&EH2.0]*** compliance requirements, and relevant ***[USB3.0]*** requirements (see Section 11).

Each assertion is formatted as follows:

Assertion #	Assertion Description	Test #	Comments

Assertion#: Unique identifier for each spec requirement. The identifier is in the form SUPPLEMENT_SECTION_NUMBER#X, where X is a unique integer for a requirement in that section.

Assertion Description: Specific requirement from the specification.

Test #: A label for a specific test description in this specification that tests this requirement. Test # can have one of the following values:

N/A This item is not explicitly tested in a test description. Items can be labeled N/A for several reasons – including items that are not testable, not important to test for interoperability, or are indirectly tested by other operations performed by the compliance test.

TD.5.X This item is covered by the test described in test description 5.X in this specification.

TBD A test description is not yet written for this assertion. The comments field provides more details on such items.

Comments: Provides additional information on requirements that are marked TBD.

2 Terms and Abbreviations

This chapter lists and defines terms, abbreviations used throughout this specification. Terms and Abbreviations specified in ***[USB3.0]*** and ***[OTG&EH3.0]*** are not duplicated here.

Term/Abbreviation	Definition
SS-OVS	SuperSpeed OTG Verification System
TD	Test Description
UUT	Unit Under Test. Generic reference to the product being tested by the SS-OVS, including SS-EH, SS-OTG (A- and B-devices), SSPO devices, and SSPC-OTG devices.

3 General Notes

3.1 Reference Document(s)

The following referenced documents can be found on the USB-IF website (www.usb.org):

[OTG&EH2.0]	*On-The-Go and Embedded Host Supplement to the USB* 2.0 Specification, Revision 2.0 plus errata and ECR
[OTG&EH3.0]	*On-The-Go and Embedded Host Supplement to the USB* 3.0Specification, Revision 1.0 plus errata and ECR
[OTG&EH3.0ComplianceChecklist]	*OTG&EH 3.0 Compliance Checklist*
[OTG&EH2.0ComplianceChecklist]	*OTG&EH 2.0 Compliance Checklist*
[OTG&EH2.0CompliancePlan]	*USB On-The-Go and Embedded Host Automated Compliance Plan, Revision 1.1*
[Micro-USB1.01]	*Universal Serial Bus Micro-USB Cables and Connectors Supplement to the USB 2.0 Specification,* revision 1.01.
[USB3.0]	*Universal Serial Bus Revision 3.0 including ECNs and errata.*
[USB2.0]	*Universal Serial Bus R*evision 2.0 Specification including ECNs and errata.
[USBSystemsChecklist]	*USB Compliance Checklist, Systems*
[USBPeripheralChecklist]	*USB Compliance Checklist, Peripheral (Excluding Hubs)*
[USBPeripheralSilicon]	*USB Compliance Checklist, Peripheral Silicon (Excluding Hub Silicon)*
[LinkLayerTestSpecification]	*USB 3.0 Link Layer Test Specification*

4 Executive Summary

This compliance plan tests only new parameters/features specified in ***[OTG&EH3.0]***. Any parameter/feature specified in ***[USB3.0]*** is assumed to have already been tested and will not be tested here. For a list of ***[USB3.0]*** tests which shall be applied see Section 11.

The significant features tested from ***[OTG&EH3.0]*** are:

- Targeted Host capabilities
- SS-OTG Device capabilities
- Role Swap Protocol
- No Silent failures – *i.e.* there must be a method of alerting the user that an unsupported device has been attached, or that the attached device violates one of the conditions required to interface to the SS-OTG device.
- Interoperability with devices on the Targeted Peripheral List

Many tests are based on the use of the SuperSpeed OTG3 Verification System (SS-OVS), which is described in SS-OVS – SuperSpeed OTG Verification System.

The USB-IF Board reserves the right to re-certify products if, after USB-IF certification, the TPL is updated such that this adds new capability to the device which has not previously been tested.

5 Submission Materials

5.1 Checklists

The manufacturer of a SuperSpeed Embedded Host (SS-EH) or an SS-OTG device, SSPC-OTG or SS-PO device shall provide a completed ***[OTG&EH3.0ComplianceChecklist]***, plus ***[OTG&EH2.0ComplianceChecklist]*** and additional ***[USB3.0]*** Checklists, depending on the type of product to be tested.

The ***[USBSystemsChecklist]*** (product and/or silicon) is required for an SS-OTG device or SS-EH with STD-A or Micro-AB ports.

The ***[USBPeripheralChecklist]*** or ***[USBPeripheralSilicon]*** (products and/or silicon) is required for an SS-OTG device or SS-EH with B ports (not Micro-AB).

5.2 Targeted Peripheral Lists

Targeted Hosts (both SS-OTG devices and SS-EHs) must provide a Targeted Peripheral List (TPL) before submitting the device for SS-OTG and SS-EH testing (see ***[OTG&EH3.0ComplianceChecklist]***). The TPL shall include the list of supported products and hubs.

5.3 Device-Specific Procedures

Manufacturers must provide device-specific procedures including (as applicable) details on execution of a role swap.

5.4 Interoperability Testing

The following sections detail the submissions which are required in order to complete Interoperability testing as defined in Manual Interoperability Tests, Section 10.

5.4.1 Functional definition

The vendor of the product to be tested is responsible for providing details of the expected functionality of the product.

5.4.2 TPL device(s)

The vendor of the product to be tested is responsible to provide the following TPL devices:

- Each device listed on the TPL (only SuperSpeed devices).
- When product is an SS-EH with multiple ports, two identical devices shall be provided.
- When the product is an SS-OTG device which supports hubs, then two identical devices shall be provided, as well as the hub(s) listed on the TPL.
- When the product is an SS-OTG device which lists itself on the TPL, two identical products shall be provided.

All listed TPL devices shall be retail and USB-IF certified.

6 Assertions

Note: Many of the Test Descriptions (TDs) in Section 10 are derived from assertions in ***[OTG&EH2.0]***, which are not listed below.

6.1 SuperSpeed Embedded Host (SS-EH) Assertions

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.1 Connectors, Cables Assemblies, and Cable Adapters			
Subsection 2.1.3 SS-EH Devices			
2.1.3#1	The SS-EH has either one or more Standard-A receptacles and/or one or more Micro-AB receptacles as defined in [USB3.0].	N/A	
2.1.3#2	If the SS-EH employs a Micro-AB receptacle as defined in [USB3.0], it enables Vbus only when the ID pin is FALSE.	N/A	
2.1.3#3	If the SS-EH implements one or more Type-B receptacles, these are implemented such that the user is unlikely confuse the EH with a USB hub.	N/A	
2.1.3#4	On detection of a valid voltage above the range defined by VOTG_SESS_VLD in [OTG&EH2.0] or when ID pin becomes TRUE an Embedded Host *should* display a non-silent failure message to the end user	TD2.2	
Subsection 2.5 Capability Limitation			
Subsection 2.5.2 Operating Speeds			
2.5.2#1	The SS-EH supports both SuperSpeed and full speed.	N/A	Manual Test for USB2
Subsection 2.5.3 Targeted Peripheral List			
2.5.3#1	A Targeted Peripheral List (TPL) containing one or more SuperSpeed peripherals has been provided.	N/A	
Subsection 2.6 No Silent Failures			
2.6#1	The SS-EH communicates messages to the user in the event of failures and such messages are self-explanatory.	TD2.2	
2.6#2	The SS-EH reports an unsupported peripheral as an error to the user.	TD2.1	

Assertion	Description	Test	Comments
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.1 OTG Descriptor			
5.1#1	If the SS-EH has a B-Port, and if either SRP or ADP is supported, this B-Port supports the OTG descriptor.	TD5.1	
5.1#2	If the SS-EH has a B-Port and supports either SRP or ADP, this B-Port returns the OTG descriptor in response to a GetDescriptor(OTG) request.	TD5.1	
5.1#3	If the SS-EH has a B-Port, and supports either SRP or ADP, this B-Port returns the OTG descriptor as part of a GetDescriptor(Configuration) request.	TD5.2	
5.1#4	If the SS-EH has a B-Port, and supports either SRP or ADP, this B-port responds to an OTG descriptor request with *bDescriptorType* = 9.	TD5.1 TD5.2	
5.1#5	If the SS-EH has a B-Port, and supports either SRP or ADP, this B-Port responds to an OTG descriptor request with bits D7-D4 of the *bmAttributes* field reserved (set to 0).	TD5.1 TD5.2	
Subsection 5.1.2 RSP Support			
5.1.2#1	If the SS-EH has a B-Port, and supports either SRP or ADP, this B-Port responds to an OTG descriptor request with D3 (RSP Support) set to FALSE.	TD5.1	
Subsection 5.1.3 OTG and EH Supplement Release Number			
5.1.3#1	If the SS-EH has a B-Port, and supports either SRP or ADP, this B-Port responds to an OTG descriptor request with a value of 0x0300 in the *bcdOTG* field.	TD5.1	

6.2 SuperSpeed OTG Devices Assertions

6.2.1 SS-OTG Device Common Assertions

Assertion	Description	Test	Comments
SECTION 1 INTRODUCTION			
Subsection 1.1 Overview			
1.1#1	The SS-OTG device operates as a SuperSpeed peripheral when connected to a SuperSpeed USB host.	TD5.3	

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.1 Connectors, Cable Assemblies, and Adapters			
Subsection 2.1.1 SS-OTG and SSPC-OTG Devices			
2.1.1#1	The SS-OTG device has one and only one USB connector: a [USB 3.0] Micro-AB receptacle as defined in [OTG&EH3.0].	N/A	
Subsection 2.3 Symmetry			
2.3#1	If RSP is supported, when this SS-OTG device is attached to another SS-OTG device, it demonstrates the same SuperSpeed behavior to the end user regardless of whether it is attached as the A-device or the B-device.	TD5.46	
2.3#2	If RSP is supported, when this SS-OTG device is attached to another SS-OTG device and the user interacts with this SS-OTG device this causes a session to be started.	TD5.4	
2.3#3	If RSP is supported, when this SS-OTG device is attached to another SS-OTG device and the user interacts with this SS-OTG device, the user is able to access or control the other SS-OTG device at SuperSpeed, using applications running on this SS-OTG device.	TD5.46	
2.3#4	If RSP is supported, when this SS-OTG device is attached to another SS-OTG device, (and using RSP), the role of host can be transferred back and forth between the A-device and the B-device any number of times.	TD5.12	
Subsection 2.5 Capability Limitation			
Subsection 2.5.3 Targeted Peripheral List			
2.5.3#2	A Targeted Peripheral List (TPL) containing one or more SuperSpeed peripherals has been provided.	N/A	
Subsection 2.6 No Silent Failures			
2.6#3	The SS-OTG device communicates messages to the user in the event of failures and such messages are self-explanatory.	TD2.2	
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.2 Standard Device Features			
Subsection 5.2.1 NTF_HOST_REL			
5.2.1#1	The SS-OTG device, in host role, uses the SET_FEATURE Request (NTF_HOST_REL) to notify the peripheral that a subsequent warm reset should be treated as a role swap.	TD5.7	

Assertion	Description	Test	Comments
5.2.1#2	The SS-OTG device, in host role, issues a SET_FEATURE Request (NTF_HOST_REL) only to a device that is operating in the Addressed or Configured state.	N/A	
5.2.1#3	The SS-OTG device, in host role, issues a SET_FEATURE Request (NTF_HOST_REL) only to the default control pipe.	TD5.4	
5.2.1#4	The SS-OTG device, in peripheral mode, responds with a Request Error if it receives a SET_FEATURE Request (NTF_HOST_REL) from an SS-OTG device (in host role), when this request is directed at an interface or endpoint that is not the default control pipe.	N/A	
Subsection 5.4 Role Swap Protocol (RSP)			
Subsection 5.4.1 RSP Process			
RSP Step 1			
5.4.1#1	The SS-OTG device, when acting as peripheral (US port) and initiating a Role Swap Protocol (RSP) request, does so using a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).	TD5.3	
RSP Step 2			
5.4.1#2	The SS-OTG device, when acting as host, (DS port) releases the host role using SET_FEATURE (NTF_HOST_REL).	TD5.4	
5.4.1#3	The SS-OTG device, when acting as host (DS port) and after having sent a SET_FEATURE (NTF_HOST_REL) request, does not subsequently generate any warm resets on the link prior to the warm reset in RSP 5.4.1 Step 4 (which concludes the RSP process).	TD5.4	
5.4.1#4	The SS-OTG device, when acting as peripheral (US port), and not having received a SET_FEATURE (NTF_HOST_REL) request, treats any warm reset signaled by the DS port as a standard warm reset.	TD5.5	
5.4.1#5	The SS-OTG device, when acting as host (DS port), immediately sends the SET_FEATURE (NTF_HOST_REL) request in response to a role swap request from the US port, if it is in a state where a role swap can be completed without undesirable side-effects.	TD5.4	
5.4.1#6	In the case of an RSP initiated by an US port, the SS-OTG device, acting as a host (DS port), and not being ready for a role swap, performs a clean-up and then sends the SET_FEATURE (NTF_HOST_REL) request within **TRSP_ACK** of receiving the HOST_ROLE_REQUEST Device Notification TP request from the peripheral.	N/A	

Assertion	Description	Test	Comments
5.4.1#7	In the case of RSP initiated by an US port, the SS-OTG device, acting as a peripheral (US Port), and not having received the SET_FEATURE (NTF_HOST_REL) request within **TRSP_ACK_ERR** of requesting host role, transitions to an error state.	TD5.6	
RSP Step 3			
5.4.1#8	The SS-OTG device, acting as US port, confirms that it is ready for the Warm Reset and Role Swap process by issuing a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM).	TD5.3	
5.4.1#9	The SS-OTG device, acting as US port, sends the Device Notification TP within **TRSP_CNF** of receiving the SET_FEATURE command in RSP Step 2.	TD5.9	
5.4.1#10	The SS-OTG device, acting as DS port and not having received the Device Notification TP within **TRSP_CNF_ERR** of issuing the SET_FEATURE command in Step 2, transitions to an error state.	TD5.8	
RSP Step 4			
5.4.1#11	The SS-OTG device, acting as host (DS port) initiates the role swap by issuing a warm reset within **TRSP_WRST** after receiving the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM).	TD5.4 TD5.11	
5.4.1#12	The SS-OTG device, acting as peripheral (US port), and not having received the warm reset within **TRSP_WRST_ERR** of issuing the Device Notification TP in Step 3, transitions to an error state.	TD5.10	
5.4.1#13	Following the warm reset (at the end of RSP), the SS-OTG device starts up in the opposite role to the one it had prior to the reset.	TD5.3 TD5.4	
5.4.1#14	After the warm reset (at the end of RSP), the SS-OTG device, if acting as peripheral prior to the warm reset, sends an LMP Port Capability packet with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.	TD5.3	
5.4.1#15	After the warm reset (at the end of RSP), the SS-OTG device, if acting as host prior to the warm reset, sends an LMP Port Capability packet with the Upstream bit (1:17) set and the Downstream bit (1:16) reset).	TD5.4	
Subsection 5.5 Device Notification TP (HOST_ROLE_REQUEST)			
5.5#1	The SS-OTG device, acting as peripheral (US port), initiates a Device Notification TP (HOST_ROLE_REQUEST) only if its RSP capability has been enabled.	TD5.3	

Assertion	Description	Test	Comments
5.5#2	When sending a Device Notification TP (HOST ROLE REQUEST), the SS-OTG device sets the reserved field bits at DW1:10 to zero (bits 10 through 31).	TD5.3	
5.5#3	When sending a Device Notification TP (HOST ROLE REQUEST), the SS-OTG device sets the reserved field bits at DW2:0 to zero (bits 0 through 31).	TD5.3	

6.2.2 SS-OTG A-Device Assertions

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.3 Symmetry			
2.3#5	When operating in SuperSpeed, the SS-OTG A-host initiates RSP when it receives a request from a B-peripheral to become the host.	TD5.16	
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.2 Standard Device Features			
Subsection 5.2.2 B3_RSP_Enable			
5.2.2#1	Once the SS-OTG A-device determines that the B-device supports RSP capability in its OTG descriptor, it enables the RSP capability within **TRSP_ENABLE** of configuring the B-device.	TD5.17	
5.2.2#2	When issuing a SET_FEATURE with B3_RSP_ENABLE set, the SS-OTG A-device does so only to the default control pipe.	TD5.17	
5.2.2#3	When issuing a SET_FEATURE request with B3_RSP_ENABLE set, the SS-OTG A-device does so only to a device that is in the addressed or configured state.	TD5.17	
Subsection 5.3 Port Capabilities for OTG Devices Operating at SuperSpeed			
5.3#1	At the start of a session, the SS-OTG A-device defaults to host role and sets the DS bit (1:16) and resets the US bit (1:17) in its Port Capabilities LMP.	TD5.15	

