

Deterministic PD Compliance MOI

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Revisions History

Date	Rev	Changes
Dec. 12, 2014	0.50	Initial release.
Mar. 30, 2015	0.60	Added initial VDM DP, Consistency tests.
June 1, 2015	0.70	Various fixes.
July 27, 2015	0.80	Added initial Sink and Source tests. Various fixes.
Oct. 30, 2015	0.85	Added initial Provider/Consumer and Consumer/Provider tests. Various fixes.
Feb. 9, 2016	0.90	Various improvements and fixes. Added assertions.
Apr. 18, 2016	0.91	Updated PHY.E23 with new interference signal. Updated SRC.E13/14 to use GetSinkCap. Updated VNDI.E7/8 to accept Vconn_Swap.
May 20, 2016	1.00	Stable release.
Jan. 23, 2017	1.10	Updated SNK.E4, tests UUT with PD3 and PD4 Source_Capabilities Deprecated SNK.E11, PC.E1 and PC.E7 Updated SNK.E10, checks for Hard Reset, not Soft Reset Updated SRC.E13 on object position used in the Request message
Oct. 11, 2017	1.11	Added SNK.E12
Mar. 27, 2018	1.12	Updated SRC.E2 and E3 to work with both PD2 and PD3 UUT Updated SNK.E9 and SNK.E10 to reflect the intention of the tests Updated VDMD.E4 and accepts NAK as a valid response
Apr. 25, 2018	1.13	Deleted PHY.E22 and E23 Updated VDMU.E7 and E11, make them applicable to UFP also Added 2.75V and 5.75V Vconn voltage requirement for cable tests Updated VNDI.E6, minus number of APDOs from Num_Snk_PDOS
Sep. 13, 2018	1.14	Updated LL.E3 and E4 to reflect the current implementation Updated VNDI.E4, UFP shall not response SOP' and SOP'' Updated SNK.E10, only accepts Hard Reset as a valid response, Soft Reset will be a failure, not a warning

Terms and Abbreviations

The terms and abbreviations specific to compliance testing are listed in the table below. All other used terms and abbreviations are from the relevant specifications.

Term	Description
Tester	The Tester is a piece of test equipment capable of running all tests described in this specification against a Unit Under Test (UUT).
Unit Under Test (UUT)	The PD device that is being tested by the Tester.

Test Procedures

PROC.PD.E1. [Bring-up procedure](#)

For UFP UUT:

- a) The test starts in a disconnected state.
- b) The tester applies R_p (3A) and waits for the UUT attachment.
- c) If R_a is detected, the tester applies V_{conn} .
- d) The tester applies V_{bus} and waits 50 ms.
- e) The tester transmits Source Capabilities until reception of GoodCrc for $t_{NoResponse}$ max (5.5 s). The Source Capabilities includes Fixed 5V 3A PDO.
- f) The tester waits for the Request from the UUT for $t_{SenderResponse}$ max (30 ms).
- g) The tester sends Accept, and when V_{bus} is stable at the target voltage, sends PS_RDY.

For DFP UUT:

- a) The test starts in a disconnected state.
- b) The tester applies R_d and waits for V_{bus} for $t_{NoResponse}$ max (5.5 s).
- c) The tester waits Source Capabilities for $t_{NoResponse}$ max (5.5 s).
- d) The tester replies GoodCrc on reception of the Source Capabilities.
- e) The tester requests 5V 0.5A.
- f) The tester waits PS_RDY for $t_{PSSourceOn}$ max (480 ms).

For Cable UUT:

- a) The test starts in a disconnected state.
- b) The tester applies R_p (3A) and waits for the UUT attachment.
- c) The tester applies R_p (3A) and R_d on CC.
- d) The tester applies V_{conn} .

Note:

1. Cable tests need to be ran twice, one time with V_{Conn} voltage set to 2.75V, and the other time with V_{Conn} voltage set to 5.75V
2. The Tester uses SOP' message in cable tests

PROC.PD.E2. [Bring-up procedure for DisplayPort](#)

For UFP UUT:

- a) The Tester establishes an explicit contract with the UUT.
 1. The test fails if the contract is not established.
- b) The Tester sends Discover Identity.

- c) The Tester verifies:
 - 1. The UUT responds with a GoodCrc within tTransmit (195us).
 - 2. The UUT responds with Discover Identity ACK within tVDMReceiverResponse (15 ms).
- d) The Tester sends Discover SVIDs.
- e) The Tester verifies:
 - 1. The UUT responds with a GoodCrc within tTransmit (195us).
 - 2. The UUT responds with Discover SVIDs ACK within tVDMReceiverResponse (15 ms).
- f) If the UUT doesn't return DP SID, the test is not applicable.
- g) The Tester sends Discover Modes using the DP SID (0xFF01).
- h) The Tester verifies:
 - 1. The UUT responds with a GoodCrc within tTransmit (195us).
 - 2. The UUT responds with Discover Modes ACK within tVDMReceiverResponse (15 ms).
 - 3. The UUT responds with SVIDs = DP SID (0xFF01) in the VDM Header.
- i) The Tester sends an Enter Mode command using DP SID (0xFF01).
- j) The Tester verifies:
 - 1. The UUT responds with NAK or ACK
 - 2. If the UUT responds with BUSY, the test fails.
 - 3. If the UUT responds with NAK, the UUT shall expose a USB Billboard device.
 - 4. If the UUT responds with ACK, this is received within tVDMEnterMode (25 ms).
 - 5. The UUT responds with SVIDs = DisplayPort (0xFF01) in the VDM Header.

For DFP UUT:

- a) The Tester enables Rd for emulating a UFP_U, as well as Ra for emulating a Vconn-Powered Accessory.
- b) The Tester awaits Discover Identity from the UUT and responds appropriately with GoodCrc and Discover Identity ACK. The test is not applicable if Discover Identity is not received timely.
- c) The Tester awaits Discover SVIDs from the UUT and responds appropriately with GoodCrc and Discover SVIDs ACK using DP SVID in SVID0 and 0x0000 in SVID1. The test is not applicable if Discover SVIDs is not received timely.
- d) The Tester awaits DisplayPort Discover Modes from the UUT and responds appropriately with GoodCrc and Discover Modes ACK (Port Data Role = UFP, Port Capability = Both UFP_D and DFP_D Capable, DP v1.3 = Yes). The test is not applicable if DisplayPort Discover Modes is not received timely.
- e) The Tester awaits DisplayPort Enter Mode from the UUT and responds appropriately with GoodCrc and Enter Mode ACK. The test fails if DisplayPort Enter Mode is not received timely.

Assertions

Common assertions to all tests

5.3#1, 5.3#2, 5.4#1, 5.5#1, 5.5#2, 5.6#1, 5.6#2, 5.6#3, 5.6.1.1#2, 5.6.1.1#3, 5.6.1.1#4, 5.6.1.3#1, 6.2.1#1, 6.2.1.1#1, 6.2.1.4#7, 6.2.1.6#2, 6.3#1, 6.3#2, 6.4#1, 6.4#2, 6.4#3, 6.4#4, 6.4.1.1.1#2, 6.4.1.1.1#3, 6.4.4#1, 6.4.4#2, 6.4.4#5, 6.4.4#11, 6.4.4.2.4#1, 6.4.4.2.4#2, 6.4.4.2.5#2, 6.6.1#1, 6.6.1#3, 6.6.1#4, 6.6.1#5, 6.6.1.1#3, 6.6.1.2#1, 6.6.1.2#2, 6.6.1.2#3

Assertions cross-reference

Assertion	Test Case
5.4#2	TD.PD.PHY.E9.
5.6.1.2.1#1	TD.PD.PHY.E9. TD.PD.VNDI.E4.
5.6.1.2.1#2	TD.PD.PHY.E10. TD.PD.VNDI.E4.
5.6.1.2.1#3	TD.PD.PHY.E9. TD.PD.VNDI.E4.
5.6.1.2.1#4	TD.PD.PHY.E9. TD.PD.VNDI.E4.
5.6.1.2.1#5	TD.PD.PHY.E9. TD.PD.VNDI.E4.
5.6.1.2.2#1	TD.PD.PHY.E11. TD.PD.VNDI.E4.
5.6.1.2.2#3	TD.PD.PHY.E12. TD.PD.VNDI.E4.
5.6.1.2.2#4	TD.PD.PHY.E12. TD.PD.VNDI.E4.
5.6.1.2.2#5	TD.PD.PHY.E11.
5.6.1.2.2#6	TD.PD.PHY.E11.
5.6.1.2.3#1	TD.PD.VNDI.E4.
5.6.1.2.3#2	TD.PD.VNDI.E4.
5.6.1.2.3#3	TD.PD.PHY.E13. TD.PD.VNDI.E4.
5.6.1.2.3#4	TD.PD.VNDI.E4.
5.6.1.2.3#5	TD.PD.PHY.E14. TD.PD.VNDI.E4.
5.6.1.2.3#6	TD.PD.PHY.E14. TD.PD.VNDI.E4.
5.6.1.2.3#7	TD.PD.PHY.E13.
5.6.1.5#1	TD.PD.PHY.E20.
5.6.1.5#2	TD.PD.PHY.E20.
5.6.1.5#3	TD.PD.PHY.E20.
5.6.1.5#4	TD.PD.PHY.E20.
5.6.1.5#5	TD.PD.PHY.E20.
5.6.3#1	TD.PD.PHY.E1.
5.6.4#1	TD.PD.PHY.E16.
5.6.4#2	TD.PD.PHY.E16.
5.6.4#3	TD.PD.PHY.E17.
5.6.4#4	TD.PD.PHY.E16.
5.6.4#5	TD.PD.PHY.E16.
5.6.4#6	TD.PD.PHY.E16. TD.PD.LL.E4.
5.6.5#1	TD.PD.PHY.E18.
5.6.5#2	TD.PD.PHY.E18. TD.PD.PHY.E19.