Assertion	Description	Test	Comments
Subsection 5.4 Role Swap Protocol (RSP)			
Subsection 5.4.2 RSP Boundary Case			
5.4.2#1	In the boundary case, when the SS-OTG B-host simultaneously initiates RSP (Step 1) along with an SS-OTG A-peripheral that initiates RSP (Step 2), the SS-OTG A-peripheral, after receiving a SET_FEATURE (NTF_HOST_REL) request, proceeds directly to complete RSP Step 3, irrespective of the state of any RSP Step 1 that may be in process.	TD5.19	

6.2.3 SS-OTG B-Device Assertions

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.3 Symmetry			
2.3#6	The SS-OTG B-host initiates the Role Swap Protocol when the SS-OTG A-peripheral requests to become host.	TD5.3	
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.1 OTG Descriptor			
5.1#6	The SS-OTG B-device returns the OTG descriptor as part of a GetDescriptor(Configuration) request.	TD5.22	
5.1#7	The SS-OTG B-device returns the OTG descriptor in response to a GetDescriptor(OTG) request.	TD5.21	
5.1#8	The SS-OTG B-device responds to an OTG descriptor request with *bLength* = 5 bytes.	TD5.21 TD5.22	
5.1#9	The SS-OTG B-device responds to an OTG descriptor request with *bDescriptorType* = 9.	TD5.21 TD5.22	
5.1#10	The SS-OTG B-device responds to an OTG descriptor request with bits D7-D4 of the *bmAttributes* field reserved (set to 0).	TD5.21 TD5.22	
Subsection 5.1.2 RSP Support			
5.1.2#2	The SS-OTG B-device responds to an OTG descriptor request with D3 (**RSP Support)** set to TRUE.	TD5.21 TD5.22	
Subsection 5.1.3 OTG and EH Supplement Release Number			
5.1.3#2	The SS-OTG B-device responds to an OTG request with a value of 0x0300 in the **bcdOTG** field.	TD5.21 TD5.22	

Assertion	Description	Test	Comments
Subsection 5.2 Standard Device Features			
Subsection 5.2.2 B3_RSP_ENABLE			
5.2.2#4	The SS-OTG B-device, if RSP-capable, accepts the SET_FEATURE (B3_RSP_ENABLE) command.	TD5.23	
5.2.2#5	The SS-OTG-B-device, if not RSP-capable, returns a STALL if it receives a SET_FEATURE (B3_RSP_ENABLE) command.	TD5.24	
5.2.2#6	The SS-OTG B-device shall not issue HOST_ROLE_REQUEST Device Notification TP if its RSP capability has not been enabled (by the A-device).	TD5.24	
5.2.2#7	The SS-OTG B-peripheral, if already configured with the B3_RSP_ENABLE feature, acknowledges any successive requests to set this feature with a response indicating a successful completion.	TD5.25	
Subsection 5.3 Port Capabilities for OTG Devices Operating at SuperSpeed			
5.3#2	At the start of a session, the SS-OTG B-device defaults to peripheral role, sets the US bit (1:17), and resets the DS bit (1:16) in its Port Capabilities LMP.	TD5.20	
Subsection 5.4 Role Swap Protocol (RSP)			
Subsection 5.4.2 RSP Boundary Case			
5.4.2#2	In the boundary case, when the B-host simultaneously initiates RSP (Step 1) along with an A-peripheral that initiates RSP (Step 2), the B-host that has completed RSP Step 2 ignores any subsequent or concurrently received HOST_ROLE_REQUEST Device Notification TPs that have the RSP Phase set to INITIATE.	TD5.26	

6.2.4 SuperSpeed Peripheral Only (SS-PO) Assertions

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.1 Connectors, Cables Assemblies, and Adapters			
Subsection 2.1.2 SS-PO Devices			
2.1.2#1	The SS-PO device has a compliant Type-B connector.	N/A	
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.1 OTG Descriptor			
5.1#11	The SS-PO device returns the OTG descriptor as part of a GetDescriptor(Configuration) request.	TD5.27 TD5.28	
5.1#12	The SS-PO device returns the OTG descriptor in response to a GetDescriptor(OTG) request.	TD5.27 TD5.28	
5.1#13	The SS-PO device responds to an OTG descriptor request with *bLength* = 5 bytes.	TD5.27 TD5.28	
5.1#14	The SS-PO device responds to an OTG descriptor request with *bDescriptorType* = 9.	TD5.27 TD5.28	
5.1#15	The SS-PO device responds to an OTG descriptor request with bits D7-D4 of the *bmAttributes* field reserved (set to 0).	TD5.27 TD5.28	
Subsection 5.1.2 RSP Support			
5.1.2#3	The SS-PO device responds to an OTG descriptor request with D3 (**RSP Support)** set to FALSE.	TD5.27 TD5.28	
Subsection 5.1.3 OTG and EH Supplement Release Number			
5.1.3#3	The SS-PO device responds to an OTG request with a value of 0x0300 in the **bcdOTG** field.	TD5.27 TD5.28	

6.2.5 SuperSpeed Peripheral Capable OTG (SSPC-OTG) Device Assertions

Assertion	Description	Test	Comments
SECTION 2 OTG AND EH KEY FEATURES			
Subsection 2.1 Connectors Cables Assemblies, and Adapters			
Subsection 2.1.1 SS-OTG and SSPC-OTG Devices			
2.1.1#2	The SuperSpeed Peripheral Capable OTG (SSPC-OTG) device has one, and only one USB connector: a USB 3.0 Micro-AB receptacle as defined in [USB3.0].	N/A	

Assertion	Description	Test	Comments
Subsection 2.3 Symmetry			
2.3#7	The SSPC-OTG device supports SuperSpeed capability as a peripheral only.	TD5.28	
2.3#8	The SSPC-OTG device does NOT support Role Swapping Protocol.	TD5.28	
SECTION 5 DEVICE FRAMEWORK			
Subsection 5.1 OTG Descriptor			
5.1#16	The SSPC-OTG device returns the OTG descriptor as part of a GetDescriptor(Configuration) request.	TD5.29 TD5.30	
5.1#17	The SSPC-OTG device returns the OTG descriptor in response to a GetDescriptor(OTG) request.	TD5.29 TD5.30	
5.1#18	The SSPC-OTG device responds to an OTG descriptor request with *bLength* = 5 bytes.	TD5.29 TD5.30	
5.1#19	The SSPC-OTG device responds to an OTG descriptor request with *bDescriptorType* = 9.	TD5.29 TD5.30	
5.1#20	The SSPC-OTG device responds to an OTG descriptor request with bits D7-D4 of the *bmAttributes* field reserved (set to 0).	TD5.29 TD5.30	
Subsection 5.1.2 RSP Support			
5.1.2#4	The SSPC-OTG device responds to an OTG descriptor request with D3 (**RSP Support)** set to FALSE.	TD5.29 TD5.30	
Subsection 5.1.3 OTG and EH Supplement Release Number			
5.1.3#4	The SSPC-OTG device responds to an OTG request with a value of 0x0300 in the **bcdOTG** field.	TD5.29 TD5.30	

6.3 State Diagrams

6.3.1 State Diagram Assertions for SS-OTG A-Devices

Assertion	Description	Test	Comments
Subsection 6.2 A-Device USB 3.0 State Diagram			
Subsection 6.2.1 All States			
6.2.1#1	From any state, the A-device (**otg** = TRUE) transitions to **a_wait_vfall** if the Micro-A plug is detached (**id** = TRUE) or if the A-device wishes to stop powering VBUS (**a_bus_drop** = TRUE).	N/A	

6.2.1#2	From any state, the A-device transitions to **a_vbus_err** if the attached device is unsupported due to an overcurrent condition (**a_vbus_vld** = FALSE) as defined in [OTG&EH2.0]).	N/A	
6.2.1#3	From any state, the A-device transitions to **a3_ds_disabled** if the device disables its SuperSpeed capability (**a3_ss_disabled** = TRUE).	N/A	
6.2.1#4	From any state, the A-device transitions to **a3_ds_resetting** if either of the following conditions are met: It initiates a directed warm reset (**a3_warm_reset** = TRUE). -or- If the A-device initiates a directed hot reset (**a3_hot_reset** = TRUE).	N/A	
Subsection 6.2.2 a3_ds_disconnected	Note: This state corresponds to the **DSPORT.Disconnected** state for a [USB3.0] hub port and the **Rx.Detect.Active** [USB3.0] LTSSM substate.		
6.2.2#1	During **a3_ds_disconnected**, the A-device drives VBus (**drv_vbus (dv))** = TRUE).	N/A	
6.2.2#2	During **a3_ds_disconnected**, **conn_stat (cs)** = FALSE.	N/A	
6.2.2#3	During **a3_ds_disconnected**, **super_speed (ss)** = TRUE.	N/A	
6.2.2#4	When **a3_ds_disconnected** is entered from **a3_us_swapping**, **RxDetect.Active** substate is entered upon completion of the warm reset.	N/A	
6.2.2#5	When **a3_ds_disconnected** is entered from any other state (other than **a3_us_swapping**), the **Rx.Detect.Active** substate is directly entered as per [USB3.0] (since entry to **Rx.Detect** is not due to a warm reset).	N/A	
6.2.2#6	From **a3_ds_disconnected**, the A-device transitions to **a3_ds_training** if the B-device's [USB3.0] Rx Terminations are detected (**a3_b_rx_term** = TRUE).	N/A	
Subsection 6.2.3 a3_ds_training	Note: This state corresponds to the **DSPORT.Training** state for a [USB3.0] hub port and the **Polling** state in the [USB3.0] LTSSM.		
6.2.3#1	During **a3_ds_training**, the A-device drives VBus (**drv_vbus (dv))** = TRUE).	N/A	
6.2.3#2	During **a3_ds_training**, **conn_stat (cs)** = FALSE.	N/A	
6.2.3#3	During **a3_ds_training**, **super_speed (ss)** = TRUE.	N/A	

6.2.3#4	Upon entry to **a3_ds_training**, the A-device initiates the polling timer (**a3_polling_tmr**).	N/A	
6.2.3#5	From **a3_ds_training**, the A-device transitions to **a3_ds_host** if link training was successful (**a3_ds_training_success** = TRUE).	N/A	
6.2.3#6	From **a3_ds_training**, the A-device transitions to **a3_ds_loopback** if the loopback bit is set in the received TS2 data sets (**a3_loopback_set** = TRUE).	N/A	
6.2.3#7	From **a3_ds_training**, the A-device transitions to **a3_ds_disconnected** if the link polling process times out (**a3_polling_tmout** = TRUE).	N/A	
6.2.3#8	From **a3_ds_training**, the A-device transitions to **a3_ds_compliance** if the link is configured to go into [USB3.0] compliance mode (**a3_compliance_mode_entry** = TRUE).	N/A	
Subsection 6.2.4 a3_ds_host	Note: This state corresponds to the **DSPORT.Enabled** state for a [USB3.0] hub port and the **U0, U1, U2, U3** or **Recovery** states in the [USB3.0] LTSSM.		
6.2.4#1	During **a3_ds_host**, the A-device drives VBus (**drv_vbus (dv)** = TRUE.	N/A	
6.2.4#2	During **a3_ds_host**, **conn_stat (cs)** = TRUE.	N/A	
6.2.4#3	During **a3_ds_host**, **super_speed (ss)** = TRUE.	N/A	
6.2.4#4	During **a3_ds_host**, the A-device uses the Recovery timer (**a3_recovery_tmr**) to check for a timeout when the link is in the **Recovery** state.	N/A	
6.2.4#5	From **a3_ds_host**, the A-device transitions to **a3_ds_rsp** if all of the following are met: ● The A-device has successfully set the B3_RSP_ENABLE feature in the B-device via the SET_FEATURE command (**a3_set_b3_rsp_en**= TRUE) ● The A-device has received a host role request Device Notification TP from B-device with the RSP Phase set to INITIATE (**b3_ntf_host_req_init** = TRUE).	N/A	
6.2.4#6	During **a3_ds_host**, the A-device transitions to **a3_ds_error i**f there is a port configuration error (**a3_port_cfg_error** = TRUE).	N/A	
6.2.4#7	During **a3_ds_host**, the A-device transitions to **a3_ds_error** if there is a timeout from the link **Recovery** state (**a3_recovery_tmout** = TRUE).	N/A	

6.2.4#8	During **a3_ds_host**, the A-device transitions to **a3_ds_error** if the exit from the U1 or U2 link states fails (**a3_u1_u2_exit_fail** = TRUE)	N/A	
Subsection 6.2.5 a3_ds_rsp	Note: This OTG A-device state corresponds to the **DSPORT.Enabled** state for a [USB3.0] hub port and the **U0** or **Recovery** states in the [USB3.0] LTSSM		
6.2.5#1	During **a3_ds_rsp**, the OTG A-device drives VBUS (**drv_vbus (dv)** = TRUE), connected (**conn_stat (cs)** = TRUE) and operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.2.5#2	During **a3_ds_rsp**, the OTG A-device uses the RSP Confirm Error timer (**rsp_cnf_err_tmr**) to ensure that the role swapping occurs in a timely manner.	N/A	
6.2.5#3	During **a3_ds_rsp**, the OTG A-device transitions to the **a3_ds_swapping** state if the A-device releases host role as part of a successful completion of the RSP process (**a_bus_req** = FALSE).	N/A	
6.2.5#4	During **a3_ds_rsp**, the OTG A-device transitions to the **a3_ds_error** state if any of the following are true: • If there is a timeout from the link **Recovery** state (**a3_recovery_tmout** = TRUE) or • If the "RSP Confirm Error timer" times-out during the RSP process (**rsp_cnf_err_tmout** = TRUE).	N/A	
Subsection 6.2.6 a3_ds_swapping	Note: This OTG A-device state corresponds to the **DSPORT.Resetting** state for a [USB3.0] hub port. This OTG A-device state corresponds to the **Rx.Detect.Reset** [USB3.0] LTSSM substate.		
6.2.6#1	Upon entry to **a3_ds_swapping**, the OTG A-device issues a warm reset (leading to a role swap).	N/A	
6.2.6#2	Upon entry to **a3_ds_swapping, a_bus_req** is set to FALSE.	N/A	
6.2.6#3	During **a3_ds_swapping**, **a3_u1_u2_exit_fail** is NOT set.	N/A	
6.2.6#4	During **a3_ds_swapping**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.6#5	During a3_ds_ swapping, **conn_stat (cs)** = TRUE.	N/A	
6.2.6#6	During a3_ds_ swapping, **super_speed (ss)** = TRUE.	N/A	
6.2.6#7	During **a3_ds_swapping**, the OTG A-device transitions to **a3_us_disconnected** when the warm reset handshake, initiated by the A-device, completes, resulting in a role swap (**wreset_rsp_complete** = TRUE).	N/A	

Subsection 6.2.7 a3_ds_compliance	Note: This A-device state corresponds to the **DSPORT.Compliance** state for a [USB3.0] hub port and the **Compliance Mode** state in the [USB3.0] LTSSM		
6.2.7#1	During **a3_ds_compliance**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.7#2	During **a3_ds_ compliance**, **conn_stat (cs)** = FALSE.	N/A	
6.2.7#3	During **a3_ds_ compliance**, **super_speed (ss)** = TRUE.	N/A	
Subsection 6.2.8 a3_ds_loopback	Note: This A-device state corresponds to the **DSPORT.Loopback** state for a [USB3.0] hub port and the **Loopback** state in the [USB3.0] LTSSM.		
6.2.8#1	During **a3_ds_loopback**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.8#2	During **a3_ds_ loopback**, **conn_stat (cs)** = FALSE.	N/A	
6.2.8#3	During **a3_ds_ loopback**, **super_speed (ss)** = TRUE.	N/A	
6.2.8#4	During **a3_ds_loopback**, the A-device transitions to **a3_ds_disconnected** if the A-device has performed a successful LFPS handshake in **Loopback.Exit** link state (**a3_loopback_exit** = TRUE).	N/A	
6.2.8#5	The A-device shall transition to **a3_ds_error** state: • If the A-device has failed to perform a successful LFPS handshake in Loopback.Exit link state (**a3_loopback_exit_error** = TRUE).	N/A	
Subsection 6.2.9 a3_ds_resetting	Note: This A-device state corresponds to the **DSPORT.Resetting** state for a [USB3.0] hub port and an undefined state in the [USB3.0] LTSSM.		
6.2.9#1	During **a3_ds_resetting**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.9#2	During **a3_ds_ resetting**, **conn_stat (cs)** = TRUE.	N/A	
6.2.9#3	During **a3_ds_ resetting**, **super_speed (ss)** = TRUE.	N/A	
6.2.9#4	During **a3_ds_resetting**, the A-device uses the polling timer (**a3_polling_tmr**) to check for timeout of the link polling process.	N/A	
6.2.9#5	During **a3_ds_resetting**, the A-device uses the Rx detect active timer (**a3_rx_detect_active_tmr**) to check for timeout on detection of USB3.0] Rx Terminations from the B-device.	N/A	