Assertion	Test Case
5.7#1	TD.PD.PHY.E5.
5.7#2	TD.PD.PHY.E5.
5.7#3	TD.PD.PHY.E5.
5.8.1.1#1	TD.PD.PHY.E1. TD.PD.PHY.E6. TD.PD.PHY.E7. TD.PD.PHY.E8.
5.8.1.2.1#1	TD.PD.PHY.E4.
5.8.1.2.1#2	TD.PD.PHY.E4.
5.8.3.1#1	TD.PD.PHY.E22.
5.8.3.1#3	TD.PD.PHY.E21.
5.8.3.2.1#1	TD.PD.PHY.E22.
5.8.3.2.1#2	TD.PD.PHY.E22.
5.8.3.2.1#3	TD.PD.PHY.E22.
5.8.3.2.2#3	TD.PD.PHY.E7. TD.PD.PHY.E8.
5.8.3.2.2#6	TD.PD.PHY.E23.
5.8.3.2.2#7	TD.PD.PHY.E23.
5.9.1#1	TD.PD.PHY.E3.
5.9.1#2	TD.PD.PHY.E3.
5.9.1#3	TD.PD.PHY.E3.
5.9.1#4	TD.PD.PHY.E3.
5.9.1#5	TD.PD.PHY.E3.
5.9.1#6	TD.PD.PHY.E3.
5.9.1#7	TD.PD.PHY.E3.
5.9.1#8	TD.PD.PHY.E3.
5.9.1.2#1	TD.PD.PHY.E2.
5.9.4#1	TD.PD.PHY.E4.
5.9.6#1	TD.PD.PHY.E22.
5.9.7#1	TD.PD.PHY.E1.
6.2.1.1#2	TD.PD.SRC.E8. TD.PD.SRC.E10.
6.2.1.2#1	TD.PD.SRC.E2. TD.PD.SRC.E8. TD.PD.SRC.E10.
6.2.1.3#1	TD.PD.LL.E5.
6.2.1.3#2	TD.PD.SRC.E14.
6.2.1.4#1	TD.PD.SRC.E2. TD.PD.SRC.E8. TD.PD.SRC.E10.
6.2.1.4#2	TD.PD.SRC.E2.
6.2.1.4#3	TD.PD.SNK.E4.
6.2.1.5#1	TD.PD.SRC.E2. TD.PD.SRC.E8. TD.PD.SRC.E10.
6.2.1.6#1	TD.PD.SRC.E2. TD.PD.SRC.E8. TD.PD.SRC.E10.
6.2.1.8#1	TD.PD.SRC.E2. TD.PD.SRC.E8. TD.PD.SRC.E10.
6.3.1#1	TD.PD.LL.E1.
6.3.1#2	TD.PD.LL.E1.
6.3.1#3	TD.PD.LL.E1.
6.3.3#1	TD.PD.SRC.E7. TD.PD.SRC.E8. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
6.3.3#2	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.3.3#5	TD.PD.LL.E5.

Assertion	Test Case
6.3.3#6	TD.PD.SRC.E7.
6.3.4#1	TD.PD.SRC.E12. TD.PD.SRC.E13.
6.3.4#2	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.3.4#7	TD.PD.SRC.E12. TD.PD.SRC.E13.
6.3.5.2#1	TD.PD.LL.E6.
6.3.6#1	TD.PD.SRC.E9. TD.PD.SRC.E10.
6.3.7#1	TD.PD.SRC.E15.
6.3.8#1	TD.PD.VNDI.E6.
6.3.10#1	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.3.10#2	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.3.13#1	TD.PD.LL.E5. TD.PD.SRC.E14. TD.PD.SNK.E9. TD.PD.SNK.E10.
6.3.13#2	TD.PD.LL.E4.
6.3.13#3	TD.PD.LL.E4.
6.3.13#4	TD.PD.LL.E3.
6.3.13#5	TD.PD.SRC.E14. TD.PD.SNK.E9. TD.PD.SNK.E10.
6.4.1#1	TD.PD.SRC.E2.
6.4.1#3	TD.PD.SRC.E2.
6.4.1.1.1#1	TD.PD.VNDI.E5.
6.4.1.2#1	TD.PD.SRC.E2. TD.PD.VNDI.E5.
6.4.1.2#2	TD.PD.SRC.E2. TD.PD.VNDI.E5.
6.4.1.2#3	TD.PD.SRC.E2. TD.PD.VNDI.E5.
6.4.1.2#4	TD.PD.SRC.E2. TD.PD.VNDI.E5.
6.4.1.2#5	TD.PD.VNDI.E5.
6.4.1.2#6	TD.PD.VNDI.E5.
6.4.1.2#7	TD.PD.VNDI.E5.
6.4.1.2#8	TD.PD.VNDI.E5.
6.4.1.2.3#1	TD.PD.SRC.E2. TD.PD.VNDI.E5.
6.4.1.2.3#2	TD.PD.VNDI.E5.
6.4.1.2.3#3	TD.PD.VNDI.E5.
6.4.1.2.3#4	TD.PD.SRC.E2.
6.4.1.2.3.1#1	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.4.1.2.3.1#2	TD.PD.VNDI.E7. TD.PD.VNDI.E8.
6.4.1.2.3.2#1	TD.PD.VNDI.E5.
6.4.1.2.3.2#2	TD.PD.VNDI.E5.
6.4.1.2.3.3#1	TD.PD.VNDI.E5.
6.4.1.2.3.4#1	TD.PD.VNDI.E5.
6.4.1.2.3.5#1	TD.PD.VNDI.E5.
6.4.1.2.3.5#2	TD.PD.VNDI.E5.
6.4.1.3#1	TD.PD.VNDI.E6.
6.4.1.3#2	TD.PD.VNDI.E6.
6.4.1.3#3	TD.PD.VNDI.E6.
6.4.1.3#4	TD.PD.VNDI.E6.

Assertion	Test Case
6.4.1.3#5	TD.PD.VNDI.E6.
6.4.1.3#6	TD.PD.VNDI.E6.
6.4.1.3#7	TD.PD.VNDI.E6.
6.4.1.3.1#2	TD.PD.VNDI.E6.
6.4.1.3.1#4	TD.PD.VNDI.E6.
6.4.1.3.1.1#1	TD.PD.VNDI.E6.
6.4.1.3.1.2#1	TD.PD.VNDI.E6.
6.4.1.3.1.3#1	TD.PD.VNDI.E6.
6.4.1.3.1.4#1	TD.PD.VNDI.E6.
6.4.1.3.1.5#1	TD.PD.VNDI.E6.
6.4.1.3.1.5#2	TD.PD.VNDI.E6.
6.4.1.3.2#1	TD.PD.VNDI.E6.
6.4.1.3.2#2	TD.PD.VNDI.E6.
6.4.1.3.2#3	TD.PD.VNDI.E6.
6.4.1.3.3#1	TD.PD.VNDI.E6.
6.4.1.3.3#2	TD.PD.VNDI.E6.
6.4.1.3.3#3	TD.PD.VNDI.E6.
6.4.2#1	TD.PD.SNK.E3.
6.4.2#2	TD.PD.SNK.E4.
6.4.2#3	TD.PD.SNK.E3. TD.PD.SNK.E4. TD.PD.SNK.E11. TD.PD.PC.E7.
6.4.2#4	TD.PD.SNK.E4.
6.4.2#5	TD.PD.SNK.E4.
6.4.2.1#1	TD.PD.SNK.E4.
6.4.2.2#1	TD.PD.SNK.E4.
6.4.2.3#1	TD.PD.SNK.E4.
6.4.2.3#2	TD.PD.SNK.E4.
6.4.2.3#3	TD.PD.SNK.E4.
6.4.2.3#4	TD.PD.SNK.E4.
6.4.2.3#5	TD.PD.SNK.E4.
6.4.2.6#1	TD.PD.SNK.E4.
6.4.2.6#3	TD.PD.SNK.E4.
6.4.2.7#1	TD.PD.SNK.E4.
6.4.2.7#2	TD.PD.SNK.E4.
6.4.2.7#3	TD.PD.SNK.E4.
6.4.2.7#5	TD.PD.SNK.E4.
6.4.2.8#1	TD.PD.SNK.E4.
6.4.2.8#2	TD.PD.SNK.E4.
6.4.2.8#3	TD.PD.SNK.E4.
6.4.3#2	TD.PD.PHY.E2.
6.4.3#3	TD.PD.PHY.E3.
6.4.3#4	TD.PD.PHY.E2.
6.4.3#7	TD.PD.PHY.E4.

Assertion	Test Case
6.4.3#9	TD.PD.PHY.E22.
6.4.3#10	TD.PD.PHY.E1.
6.4.3.1#1	TD.PD.PHY.E2.
6.4.3.1#2	TD.PD.PHY.E2.
6.4.3.1#3	TD.PD.PHY.E2.
6.4.3.1#4	TD.PD.PHY.E2.
6.4.3.1#5	TD.PD.PHY.E2.
6.4.3.2#1	TD.PD.PHY.E3.
6.4.3.2#2	TD.PD.PHY.E3.
6.4.3.2#3	TD.PD.PHY.E3.
6.4.3.2#4	TD.PD.PHY.E3.
6.4.3.2#5	TD.PD.PHY.E3.
6.4.3.2#6	TD.PD.PHY.E3.
6.4.3.2#7	TD.PD.PHY.E3.
6.4.3.2#8	TD.PD.PHY.E3.
6.4.3.2#9	TD.PD.PHY.E3.
6.4.3.3#1	TD.PD.PHY.E2.
6.4.3.6#1	TD.PD.PHY.E4.
6.4.3.8#1	TD.PD.PHY.E22.
6.4.3.9#1	TD.PD.PHY.E1.
6.4.3.9#2	TD.PD.PHY.E1.
6.4.4#7	TD.PD.VDMU.E1.
6.4.4#9	TD.PD.VDMU.E17.
6.4.4#10	TD.PD.VDMU.E16.
6.4.4.2#5	TD.PD.VDMU.E10. TD.PD.VDMU.E11. TD.PD.VDMU.E12. TD.PD.VDMU.E13. TD.PD.VDMU.E14.
6.4.4.2#6	TD.PD.VDMU.E10. TD.PD.VDMU.E11. TD.PD.VDMU.E12. TD.PD.VDMU.E13. TD.PD.VDMU.E14.
6.4.4.2#8	TD.PD.VDMU.E1.
6.4.4.2#9	TD.PD.VDMU.E1.
6.4.4.2#10	TD.PD.VDMU.E1.
6.4.4.2#11	TD.PD.VDMU.E1.
6.4.4.2#12	TD.PD.VDMU.E1.
6.4.4.2#13	TD.PD.VDMU.E1.
6.4.4.2.1#1	TD.PD.VDMU.E1.
6.4.4.2.2#1	TD.PD.VDMU.E1.
6.4.4.2.3#1	TD.PD.VDMU.E1.
6.4.4.2.3#2	TD.PD.VDMU.E19.
6.4.4.2.4#5	TD.PD.VDMU.E1.
6.4.4.2.5#1	TD.PD.VDMU.E1.
6.4.4.2.5#3	TD.PD.VDMU.E1.

Assertion	Test Case
6.4.4.2.5#4	TD.PD.VDMU.E10. TD.PD.VDMU.E11. TD.PD.VDMU.E12. TD.PD.VDMU.E13. TD.PD.VDMU.E14.
6.4.4.2.6#1	TD.PD.VDMU.E1.
6.4.4.3.1#3	TD.PD.VDMU.E1.
6.4.4.3.1#4	TD.PD.VDMU.E1.
6.4.4.3.1#5	TD.PD.VDMU.E1.
6.4.4.3.1#6	TD.PD.VDMU.E1.
6.4.4.3.1#7	TD.PD.VDMU.E1.
6.4.4.3.1#8	TD.PD.VDMU.E1.
6.4.4.3.1.1#1	TD.PD.VDMU.E1.
6.4.4.3.1.1#2	TD.PD.VNDI.E1.
6.4.4.3.1.1#3	TD.PD.VNDI.E1.
6.4.4.3.1.1#4	TD.PD.VDMU.E1.
6.4.4.3.1.1#5	TD.PD.VNDI.E1.
6.4.4.3.1.4#1	TD.PD.VNDI.E1.
6.4.4.3.1.4#2	TD.PD.VNDI.E1.
6.4.4.3.1.4#3	TD.PD.VNDI.E1.
6.4.4.3.1.4#4	TD.PD.VNDI.E1.
6.4.4.3.1.4#5	TD.PD.VNDI.E1.
6.4.4.3.1.4#6	TD.PD.VNDI.E1.
6.4.4.3.1.4#7	TD.PD.VNDI.E1.
6.4.4.3.1.6#1	TD.PD.VNDI.E1.
6.4.4.3.1.7#1	TD.PD.VNDI.E1.
6.4.4.3.1.7#2	TD.PD.VDMU.E1.
6.4.4.3.1.8#1	TD.PD.VNDI.E1.
6.4.4.3.1.9#1	TD.PD.VNDI.E1.
6.4.4.3.1.9#2	TD.PD.VNDI.E1.
6.4.4.3.1.9#3	TD.PD.VNDI.E1.
6.4.4.3.1.10#1	TD.PD.VNDI.E1.
6.4.4.3.1.10#2	TD.PD.VNDI.E1.
6.4.4.3.1.10#3	TD.PD.VNDI.E1.
6.4.4.3.2#1	TD.PD.VDMU.E2.
6.4.4.3.2#2	TD.PD.VNDI.E2.
6.4.4.3.2#3	TD.PD.VNDI.E2.
6.4.4.3.2#4	TD.PD.VDMU.E2.
6.4.4.3.2#5	TD.PD.VDMU.E2.
6.4.4.3.2#6	TD.PD.VDMU.E2.
6.4.4.3.3#1	TD.PD.VDMU.E3.
6.4.4.3.3#2	TD.PD.VDMU.E3. TD.PD.VNDI.E3.
6.4.4.3.4#1	TD.PD.VDMU.E4.
6.4.4.3.4#2	TD.PD.VDMU.E4.
6.4.4.3.4#3	TD.PD.VDMU.E4.

Assertion	Test Case
6.4.4.3.4#4	TD.PD.VDMU.E4.
6.4.4.3.4#8	TD.PD.VDMU.E4. TD.PD.VDMU.E13.
6.4.4.3.4#9	TD.PD.VDMU.E4.
6.4.4.3.4#16	TD.PD.VDMU.E18.
6.4.4.3.4#20	TD.PD.VDMU.E18.
6.4.4.3.5#1	TD.PD.VDMU.E5.
6.4.4.3.5#3	TD.PD.VDMU.E5.
6.4.4.3.5#6	TD.PD.VDMU.E14.
6.4.4.4#1	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.4.4.4#2	TD.PD.VDMD.E1.
6.4.4.4#3	TD.PD.VNDI.E1.
6.4.4.5#1	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#2	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#3	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#4	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#5	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#6	TD.PD.VDMU.E16. TD.PD.VDMD.E5.
6.4.4.5#7	TD.PD.VDMU.E16. TD.PD.VDMU.E17. TD.PD.VDMD.E5. TD.PD.VDMD.E6.
6.5.1#1	TD.PD.LL.E2.
6.5.1#2	TD.PD.LL.E2.
6.5.1#3	TD.PD.LL.E2.
6.5.1#4	TD.PD.LL.E1. TD.PD.LL.E2.
6.5.1#5	TD.PD.LL.E1. TD.PD.LL.E2.
6.5.1#6	TD.PD.DPD.E2.
6.5.1#7	TD.PD.LL.E1.
6.5.2#1	TD.PD.SRC.E4. TD.PD.SRC.E5. TD.PD.SNK.E6.
6.5.2#2	TD.PD.SRC.E5. TD.PD.SNK.E6.
6.5.2#3	TD.PD.SRC.E4. TD.PD.SRC.E5. TD.PD.SNK.E6.
6.5.2#4	TD.PD.SRC.E4.
6.5.2#5	TD.PD.SRC.E7. TD.PD.SNK.E3.
6.5.2#6	TD.PD.SRC.E7.
6.5.3.2#5	TD.PD.LL.E6.
6.5.4.1#1	TD.PD.SRC.E3.
6.5.4.1#2	TD.PD.SRC.E3.
6.5.4.3#1	TD.PD.SRC.E1.
6.5.6.1#1	TD.PD.SNK.E8.
6.5.6.2#1a	TD.PD.CP.E1. TD.PD.CP.E2.
6.5.6.2#1b	TD.PD.CP.E1. TD.PD.CP.E2.
6.5.6.2#3	TD.PD.CP.E2.
6.5.6.3#1	TD.PD.PC.E3. TD.PD.PC.E4.
6.5.8.1#1	TD.PD.PHY.E4.
6.5.9.2#1	TD.PD.CP.E4.

Assertion	Test Case
6.5.9.2#2	TD.PD.CP.E4.
6.5.9.2#3	TD.PD.PC.E5.
6.5.10.2#1	TD.PD.SRC.E6.
6.5.10.3#1	TD.PD.VDMU.E18.
6.5.11.1#1	TD.PD.VDMD.E1.
6.5.11.1#6	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.5.11.1#7	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.6.1.1#1	TD.PD.LL.E5.
6.6.1.1#2	TD.PD.LL.E2.
6.6.5#1	TD.PD.PHY.E2.
6.6.5#2	TD.PD.PHY.E2.
6.6.5#3	TD.PD.PHY.E2.
6.6.7#1	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.6.7#2	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.6.7#3	TD.PD.VDMU.E6. TD.PD.VDMU.E7. TD.PD.VDMU.E8. TD.PD.VDMU.E9.
6.7.1#1	TD.PD.LL.E3.
6.7.1#2	TD.PD.LL.E2. TD.PD.SRC.E14. TD.PD.SNK.E9. TD.PD.SNK.E10.
6.7.1#4	TD.PD.LL.E2. TD.PD.LL.E3.
6.7.1#5	TD.PD.LL.E3. TD.PD.SNK.E9. TD.PD.SNK.E10.
6.7.1#6	TD.PD.LL.E3. TD.PD.SRC.E14.
6.7.1#7	TD.PD.LL.E3. TD.PD.SRC.E14.
6.7.2.1#1	TD.PD.LL.E4.
6.7.2.1#2	TD.PD.LL.E4.
6.7.2.3#1	TD.PD.LL.E4.
6.7.3#1	TD.PD.PHY.E18.
6.7.3#2	TD.PD.PHY.E18.
6.7.3#3	TD.PD.PHY.E18.
6.7.3#9	TD.PD.PHY.E18.
6.8.2.1.1#1	TD.PD.LL.E5.
6.8.2.1.3#1	TD.PD.LL.E3.
6.8.2.1.3#2	TD.PD.LL.E3.
6.8.2.1.3#3	TD.PD.LL.E3.
6.8.2.1.4#1	TD.PD.LL.E3.
6.8.2.1.4#2	TD.PD.LL.E3.
6.8.2.1.5#1	TD.PD.LL.E1. TD.PD.LL.E2.
6.8.2.1.5#2	TD.PD.LL.E1.
6.8.2.1.5#3	TD.PD.LL.E2.
6.8.2.1.6#1	TD.PD.LL.E2.
6.8.2.1.6#2	TD.PD.LL.E1.
6.8.2.1.6#3	TD.PD.LL.E2.
6.8.2.1.8#1	TD.PD.LL.E2.
6.8.2.1.8#2	TD.PD.LL.E2.