6.2.9#6	During a3_ds_resetting, the A-device transitions to **a3_ds_disconnected** if the link polling process times out (**a3_polling_tmout** = TRUE).	N/A	
6.2.9#7	During **a3_ds_resetting**, the A-device transitions to **a3_ds_disconnected** if the Rx detect active process times out (**a3_rx_detect_active_tmout** = TRUE).	N/A	
6.2.9#8	During **a3_ds_resetting**, the A-device transitions to **a3_ds_host** when the directed reset completes (**a3_reset_complete** = TRUE).	N/A	
Subsection 6.2.10 a3_ds_error	Note: This A-device state corresponds to the **DSPORT.Error** state for a [USB3.0] hub port and the **SS.Inactive** state in the [USB3.0] LTSSM.		
6.2.10#1	During **a3_ds_error**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.10#2	During **a3_ds_ error**, **conn_stat (cs)** = FALSE.	N/A	
6.2.10#3	During **a3_ds_ error**, **super_speed (ss)** = TRUE.	N/A	
6.2.10#4	During **a3_ds_error**, the A-device issues a directed warm reset or a directed hot reset in order to transition out of this state.	N/A	
Subsection 6.2.11 a3_ds_disabled	Note: This A-device state corresponds to the **DSPORT.Disabled** state for a [USB3.0] hub port and the **SS.Disabled** state in the [USB3.0] LTSSM.		
6.2.11#1	During **a3_ds_disabled**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.11#2	During **a3_ds_ disabled**, **conn_stat (cs)** = FALSE.	N/A	
6.2.11#3	During **a3_ds_ disabled**, **super_speed (ss)** = FALSE.	N/A	
6.2.11#4	The OTG A-device transitions to **a3_ds_disconnected** if operation at SuperSpeed has been enabled (**a3_ss_disabled** = FALSE).	N/A	
Subsection 6.2.12 a3_us_disconnected	Note: This OTG A-device state corresponds to the **USPORT.Powered On** state for a [USB3.0] peripheral device upstream port and the **Rx.Detect.Active** substate in the [USB3.0] LTSSM.		
6.2.12#1	During **a3_us_disconnnected**, the OTG A-device is driving VBUS (**drv_vbus (dv)** = TRUE), not connected (**conn_stat (cs)** = FALSE) and operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	

6.2.12#2	When **a3_us_disconnected** is entered from **a3_ds_swapping**, the **Rx.Detect.Active** substate is entered as per [USB3.0] on the completion of a warm reset (**wreset_rsp_complete** = TRUE).	N/A	
6.2.12#3	When **a3_us_disconnected** is entered from any other state (other than **a3_ds_swapping**), the **Rx.Detect.Active** substate is directly entered as per [USB3.0] (since entry to Rx.Detect is not due to a warm reset).	N/A	
6.2.12#4	The OTG A-device transitions to the **a3_us_training** state if the OTG A-device detects the [USB3.0] Rx Terminations from the OTG B-device (**a3_b_rx_term** = TRUE).	N/A	
6.2.12#5	The OTG A-device transitions to the **a3_us_error** state if the Rx detection limit is reached during the detection of the [USB3.0] Rx Terminations from the OTG B-device (**us_rx_detect_limit_reached** = TRUE).	N/A	
Subsection 6.2.13 a3_us_training	Note: This OTG A-device state corresponds to the **USDPORT.Training** state for a [USB3.0] peripheral device upstream port and the **Polling** state in the [USB3.0] LTSSM.		
6.2.13#1	During **a3_us_training**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.13#2	During **a3_us_training**, **conn_stat (cs)** = FALSE.	N/A	
6.2.13#3	During **a3_us_training**, **super_speed (ss)** = TRUE.	N/A	
6.2.13#4	During **a3_us_training**, the OTG A-device uses the polling timer (**a3_polling_tmr**) to check for timeout of the link polling process.	N/A	
6.2.13#5	During **a3_us_training**, the OTG A-device transitions to **a3_us_peripheral** if the upstream link training process is successful (**a3_us_training_success** = TRUE).	N/A	
6.2.13#6	During **a3_us_training**, the OTG A-device transitions to **a3_us_error** if the link polling process times out (**a3_polling_tmout** = TRUE).	N/A	
Subsection 6.2.14 a3_us_periperal	Note: This OTG A-device state corresponds to the **USDPORT.Connected/Enabled** states for a [USB3.0] peripheral device upstream port and the **U0, U1, U2, U3** or **Recovery** states in the [USB3.0] LTSSM.		
6.2.14#1	During **a3_us_periperal state**, the OTG A-device operates as a SuperSpeed peripheral device.	N/A	
6.2.14#2	During **a3_us_peripheral**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.14#3	During **a3_us_ peripheral**, **conn_stat (cs)** = TRUE.	N/A	

6.2.14#4	During **a3_us_ peripheral**, **super_speed (ss)** = TRUE.	N/A	
6.2.14#5	During **a3_us_ peripheral**, the OTG A-device uses the Recovery timer (**a3_recovery_tmr**) to check for a timeout when the link is in the **Recovery** state.	N/A	
6.2.14#6	During **a3_us_peripheral**, the OTG A-device transitions to the **a3_us_rsp** state if the OTG A-device has sent a host request device notification transaction packet with the RSP Phase set to INITIATE (**a3_ntf_host_req_init** = TRUE).	N/A	
6.2.14#7	During **a3_us_peripheral**, the OTG A-device transitions to the **a3_us_rsp** state if the OTG A-device receives a SET_FEATURE request from the B-device that initiates the RSP process (**b3_ntf_host_rel** = TRUE).	N/A	
6.2.14#8	During **a3_us_peripheral**, the OTG A-device transitions to the **a3_us_error** state if there is a timeout from the link **Recovery** state (**a3_recovery_tmout** = TRUE).	N/A	
6.2.14#9	During **a3_us_peripheral**, the OTG A-device transitions to **a3_us_error** if there is a port configuration error (**a3_port_cfg_error** = TRUE).	N/A	
6.2.14#10	During a3_us_peripheral, the OTG A-device transitions to **a3_us_error** if the exit from the U1 or U2 link states fails (**a3_u1_u2_exit_fail** = TRUE)	N/A	
6.2.14#11	During **a3_us_peripheral**, the OTG A-device remains in **a3_us_peripheral** if a hot reset is received from the OTG B-device (**a3_b_hreset_detect** = TRUE).	N/A	
6.2.14#12	During **a3_us_peripheral**, the OTG A-device transitions to **a3_us_disconnected** if a Warm Reset is detected from the OTG B-device (**a3_b_wreset_detect** = TRUE).	N/A	
Subsection 6.2.15 a3_us_rsp	Note: This OTG A-device state corresponds to the **USDPORT.Connected/Enabled** states for a [USB3.0] peripheral device upstream port and the **U0**, **SS.Inactive** or **Recovery** states in the [USB3.0] LTSSM.		
6.2.15#1	During **a3_us_rsp**, the OTG A-device is driving VBUS (**drv_vbus (dv)** = TRUE).	N/A	
6.2.15#2	During **a3_us_rsp**, the OTG A-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.2.15#3	During **a3_us_rsp**, the OTG A-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.2.15#4	During **a3_us_rsp**, the OTG A-device uses the recovery timer (**a3_recovery_tmr**) to check for a timeout when the link is in the **Recovery** state.	N/A	

6.2.15#5	During **a3_us_rsp**, the OTG A-device uses the RSP Acknowledge Error timer (**rsp_ack_err_tmr**) and the RSP Warm Reset Error timer (**rsp_wrst_err_tmr**) to ensure that the role swapping occurs in a timely manner.	N/A	
6.2.15#6	During **a3_us_rsp**, the OTG A-device transitions to the **a3_us_error** state if the RSP Acknowledge Error timer times-out during the RSP process (**rsp_ack_err_tmout** = TRUE).	N/A	
6.2.15#7	During **a3_us_rsp**, the OTG A-device transitions to the **a3_us_error** state if the RSP Warm Reset Error timer times-out during the RSP process (**rsp_wrst_err_tmout** = TRUE).	N/A	
6.2.15#8	During **a3_us_rsp**, the OTG A-device transitions to the **a3_us_error** state if there is a timeout from the link Recovery state (**a3_recovery_tmout** = TRUE).	N/A	
6.2.15#9	During **a3_us_rsp,** the OTG A-device remains in the **a3_us_rsp** state if a hot reset is received from the OTG B-device (**a3_b_hreset_detect** = TRUE).	N/A	
6.2.15#10	During **a3_us_rsp**, the OTG A-device transitions to the **a3_us_swapping** state: ●If a warm reset generated by the OTG B-device is detected (**a3_b_wreset_detect** = TRUE). ● And the notification from OTG B-device to release host role has already been received (**b3_ntf_host_rel** = TRUE). (Note: This transition is when a warm reset is received at the end of a successful RSP process as described in Section 5.4.1)	N/A	
6.2.15#11	During **a3_us_rsp**, the OTG A-device shall transition to the **a3_us_disconnected** state: • If a Warm reset is detected from the OTG B-device (**a3_b_wreset_detect** = TRUE) •And the notification from the OTG B-device to release host role has not been received (**b3_ntf_host_rel** = FALSE).	N/A	
Subsection 6.2.16 a3_us_swapping	Note: This OTG A-device state corresponds to the **USDPORT.Powered On** state for a [USB3.0] peripheral device upstream port and the **Rx.Detect.Reset** [USB3.0] LTSSM substate.		
6.2.16#1	During **a3_us_swapping**, the A-device drives VBUS (**drv_vbus (dv)** = TRUE).	N/A	
6.2.16#2	During **a3_us_swapping, conn_stat (cs)** = FALSE.	N/A	
6.2.16#3	During **a3_us_swapping,** the A-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	

6.2.16#4	During **a3_us_swapping,** the OTG A-device transitions to **a3_ds_disconnected** if the warm reset handshake, initiated by the B-device, completes, resulting in a role swap (**wreset_rsp_complete** = TRUE).	N/A	
Subsection 6.2.17 a3_us_error	Note: This OTG A-device state corresponds to the **USDPORT.Error** state for a [USB3.0] peripheral device upstream port and the **SS.Inactive** state in the [USB3.0] LTSSM.		
6.2.17#1	During **a3_us_error**, the A-device drives VBus **(drv_vbus (dv))** = TRUE.	N/A	
6.2.17#2	During **a3_us_error**, **conn_stat (cs)** = FALSE.	N/A	
6.2.17#3	During **a3_us_error**, **super_speed (ss)** = TRUE.	N/A	
6.2.17#4	During a3_us_error, the A-device transitions to **a3_us_disconnected** if a Warm reset is detected from the OTG B-device (**a3_b_wreset_detect** = TRUE).	N/A	

6.3.2 State Diagram Assertions for SS-OTG B-Devices

Assertion	**Description**	**Test**	**Comments**
Subsection 6.3 B-device USB 3.0 State Diagram			
Subsection 6.3.1 All States			
6.3.1#1	The OTG B-device transitions to the **b_idle** state if **otg** = TRUE and a Micro-A plug is attached (**id** = FALSE).	N/A	
6.3.1#2	The OTG B-device transitions to the **b_idle** state if it detects that the voltage on VBUS is below VOTG_SESS_VLD threshold. (**b_sess_vld** = FALSE).	N/A	
6.3.1#3	The OTG B-device transitions to the **b3_ds_resetting** state if it initiates a directed warm reset (**b3_warm_reset** = TRUE). *Note: This transition shall not apply to the **b3_ds_swapping** state where a warm reset is issued by the B-device in order to initiate role swapping. A B-device shall not issue a warm reset when operating as an upstream port.*	N/A	
6.3.1#4	The OTG B-device transitions to the **b3_ds_resetting** state if it initiates a directed hot reset (**b3_hot_reset** = TRUE). *Note: A B-device shall not issue a hot reset when operating as an upstream port.*	N/A	

Assertion	Description	Test	Comments
Subsection 6.3.2 b3_us_disconnected	Note: This is the entry state for the USB3 B-device state machine and corresponds to the **USDPORT.Powered On** state for a [USB3.0] peripheral device upstream port and to the Rx.Detect.Active [USB3.0] LTSSM substate.		
6.3.2#1	During **b3_us_disconnected**, the B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.2#2	During **b3_us_disconnected**, the B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.2#3	When **b3_us_disconnected** is entered from **b3_ds_swapping**, the **Rx.Detect.Active** substate is entered as per [USB3.0] on the completion of a warm reset (**wreset_rsp_complete** = TRUE).	N/A	
6.3.2#4	When **b3_us_disconnected** is entered from any other state (other than **b3_ds_swapping**), the **Rx.Detect.Active** substate is directly entered as per [USB3.0] (since entry to **Rx.Detect** is not due to a warm reset).	N/A	
6.3.2#5	The B-device shall transitions to the **b3_us_training** state if it detects the [USB3.0] Rx Terminations from an A-device (**b3_a_rx_term** = TRUE).	N/A	
6.3.2#6	During **b3_us_disconnected**, when entered from the **b3_us_disabled state**, the number of far-end receiver termination detection events required to set the **us_rx_detect_limit_reached** parameter to TRUE equals 1.	N/A	
6.3.2#7	During **b3_us_disconnected**, when not entered from the **b3_us_disabled state**, the number of far-end receiver termination detection events required to set the **us_rx_detect_limit_reached** parameter to TRUE equals 8.	N/A	
6.3.2#8	During **b3_us_disconnected**, the B-device transitions to **b3_us_disabled** when the Rx detection limit is reached during the detection of the [USB3.0] Rx Terminations from the OTG A-device (**us_rx_detect_limit_reached** = TRUE).	N/A	
Subsection 6.3.3 b3_us_training	Note: This B-device state corresponds to the **USDPORT.Training** state for a [USB3.0] peripheral device upstream port and the **Polling** state in the [USB3.0] LTSSM.		
6.3.3#1	During **b3_us_training**, the B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.3#2	During **b3_us_training**, the B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	

Assertion	Description	Test	Comments
6.3.3#3	During **b3_us_training**, the B-device uses the polling timer (**b3_polling_tmr**) to check for timeout of the link polling process.	N/A	
6.3.3#4	During **b3_us_training**, the B-device transitions to **b3_us_peripheral** if the upstream link training process is successful (**b3_us_training_success** = TRUE).	N/A	
6.3.3#5	During **b3_us_training**, the B-device transitions to **b3_us_disabled_error** if the link polling process times out (**b3_polling_tmout** = TRUE).	N/A	
6.3.3#6	During **b3_us_training**, the B-device transitions to **b3_us_compliance** if the link is configured to go into [USB3.0] compliance mode (**b3_compliance_mode_entry** = TRUE).	N/A	
Subsection 6.3.4 b3_us_compliance	Note: This B-device state corresponds to the **USDPORT.Compliance** state for a [USB3.0] upstream port and the **Compliance Mode** state in the [USB3.0] LTSSM		
6.3.4#1	During **b3_us_compliance**, the B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.4#2	During **b3_us_compliance,** the B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
Subsection 6.3.5 b3_us_peripheral	Note: This B-device state corresponds to the **USDPORT.Connected/Enabled** states for a [USB3.0] peripheral device upstream port and the **U0**, **U1**, **U2**, **U3** or **Recovery** states in the [USB3.0] LTSSM.		
6.3.5#1	During **b3_us_peripheral**, the B-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.3.5#2	During **b3_us_peripheral**, the B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.5#3	During **b3_us_peripheral**, the B-device uses the recovery timer (**b3_recovery_tmr**) to check for a timeout when the link is in the Recovery state.	N/A	
6.3.5#4	During b3_us_peripheral, the B-device transitions to the **b3_us_rsp** state if both of the following are true: • The RSP capability has been enabled (**b3_rsp_en**= TRUE) • The B-device has sent a host role request Device Notification TP with the RSP Phase set to INITIATE (**b3_ntf_host_req_init** = TRUE).	N/A	
6.3.5#5	During **b3_us_peripheral**, the B-device transitions to **b3_us_disabled** if there is a port configuration error (**b3_port_cfg_error** = TRUE).	N/A	