Assertion	Test Case
6.8.2.1.8#3	TD.PD.LL.E3.
6.8.2.1.9#1	TD.PD.LL.E3.
6.8.2.1.9#2	TD.PD.LL.E3.
6.8.2.2.1#3	TD.PD.LL.E5.
6.8.2.2.2#3	TD.PD.LL.E5.
6.8.2.2.5#1	TD.PD.LL.E6.
6.9#1	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#2	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#3	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#4	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#5	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#6	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#7	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#0	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#13	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#14	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#15	TD.PD.PHY.E1.
6.9#16	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
6.9#17	TD.PD.VDMU.E15. TD.PD.VDMD.E4.
7.3.6#1	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.6#2	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.6#3	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.6#6	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.8#1	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.8#2	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.8#3	TD.PD.SNK.E11. TD.PD.PC.E7.
7.3.8#5	TD.PD.SNK.E11. TD.PD.PC.E7.
8.2.6.2#2	TD.PD.PC.E6.
8.3.3.2.1#4	TD.PD.CP.E4.
8.3.3.2.2#1	TD.PD.SRC.E3.
8.3.3.2.2#2	TD.PD.SRC.E3.
8.3.3.2.3#1	TD.PD.SRC.E3.
8.3.3.2.3#2	TD.PD.SRC.E3.
8.3.3.2.3#3	TD.PD.SRC.E4.
8.3.3.2.3#7	TD.PD.SRC.E3.
8.3.3.2.3#8	TD.PD.SRC.E5.
8.3.3.2.4#1	TD.PD.SRC.E7. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.4#2	TD.PD.SRC.E7. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.4#3	TD.PD.SRC.E7. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.5#1	TD.PD.SRC.E7. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.5#2	TD.PD.SRC.E7. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.5#3	TD.PD.SRC.E9. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.

Assertion	Test Case
8.3.3.2.5#4	TD.PD.SRC.E9. TD.PD.SRC.E11. TD.PD.SRC.E16. TD.PD.CP.E5.
8.3.3.2.6#7	TD.PD.SRC.E15.
8.3.3.2.12#1	TD.PD.SRC.E15.
8.3.3.2.12#2	TD.PD.SRC.E15.
8.3.3.3#1	TD.PD.LL.E6.
8.3.3.3.1#2	TD.PD.SNK.E4.
8.3.3.3.3#1	TD.PD.SNK.E2.
8.3.3.3.3#2	TD.PD.SNK.E3.
8.3.3.3.4#1	TD.PD.SNK.E3.
8.3.3.3.4#2	TD.PD.SNK.E3.
8.3.3.3.4#3	TD.PD.SNK.E3. TD.PD.SNK.E6.
8.3.3.3.5#1	TD.PD.SNK.E3.
8.3.3.3.5#2	TD.PD.SNK.E3.
8.3.3.3.5#3	TD.PD.SNK.E5. TD.PD.SNK.E6.
8.3.3.3.5#4	TD.PD.SNK.E7. TD.PD.SNK.E8.
8.3.3.3.5#7	TD.PD.SNK.E6.
8.3.3.3.6#1	TD.PD.SNK.E7. TD.PD.SNK.E8.
8.3.3.3.7#9	TD.PD.LL.E6.
8.3.3.4.1.1#1	TD.PD.LL.E3.
8.3.3.4.1.1#2	TD.PD.LL.E3.
8.3.3.4.1.1#3	TD.PD.LL.E3.
8.3.3.4.1.1#4	TD.PD.LL.E3.
8.3.3.4.1.1#5	TD.PD.LL.E4.
8.3.3.4.1.1#6	TD.PD.LL.E4.
8.3.3.4.1.2#1	TD.PD.LL.E5.
8.3.3.4.1.2#2	TD.PD.LL.E5.
8.3.3.4.1.2#3	TD.PD.LL.E5.
8.3.3.4.1.2#4	TD.PD.LL.E5.
8.3.3.4.2.1#1	TD.PD.LL.E3.
8.3.3.4.2.1#2	TD.PD.LL.E3.
8.3.3.4.2.1#3	TD.PD.LL.E3.
8.3.3.4.2.1#4	TD.PD.LL.E3.
8.3.3.4.2.1#5	TD.PD.LL.E4.
8.3.3.4.2.1#6	TD.PD.LL.E4.
8.3.3.4.2.1#7	TD.PD.LL.E4.
8.3.3.4.2.2#1	TD.PD.LL.E5.
8.3.3.4.2.2#2	TD.PD.LL.E5.
8.3.3.4.2.2#3	TD.PD.LL.E5.
8.3.3.4.2.2#4	TD.PD.LL.E5.
8.3.3.6.3.1.3#1	TD.PD.PC.E1.
8.3.3.6.3.1.3#2	TD.PD.PC.E1.
8.3.3.6.3.1.4#1	TD.PD.PC.E1.

Assertion	Test Case
8.3.3.6.3.1.5#1	TD.PD.PC.E2. TD.PD.CP.E3.
8.3.3.6.3.1.5#2	TD.PD.PC.E2. TD.PD.CP.E3.
8.3.3.6.3.1.6#1	TD.PD.PC.E2.
8.3.3.6.3.1.6#2	TD.PD.PC.E3. TD.PD.PC.E4.
8.3.3.6.3.1.6#5	TD.PD.PC.E4.
8.3.3.6.3.1.7#7	TD.PD.PC.E1.
8.3.3.6.3.2.3#1	TD.PD.CP.E2.
8.3.3.6.3.2.3#2	TD.PD.CP.E2.
8.3.3.6.3.2.4#1	TD.PD.CP.E2.
8.3.3.6.3.2.4#2	TD.PD.CP.E2.
8.3.3.6.3.2.6#1	TD.PD.CP.E3.
8.3.3.6.3.2.6#3	TD.PD.CP.E3.
8.3.3.6.3.2.6#4	TD.PD.CP.E3.
8.3.3.6.3.2.7#1	TD.PD.CP.E2.
8.3.3.6.3.2.7#6	TD.PD.CP.E2.
8.3.3.8.1.1#1	TD.PD.VDMU.E1.
8.3.3.8.1.1#2	TD.PD.VDMU.E1.
8.3.3.8.1.1#3	TD.PD.VDMU.E1.
8.3.3.8.1.2#1	TD.PD.VDMU.E1.
8.3.3.8.1.2#2	TD.PD.VDMU.E1.
8.3.3.8.1.3#1	TD.PD.VDMU.E1.
8.3.3.8.1.3#2	TD.PD.VDMU.E1.
8.3.3.8.2.1#1	TD.PD.VDMU.E2.
8.3.3.8.2.1#2	TD.PD.VDMU.E2.
8.3.3.8.2.1#3	TD.PD.VDMU.E2.
8.3.3.8.2.2#1	TD.PD.VDMU.E2.
8.3.3.8.2.2#2	TD.PD.VDMU.E2.
8.3.3.8.2.3#1	TD.PD.VDMU.E2.
8.3.3.8.2.3#2	TD.PD.VDMU.E2.
8.3.3.8.3.1#1	TD.PD.VDMU.E3.
8.3.3.8.3.1#2	TD.PD.VDMU.E3.
8.3.3.8.3.1#3	TD.PD.VDMU.E3.
8.3.3.8.3.2#1	TD.PD.VDMU.E3.
8.3.3.8.3.2#2	TD.PD.VDMU.E3.
8.3.3.8.3.3#1	TD.PD.VDMU.E3.
8.3.3.8.3.3#2	TD.PD.VDMU.E3.
8.3.3.8.4.1#1	TD.PD.VDMU.E4.
8.3.3.8.4.1#2	TD.PD.VDMU.E4.
8.3.3.8.4.1#3	TD.PD.VDMU.E4.
8.3.3.8.4.2#1	TD.PD.VDMU.E4.
8.3.3.8.4.2#2	TD.PD.VDMU.E4.
8.3.3.8.4.3#1	TD.PD.VDMU.E4.

Assertion	Test Case
8.3.3.8.4.3#2	TD.PD.VDMU.E4.
8.3.3.8.5.1#1	TD.PD.VDMU.E5.
8.3.3.8.5.1#2	TD.PD.VDMU.E5.
8.3.3.8.5.1#3	TD.PD.VDMU.E5.
8.3.3.8.5.2#1	TD.PD.VDMU.E5.
8.3.3.8.5.2#2	TD.PD.VDMU.E5.
8.3.3.8.5.3#1	TD.PD.VDMU.E5.
8.3.3.8.5.3#2	TD.PD.VDMU.E5.
8.3.3.9.1.1#1	TD.PD.VDMD.E1.
8.3.3.9.1.1#2	TD.PD.VDMD.E1.
8.3.3.9.1.1#3	TD.PD.VDMD.E1.
8.3.3.9.1.2#1	TD.PD.VDMD.E1.
8.3.3.9.1.2#2	TD.PD.VDMD.E1.
8.3.3.9.3.1#1	TD.PD.VDMD.E1.
8.3.3.9.3.1#3	TD.PD.VDMD.E2. TD.PD.VDMD.E3.
8.3.3.10.2.2#1	TD.PD.VDMU.E2.
8.3.3.10.2.2#2	TD.PD.VDMU.E2.
8.3.3.10.2.3#1	TD.PD.VDMU.E2.
8.3.3.10.2.3#2	TD.PD.VDMU.E2.
8.3.3.10.7.1#1	TD.PD.LL.E5.
8.3.3.10.7.1#2	TD.PD.LL.E5.
8.3.3.10.7.1#3	TD.PD.LL.E5.
8.3.3.10.11.1#5	TD.PD.VDMU.E2.
8.3.3.11.3.4#1	TD.PD.PHY.E4.

Type-C Tests

TD.PD.C.E1. DFP Attach / Detach Detection

Applicable to:

- PHY: BMC
- UUT: DFP, DRP

Description:

Check that the DFP UUT detects attachment for the range of allowed R_d .

Steps:

- Define a constant $t_{DrpMaxVbusOn}$ at 545 ms ($t_{DRP\ max} * dcSRC.DRP\ max + t_{CCDebounce\ max} + t_{VbusOn\ max}$).
- Define a constant $t_{DrpMaxVbusOff}$ at 670 ms ($t_{PDDebounce\ max} + t_{VbusOff\ max}$).
- Configure all lines as high impedance (CC / Vconn / Vbus).
- Check that Vbus is in the range 0.0 to 0.25 V.
- Enable 1 k Ω to GND on CC and wait $t_{DrpMaxVbusOn}$ (545 ms).
- Check that Vbus is in the range 0.0 to 0.25 V.
- Release CC.
- Enable 1 k Ω to GND on VConn and wait $t_{DrpMaxVbusOn}$ (545 ms).
- Check that Vbus is in the range 0.0 to 0.25 V and Vconn is in the range 0.0 to 0.75 V.
- Release VConn.
- Enable 5.1 k Ω -20% (4.08 k Ω) to GND on CC and wait $t_{DrpMaxVbusOn}$ (545 ms).
- Check that Vbus is in the range 4.4 to 5.25 V.
- Enable 5.1 k Ω +20% (6.12 k Ω) to GND on CC and wait $t_{DrpMaxVbusOff}$ (670 ms).
- Check that Vbus is in the range 4.4 to 5.25 V.
- Release CC and wait $t_{DrpMaxVbusOff}$ (670 ms).
- Check that Vbus is in the range 0.0 to 0.8 V.

TD.PD.C.E2. UFP R_p

Applicable to:

- PHY: BMC
- UUT: UFP, DRP

Description:

Check that the UFP UUT presents a valid R_p .

Steps:

- a) Configure all lines as high impedance (CC / Vconn / Vbus).
- b) Enable 56 k Ω +10% (61.6 k Ω) to +5V and wait 270 ms.
- c) Check that CC level is in the range 0.25 to 1.5 V during 100 ms.
- d) Enable 56 k Ω -10% (50.4 k Ω) to +5V.
- e) Check that CC level is in the range 0.25 to 1.5 V during 100 ms.
- f) Enable 22 k Ω +10% (24.2 k Ω) to +5V.
- g) Check that CC level is in the range 0.45 to 1.5 V during 100 ms.
- h) Enable 22 k Ω -10% (19.8 k Ω) to +5V.
- i) Check that CC level is in the range 0.45 to 1.5 V during 100 ms.
- j) Enable 10 k Ω +10% (11 k Ω) to +5V.
- k) Check that CC level is in the range 0.85 to 2.45 V during 100 ms.
- l) Enable 10 k Ω -10% (9 k Ω) to +5V.
- m) Check that CC level is in the range 0.85 to 2.45 V during 100 ms.
- n) Release CC.

TD.PD.C.E3. [Cable Ra](#)

Applicable to:

- PHY: BMC
- UUT: Cable

Description:

Check that the Cable UUT presents a valid Ra.

Steps:

- a) Configure all lines as high impedance (CC / Vconn / Vbus).
- b) Enable 56 k Ω +10% (61.6 k Ω) to +5V on Vconn and wait 10 ms.
- c) Check that Vconn level is in the range 0.0 to 0.15 V.
- d) Enable 56 k Ω -10% (50.4 k Ω) to +5V on Vconn and wait 10 ms.
- e) Check that Vconn level is in the range 0.0 to 0.15 V.
- f) Enable 22 k Ω +10% (24.2 k Ω) to +5V on Vconn and wait 10 ms.
- g) Check that Vconn level is in the range 0.0 to 0.35 V.
- h) Enable 22 k Ω -10% (19.8 k Ω) to +5V on Vconn and wait 10 ms.
- i) Check that Vconn level is in the range 0.0 to 0.35 V.
- j) Enable 10 k Ω +10% (11 k Ω) to +5V on Vconn and wait 10 ms.
- k) Check that Vconn level is in the range 0.0 to 0.75 V.
- l) Enable 10 k Ω -10% (9 k Ω) to +5V on Vconn and wait 10 ms.

- m) Check that Vconn level is in the range 0.0 to 0.75 V.
- n) Release Vconn.

TD.PD.C.E4. [Cable Receiver Impedance - Deprecated](#)

Applicable to:

- PHY: BMC
- UUT: Cable

Description:

Check that the UUT is high-impedance when not transmitting.

Steps:

- a) Do the bring-up procedure for PHY tests.
- b) Transmit a BIST message with BIST Test Data object.
- c) Check that the CC level is as expected, knowing Vp, Rp and Rd by calibration.

TD.PD.C.E5. [DRP](#)

Applicable to:

- PHY: BMC
- UUT: DRP

Description:

Check the DRP UUT over the connection state diagram.

Steps:

- a) Configure all lines as high impedance (CC / Vconn / Vbus).
- b) Enable 100 k Ω to GND on CC. This is required to measure Rp without attachment being detected.
- c) Wait CC level is lower than 0.150 V (UUT as Sink). If CC doesn't reach the target voltage within 100 ms (tDRP max), the test is inconclusive.
- d) Repeat 10 times:
 - 1. Start a timer when CC level is higher than 2.0 V (UUT as Source). If CC doesn't reach the target voltage within 100 ms (tDRP max), the test is inconclusive.
 - 2. Stop the timer when CC level is lower than 0.150 V (UUT as Sink) and store as tUutSrc.
 - 3. Start a timer.
 - 4. Stop the timer when CC level is higher than 2.0 V (UUT as Source) and store as tUutSink.
 - 5. Check that tUutSrc + tUutSink is in the range 50 to 100 ms (tDRP).
 - 6. Check that that tUutSrc / (tUutSrc + tUutSink) is in the range 30% to 70% (dcDFP.SRC).

- e) It is assumed the UUT just transitioned to Unattached.SRC. Enable 10 k Ω to +5V on CC.
- f) Wait 70 ms ($t_{DRP\ max} * dc_{SRC.DRP\ max}$).
- g) Check every 1 ms that CC level is in the range 0.85 to 2.45 V during 200 ms ($t_{CCDebounce\ max}$)
- h) Release the 10 k Ω resistor.
- i) Enable a 5.1 k Ω resistor to GND on CC.
- j) Check that Vbus reaches a range of 4.4 to 5.25 V within 565 ms ($t_{PDDebounce\ max} + t_{DRP\ max} * dc_{SRC.DRP\ max} + t_{CCDebounce\ max} + t_{VbusOn\ max}$).
- k) Release CC and check Vbus reaches a range of 0.0 to 0.8 V within 670 ms ($t_{PDDebounce\ max} + t_{VbusOff\ max}$).

Physical Layer Tests

TD.PD.PHY.E1. [BIST Test Data](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.3#1, 5.8.1.1#1, 5.9.7#1, 6.4.3#10, 6.4.3.9#1, 6.4.3.9#2, 6.9#15

Description:

Check that the UUT implements BIST Test Data mode and successfully receives BIST Test Data messages.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object.
- c) Transmit 1,000 BIST Test Data message with random content and valid CRC. All packets shall be acknowledged with GoodCrc.
- d) Transmit a BIST Test Data message with an invalid CRC. GoodCrc shall not be send by the UUT.
- e) Transmit 10 BIST Test Data message with random content and valid CRC. All packets shall be acknowledged with GoodCrc.