Assertion	Description	Test	Comments
6.3.5#6	During **b3_us_peripheral**, the B-device transitions to **b3_us_error** if there is a timeout from the link Recovery state (**b3_recovery_tmout** = TRUE).	N/A	
6.3.5#7	During **b3_us_peripheral**, the B-device shall transition to the **b3_us_error** state if the exit from the U1 or U2 link states fails (**b3_u1_u2_exit_fail** = TRUE).	N/A	
6.3.5#8	During **b3_us_peripheral**, the B-device remains in **b3_us_peripheral** if a hot reset is received from the OTG A-device (**b3_a_hreset_detect** = TRUE).	N/A	
6.3.5#9	During **b3_us_peripheral**, the B-device transitions to **b3_us_disconnected** if a warm reset is received from the OTG A-device (**b3_a_wreset_detect** = TRUE).	N/A	
Subsection 6.3.6 b3_us_rsp	Note: This OTG B-device state corresponds to the **USDPORT.Connected/Enabled** states for a [USB3.0] peripheral device upstream port and the **U0**, **SS.Inactive** or **Recovery** states in the [USB3.0] LTSSM.		
6.3.6#1	During **b3_us_rsp**, the OTG B-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.3.6#2	During **b3_us_rsp** the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.6#3	During **b3_us_rsp**, the OTG B-device uses the recovery timer (**b3_recovery_tmr**) to check for a timeout when the link is in the **Recovery** state.	N/A	
6.3.6#4	During **b3_us_rsp**, the OTG B-device uses the RSP Acknowledge Error timer (**rsp_ack_err_tmr**) and the RSP Warm Reset Error timer (**rsp_wrst_err_tmr**) to ensure that the role swapping occurs in a timely manner.	N/A	
6.3.6#5	During **b3_us_rsp**, the OTG B-device transitions to the **b3_us_error** state if the RSP Acknowledge Error timer times-out during the RSP process (**rsp_ack_err_tmout** = TRUE).	N/A	
6.3.6#6	During **b3_us_rsp**, the OTG B-device transitions to the **b3_us_error** state if the RSP Warm Reset Error timer times-out during the RSP process (**rsp_wrst_err_tmout** = TRUE).	N/A	
6.2.6#7	During **b3_us_rsp**, the OTG B-device transitions to the **b3_us_error** state if there is a timeout from the link Recovery state (**b3_recovery_tmout** = TRUE).	N/A	
6.3.6#8	During **b3_us_rsp**, the OTG B-device remains in the **b3_us_rsp** state if the any of following are true: • A hot reset is received from the OTG A-device (**b3_a_hreset_detect** = TRUE).	N/A	

Assertion	Description	Test	Comments
6.3.6#9	The OTG B-device transitions to the **b3_us_swapping** state if a warm reset generated by the OTG A-device (**b3_a_wreset_detect** = TRUE).	N/A	
6.3.6#10	During **b3_us_rsp**, the OTG B-device shall transition to the **b3_us_disconnected** state if a warm reset generated by the OTG A-device is detected (**b3_a_wreset_detect** = TRUE) prior to receiving SetFeature (NTF_HOST_REL). Refer to RSP Step 2 in Section 5.4.1.	N/A	
Subsection 6.3.7 b3_us_swapping	Note: This OTG B-device state corresponds to the **USDPORT.Powered On** state for a [USB3.0] peripheral device upstream port and the **Rx.Detect.Reset** [USB3.0] LTSSM substate.		
6.3.7#1	During **b3_us_swapping**, the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.7#2	During **b3_us_swapping**, the OTG B-device is operating at SuperSpeed (super_speed (ss) = TRUE).	N/A	
6.3.7#3	During **b3_us_swapping,** the OTG B-device transitions to **b3_ds_disconnected** if the warm reset generated by the OTG A-device completes (**wreset_rsp_complete** = TRUE.	N/A	
Subsection 6.3.8 b3_us_disabled	Note: This B-device state corresponds to the **USDPORT.Disabled** state for a [USB3.0] peripheral device upstream port and the **SS.Disabled** state in the [USB3.0] LTSSM.		
6.3.8#1	During **b3_us_disabled**, the B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.8#2	During **b3_us_disabled**, the B-device is not operating at SuperSpeed (super_speed (ss) = FALSE).	N/A	
6.3.8#3	During **b3_us_disabled**, the OTG B-device transitions to **b3_us_disconnected** if a [USB2.0] reset is detected from the A-device (**b_reset_detect** = TRUE).	N/A	
6.3.8#4	During **b3_us_disabled**, the OTG-B device, operating as a peripheral in High Speed mode, re-enables SS terminations upon reception of a [USB 2.0] Reset.	N/A	
Subsection 6.3.9 b3_us_disabled error	Note: This B-device state corresponds to the **USDPORT.Disabled_Error** state for a [USB3.0] peripheral device upstream port and the **SS.Disabled** state in the [USB3.0] LTSSM.		
6.3.9#1	During **b3_us_disabled_error,** the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	

Assertion	Description	Test	Comments
6.3.9#2	During **b3_us_disabled_error,** the OTG B-device is NOT operating at SuperSpeed (**super_speed (ss)** = FALSE).	N/A	
6.3.9#3	The B-device remains in **b3_us_disabled_error** if a [USB 2.0] Reset is detected (**b_reset_detect** = TRUE).	N/A	
Subsection 6.3.10 b3_us_error	Note: This B-device state corresponds to the **USDPORT.Error** state for a [USB3.0] peripheral device upstream port and the **SS.Inactive** state in the [USB3.0] LTSSM.		
6.3.10#1	During **b3_us_error,** the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.10#2	During **b3_us_error** the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.10#3	During **b3_us_error**, the B-device transitions to **b3_us_disconnected** if the [USB3.0] Rx Terminations are removed (**b3_a_rx_term** = FALSE).	N/A	
6.3.10#4	During **b3_us_error**, the B-device transitions to **b3_us_disconnected** if a warm reset is received from the OTG A-device (**b3_a_wreset_detect** = TRUE).	N/A	
Subsection 6.3.11 b3_ds_disconnected	Note: This OTG B-device state corresponds to the **DSPORT.Disconnected** state for a [USB3.0] hub port and the **Rx.Detect.Active** [USB3.0] LTSSM substate.		
6.3.11#1	During **b3_ds_disconnected,** the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.11#2	During **b3_ds_disconnected**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE.	N/A	
6.3.11#3	During **b3_ds_disconnected**, the OTG B-device uses the Rx detect active timer (**b3_rx_detect_active_tmr**) to check for timeout on detection of Far-End Rx Terminations.	N/A	
6.3.11#4	During **b3_ds_disconnected**, the B-device transitions to **b3_ds_training** if the A-device's [USB3.0] Rx Terminations are detected (**b3_a_rx_term** = TRUE).	N/A	
6.3.11#5	During **b3_ds_disconnected**, the OTG B-device transitions to **b3_ds_error** if the Rx detect active process times out (**b3_rx_detect_active_tmout** = TRUE).	N/A	
Subsection 6.3.12 b3_ds_training	Note: This state corresponds to the **DSPORT.Training** state for a [USB3.0] hub port and the **Polling** state in the [USB3.0] LTSSM.		

Assertion	Description	Test	Comments
6.3.12#1	During **b3_ds_training**, the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.12#2	During **b3_ds_training**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.12#3	During **b3_ds_training**, the OTG B-device uses the polling timer (**b3_polling_tmr**) to check for timeout of the link polling process.	N/A	
6.3.12#4	During **b3_ds_training**, the OTG B-device transitions to **b3_ds_host** if link training was successful (**b3_ds_training_success** = TRUE).	N/A	
6.3.12#5	During **b3_ds_training**, the OTG B-device transitions to **b3_ds_disconnected** if the link polling process times out (**b3_polling_tmout** = TRUE).	N/A	
Subsection 6.3.13 b3_ds_host	Note: This state corresponds to the **DSPORT.Enabled** state for a [USB3.0] hub port and the **U0, U1, U2, U3** or **Recovery** states in the [USB3.0] LTSSM.		
6.3.13#1	During **b3_ds_host**, the OTG B-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.3.13#2	During **b3_ds_host**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.13#3	During **b3_ds_host**, the OTG B-device uses the Recovery timer (**b3_recovery_tmr**) to check for a timeout when the link is in the Recovery state.	N/A	
6.3.13#4	During **b3_ds_host**, the OTG B-device transitions to the **b3_ds_rsp** state if the OTG B-device application no longer wishes to take the host role and has notified the A-device via a SET_FEATURE (**b3_ntf_host_rel** = TRUE).	N/A	
6.3.13#5	During **b3_ds_host**, the OTG B-device transitions to the **b3_ds_rsp** state if the OTG B-device receives a device notification TP from the A-device with the RSP Phase set to INITIATE (**a3_ntf_host_req_init** = TRUE).	N/A	
6.3.13#6	During **b3_ds_host**, the OTG B-device transitions to the **b3_ds_error** state if there is a port configuration error (**b3_port_cfg_error** = TRUE).	N/A	
6.3.13#7	During **b3_ds_host**, the OTG B-device transitions to the **b3_ds_error** state if there is a timeout from the link **Recovery** state (**b3_recovery_tmout** = TRUE).	N/A	

Assertion	Description	Test	Comments
6.3.13#8	During **b3_ds_host**, the OTG B-device transitions to the **b3_ds_error** state if the exit from the U1 or U2 link states fails (**b3_u1_u2_exit_fail** = TRUE).	N/A	
Subsection 6.3.14 b3_ds_rsp	Note: This OTG B-device state corresponds to the **DSPORT.Enabled** state for a [USB3.0] hub port and the **U0** or **Recovery** states in the [USB3.0] LTSSM.		
6.3.14#1	During **b3_ds_rsp**, the OTG B-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.3.14#2	During **b3_ds_rsp**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.14#3	During **b3_ds_rsp**, the OTG B-device uses the RSP Confirm Error timer (**rsp_cnf_err_tmr**) to ensure that the role swapping occurs in a timely manner.	N/A	
6.3.14#4	During **b3_ds_rsp**, the OTG B-device transitions to the **b3_ds_swapping** state if the B-device releases host role as part of a successful completion of the RSP process (**b_bus_req** = FALSE).	N/A	
6.3.14#5	During **b3_ds_rsp**, the OTG B-device transitions to the **b3_ds_error** state if there is a timeout from the link **Recovery** state (**b3_recovery_tmout** = TRUE).	N/A	
6.3.14#6	During **b3_ds_rsp**, the OTG B-device transitions to the **b3_ds_error** state if the "RSP Confirm Error timer" times-out during the RSP process (**rsp_cnf_err_tmout** = TRUE).	N/A	
Subsection 6.3.15 b3_ds_swapping	Note: This OTG B-device state corresponds to the **DSPORT.Resetting** state for a [USB3.0] hub port. This OTG B-device state corresponds to the **Rx.Detect.Reset** [USB3.0] LTSSM substate		
6.3.15#1	During **b3_ds_swapping**, the OTG B-device is connected (**conn_stat (cs)** = TRUE).	N/A	
6.3.15#2	During **b3_ds_swapping**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.15#3	During **b3_ds_swapping**, the OTG B-device transitions to the **b3_us_disconnected** state if the warm reset handshake, initiated by the B-device, completes (**wreset_rsp_complete**= TRUE).	N/A	
Subsection 6.3.16 b3_ds_resetting	Note: This OTG B-device state corresponds to the **DSPORT.Resetting** state for a [USB3.0] hub port and an undefined state in the [USB3.0] LTSSM		

Assertion	Description	Test	Comments
6.3.16#1	During **b3_ds_resetting**, the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.16#2	During **b3_ds_resetting**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE.	N/A	
6.3.16#3	During **b3_ds_resetting**, the OTG B-device uses the polling timer (**b3_polling_tmr**) to check for timeout of the link polling process.	N/A	
6.3.16#4	During **b3_ds_resetting**, the OTG B-device uses the Rx detect active timer (**b3_rx_detect_active_tmr**) to check for timeout on detection of Far End Rx Terminations.	N/A	
6.3.16#5	During **b3_ds_resetting**, the OTG B-device transitions to **b3_ds_disconnected** if the link polling process times out (**b3_polling_tmout** = TRUE).	N/A	
6.3.16#6	During **b3_ds_resetting**, the OTG B-device transitions to **b3_ds_host** when the directed reset completes (b3_reset_complete = TRUE).	N/A	
6.3.16#7	During **b3_ds_resetting**, the OTG B-device transitions to **b3_ds_error** if the Rx detect active process times out (**b3_rx_detect_active_tmout** = TRUE).	N/A	
Subsection 6.3.17 b3_ds_error	Note: This OTG B-device state corresponds to the **DSPORT.Error** state for a [USB3.0] hub port and the **SS.Inactive** state in the [USB3.0] LTSSM.		
6.3.17#1	During **b3_ds_error**, the OTG B-device is not connected (**conn_stat (cs)** = FALSE).	N/A	
6.3.17#2	During **b3_ds_error**, the OTG B-device is operating at SuperSpeed (**super_speed (ss)** = TRUE).	N/A	
6.3.17#3	During b3_ds_error, the OTG B-device issues a directed warm reset or a directed hot reset in order to transitions out of this state.	N/A	

7 Timer Values and Definitions

Timer values referred to throughout this document are listed below for reference only. These values are defined in ***[OTG&EH3.0]*** or ***[LinkLayerTestSpecification]***.

Table 7-1 Timer Values and Definitions

Parameter	Symbol	TD	Min	Max
Time from when the A-device selects a non-zero configuration until when the SET_FEATURE for enabling RSP is issued on the link.	**TRSP_ENABLE**	5.17 5.18 5.23 5.24 5.25		2sec
Time spent by a DS device between the reception of an RSP Device Notification TP - INITIATE and the transmission of a SET_FEATURE. (RSP Step 1 to RSP Step 2)	**TRSP_ACK**	5.5 5.7 5.10 5.11		2sec
Time spent by a US device waiting between the transmission of an RSP Device Notification TP – INITIATE and the transition to an Error State (on failure to detect a SET_FEATURE). (RSP Step 1 to Error State)	**TRSP_ACK_ERR**	5.6	2.5sec	3sec
Time spent by a US device between the reception of a SET_FEATURE and the transmission of a Device Notification TP – CONFIRM to confirm the RSP process. (RSP Step 2 to RSP Step 3)	**TRSP_CNF**	5.9 5.10		100ms
Time spent by a DS device between the transmission of a SET_FEATURE and the transition to an Error State. (RSP Step 2 to Error State)	**TRSP_CNF_ERR**	5.8	150ms	200ms
Time spent by a DS device between the reception of a Device Notification TP – CONFIRM and the generation of warm reset. (RSP Step 3 to RSP Step 4)	**TRSP_WRST**	5.3 5.4 5.10 5.11		100ms
Time spent by a US device between the transmission of a Device Notification TP – CONFIRM and the transition to an error state. (RSP Step 3 to RSP Step 4)	**TRSP_WRST_ERR**	5.10	150ms	200ms
Time used in most TDs to confirm link stays stable and active. Parameter defined in ***[LinkLayerTestSpecification]***	**T_LINK_ACTV**	N/A		50ms
The maximum delay induced by the PHY and link layers when a bus event occurs, until the respective action is made. This is measured from the time a packet is received, until the time a response is generated on the transmit side. Parameter defined in ***[LinkLayerTestSpecification]***	**T_LINK_TURNAROUND**	N/A		500ns

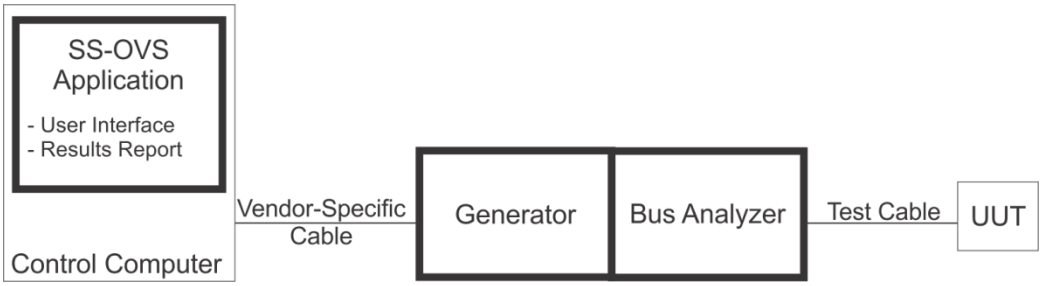
8 SS-OVS – SuperSpeed OTG Verification System

The SS-OVS is an automated test device aimed at executing compliance tests defined in the Test Descriptions section of this document and confirming proper operation of the UUT to each of these tests. The SS-OVS includes several major functional areas, including a generator (emulator), analyzer (monitor), script-based test execution, a user interface to control these features automatically, a summary pass/fail report, and possibly special test cables, depending on the manufacturer of the SS-OVS.