TD.PD.PHY.E2. [BIST Receiver Mode](#)

Applicable to:

- PHY: BMC (optional), FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.9.1.2#1, 6.4.3#2, 6.4.3#4, 6.4.3.1#1, 6.4.3.1#2, 6.4.3.1#3, 6.4.3.1#4, 6.4.3.1#5, 6.4.3.3#1, 6.6.5#1, 6.6.5#2, 6.6.5#3, 8.3.3.11.1#1

Description:

Check that the UUT implements BIST Receiver mode and successfully receives BIST Test frames.
BMC UUT is not required to support BIST Receiver Mode.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Receiver Mode object.
- c) Transmit 1,000 valid BIST Test frames. All packets shall be acknowledged with a BIST message containing Returned BIST Counters indicating 0 bit error.
- d) Transmit a BIST Test frame with three bit errors. The UUT shall acknowledge with a BIST message containing Returned BIST Counters indicating 3 bit error.
- e) Transmit 10 valid BIST Test frames. All packets shall be acknowledged with a BIST message containing Returned BIST Counters indicating 0 bit error.

TD.PD.PHY.E3. [BIST Transmitter Mode](#)

Applicable to:

- PHY: BMC (optional), FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.9.1#1, 5.9.1#2, 5.9.1#3, 5.9.1#4, 5.9.1#5, 5.9.1#6, 5.9.1#7, 5.9.1#8, 6.4.3#3, 6.4.3.2#1, 6.4.3.2#2, 6.4.3.2#3, 6.4.3.2#4, 6.4.3.2#5, 6.4.3.2#6, 6.4.3.2#7, 6.4.3.2#8, 6.4.3.2#9

Description:

Check that the UUT implements BIST Transmitter mode and successfully transmits BIST Test frames. BMC UUT is not required to support BIST Transmitter Mode.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Transmitter Mode object.
- c) Wait 1,000 BIST Test frames and acknowledge with BIST messages containing Returned BIST Counters indicating the bit error count. The BIST Test frames shall be received with 0 bit errors.

TD.PD.PHY.E4. [Transmitter Bit Rate and Bit Rate Drift](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.8.1.2.1#1, 5.8.1.2.1#2, 5.9.4#1, 6.4.3#7, 6.4.3.6#1, 6.5.8.1#1, 8.3.3.11.3.4#1

Description:

Check that the UUT's transmitter bit rate and drift are within specification requirements.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Carrier Mode 2 object.
- c) The UUT shall start transmitting alternating 1s and 0s within tBISTMode.
- d) Wait 32 bits.
- e) Measure the average bit rate over 32 bits and store to fBitRateRef.
- f) Initialize fBitRateMin at the maximum value and fBitRateMax at the minimum value.
- g) Compute a moving average with a window of 32 bits during the following 1,044 bits, and at every new bit, update fBitRateMin and fBitRateMax with the new sample.
- h) Check that fBitRateMin is greater or equal than 270 kbps.
- i) Check that fBitRateMax is lesser or equal than 330 kbps.
- j) Compute $pBitRateMax = (fBitRateMax - fBitRateRef) / fBitRateRef$.
- k) Check that pBitRateMax is less than 0.25%.
- l) Compute $pBitRateMin = (fBitRateRef - fBitRateMin) / fBitRateRef$.
- m) Check that pBitRateMin is less than 0.25%.
- n) Repeat the measurement 256 times. Since PD 2.1, the carrier lasts tBISTContMode (30 to 60 ms), so if the carrier stops during a measurement, the measurement is canceled and a new BIST message with BIST Carrier Mode 2 object is transmitted to restart the carrier.
- o) The test fails if any of the measurement is not within the expected limit a single time.

TD.PD.PHY.E5. [Transmitter Collision Avoidance](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.7#1, 5.7#2, 5.7#3

Description:

Check that the UUT properly implements collision avoidance requirements.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object.

- c) Transmit a BIST Test Data message with random content and valid CRC.
- d) Transmit a bitstream sequence (alternating 1s and 0s simulating a preamble) exactly 20 us after the end of the previous packet for a duration of 200 us.
- e) The test fails if a GoodCrc is received within 10 ms.
- f) Repeat the test with a continuous stream of 0s immediately after the end of the previous packet for a duration of 195us.

TD.PD.PHY.E6. [Receiver Swing Tolerance](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.8.1.1#1

Description:

Check that the UUT's receiver can operate over the specified swing range.

Steps:

- a) Configure the Tester's transmitter with the maximum swing level (vSwing max of 1.2V for BMC and vTX max of 200mVRMS for FSK).
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) Transmit 1,000 BIST Test Data message with random content and valid CRC. All packets shall be acknowledged with GoodCrc.
- d) Repeat the above steps with the minimum swing level (vSwing min of 1.05V for BMC and vTX min of 100mVRMS for FSK).

TD.PD.PHY.E7. [Receiver Bit Rate Tolerance](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.8.1.1#1, 5.8.3.2.2#3

Description:

Check that the UUT's receiver can operate over the specified bit rate range.

Steps:

- a) Configure the Tester's transmitter with fBitRate min (270kbps).
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) Transmit 1,000 BIST Test Data message with random content and valid CRC. All packets shall be acknowledged with GoodCrc.
- d) Repeat the above steps with fBitRate max (330kbps).

TD.PD.PHY.E8. [Receiver Bit Rate Deviation Tolerance](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.8.1.1#1, 5.8.3.2.2#3

Description:

Check that the UUT's receiver can operate over the specified bit rate deviation.

Steps:

- a) Configure the Tester's transmitter with the nominal data rate of 300kbps during the last 32 bits of the Preamble, and -0.25% deviation (299.25kbps) for the subsequent bits.
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) Transmit 1,000 BIST Test Data message with random content and valid CRC. All packets shall be acknowledged with GoodCrc.
- d) Repeat the above steps with a deviation of +0.25% (300.75kbps).

TD.PD.PHY.E9. [Valid SOP Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.4#2, 5.6.1.2.1#1, 5.6.1.2.1#3, 5.6.1.2.1#4, 5.6.1.2.1#5

Description:

Check that ports (DFP / UFP) reply to SOP, and that cables do not reply to SOP.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with perfect SOP and valid CRC. All packets shall be acknowledged with GoodCrc by ports, and shall be ignored by cables.
- d) Repeat the step above by flipping one bit at a time for each of the 20 framing bits. This is informational as UUT is not required to support flip bit tolerance (it is recommended).

TD.PD.PHY.E10. [Invalid SOP Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.2.1#2

Description:

Check that UUT doesn't reply to invalid SOP.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with SOP having one bit flip on the first two symbols (number 1-2) and valid CRC. All packets shall be ignored.
- d) Repeat last step with all combinations of one bit flip in two symbols (number 1-3, 1-4, 2-3, 2-4, 3-4).

TD.PD.PHY.E11. [Valid SOP' Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.2.2#1, 5.6.1.2.2#5, 5.6.1.2.2#6

Description:

Check that cables reply to SOP', that DFPs / Sources reply to SOP' with no explicit contract (informational as DFPs are not required to communicate with cables), and that UFPs do not reply to SOP' with no explicit contract.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with perfect SOP' and valid CRC. All packets shall be acknowledged with GoodCrc by cables and DFPs / Sources, and shall be ignored by UFPs.
- d) Repeat the step above by flipping one bit at a time for each of the 20 framing bits. This is informational as UUT is not required to support flip bit tolerance (it is recommended).

TD.PD.PHY.E12. Invalid SOP' Framing

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.2.2#3, 5.6.1.2.2#4

Description:

Check that UUT doesn't reply to invalid SOP'.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with SOP' having one bit flip on the first two symbols (number 1-2) and valid CRC. All packets shall be ignored.
- d) Repeat last step with all combinations of one bit flip in two symbols (number 1-3, 1-4, 2-3, 2-4, 3-4).

TD.PD.PHY.E13. Valid SOP" Framing

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.2.3#3, 5.6.1.2.3#7

Description:

Check that cables optionally reply to SOP", and that ports (DFP / UFP) do not reply to SOP" with no explicit contract.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with perfect SOP" and valid CRC. All packets shall be acknowledged with GoodCrc by cables embedding an SOP" chip, and shall be ignored by ports.
- d) Repeat the step above by flipping one bit at a time for each of the 20 framing bits. This is informational as UUT is not required to support flip bit tolerance (it is recommended).

TD.PD.PHY.E14. Invalid SOP" Framing

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.2.3#5, 5.6.1.2.3#6

Description:

Check that UUT doesn't reply to invalid SOP".

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit 10 BIST Test Data messages with SOP" having one bit flip on the first two symbols (number 1-2) and valid CRC. All packets shall be ignored.
- d) Repeat last step with all combinations of one bit flip in two symbols (number 1-3, 1-4, 2-3, 2-4, 3-4).

TD.PD.PHY.E15. [SOP' _Debug / SOP'' _Debug Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

None

Description:

Check that ports (DFP / UFP) and cables do not reply to SOP' _Debug / SOP'' _Debug. This test is informational.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Transmit a BIST message with BIST Test Data object with SOP*.
- Transmit 10 BIST Test Data messages with SOP' _Debug and valid CRC. All packets shall be ignored by ports and cables.
- Repeat the step above by flipping one bit at a time for each of the 20 framing bits.
- Transmit 10 BIST Test Data messages with SOP'' _Debug and valid CRC. All packets shall be ignored by ports and cables.
- Repeat the step above by flipping one bit at a time for each of the 20 framing bits.

TD.PD.PHY.E16. [Valid Hard Reset Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.4#1, 5.6.4#2, 5.6.4#4, 5.6.4#5, 5.6.4#6

Description:

Check that ports (DFP / UFP) handle Hard Reset, and that cables ignore Hard Reset.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Transmit a BIST message with BIST Test Data object with SOP*.
- Transmit a BIST Test Data message with SOP* and valid CRC. The packet shall be acknowledged with GoodCrc.