The Vendor-Specific Cable, as shown below, interfaces a control computer to the Generator/Analyzer hardware of the SS-OVS. This cable is specified by the manufacturer of the SS-OVS, and may for example be a USB 2.0 cable, USB 3.0 cable, an Ethernet cable, or other I/O cable.

The Test Cable, as shown below, may be a modified USB cable (to break-out the ID pin) or alternately, a standard USB Cable. Details are provided in the Test Cables section below.

Figure 8-1 Major Functional Areas of SS-OVS



8.1 Generator

The generator feature executes the scripts for each TD, emulating either an upstream-facing device or a downstream-facing device, depending on (opposite to) the UUT's US or DS perspective.

8.2 Analyzer

The analyzer monitors and records the bus activity between the generator and the UUT, allowing for inspection of this activity, which is especially useful for debug of failed TDs.

8.3 Scripts

Scripts for each TD are executed by the generator under the control of the SS-OVS application. .

8.4 Test Cables

The SS-OVS is connected to the UUT by means of a Test Cable, either a standard or modified USB cable, depending on the implementation used by the SS-OVS manufacturer. This modified cable is referred to herein as the Special Test Cable.

The Special Test Cable (shown in the figure below), breaks out the ID pin, which is routed to an auxiliary connection on the SS-OVS in order to automatically ground or not ground the ID pin, depending on the test requirements.

Figure 8-2 Special Test Cable

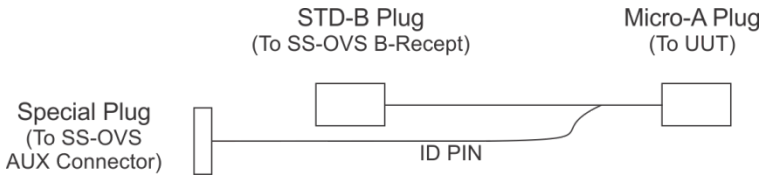


Table 1 Special Test Cable Assembly Wiring Diagram

Special AUX Plug		**USB3.0 STD-B Plug**		**Wire**		**USB3.0 Micro-A Plug**	
Pin Number	Signal Name	Pin Number	Signal Name	Wire Number	Signal Name	Pin Number	Signal Name
		1	VBUS	1	PWR	1	VBUS
		2	D-	2	UTP_D-	2	D-
		3	D+	3	UTP_D+	3	D+
1	Switched GND	No Connect		No Connect		4	ID
		4	GND	4	GND_PWRrt	5	GND
		5	StdB_SSTX-	8	SDP2-	MicA_SSRX-	9
		6	StdB_SSTX+	9	SDP2+	MicA_SSRX+	10
		7	GND_Drain	7 and 10	SDP1_Drain SDP2_Drain	GND_DRAIN	8
		8	StdB_SSRX-	5	SDP1-	MicA_SSTX-	6
		9	StdB_SSRX+	6	SDP1+	MicA_SSTX+	7
		Shell	Shield	Braid	Shell	Shell	Shield

An alternate approach to using the Special Test Cable is to use standard USB cables (e.g., STD-A-to-Micro-B or STD-B-to-Micro-A) to force the UUT to assume a particular role (e.g., A or B device). In this approach, the test operator will need to manually attach the appropriate cable for a given set of tests. Test setups for all UUTs are specified in Section 8.5.

8.5 Test Setups

8.5.1 Testing of SS-EH

To run the TDs specific for an SS-EH, the test operator must set up the SS-OVS and the SS-EH UUT as shown in the figures below.

Figure 8-3 Test Setup for SS-EH A-Port (SS-EH using Micro-AB Receptacle)

Figure 8-4 Alternate Test Setup for SS-EH (SS-EH using Micro-AB Receptacle)

Figure 8-5 Special Setup for SS-OVS A-Port Connected via Micro-B to SS-EH A-Port

Figure 8-6 Alternate Test Setup for SS-EH (SS-EH using STD-A Receptacle)

8.5.2 Testing of B-Port on SS-EH

To run the TDs specific for an SS-EH B-port, the test operator must set up the SS-OVS and the SS-EH UUT as per the figures below.

Figure 8-7 Test Setup for SS-EH B-Port (B-Port using Micro-AB Receptacle)

Figure 8-8 Alternate Test Setup for SS-EH (B-Port using Micro-AB Receptacle)

Figure 8-9 Alternate Test Setup for SS-EH (B-Port using STD-B Receptacle)

8.5.3 Testing of SS-OTG Device (Common Tests)

To run the TDs specific for an SS-OTG device (SS-OTG Device Common Tests), the test operator must set up the SS-OVS and the SS-OTG UUT as per the figures below.

Figure 8-10 Test Setup for SS-OTG Device (Common Tests)

Figure 8-11 Alternate Test Setup for SS-OTG Device (Common Tests)

8.5.4 Testing of SS-OTG A-Device

To run the TDs specific for an SS-OTG A-Device, the test operator must set up the SS-OVS and the SS-OTG UUT as per one of the figures below.

Figure 8-12 Test Setup for SS-OTG A-Device

Figure 8-13 Alternate Test Setup for SS-OTG A-Device

8.5.5 Testing of SS-OTG B-Device

To run the TDs specific for an SS-OTG B-Device, the test operator must set up the SS-OVS and the SS-OTG UUT as per the figures below.

Figure 8-14 Test Setup for SS-OTG B-Device

Figure 8-15 Alternate Test Setup for SS-OTG A-Device

8.5.6 Testing of SS-PO Device

To run the TDs specific for an SS-PO Device, the test operator must set up the SS-OVS and the SS-PO UUT as per one of the figures below.

Note: For UUT's implementing captive cabling, the user may use cable adapters in order to connect to the STD-A port of the SS-OVS.

Figure 8-16 Test Setup for SS-PO Device

Figure 8-17 Alternate Test Setup for SS-PO Device (SS-PO using Micro-AB Receptacle)

Figure 8-18 Alternate Test Setup for SS-PO Device (SS-PO using STD-B Receptacle)

8.5.7 Testing of SSPC-OTG Device

To run the TDs specific for an SSPC Device, the test operator must set up the SS-OVS and the SSPC-OTG UUT as per one of the figures below.

Figure 8-19 Test Setup for SSPC-OTG Device

Figure 8-20 Alternate Test Setup for SSPC-OTG Device

9 Test Descriptions

The tests in this section test only a partial list of all possible parameters and compliant behaviors. These tests should not be considered as a full validation test plan. It is the responsibility of the product manufacturer to verify compliance of their products according to [USBOTG&EH3.0].

9.1 Link Initialization Procedure

Applies to	SS-OTG, SS-EH, SS-PO, SSPC-OTG
Description	The purpose of the Link Initialization Procedure is to establish the link between the SS-OVS and the unit under test (UUT) and to check that link establishment and initialization is followed properly. This procedure is used in most TDs, and is in and of itself not an individual TD. It is defined here to avoid repetition in the individual TDs. Some tests are designed to follow the Link Initialization Procedure up to a certain point and then introduce different test steps. This is reflected in each specific TD.
Test setup	See the specific TD for setup information.
Assertions	1.1#1, 2.3#2
Pass Criteria	● The UUT shall link train (achieve U0). ● The Header Sequence Number Advertisement transmitted by the UUT is LGOOD_7. ● The UUT transmits the following Rx Header Buffer Credit Advertisements: LCRD_A, LCRD_B, LCRD_C and LCRD_D. ● The UUT transmits Port Capabilities and Port Configuration LMPs within **$T_{PortConfiguration}$** as defined in ***[USB3.0]***.

Test Steps

1. The SS-OVS and the UUT go through the initial steps of the LTSSM (SS.Disabled or SS.Inactive, Rx.Detect, Polling) to reach U0.

2. In U0, the SS-OVS will transmit the Header Sequence Number advertisement and the Receiver Header Buffer Credit advertisement.

3. The SS-OVS verifies that the Header Sequence Number Advertisement transmitted by the UUT is LGOOD_7, and that the UUT transmits the following Rx Header Buffer Credit Advertisements: LCRD_A, LCRD_B, LCRD_C and LCRD_D.

4. The SS-OVS and the UUT exchange Port Configuration LMP transactions:

    a. If the SS-OVS is configured as a downstream port:

        i. SS-OVS waits for the UUT's Port Capabilities LMP.

        ii. SS-OVS verifies that the Port Capabilities LMP is valid.

        iii. SS-OVS transmits its Port Capabilities LMP.

        iv. SS-OVS transmits its Port Configuration LMP.

        v. SS-OVS waits for the UUT's Port Configuration Response LMP.

        vi. SS-OVS verifies that the UUT's Port Configuration Response LMP is valid.

vii. The SS-OVS places the UUT into the addressed state (i.e. assigns a non-zero address).

viii. The SS-OVS places the UUT into the configured state.

b. If the SS-OVS is configured as an upstream port:

i. SS-OVS waits for the UUT's Port Capabilities LMP.

ii. SS-OVS verifies that the UUT's Port Capabilities LMP is valid.

iii. SS-OVS transmits its Port Capabilities LMP.

iv. SS-OVS waits for the UUT's Port Configuration LMP.

v. SS-OVS verifies that the UUT's Port Configuration LMP is valid.

vi. SS-OVS transmits its Port Configuration Response LMP.

5. The SS-OVS verifies that the UUT transmits both LMPs within **$T_{PortConfiguration}$** as defined in ***[USB3.0]***.

6. The SS-OVS keeps the link active by sending Link Pollings (LUP or LDN as applicable) for **$T_{\_LINK\_ACTV}$**.

9.2 SuperSpeed Embedded Host Tests

9.2.1 TD2.1 No Silent Failures- Reporting of an Unsupported Peripheral

Applies to	SS-EH
Description	This test verifies that the UUT will report an unsupported peripheral to the test operator. The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.1, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	2.6#1
Pass Criteria	● The UUT shall request the Device Descriptor. ● The UUT shall display an error message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure.

2. The UUT requests the device descriptor from the SS-OVS.

3. The SS-OVS identifies its VID/PID as unsupported, using 0x1A0A / 0x0201.

4. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.2.2 TD2.2 No Silent Failures- Device Descriptor Request Ignored

Applies to	SS-EH
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS ignores a device descriptor request from the UUT The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.1, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	2.6#3, 2.1.3#4
Pass Criteria	● The UUT shall request the Device Descriptor ● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure
2. The UUT requests the device descriptor from the SS-OVS.
3. The SS-OVS properly manages link layer replies to the device descriptor request, but does not reply at the protocol layer (i.e., does not reply with the normally expected data packet during the IN transaction phase).
4. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.2.3 TD2.3 No Silent Failures – Failure to Link Train

Applies to	SS-EH
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS prohibits a successful progression to U0 (i.e., forces a failure to fully link train with the UUT). The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.1, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	2.6#2, 2.1.3#3
Pass Criteria	● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the initial steps of the Link Initialization Procedure up through and including the exchange of Polling.LFPS signaling, but will not progress beyond that point.
2. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.2.4 TD2.4 No Silent Failures – Reversed VBus and Floating ID Pin Test

Applies to	SS-EH with a Micro-AB receptacle.
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS supplies both VBus and a floating ID pin to the UUT. This emulates an attachment to another host via a STD-A (or Micro-A) to Micro-B cable. The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.2, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	2.1.3#3
Pass Criteria	The UUT shall display a failure message.

Test Steps

1. The SS-OVS supplies VBus to the UUT, with ID not grounded.
2. The UUT provides an error message to the user.
3. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.2.5 TD5.1 OTG Descriptor – GetDescriptor(OTG) Request

Note: The SS-OVS application will make B-Port tests available only if the test operator checks the SS-EH B-PORT PRESENT box on the SS-OVS application prior to test initiation.

Applies to	SS-EH with a B-Port.
Description	This test verifies that the SS-EH B port, if present, returns an OTG descriptor in response to an OTG descriptor request from the SS-OVS.
Test setup	Setup is per Section 8.5.2, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	5.1#2, 5.1#4, 5.1#5, 5.1.2#1, 5.1.3#1
Pass Criteria	● The UUT returns the OTG descriptor. ● The UUT returns *bDescriptorType* = 9 ● The UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0). ● The UUT returns D3 (RSP Support) set to FALSE. ● The UUT returns a value of 0x0300 in the *bcdOTG* field. ● The link stays in U0 for **T_LINK_ACTV** on completion of the tests.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure
2. The SS-OVS requests the OTG descriptor from the UUT and verifies receipt of data as indicated above.

3. The SS-OVS keeps the link active in U0 for **T_LINK_ACTV**.

9.2.6 TD5.2 OTG Descriptor – GetDescriptor(Configuration) Request

Applies to	SS-EH with a B-Port.
Description	This test verifies that the SS-EH B port returns an OTG descriptor as part of a Configuration descriptor request from the SS-OVS.
Test setup	Setup is per Section 8.5.2, depending on the connector type on the UUT and the SS-OVS manufacturer.
Assertions	5.1#2, 5.1#4, 5.1#5, 5.1.2#1, 5.1.3#1
Pass Criteria	● The UUT returns the OTG descriptor. ● The UUT returns *bDescriptorType* = 9 ● The UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0). ● The UUT returns D3 (RSP Support) set to FALSE. ● The UUT returns a value of 0x0300 in the *bcdOTG* field. ● The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV** on completion of the tests.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS requests the Configuration Descriptor from the UUT and verifies receipt of data as indicated above.
3. The SS-OVS keeps the link active in U0 for **T_LINK_ACTV**.

9.3 SS-OTG Device Common Tests

9.3.1 TD5.3 Role Swap Protocol – B-Peripheral Assumes Host Role

Applies to	SS-OTG Device.
Description	This test confirms that the UUT properly supports a role swap from B-peripheral to B-host.
Test setup	Setup is per Section 8.5.3.
Assertions	5.4.1#1, 5.4.1#8, 5.4.1#9, 5.4.1#13, 5.4.1#14, 5.5#2, 5.5#3
Pass Criteria	● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The reserved field bits at DW1:10 (bits 10 through 31) and DW2:0 (bits 0 through 31) in the Device Notification TP (HOST ROLE REQUEST) are set to zero. ● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF**. ● The UUT starts up in the opposite role by sending Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset. ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.
2. The SS-OVS keeps the lnk in U0 for 20s, waiting for the RSP to start.
3. The SS-OVS displays a dialog requesting the operator to initiate a role swap from the UUT.
4. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).
5. The SS-OVS verifies that the the reserved field bits at DW1:10 (bits 10 through 31) and DW2:0 (bits 0 through 31) in the Device Notification TP (HOST ROLE REQUEST) are set to zero.
6. The SS-OVS issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK.**
7. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**
8. The SS-OVS issues a Warm Reset LFPS (within **TRSP_WRST**).
9. The SS-OVS verifies that the UUT starts up in the opposite role by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.
10. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.
11. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

9.3.2 TD5.4 Role Swap Protocol – B-Host Releases Host Role

Applies to	SS-OTG Device.
Description	This test confirms that the UUT (which will be transtioned to B-host) properly supports a role swap from B-host to B-peripheral.
Test setup	Setup is per Section 8.5.3.
Assertions	5.2.1#3, 5.4.1#2, 5.4.1#3, 5.4.1#5, 5.4.1#6, 5.4.1#11, 5.4.1#13, 5.4.1#1
Pass Criteria	● The UUT issues a SET_FEATURE (NTF_HOST_REL). ● The UUT issues a Warm Reset LFPS (within **TRSP_WRST**), and that the UUT does not prematurely issue a warm reset until this point. ● The UUT starts up in the opposite role by sending a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set. ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the steps described in TD5.3 to place the UUT into the B-host role.
2. The SS-OVS displays a dialog requesting the operator to initiate a role swap from the UUT.
3. The SS-OVS verifies that the UUT issues a SET_FEATURE (NTF_HOST_REL).
4. The SS-OVS sends a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**

5. The SS-OVS verifies that the UUT issues a Warm Reset LFPS (within **TRSP_WRST**), and that the UUT does not prematurely issue a warm reset until this point (after the previous step above)

6. The SS-OVS verifies that the UUT starts up in the opposite role by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.

7. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.

8. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

9.3.3 TD5.5 Treatment of Warm Reset without Reception of SET_FEATURE (NTF_HOST_REL)

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, when acting as B-peripheral , and not having received a SET_FEATURE (NTF_HOST_REL) request, treats a warm reset signaled by the SS-OVS port as a standard warm reset.
Test setup	Setup is per Section 8.5.3.
Assertions	5.4.1#4
Pass Criteria	● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The UUT transitions from U0 to Rx.Detect, Polling, and back to U0. ● The UUT starts up in the same role (B-Peripheral) by sending a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set. ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.

2. The SS-OVS displays a dialog requesting the test operator to initiate a role swap.

3. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

4. The SS-OVS issues a Warm Reset LFPS (prior to **TRSP_ACK** timeout).

5. The SS-OVS verifies that the UUT transitions from U0 to Rx.Detect, Polling, and back to U0.

6. The SS-OVS verifies that the UUT starts up in the same role (B-Peripheral) by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.

7. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.

8. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

9.3.4 TD5.6 Non-Reception of SET_FEATURE (NTF_HOST_REL) Request

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, acting as a B-peripheral and not having received the SET_FEATURE (NTF_HOST_REL) request within **TRSP_ACK_ERR** of requesting the host role, transitions to an error state.
Test setup	Setup is per Section 8.5.3.
Assertions	5.4.1#7
Pass Criteria	● The UUT transitions to an error state within **TRSP_ACK_ERR.**

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.
2. The SS-OVS displays a dialog requesting the test operator to initiate a role swap.
3. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

Note: The SS-OVS does not send the SET_FEATURE (NTF HOST_REL) request.

4. The SS-OVS verifies that the UUT transitions to an error state within **TRSP_ACK_ERR** of issuing the Device Notification TP in step 3 above.

9.3.5 TD5.7 Deadline Test for SET_FEATURE (NTF_HOST_REL) Request

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, acting as a B-peripheral, having received the SET_FEATURE (NTF_HOST_REL) request at the expiration of **TRSP_ACK** minus **T_LINK_TURNAROUND,** completes the role swap and does not transition to an error state.
Test setup	Setup is per Section 8.5.3.
Assertions	5.4.1#7
Pass Criteria	● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The UUT does not transition to an error state. ● The role swap completes successfully.

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.
2. The SS-OVS displays a dialog requesting the test operator to initiate a role swap.
3. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).
4. The SS-OVS sends SET_FEATURE (NTF_HOST_REL) at the expiration of **TRSP_ACK** (minus **T_LINK_TURNAROUND**].
5. The SS-OVS verifies that the UUT does not transition to an error state.

6. The SS-OVS verifies that the role swap completes successfully.

9.3.6 TD5.8 Non-Reception of Device Notification TP (HOST_ROLE_REQUEST – CONFIRM)

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, in B-Host role, transitions to an error state if it does not receive the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) prior to **TRSP_CNF_ERR** of issuing the SET_FEATURE (NTF_HOST_REL) request.
Test setup	Setup is per Section 8.5.3.
Assertions	5.2.1#10
Pass Criteria	● The UUT issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK** ● The UUT transitions to an error state within **TRSP_CNF_ERR** of issuing the SET_FEATURE (NTF_HOST_REL).

Test Steps

1. The SS-OVS performs the steps necessary to place the UUT into the B-host role.
2. The SS-OVS, acting as A-Peripheral, issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).
3. The SS-OVS verifies that the UUT issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK.**

Note: The SS-OVS will not send the TP HOST_ROLE_REQUEST – CONFIRM.

4. The SS-OVS verifies that the UUT transitions to an error state (ss.disabled) within **TRSP_CNF_ERR** of issuing the SET_FEATURE (NTF_HOST_REL) request in step 3 above.

9.3.7 TD5.9 Deadline Test for Device Notification TP (HOST_ROLE_REQUEST – CONFIRM)

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, in B-Host role, completes the role swap and does not transition to an error state if it receive the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) at the expiration of **TRSP_CNF** (minus **T_LINK_TURNAROUND**).
Test setup	Setup is per Section 8.5.3.
Assertions	5.2.1#10
Pass Criteria	● The UUT issues a SET_FEATURE (NTF_HOST_REL). ● The UUT does not transition to an error state. ● The role swap completes successfully.

Test Steps

1. The SS-OVS and the UUT perform the steps described in TD6.3.3 to place the UUT into the B-host role.

2. The SS-OVS, acting as A-Peripheral, issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

3. The SS-OVS verifies that the UUT issues a SET_FEATURE (NTF_HOST_REL).

4. The SS-OVS sends the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) at the expiration of **TRSP_CNF** (minus **T_LINK_TURNAROUND**).

5. The SS-OVS verifies that the UUT does not transition to an error state.

6. The SS-OVS verifies that the role swap completes successfully.

9.3.8 TD5.10 Non-Reception of Warm Reset LFPS

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, acting as B-peripheral, and not having received a Warm Reset LFPS within **TRSP_WRST_ERR** of issuing the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM), transitions to an error state.
Test setup	Setup is per Section 8.5.3.
Assertions	5.2.1#11
Pass Criteria	● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) prior to **TRSP_CNF MAX** ● The UUT transitions to an error state within **TRSP_WRST_ERR** of issuing the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM).

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.

2. The SS-OVS displays a dialog requesting the test operator to initiate a role swap.

3. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

4. The SS-OVS issues a SET_FEATURE (NTF_HOST_REL) prior to **TRSP_ACK MAX.**

5. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) prior to **TRSP_CNF MAX**

Note: The SS-OVS does not send the Warm Reset LFPS.

6. The SS-OVS verifies that the UUT transitions to an error state within **TRSP_WRST_ERR** of issuing the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) in step 3 above.

9.3.9 TD5.11 Deadline Test for Warm Reset LFPS

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, acting as B-peripheral, completes the role swap and does not transition to an error state if it receives a warm reset at **TRSP_WRST MAX** minus **T_LINK_TURNAROUND** of issuing the Device Notification TP (HOST_ROLE_REQUEST – CONFIRM), transitions to an error state.
Test setup	Setup is per Section 8.5.3.
Assertions	5.2.1#11
Pass Criteria	● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.** ● The UUT does not transition to an error state. ● The role swap completes successfully.

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.
2. The SS-OVS displays a dialog requesting the test operator to initiate a role swap.
3. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).
4. The SS-OVS issues a SET_FEATURE (NTF_HOST_REL) prior to **TRSP_ACK MAX**
5. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**
6. The SS-OVS sends TP (HOST_ROLE_REQUEST – CONFIRM) at **TRSP_WRST MAX** minus **T_LINK_TURNAROUND.**
7. The SS-OVS verifies that the UUT does not transition to an error state.
8. The SS-OVS verifies that the role swap completes successfully.

9.3.10 TD5.12 Role Swap Protocol - Multiple Swaps

Applies to	SS-OTG Device.
Description	This test confirms that the UUT properly supports multiple “back and forth” occurences of RSP. In this test, the role swap will be executed 4 times.
Test setup	Setup is per Section 8.5.3.
Assertions	2.3#4
Pass Criteria	**UUT Transitions from B-Peripheral to B-Host:** ● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE). ● The reserved field bits at DW1:10 (bits 10 through 31) and DW2:0 (bits 0 through 31) in the Device Notification TP (HOST ROLE REQUEST) are set to zero ● The UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.** ● The UUT does not transition to an error state. ● The direction bits in the UUT’s Port Capabilities LMP are correct. ● UUT Transition from B-Host to B-Peripheral ● The UUT issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK** ● The UUT issues a Warm Reset LFPS (within **TRSP_WRST**). ● The direction bits in the UUT’s Port Capabilities LMP are correct.

Test Steps

1. The SS-OVS and the UUT perform the link initialization procedure.
2. The SS-OVS keeps the lnk in U0 for 20s, waiting for the RSP to start.
3. The SS-OVS displays a dialog requesting the operator to initiate a role swap from the UUT.
4. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).
5. The SS-OVS verifies that the the reserved field bits at DW1:10 (bits 10 through 31) and DW2:0 (bits 0 through 31) in the Device Notification TP (HOST ROLE REQUEST) are set to zero.
6. The SS-OVS issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK.**
7. The SS-OVS verifies that the UUT issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**
8. The SS-OVS issues a Warm Reset LFPS (within **TRSP_WRST**).
9. The SS-OVS verifies that the UUT starts up in the opposite role by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.
10. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.

Note: The UUT is now the B-Host; the SS-OVS is now the A-Peripheral

11. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

12. The SS-OVS initiates RSP by issuing a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

13. The SS-OVS verifies the UUT issues a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK.**

14. The SS-OVS issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**

15. The SS-OVS verifies that the UUT issues a Warm Reset LFPS (within **TRSP_WRST**).

16. The SS-OVS verifies that the UUT starts up in the opposite role by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.

17. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.

Note: The UUT is now the B-Peripheral; the SS-OVS is now the A-Host

18. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

19. Repeat steps 3 through 18.

9.4 SS-OTG A-Device Tests

9.4.1 TD5.15 Port Capabilities LMP

Applies to	SS-OTG Device
Description	This test verifies that the UUT, acting as A-host, defaults to host role, sets the DS bit (1:16), and resets the US bit (1:17) in its Port Capabilities LMP.
Test setup	Setup is per Section 8.5.4
Assertions	5.3#1
Pass Criteria	● The DS bit (1:16) is set and the US bit (1:17) is reset in the Port Capabilities LMP from the UUT.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS verifies that the DS bit (1:16) is set and the US bit (1:17) is reset in the Port Capabilities LMP from the UUT.

9.4.2 TD5.16 B-Peripheral Request to Become Host

Applies to	SS-OTG Device.
Description	This test verifies that the UUT, acting as A-host, will correctly reply to a request from the SS-OVS, acting as B-peripheral, to become the host.
Test setup	Setup is per Section 8.5.4
Assertions	2.3#5, 5.1#6
Pass Criteria	● The UUT requests the OTG descriptor. ● The UUT requests other descriptors from the SS-OVS (B-peripheral). ● The UUT replies with a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK**. ● The UUT issues a Warm Reset LFPS prior to **TRSP_ACK**. ● The UUT starts up in the opposite role, sending a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set. ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS verifies that the UUT requests the OTG descriptor.
3. The SS-OVS returns the OTG descriptor (D3 (RSP Support) is set to TRUE).
4. The UUT requests other descriptors from the SS-OVS (B-peripheral).
5. The SS-OVS issues a Device Notification TP (HOST_ROLE_REQUEST – INITIATE).

6. The SS-OVS verifies that the UUT replies with a SET_FEATURE (NTF_HOST_REL) within **TRSP_ACK.**

7. The SS-OVS issues a Device Notification TP (HOST_ROLE_REQUEST – CONFIRM) within **TRSP_CNF.**

8. The SS-OVS verifies that the UUT issues a Warm Reset LFPS prior to **TRSP_ACK.**

9. The SS-OVS verifies that the UUT starts up in the opposite role by confirming that it sends a Port Capabilities LMP with the Downstream bit (1:16) reset and the Upstream bit (1:17) set.

10. The SS-OVS sends a Port Capabilities LMP with the Downstream bit (1:16) set and the Upstream bit (1:17) reset.

11. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

9.4.3 TD5.17 A-Host Enables RSP in B-Peripheral

Applies to	SS-OTG Device.
Description	This test confirms that the UUT, acting as A-host, enables RSP capability in a B-peripheral (emulated by the SS-OVS), within **TRSP_ENABLE** of configuring the B-peripheral.
Test setup	Setup is per Section 8.5.4
Assertions	5.2.2#1, 5.2.2#2, 5.2.2#3
Pass Criteria	● The UUT requests the OTG descriptor. ● The UUT issues a SET_FEATURE (B3_RSP_ENABLE) request within **TRSP_ENABLE** of the SetConfiguration ● The SET_FEATURE (B3_RSP_ENABLE) request is issued to the default control pipe

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure (including a SetConfiguration operation initiated by the UUT).

2. The SS-OVS verifies that the UUT (A-host) requests the OTG descriptor.

3. The SS-OVS returns the OTG descriptor (D3 (RSP Support) is set to TRUE).

4. The SS-OVS verifies that the UUT issues a SET_FEATURE (B3_RSP_ENABLE) request within **TRSP_ENABLE** of the SetConfiguration request in step 1 above.

5. The SS-OVS verifies that the SET_FEATURE (B3_RSP_ENABLE) request is issued to the default control pipe.

9.4.4 TD5.18 OTG Descriptor - *bmAttributes* D3 (RSP Support) = FALSE

Applies to	SS-OTG Device.
Description	This test verifies that the UUT, acting as A-host, properly manages an advertisement from the B-Peripheral that it does not support RSP ((D3 (RSP Support)) = FALSE in the OTG descriptor (*bmAttributes* field*)*. If *bmAttributes* D3 (RSP Support) were TRUE, the UUT would be expected to issue a Set Feature B3_RSP_Enable within **TRSP_ENABLE** after configuration. In this case, since *bmAttributes* D3 (RSP Support) is returned as FALSE, the SS-OVS will verify that the Set Feature (B3_RSP_Enable) command is not sent.
Test setup	Setup is per Section 8.5.4
Assertions	5.2.2#1
Pass Criteria	● The UUT issues a GetDescriptor request. ● The UUT does not issue a Set Feature (B3_RSP_Enable). ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The UUT issues a GetDescriptor request to read the OTG descriptor from the SS-OVS.
3. The SS-OVS returns *bmAttributes* D3 (RSP Support) as FALSE.
4. The SS-OVS verifies that the UUT does not issue a Set Feature (B3_RSP_Enable).
5. The SS-OVS verifies that the link stays in U0 for **T_LINK_ACTV**.

9.4.5 TD 5.19 RSP Request Directed at Non-RSP Device

Applies to	SS-OTG device that does not support RSP.
Description	This test confirms that a UUT that does not declare support for RSP responds correctly when the SS-OVS attempts a role swap. The SS-OVS will read the UUT's descriptors at the start of testing, and if RSP support is not indicated, it will populate this test into the test suite.
Test setup	Setup is per Section 8.5.4
Assertions	5.2.2#5
Pass Criteria	● The UUT stalls the request from the SS-OVS to initiate the role swap. ● The link stays in U0 for **T_LINK_ACTV**.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS reads the UUT's Configuration descriptor.
3. The SS-OVS issues a Device Notification TP (HOST_ROLE_REQUEST- INITIATE) to the UUT.

4. The SS-OVS verifies that the UUT stalls this request.

9.4.6 TD5.14 No Silent Failures – Device Descriptor Request Ignored

Applies to	SS-OTG Device
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS ignores a device descriptor request from the UUT The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is as per Section 8.5.5.
Assertions	2.6#3,
Pass Criteria	● The UUT shall request the Device Descriptor ● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure
2. The UUT requests the device descriptor from the SS-OVS.
3. The SS-OVS properly manages link layer replies to the device descriptor request, but does not reply at the protocol layer (i.e., does not reply with the normally expected data packet during the IN transaction phase).
4. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.4.7 TD5.15 No Silent Failures – Unsupported Device

Applies to	SS-OTG Device
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS declares itself to the UUT as a device not listed on the device's TPL. The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is as per Section 8.5.5.
Assertions	2.6#3
Pass Criteria	● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure
2. The UUT requests the device descriptor from the SS-OVS.
3. The SS-OVS responds to the Device Descriptor request with a VID/PID combination not listed on the UUT's TPL.

4. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.4.8 TD5.16 No Silent Failures – Failure to Link Train

Applies to	SS-OTG
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS prohibits a successful progression to U0 (i.e., forces a failure to fully link train with the UUT). The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.5.
Assertions	2.6#3
Pass Criteria	● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the initial steps of the Link Initialization Procedure up through and including the exchange of Polling.LFPS signaling, but will not progress beyond that point.

2. The SS-OVS application provides the test operator with a dialog to verify the presence of the error message.

9.4.9 TD5.17 No Silent Failures - Hub Test (Hub Not Supported)

Applies to	SS-OTG Device NOT Showing Hub Support on TPL
Description	This test verifies that the UUT will display a failure message to the user when the SS-OVS enumerates as a hub. The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.5.
Assertions	2.6#3
Pass Criteria	● The UUT shall display a failure message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure.

2. The SS-OVS verifies that the UUT requests descriptors from the SS-OVS, which will respond to these descriptor requests as a hub.

3. The SS-OVS application provides a dialog to the test operator to verify the presence of a UUT error message that shall indicate that hubs are not supported.