- d) Transmit Hard Reset with perfect framing.
- e) Depending on the port type:
 - 1. If DFP, the test fails if no SourceCap is received within tNoResponse.
 - 2. If UFP, the Tester turns off Vbus waiting vSafe0 is reached, then turns on Vbus to vSafe5, then transmits SourceCap every 100 ms until a GoodCrc is received timely followed by a Request within tSenderResponse. The test fails if a Request is not received within tNoResponse.
 - 3. If Cable, the Tester transmit VDM Discover Identity every tDiscoverIdentity until a GoodCrc is received timely followed by a VDM Discover Identity ACK within tVDMSenderResponse. The test fails if a GoodCrc or an ACK is not received after nDiscoverIdentityCount.
- f) Repeat the steps above by flipping one bit at a time for each of the 20 framing bits. This is informational as UUT is not required to support flip bit tolerance (it is recommended).

TD.PD.PHY.E17. Invalid Hard Reset Framing

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.4#3

Description:

Check that UUT ignores invalid Hard Reset with framing errors.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit a BIST Test Data message with SOP* and valid CRC. The packet shall be acknowledged with GoodCrc.
- d) Transmit Hard Reset having one bit flip on the first two symbols (number 1-2).
- e) Depending on the port type:
 - 1. If DFP, the test fails if a SourceCap is received within tNoResponse.
 - 2. If UFP, the Tester turns off Vbus waiting vSafe0 is reached, then turns on Vbus to vSafe5, then transmits SourceCap every 100 ms during tNoResponse. The test fails if a Request is received.
 - 3. If Cable, the Tester transmits VDM Discover Identity every tDiscoverIdentity for nDiscoverIdentityCount times. The test fails if VDM Discovery Identity ACK is received.
- f) Repeat the steps above with all combinations of one bit flip in two symbols (number 1-3, 1-4, 2-3, 2-4, 3-4).

TD.PD.PHY.E18. [Valid Cable Reset Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.5#1, 5.6.5#2, 6.7.3#1, 6.7.3#2, 6.7.3#3, 6.7.3#9

Description:

Check that cables handle Cable Reset, and that ports (DFP / UFP) ignore Cable Reset.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit a BIST Test Data message with SOP* and valid CRC. The packet shall be acknowledged with GoodCrc.
- d) Transmit Cable Reset with perfect framing.
- e) Depending on the port type:
 1. If DFP, the test fails if SourceCap is received within tTypeCSendSourceCap in case of BMC, and tSendSourceCap in case of FSK.
 2. If UFP, transmit SourceCap. The test fails if a GoodCrc is not received within tReceive, or if Request is received within tSenderResponse.
 3. If Cable, transmit VDM Discover identity. The test fails if a GoodCrc is not received within tReceive, or if no VDM Discovery Identity ACK is received within tVDMSenderResponse.
- f) Repeat the steps above by flipping one bit at a time for each of the 20 framing bits. This is informational as UUT is not required to support flip bit tolerance (it is recommended).

TD.PD.PHY.E19. [Invalid Cable Reset Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.5#2

Description:

Check that UUT ignore invalid Cable Reset with framing errors.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit a BIST Test Data message with SOP* and valid CRC. The packet shall be acknowledged with GoodCrc.
- d) Transmit Cable Reset having one bit flip on the first two symbols (number 1-2).
- e) Depending on the port type:
 1. If DFP, the test fails if a SourceCap is received within tTypeCSendSourceCap in case of BMC, and tSendSourceCap in case of FSK.
 2. If UFP, transmit SourceCap. The test fails if a GoodCrc is not received within tReceive, or if a Request is received within tSenderResponse.
 3. If Cable, transmit VDM Discover identity. The test fails if a GoodCrc is not received within tReceive, or if VDM Discovery Identity ACK is received within tVDMSenderResponse.
- f) Repeat the steps above with all combinations of one bit flip in two symbols (number 1-3, 1-4, 2-3, 2-4, 3-4).

TD.PD.PHY.E20. [EOP Framing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.6.1.5#1, 5.6.1.5#2, 5.6.1.5#3, 5.6.1.5#4, 5.6.1.5#5

Description:

Check that UUT correctly handle bad EOP and premature EOP.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object with SOP*.
- c) Transmit a BIST Test Data message with SOP* and valid CRC. The packet shall be acknowledged with GoodCrc.
- d) Transmit a BIST Test Data message with SOP*, valid CRC and EOP with a bit flip on the first bit. The packet shall be ignored. Repeat for all EOP bits.
- e) Transmit a BIST Test Data message with premature EOP (one byte early). The packet shall be ignored. Repeat removing one byte until the EOP is located immediately after the SOP*.

TD.PD.PHY.E21. [Preamble](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP, Cable

Assertions Tested:

5.8.3.1#3

Description:

Check that the UUT's receiver tolerates the loss of the first preamble edge (normative), and the minimum preamble required by the UUT's receiver (informative). Check also that the receiver tolerates a longer preamble (informative).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a BIST message with BIST Test Data object.
- c) Transmit 10 BIST Test Data messages with normal preamble of 64-bits (beginning with '0') and valid CRC. All packets shall be acknowledged with GoodCrc.
- d) Transmit 10 BIST Test Data messages with a preamble of 63-bits beginning with '1' and valid CRC. All packets shall be acknowledged with GoodCrc.
- e) Informative: Transmit 10 BIST Test Data messages with a preamble of 72-bits beginning with '0' and valid CRC. All packets shall be acknowledged with GoodCrc.
- f) Informative: Transmit 10 BIST Test Data messages by removing 2 bits from the beginning of the preamble. Continue removing bits until the UUT's receiver stops responding GoodCrc, or when 32 bits of preamble are left.

Link Layer Tests

TD.PD.LL.E1. [GoodCRC Timing](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP

Assertions Tested:

6.3.1#1, 6.3.1#2, 6.3.1#3, 6.5.1#4, 6.5.1#5, 6.5.1#7, 6.8.2.1.5#1, 6.8.2.1.5#2, 6.8.2.1.6#2

Description:

Check that the UUT will accept GoodCRC with the shortest and longest delays.

Steps:

- a) Configure the Tester to reply GoodCRC with the shortest allowed delay of 25 us (tInterFrameGap).
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) The test fails if there is any retransmission.
- d) Repeat the test with the longest allowed delay of 900 us (tReceive min).

TD.PD.LL.E2. [Retransmission](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP

Assertions Tested:

6.5.1#1, 6.5.1#2, 6.5.1#3, 6.5.1#4, 6.5.1#5, 6.6.1.1#2, 6.7.1#2, 6.7.1#4, 6.8.2.1.5#1, 6.8.2.1.5#3, 6.8.2.1.6#1, 6.8.2.1.6#3, 6.8.2.1.8#1, 6.8.2.1.8#2

Description:

Check that the UUT will retransmit a packet if the GoodCRC is too late, correctly timed but with CRC error, not sent, or if the MessageID is incorrect.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role, with the exception that the first GoodCRC is sent with an invalid delay of 1,250 us (tReceive max + 50 us), measured from the end of the last bit of the packet received from the UUT to the end of the last bit of the GoodCRC.

- b) Check that the packet is retransmitted with the same MessageID. For this specific case of too-late GoodCrc, implementations may also consider the GoodCrc as an unexpected message during an atomic sequence, where the outcome is SoftReset. SoftReset shall then be also accepted for this specific case. In addition to SoftReset, HardReset shall also be accepted for this specific case.
- c) Repeat the test with the following conditions:
 - 1. GoodCrc sent with a valid delay of 25 us (tInterFrameGap) but with incorrect CRC.
 - 2. GoodCrc sent with a valid delay of 25 us (tInterFrameGap) but with incorrect MessageID.
 - 3. GoodCrc not sent at all.

TD.PD.LL.E3. [Soft Reset Usage](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP

Assertions Tested:

6.3.13#4, 6.7.1#1, 6.7.1#4, 6.7.1#5, 6.7.1#6, 6.7.1#7, 6.8.2.1.3#1, 6.8.2.1.3#2, 6.8.2.1.3#3, 6.8.2.1.4#1, 6.8.2.1.4#2, 6.8.2.1.8#3, 6.8.2.1.9#1, 6.8.2.1.9#2, 8.3.3.4.1.1#1, 8.3.3.4.1.1#2, 8.3.3.4.1.1#3, 8.3.3.4.1.1#4, 8.3.3.4.2.1#1, 8.3.3.4.2.1#2, 8.3.3.4.2.1#3, 8.3.3.4.2.1#4

Description:

Check that the UUT will issue a Soft Reset after unsuccessful retries, and that the link can be successfully recovered after that.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Send a Get_Sink_Cap message to the UUT, wait for a reply and do not send GoodCrc for nRetryCount + 1 times (nRetryCount equals 3 since PD 2.1).
- c) Check that the UUT issues a Soft Reset.
- d) Handle correctly the Soft Reset procedure.
- e) Continue the bring-up procedure and check that the link is successfully established.