9.4.10 TD5.18 Hub Test (Hub Supported)

Applies to	SS-OTG Device Showing Hub Support on TPL
Description	This test verifies that the UUT will NOT display a failure message to the user when the SS-OVS enumerates as a hub. The test operator will be required to confirm the message via a dialog on the SS-OVS application.
Test setup	Setup is per Section 8.5.5.
Assertions	2.6#3
Pass Criteria	● The UUT shall NOT display a failure message.

Test Steps

1. The UUT and SS-OVS perform the Link Initialization Procedure.
2. The SS-OVS verifies that the UUT requests descriptors from the SS-OVS, which will respond to these descriptor requests as a hub.
3. The SS-OVS application provides a dialog to the test operator to verify that a UUT error message is not present.

9.5 SS-OTG B-Device Tests

9.5.1 TD5.20 Port Capabilities LMP

Applies to	SS-OTG Device.
Description	This test verifies that the UUT defaults to peripheral role, resets the DS bit (1:16), and sets the US bit (1:17) in its Port Capabilities LMP.
Test setup	Setup is per Section 8.5.5
Assertions	5.1#2, 5.1#4, 5.1#5, 5.1.2#1, 5.1.3#1
Pass Criteria	● The DS bit (1:16) is reset and the US bit (1:17) is set in the Port Capabilities LMP from the UUT.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS verifies that the DS bit (1:16) is reset and the US bit (1:17) is set in the Port Capabilities LMP from the UUT.

9.5.2 TD5.21 OTG Descriptor – GetDescriptor(OTG) Request

Applies to	SS-OTG Device.
Description	This test confirms that the UUT (which will be transtioned to B-host) properly supports a role swap from B-host to B-peripheral.
Test setup	Setup is per Section 8.5.5
Assertions	5.1#2, 5.1#4, 5.1#5, 5.1#7, 5.1#8, 5.1#9, 5.1#10, 5.1.2#1, 5.1.3#1
Pass Criteria	● The UUT returns an OTG descriptor. ● The UUT returns *bDescriptorType* = 9. ● The UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0). ● The UUT returns D3 (RSP Support) set to TRUE (if RSP is supported). ● The UUT returns a value of 0x0300 in the *bcdOTG* field.

Test Steps

1. The SS-OVS and the UUT perform theLink Initialization Procedure.
2. The SS-OVS requests the OTG descriptor from the UUT.
3. The SS-OVS verifies that the UUT returns an OTG descriptor.
4. The SS-OVS verifies that the UUT returns *bDescriptorType* = 9.
5. The SS-OVS verifies that the UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0).
6. The SS-OVS verifies that the UUT returns D3 (RSP Support) set to TRUE (if RSP is supported).
7. The SS-OVS verifies that the UUT returns a value of 0x0300 in the *bcdOTG* field.

9.5.3 TD5.22 OTG Descriptor – GetDescriptor(Configuration) Request

Applies to	SS-OTG Device.
Description	This test verifies that the SS-OTG UUT returns an OTG descriptor as part of a Configuration descriptor request from the SS-OVS.
Test setup	Setup is per Section 8.5.5
Assertions	5.1#2, 5.1#4, 5.1#5, 5.1#6, 5.1#8, 5.1#9, 5.1#10, 5.1.2#1, 5.1.3#1
Pass Criteria	● The UUT returns an OTG descriptor as part of its Configuration descriptor. ● The UUT returns *bDescriptorType* = 9. ● The UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0). ● The UUT returns D3 (RSP Support) set to TRUE (if RSP is supported). ● The UUT returns a value of 0x0300 in the *bcdOTG* field.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure..
2. The SS-OVS requests the Configuration descriptor from the UUT.
3. The SS-OVS verifies that the UUT returns an OTG descriptor as part of its Configuration descriptor.
4. The SS-OVS verifies that the UUT returns *bDescriptorType* = 9.
5. The SS-OVS verifies that the UUT returns bits D7-D4 of the *bmAttributes* field as reserved (set to 0).
6. The SS-OVS verifies that the UUT returns D3 (RSP Support) set to TRUE (if RSP is supported).
7. The SS-OVS verifies that the UUT returns a value of 0x0300 in the *bcdOTG* field.

9.5.4 TD5.23 SET_FEATURE (B3_RSP_ENABLE) to Default Control Pipe

Applies to	SS-OTG Device.
Description	This test verifies that the UUT (B-peripheral) accepts the SET_FEATURE (B3_RSP_ENABLE) command.
Test setup	Setup is per Section 8.5.5
Assertions	5.2.2#4
Pass Criteria	● The UUT returns D3 (RSP Support) = TRUE. ● The UUT accepts (and does not stall) the request

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS requests the OTG descriptor form the UUT.
3. The SS-OVS verifies that the UUT returns D3 (RSP Support) = TRUE.
4. The SS-OVS issues a SET FEATURE (B3_RSP_ENABLE) request to the default control pipe within **TRSP_ENABLE** of configuring the UUT in step 1 above.
5. The SS-OVS verifies that the UUT accepts (and does not stall) the request.

9.5.5 TD5.24 RSP Boundary Case

Applies to	SS-OTG Device.
Description	In this test, the UUT, acting as B-host, will initiate RSP by Sending a SET_FEATURE (NTF_HOST_REL). This is RSP Step 2. The SS-OVS, acting as A-peripheral, will send a SET_FEATURE (HOST_ROLE_REQUEST – INITIATE) immediately upon receipt of the SET_FEATURE (NTF_HOST_REL) from the B-host. The B-host is expected to ignore this request and shall proceed along with the SS-OVS to complete the RSP process.
Test setup	Setup is per Section 5
Assertions	5.4.2#1
Pass Criteria	● The first role swap completes successfully. ● The second role swap completes successfully.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS application instructs the test operator to initiate a role swap (to transition the UUT from B-peripheral to B-host).
3. The SS-OVS verifies that the role swap is successful and that UUT comes up in the opposite role (B-host).
4. The SS-OVS application instructs the test operator to initiate a role swap (to transition the UUT from B-host to B-peripheral).
5. The SS-OVS verifies that the UUT issues a SET_FEATURE (NTF_HOST_REL). The SS-OVS responds immediately with SET_FEATURE (HOST_ROLE_REQUEST – INITIATE).
6. The SS-OVS sends a Device Notification TP (HOST_ROLE_REQUEST - Confirm) within **TRSP_CNF**.
7. The SS-OVS verifies that the UUT continues normally (within the defined RSP process) by sending a Warm Reset within **TRSP_WRST**.
8. The SS-OVS verifies that the UUT comes up in the opposite role and stays in U0 for **T_LINK_ACTV**.

9.5.6 TD5.25 Successive B3_RSP_ENABLE Requests

Applies to	SS-OTG Device.
Description	This test verifies that the UUT, a B-peripheral, will acknowledge a request to set the B3_RSP_ENABLE feature when it has already been configured with this feature.
Test setup	Setup is per Section 8.5.5.
Assertions	5.2.2#7
Pass Criteria	● The UUT returns D3 (RSP Support) = TRUE. ● The UUT accepts (and does not stall) the SET FEATURE (B3_RSP_ENABLE) request. ● The UUT accepts the successive SET FEATURE (B3_RSP_ENABLE) request.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS requests the OTG descriptor from the UUT.
3. The SS-OVS verifies that the UUT returns D3 (RSP Support) = TRUE.
4. The SS-OVS issues a SET FEATURE (B3_RSP_ENABLE) request to the default control pipe within **TRSP_ENABLE** of configuring the UUT in step 1 above.
5. The SS-OVS verifies that the UUT accepts (and does not stall) the request.
6. The SS-OVS issues a (successive) SET FEATURE (B3_RSP_ENABLE) request to the default control pipe.
7. The SS-OVS verifies that the UUT accepts this request.

9.6 SS-PO Device Tests

9.6.1 TD5.27 OTG Descriptor (Configuration Descriptor)

Applies to	SS-OTG Device.
Description	This test verifies that the SS-PO device returns the OTG descriptor in response to a GetDescriptor(Configuration) request.
Test setup	Setup is per Section 8.5.6.
Assertions	5.1#11, 5.1#12, 5.1#13, 5.1#14, 5.1#15, 5.1.2#3, 5.1.3#3
Pass Criteria	● The UUT returns the OTG descriptor with the attributes below: ● *bLength* = 5 bytes. ● *bDescriptorType* = 9. ● Bits D7-D4 of the *bmAttributes* field reserved (set to 0). ● Bit D3 (**RSP Support**) = FALSE. ● **bcdOTG** field = 0x0300.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS issues a GetDescriptor(Configuration) request.
3. The SS-OVS verifies that the UUT returns the OTG descriptor in response to a Configuration descriptor request.
4. The SS-OVS verifies that the UUT responds with:
    a. *bLength* = 5 bytes
    b. *bDescriptorType* = 9
    c. Bits D7-D4 of the *bmAttributes* field reserved (set to 0).
    d. Bit D3 (**RSP Support**) = FALSE.
    e. The **bcdOTG** field = 0x0300.

9.6.2 TD5.28 OTG Descriptor

Applies to	SS-OTG Device.
Description	This test verifies that the SS-PO device returns the OTG descriptor in response to an OTG Descriptor request.
Test setup	Setup is per Section 8.5.6.
Assertions	5.1#11, 5.1#12, 5.1#13, 5.1#14, 5.1#15, 5.1.2#3, 5.1.3#3
Pass Criteria	● The UUT returns the OTG descriptor with the attributes below: ● *bLength* = 5 bytes. ● *bDescriptorType* = 9. ● Bits D7-D4 of the *bmAttributes* field reserved (set to 0). ● Bit D3 (**RSP Support**) = FALSE. ● **bcdOTG** field = 0x0300.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS issues a GetDescriptor(OTG) request.
3. The SS-OVS verifies that the UUT returns the OTG descriptor.
4. The SS-OVS verifies that the UUT responds with:
    a. *bLength* = 5 bytes
    b. *bDescriptorType* = 9
    c. Bits D7-D4 of the *bmAttributes* field reserved (set to 0).
    d. Bit D3 (**RSP Support**) = FALSE.
    e. The **bcdOTG** field = 0x0300.

9.7 SSPC-OTG Device Tests

9.7.1 TD5.28 Peripheral-Only SuperSpeed Support

Applies to	SS-OTG Device.
Description	This test verifies that the UUT supports SuperSpeed as a peripheral only.
Test setup	Setup is per Section 8.5.7
Assertions	2.3#7
Pass Criteria	● The UUT's Port Capabilities LMP sets the Downstream Port field to 0x00

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS verifies that the UUT's Port Capabilities LMP sets the Downstream Port field to 0x00.

9.7.2 TD5.29 OTG Descriptor (Configuration Descriptor)

Applies to	SS-OTG Device.
Description	This test verifies that the SSPC-OTG device returns the OTG descriptor as part of a GetDescriptor(Configuration) request
Test setup	Setup is per Section 8.5.7
Assertions	5.1#16, 5.1#17, 5.1#18, 5.1#19, 5.1#20, 5.1.2#4, 5.1.3#4
Pass Criteria	● The UUT returns the OTG descriptor with the attributes below: ● *bLength* = 5 bytes. ● *bDescriptorType* = 9. ● Bits D7-D4 of the *bmAttributes* field reserved (set to 0). ● Bit D3 (**RSP Support**) = FALSE. ● **bcdOTG** field = 0x0300.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS issues a GetDescriptor(Configuration) request.
3. The SS-OVS verifies that the UUT returns the OTG descriptor as part of the Configuration descriptor.
4. The SS-OVS verifies that the UUT responds with:
    a. *bLength* = 5 bytes
    b. *bDescriptorType* = 9

c. Bits D7-D4 of the *bmAttributes* field reserved (set to 0).

d. Bit D3 (**RSP Support**) = FALSE.

e. The **bcdOTG** field = 0x0300.

9.7.3 TD5.30 OTG Descriptor

Applies to	SS-OTG Device.
Description	This test verifies that the SSPC-OTG device returns the OTG descriptor as part of an OTG Descriptor request.
Test setup	Setup is per Section 8.5.7
Assertions	5.1#16, 5.1#17, 5.1#18, 5.1#19, 5.1#20, 5.1.2#4, 5.1.3#4
Pass Criteria	● The UUT returns the OTG descriptor with the attributes below: ● *bLength* = 5 bytes. ● *bDescriptorType* = 9. ● Bits D7-D4 of the *bmAttributes* field reserved (set to 0). ● Bit D3 (**RSP Support**) = FALSE. ● **bcdOTG** field = 0x0300.

Test Steps

1. The SS-OVS and the UUT perform the Link Initialization Procedure.
2. The SS-OVS issues a GetDescriptor(OTG) request.
3. The SS-OVS verifies that the UUT returns the OTG descriptor as part of the Configuration descriptor.
4. The SS-OVS verifies that the UUT responds with:
    a. *bLength* = 5 bytes
    b. *bDescriptorType* = 9
    c. Bits D7-D4 of the *bmAttributes* field reserved (set to 0).
    d. Bit D3 (**RSP Support**) = FALSE.
    e. The **bcdOTG** field = 0x0300.

10 Manual Interoperability Tests

10.1 Introduction

Testing performed in this Section is performed in a manual fashon, i.e., not under the control of any automated processes or test equipment. Herein, Targeted Hosts are tested for interoperability with peripherals from the Targeted Hosts's Targeted Peripheral List (TPL).

A Targeted Host is a USB host that supports a specific, targeted set of peripherals. The developer of each Targeted Host lists supported peripherals on its TPL. A Targeted Host needs to provide only the power, bus speeds, data flow types, etc., that the peripherals on its TPL require.

There are two categories of Targeted Hosts:

1. Embedded Hosts: An Embedded Host (EH) product provides Targeted Host functionality over one or more Standard-A or Micro-AB receptacles. Embedded Host products may also offer USB peripheral capability, delivered separately via one or more Type-B receptacles.

2. On-The-Go: An OTG product is a portable device that uses a single Micro-AB receptacle (and no other USB receptacles) to operate at times as a USB Targeted Host and at times as a USB peripheral. OTG devices shall always operate as a standard peripheral when connected to a standard USB host.

Only SuperSpeed is tested (except for certain tests requiring legacy checks); USB 2.0 manual testing is defined in ***[OTG&EH2.0CompliancePlan]***.

10.1.1 Definition of "Category"

Test procedures in this Section refer to "categories." The use of this term refers to the general type of a specific Targeted Peripheral that a Targeted Host lists on its TPL.

Examples of categories are: memory sticks, CDROMs, MTP peripherals, audio headsets, mice, keyboards, etc. For example, the "storage" category might include a USB hard drive, flash card reader, etc.

10.1.2 Definition of "Prove Functionality"

Test procedures in this Section refer to the requirement to "prove functionality." This term is intended to ensure that the Unit Under Test (UUT) functions in the way that has been defined by the UUT's vendor. Proving the functionality of a device can be limited to very basic operations, e.g., a device of the memory stick category may have a single function to read out specific file types and may provide no other function.

There should however be some demonstrable operation which provides value to the end user; it is not sufficient to enumerate the device and show the device as available to the user without proving any further functionality.

10.1.3 Output Power

A Targeted Host is permitted to limit its output power based on the requirements of the connected Targeted Peripheral. For example, if an SS-EH limits its output power to 100mA based on the power requirements of a particular Targeted Peripheral, it can only additionally support devices that consume no more than 100mA.

10.2 Interoperability Requirements

10.2.1 Targeted Peripheral List

Any Targeted Host must work with all peripherals listed on its TPL (i.e., any Targeted Host must prove functionality with these peripherals). For testing performed in this Section, the manufacturer of a Targeted Host shall provide a

subset of the peripheral(s) from the device's TPL. The manufacturer is responsible for verifying that the Targeted Host supports the entirety of all peripherals listed on the TPL.

10.2.2 Error Messages

Silent failures are not allowed and therefore a clear message shall be generated when any sort of error situation occurs.

Where hubs are non-supported, a clear "Hub not supported" or similar error message shall appear, not a generic "not supported" or similar error message.

10.2.3 Hub Support

If a UUT supports hubs, the following items shall be taken into account:

- Simultaneous operation of multiple peripherals shall be supported
- Full-speed hubs shall be supported
- Where bus-powered Superspeed hubs are supported, the source current of 150mA for each downstream-facing port shall be considered.

10.3 Interoperability Test Descriptions

10.3.1 TD 5.31 Functionality with TPL Devices

Purpose	Prove the functionality of a Targeted Host with TPL device(s)
Applies to	Targeted Hosts
Description	Demonstrate the functionality of SuperSpeed TPL devices(s)
Pass Criteria	Devices tested under all categories demonstrate functionality

Test Steps

1. Power ON the UUT.
2. Attach a B-device taken from the TPL and prove functionality.
3. Detach the B-device and verify the device is disconnected correctly.
4. Attach the B-device and prove functionality.
5. Repeat the steps above with at east one device from each of the categories supported

10.3.2 TD 5.32 Legacy Speed Test

Purpose	Prove the functionality of the Targeted Host in Full Speed (and High Speed if supported)
Applies to	Targeted Hosts
Description	Test the legacy functionality of the device
Pass Criteria	The functionality of the FS device is proven. If HS is supported, test HS as well.

Test Steps

1. Power ON the UUT.

2. Attach a Full Speed B-device and prove functionality.
3. Remove the Full Speed device.
4. If the TPL indicates High Speed is supported, attach a High Speed B-device and prove functionality.

10.3.3 TD 5.33 SS-EH Concurrent and Independent Test

Purpose	Prove the functionality of all downstream ports
Applies to	SS-EH with multiple B ports
Description	Test the concurrent and independent functioning of the SuperSpeed TPL peripherals on each downstream port.
Pass Criteria	The UUT can operate the device concurrently and independently, or a selection method is available for the end-user to select a device. Note that a UUT is allowed to handle a limited number of concurrent peripherals.

Test Steps

1. Power on the UUT.
2. Attach a supported B-device to port 1.
3. Attach another supported B-device of the same category to an available downstream port.
4. Continue attaching B-devices of the same category until all ports are full.
5. Prove functionality of each attached B-device.
6. Verify the attached devices operate concurrently and independently or that a selection method is available such that the user can select the active B-device.
7. If multiple categories are supported, remove one device and replace it with a device of another category.
8. Verify the attached devices operate concurrently and independently or that a selection method is available such that the user can select the active B-device.
9. Remove all peripherals.
10. Repeat the above steps for each supported category.

10.3.4 TD 5.34 Unsupported Device Message Test

Purpose	Prove that the Targeted Host generates a clear error message when attaching an unsupported device
Applies to	Targeted Hosts
Description	Observe error messages when attaching unsupported peripherals
Pass Criteria	A clear error message is generated by the UUT when attaching an unsupported device.

Test Steps

1. Power on the UUT.
2. Attach a Full Speed unsupported device (use a device class that is listed on the TPL).
3. Verify that a clear error message is generated to the end-user.
4. Remove the Full Speed device.
5. Attach a SuperSpeed unsupported device (use a device class that is listed on the TPL).
6. Verify that a clear error message is generated to the end-user.

7. Remove the SuperSpeed Device.
8. Attach a SuperSpeed device of a class that is not listed on the TPL.
9. Verify that a clear error message is generated to the end-user.

10.3.5 TD 5.35 Hub Error Message Test

Purpose	Prove that a Targeted Host generates a hub error message
Applies to	Targeted Hosts that DO NOT support SuperSpeed hubs
Description	Test that a hub error message is displayed
Pass Criteria	A clear message is displayed that hubs are not supported and the device does not function on the downstream ports of the hub.

Test Steps

1. Power on the UUT.
2. Connect external power to the hub (if required) and attach the hub.
3. Verify that a clear “hub not supported” message (or similar message) appears.
4. Attach a TPL device on one of the hub’s downstream ports.
5. Check that the attached device does not function.

10.3.6 TD 5.36 Hub Functionality Test

Purpose	Prove the functionality of an attached hub and a device attached to one of the hub’s downstream ports.
Applies to	Targeted Hosts that DO support SuperSpeed hubs
Description	Test the hub functionality with TPL peripherals
Test setup	One 4 port SuperSpeed Self Powered Hub (If hub support is performed by VID/PID in TPL use this Hub) High Speed device if listed on TPL At least one TPL device from each category FS device if listed on TPL (for TT stress)
Pass Criteria	Prove the functionality of the all device categories listed in TPL attached downstream from one hub

Test Steps

1. Power on the UUT.
2. Connect external power to the hub (if required) and attach the hub. Note: If hub support is performed by VID/PID (as described in the TPL), use a hub with this VID/PID.
3. Attach one supported Superspeed device on one of the hub’s downstream ports and prove its functionality.
4. Repeat the step above for each supported category.
5. Detach the device.
6. Attach one supported Full Speed device (if supported) on one of the hub’s downstream ports and prove its functionality.

10.3.7 TD 5.37 Hub Maximum Tier Test

Purpose	Prove the maximum tier hub functionality of a Targeted Host
Applies to	Targeted Hosts that DO support SuperSpeed hubs
Description	Test the functionality of the TPL peripherals after the maximum defined tier of hubs and verify that an appropriate error message is generated when exceeding the maximum tier.
Pass Criteria	One TPL device to prove to work downstream from the maximum defined tier of hubs. When exceeding the maximum tier of hubs the appropriate error message was generated.

Test Steps

1. Power on the UUT.
2. Attach one or more hubs to arrive at the maximum supported hub depth as listed on the TPL.
3. Attach one TPL device on one of the hub's downstream ports (furthest downstream hub) and prove functionality.
4. Detach the device.
5. Attach another hub downstream (to exceed maximum supported hub depth).
6. Verify that an appropriate error message is generated.

10.3.8 TD 5.38 Hub Concurrent and Independent Test

Purpose	Prove the functionality of multiple TPL peripherals attached to a hub's downstream ports
Applies to	Targeted Hosts that DO support SuperSpeed hubs
Description	Test the functionality of the TPL peripherals in several configurations and ensure that each device is able to operate concurrently and independently.
Pass Criteria	The UUT can operate the peripherals concurrently and independently or a selection method is available for the end-user to select a device.

Test Steps

1. Power on the UUT.
2. Connect external power to the hub (if required) and attach the hub. Note: If hub support is performed by VID/PID (as described in the TPL), use a hub with this VID/PID.
3. Attach one supported Superspeed device on one of the hub's downstream ports and prove its functionality.
4. Attach similar peripherals (of the same category) to all other available hub ports.
5. Prove the functionality of each attached device.
6. Verify that the attached devices operate concurrently and independently or that a selection method is available such that the user can select the active device.
7. If additional categories are supported, replace all attached peripherals with peripherals from another category.
8. Verify that the attached devices operate concurrently and independently, or that a selection method is available such that the user can select the active device.
9. Detach one device and replace it with a device of another category (if multiple categories are supported).

10. Verify that the attached devices operate concurrently and independently or that a selection method is available such that the user can select the active device.
11. Repeat as needed for any additional supported categories.

10.3.9 TD 5.39 Power Exceeded Test

Purpose	Prove that the Targeted Host generates an appropriate error message when connecting a high-power device to one of a bus-powered hub's downstream ports.
Applies to	Targeted Hosts that DO support SuperSpeed hubs
Description	Verify that the UUT is able to detect and prevent an overcurrent event on a bus-powered hub.
Pass Criteria	An appropriate error message was generated.

Test Steps

1. Power on the UUT.
2. Attach a bus-powered hub.
3. Attach a high-power device from the TPL (Max_Power descriptor >150ma) to one of the hub's downstream ports. Note: If a high-power device is not listed on the TPL, use any other high-power device.
4. Verify that an appropriate error message is generated by the UUT.

10.3.10 TD 5.40 Maximum Concurrent Devices Exceeded Message Test

Purpose	Prove that the Targeted Host generates an appropriate error message when exceeding the maximum allowed number of concurrent peripherals
Applies to	Targeted Hosts which list limited support (as listed on the TPL) for the number of concurrently attached SuperSpeed peripherals
Description	Test the UUT for appropriate behavior when exceeding the maximum number of supported concurrent peripherals up to a maximum of four.
Pass Criteria	Prove that the specified maximum number of concurrent peripherals function correctly, and either that an error message is given when exceeding this number or that it is able to handle 4 peripherals.

Test Steps

Note: Only if needed, the test operator may attach one or more hubs in order to exceed the maximum number of attached peripherals.

1. Power ON the UUT.
2. Attach a SuperSpeed B-device and prove its functionality.
3. Add additional devices of the same category until the maximum number of devices is reached. Prove the functionality of each device before adding the next device.
4. Verify that an appropriate error message is generated by the UUT.

10.3.11 TD 5.41 Standby (U3) Test

Purpose	Prove that the Targeted Host manages Standby correctly
Applies to	Targeted Hosts which support Standby (U3)
Description	With a B-device connected, verify Standby operation of the UUT.
Pass Criteria	Compliant Standby behavior is observed.

Test Steps

1. Power ON the UUT.
2. Attach a SuperSpeed B-device from the TPL and prove its functionality.
3. Place the UUT in Standby (follow the UUT vendor guidelines to force the Targeted Host into Standby mode).
4. Take the UUT out of Standby mode (UUT may also come out of Standby automatically on detach).
5. Prove the functionality of the B-device.
6. Perform this test for each supported category.

10.3.12 TD 5.42 Standby (U3) Detach Test

Purpose	Prove the Standby functionality of a Targeted Host when a peripheral is detached during Standby mode
Applies to	Targeted Hosts which support Standby (U3)
Description	Detach TPL peripheral while UUT is in Standby mode. Verify that the UUT operates correctly after the UUT leaves Standby mode.
Test setup	At least one TPL SuperSpeed peripheral
Pass Criteria	Compliant Standby behavior is observed.

Test Steps

1. Power ON the UUT.
2. Attach a peripheral from the TPL and prove its functionality.
3. Place the UUT into Standby (follow UUT vendor guidelines to force the Targeted Host into Standby mode).
4. Detach the peripheral.
5. Take the UUT out of Standby (UUT may also come out of Standby automatically on detach).
6. Verify that UUT operates correctly by attaching the peripheral to the UUT and proving functionality.

10.3.13 TD 5.43 Standby (U3) Attach Test

Purpose	Prove the Standby functionality of the Targeted Host when a peripheral is attached during Standby mode
Applies to	Targeted Hosts which support Standby
Description	Attach a TPL peripheral while the UUT is in Standby mode. Verify UUT operates correctly after the UUT leaves Standby mode
Pass Criteria	Compliant Standby behavior is observed.

Test Steps

1. Power ON the UUT.
2. Place the UUT into Standby (follow UUT vendor guidelines to force the host into Standby mode).
3. Attach a supported SuperSpeed peripheral.
4. Take the UUT out of Standby mode (UUT may also come out of Standby automatically on attach).
5. Verify that UUT behaves normally by proving the functionality of the peripheral.

10.3.14 TD 5.44 Standby (U3) Topology Change Test

Purpose	Prove the Standby functionality of the Targeted Host when the topology changes during Standby.
Applies to	A Targeted Host which supports both hubs and Standby. An SS-EH with multiple ports which supports Standby.
Description	Switch the topology of TPL SuperSpeed peripherals while the UUT is in Standby, verify that the UUT does not behave abnormally after the UUT leaves Standby mode.
Pass Criteria	Compliant Standby behavior is observed.

Test Steps

1. Power ON the UUT.
2. Attach a hub if required.
3. Attach a SuperSpeed B-device from the TPL and prove functionality.
4. Place the UUT into Standby (follow UUT vendor guidelines to force the host into Standby mode).
5. Detach the B-device and attach it to another SS-EH port (or if using a hub, to another downstream hub port).
6. Take the UUT out of Standby (UUT may also come out of Standby automatically on attach).
7. Verify that UUT behaves normally by proving the functionality of the B-device.

10.3.15 TD 5.45 Standby Remote Wakeup Test

Purpose	Prove the remote wakeup functionality of a Targeted Host
Applies to	Targeted Hosts which support Standby and remote wakeup.
Description	Perform a USB remote wakeup event and verify that the UUT operates correctly after the UUT leaves Standby mode.
Pass Criteria	Compliant Standby behavior is observed when a remote wakeup event is performed during Standby.

Test Steps

1. Power ON the UUT.
2. Attach a SuperSpeed B-device from the TPL (supporting remote wake).
3. Prove the functionality of the UUT with the B-device.
4. Put the UUT into Standby (follow UUT vendor guidelines to force the Targeted Host into Standby mode).
5. Perform a USB remote wakeup event from the B-device.
6. Prove the functionality of the UUT with the B-device.

10.3.16 TD 5.46 SS-OTG A-Device to SS-OTG B-Device Test

Purpose	Prove the functionality of two attached SS-OTG devices
Applies to	SS-OTG A-devices that have SS-OTG devices on their TPL
Description	Prove the functionality when connecting two OTG devices
Pass Criteria	The functionality between the two products is proved and is the same regardless of the cable direction.

Test Steps

1. Power ON the UUT.
2. Attach the Micro-A plug to the SS-OTG A-device (the UUT).
3. Attach the Micro-B plug to the supported SS-OTG B-device.
4. Prove the functionality of the SS-OTG A-device (UUT) with the SS-OTG B-device.
5. Reverse the cable between the devices.
6. Prove that the functionality is the same functionality as seen above.

11 USB-IF Required Tests

Devices which support features of ***[USB3.0]*** shall undergo additional testing beyond the tests described in this document.

[OTG&EH2.0ComplianceChecklist] and associated testing shall be completed for all USB 2.0 functions of the device. USB 3.0 functions of the device shall complete testing as described in Table 11-1.

The following symbols and abbreviations are used in the table below:

✓ Always required
n/a Not applicable
UFP Upstream-facing port
DFP Downstream-facing port
LVS Link Verification System

Table 11-1: USB 3.0 Test Requirements

		USBCV Chap 9 Tests	USBCV Class Tests	xHCI Host Tests	USB 3.0 Hub Tests	USB 3.0 Elec	USB 3.0 Interop	USB 3.0 Backward Compat-ibility	Link Layer Tests	Current Test Meas	Batt Chg
xHCI Host	**Silicon and IP**	All SS Silicon	All tests, all SS silicon	Full Test Suite	n/a	√	√	√	√	n/a	√
	End Product	All SS Silicon	All tests, all SS silicon	Interface Tests	n/a	√	√	√	√	n/a	√
USB 3.0 Devices: Silicon, IP, End Product	**Device**	√	MSC UASP HID UVC PHDC OTG	n/a	n/a	√	√	n/a	√	√	√
USB 3.0 Hubs	**Silicon and IP**	√	All classes DS	n/a	SS Hub, Analyzer and Loopback Tests	UFP and DFPs	√	√	Hub LVS + Link UFP and DFPs	√	√
	End Product	√	All classes DS	n/a	SS Hub Tests	UFP and DFPs	√	n/a	Hub LVS + Link UFP and DFPs	√	√

11.1 Description of Required Tests

The following sections briefly describe each of the required test areas.

- For more details, please visit www.usb.org/developers.
- Test procedures can be found at: http://www.usb.org/developers/docs or http://www.usb.org/developers/ssusb/testing.
- Tools can be found at http://www.usb.org/developers/ssusb/ssusbtools.

11.1.1 USBCV Chapter 9

USB 3.0 Command Verifier (USB30CV) is the official tool for USB 3.0 (SuperSpeed USB) Hub and Device Framework testing. Chapter 9 covers Device Framework.

11.1.2 USBCV Class Tests

Certain device class test suites are included with USB30CV.

11.1.3 xHCI Host Tests

Interoperability testing for xHCI hosts involving “gold- tree” peripherals and hubs.

11.1.4 USB 3.0 Hub Tests

These tests are enabled with specific vendor test equipment, referred to as the Superspeed Link Layer Verification System (SS-LVS). Tests are conducted on the UPF and DFPs.

11.1.5 USB 3.0 Electrical

These tests address electrical requirements for physical layer design.

11.1.6 USB 3.0 Interoperability for Peripheral, Hubs, Hosts

xHCI interoperability testing covers peripherals, hubs, and hosts, and includes several areas, such as device framework, demonstrated operation, and the device’s ability to operate and coexist with other USB devices. It also provides insight into usability issues of the device and the associated software.

11.1.7 USB 3.0 Backward Compatibility for Hosts

xHCI backwards compatibility testing covers hosts and hubs, and includes several areas, such as device framework and interoperation with numerous USB devices.

11.1.8 Link Layer Tests

These tests check link layer (Chapter 7) operation on hosts, devices, and hubs (both UFP and DFPs). Tests are operated by the SS-LVS. Some Chapter 6 tests (physical layer) are also included as part of this test suite.

11.1.9 Current Test Measurements

These tests verify that devices or hubs draw no more than allowed current in various states.

11.1.10 Battery Charging Tests

This compliance plan enables test and certification of USB Portable Devices and Host Charging ports.

11.2 Test Procedures and Tools

Test procedures can be found at: http://www.usb.org/developers/docs/

Tools can be found at http://www.usb.org/developers/ssusb/ssusbtools

11.3 Technical Questions

Technical questions relating to compliance should be sent to techadmin@usb.org.