TD.PD.LL.E4. [Hard Reset Usage](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP

Assertions Tested:

5.6.4#6, 6.3.13#2, 6.3.13#3, 6.7.2.1#1, 6.7.2.1#2, 6.7.2.3#1, 8.3.3.4.1.1#5, 8.3.3.4.1.1#6, 8.3.3.4.2.1#5, 8.3.3.4.2.1#6, 8.3.3.4.2.1#7

Description:

Check that the UUT will issue a Hard Reset if the Soft Reset fails, and that the link can be successfully recovered after that.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Send a Get_Sink_Cap message to the UUT, wait for a reply and do not send GoodCrc for nRetryCount + 1 times (nRetryCount equals 3 since PD 2.1).
- Wait the nRetryCount + 1 (four) Soft Resets from the UUT and do not reply GoodCrc.
- Check that the UUT issues a Hard Reset.
- Do the bring-up procedure for Link tests and check that the link is successfully established.

TD.PD.LL.E5. [Soft Reset](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP, UFP

Assertions Tested:

6.2.1.3#1, 6.3.3#5, 6.3.13#1, 6.6.1.1#1, 6.8.2.1.1#1, 6.8.2.2.1#3, 6.8.2.2.2#3, 8.3.3.4.1.2#1, 8.3.3.4.1.2#2, 8.3.3.4.1.2#3, 8.3.3.4.1.2#4, 8.3.3.4.2.2#1, 8.3.3.4.2.2#2, 8.3.3.4.2.2#3, 8.3.3.4.2.2#4, 8.3.3.10.7.1#1, 8.3.3.10.7.1#2, 8.3.3.10.7.1#3

Description:

Check that the UUT will correctly complete the Soft Reset procedure.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Initiate a Soft Reset and check that the procedure is completed successfully.

TD.PD.LL.E6. [Ping](#)

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.3.5.2#1, 6.5.3.2#5, 6.8.2.2.5#1, 8.3.3.3#1, 8.3.3.3.7#9

Description:

Check that the UUT supports reception of Ping packet.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Send a Ping packet every 1 ms for 100 ms and check that GoodCrc is received in time, that neither Soft Reset nor Hard Reset are received, and that there is no disconnection.

Source Tests

TD.PD.SRC.E1. Source Capabilities sent timely

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.5.4.3#1

Description:

As Consumer (UFP), the Tester verifies a Source Capabilities message from the Provider (DFP, UUT) is received timely.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The test fails if the first bit of a Source Capabilities message is not received from the Provider within 250 ms (tFirstSourceCap max) after VBus present.

TD.PD.SRC.E2. Source Capabilities Fields Checks

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.2.1.2#1, 6.2.1.4#2, 6.2.1.8#1, 6.4.1#1, 6.4.1#3, 6.4.1.2#1, 6.4.1.2#2, 6.4.1.2#3, 6.4.1.2#4, 6.4.1.2.3#1, 6.4.1.2.3#4, 6.2.1.4#1, 6.2.1.5#1, 6.2.1.6#1

Description:

As Consumer (UFP), the Tester waits for a Source Capabilities message from the Provider (DFP, UUT) and verifies correct field values.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, if the Specification Revision field is 10b (Rev 3.0), the test passes and stops here, otherwise the Tester verifies:
 1. Number of Data Objects field equals the number of Src_PDOs in the message and is not 000b.

2. Port Power Role field = 1b (Source)
 3. Specification Revision field = 01b (Rev 2.0)
 4. Port Data Role field = 1b (DFP)
 5. Message Type field = 0001b (Source Capabilities)
 6. Bit 15 = 0b (Reserved)
 7. Bit 4 = 0b (Reserved)
- c) For the first PDO, the Tester verifies:
1. Bits 31..30 (PDO type) are 00b (Fixed Supply).
 2. Voltage field = 100 (5 V)
 3. Bits 24..22 = 000b (Reserved)
- d) For the other PDOs (if any), the Tester verifies:
1. Bits 31..30 (PDO type) are 00b (Fixed Supply), 01b (Battery), or 10b (Variable Supply).
 2. If Bits 31..30 are 00b, Bits 29..22 are set to 0.
 3. PDOs are in the order of Fixed Supply Objects (if present), Battery Supply Objects (if present) and then Variable Supply Objects (if present).
 4. Fixed Supply Objects (if present) are in voltage order; lowest to highest.
 5. Battery Supply Objects (if present) are in Minimum Voltage order; lowest to highest.
 6. Variable Supply Objects (if present) are in Minimum Voltage order; lowest to highest.
- e) The test fails if any verification is not satisfied.

TD.PD.SRC.E3. SourceCapabilityTimer Timeout

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.5.4.1#1, 6.5.4.1#2, 8.3.3.2.2#1, 8.3.3.2.2#2, 8.3.3.2.3#1, 8.3.3.2.3#2, 8.3.3.2.3#7

Description:

As Consumer (UFP), the Tester waits for a Source Capabilities message from the Provider (DFP, UUT). The Tester intentionally does not reply with a GoodCRC in order to force a SourceCapabilityTimer timeout, then verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the first Source Capabilities messages from the Provider, the Tester intentionally does not reply with a GoodCRC message and waits for the next Source Capabilities message.

- c) The tester sets the value of a variable t to 0.
- d) Upon receipt of the Source Capabilities message, the Tester does not reply with a GoodCRC and measures the delay from the last bit of the last Source Capabilities message EOP to the first bit of the preamble of the Source Capabilities message received just now. If the delay is larger than t , sets the value of t to the delay.
- e) Repeat d) until the Tester has received the fifth Source Capabilities message.
- f) If the value of t is larger than 201.1 ms ($t_{\text{TypeCSendSourceCap max}} + t_{\text{Receive max}}$), the test fails.
- g) If the value of t is smaller than 100.9 ms ($t_{\text{TypeCSendSourceCap min}} + t_{\text{Receive min}}$), the test fails.

TD.PD.SRC.E4. [SenderResponseTimer Deadline - Request](#)

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.5.2#1, 6.5.2#3, 6.5.2#4, 8.3.3.2.3#3

Description:

This test verifies that the UUT accepts a Request message sent at the deadline limit of $t_{\text{SenderResponse min}}$ (24 ms) in reply to a Source Capabilities message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the UUT, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request message 24 ms after the reception of Source Capabilities message. This delay is measured from the last bit of the GoodCRC message EOP to the last bit of Request message EOP.
- d) The test fails if a Hard Reset is detected within 30 ms after the time when the last bit of the GoodCRC message EOP was sent.
- e) The test passes if the Tester receives a GoodCRC message from the UUT.

TD.PD.SRC.E5. SenderResponseTimer Timeout - Request

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.5.2#1, 6.5.2#2, 6.5.2#3, 8.3.3.2.3#8

Description:

As Consumer (UFP), the Tester intentionally does not send the Request message, which is intended to cause a SenderResponseTimer timeout on the Provider (DFP, UUT). The Tester verifies correct implementation of this timer.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- The Tester intentionally does not send a Request message and waits for a Hard Reset.
- If a Hard Reset is not detected within 30 ms from the time the last bit of the GoodCRC message EOP has been sent, the test fails.
- If a Hard Reset is detected before 24 ms from the time the last bit of the GoodCRC message EOP has been sent, the test fails.

TD.PD.SRC.E6. PSHardResetTimer Timeout

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.5.10.2#1

Description:

As Consumer (UFP), the Tester intentionally does not send the Request message, which is intended to cause a Hard Reset. The Tester verifies correct implementation of the PSHardResetTimer.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.

- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester intentionally does not send a Request message and waits for a Hard Reset.
- d) After a Hard Reset signaling is received, the Tester verifies Vbus is kept for at least tPSHardReset min (25 ms) and no longer than tPSHardReset max (35 ms) before starting to transition to vSafe0V.
- e) The test fails if the above mentioned verification is not satisfied.

TD.PD.SRC.E7. Accept sent timely

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.3#1, 6.3.3#6, 6.5.2#5, 6.5.2#6, 8.3.3.2.4#1, 8.3.3.2.4#2, 8.3.3.2.4#3, 8.3.3.2.5#1, 8.3.3.2.5#2

Description:

As Consumer (UFP), the Tester requests 100% of the offered current or power under the terms of the last PDO on the UUT, and verifies that the Accept message is received timely.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request for power under the conditions of the last Power Data Object, requesting 100% of the current or power offered depending on the type of the PDO.
- d) If an Accept message is not received within tReceiverResponse max (15 ms), the test fails. This delay is measured from the time the last bit of Request message EOP has been transmitted to the time the first bit of the Accept message preamble has been received.

TD.PD.SRC.E8. Accept Fields Checks

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.2.1.1#2, 6.2.1.2#1, 6.2.1.4#1, 6.2.1.5#1, 6.2.1.6#1, 6.2.1.8#1, 6.3.3#1

Description:

As Consumer (UFP), the Tester requests 100% of the offered current or power under the terms of the last PDO on the UUT, waits for an Accept message from the Provider (DFP, UUT) and verifies correct field values.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request for power under the conditions of the last Power Data Object, requesting 100% of the current or power offered depending on the type of the PDO.
- d) Upon receipt of the Accept message, the Tester verifies:
 1. Number of Data Objects field = 000b
 2. Port Power Role field = 1b (Source)
 3. Specification Revision field = 01b (Rev 2.0)
 4. Port Data Role field = 1b (DFP)
 5. Message Type field = 0011b (Accept)
 6. Bit 15 = 0b (Reserved)
 7. Bit 4 = 0b (Reserved)
- e) The test fails if any verification is not satisfied.

TD.PD.SRC.E9. PS_RDY sent timely

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.6#1, 8.3.3.2.5#3, 8.3.3.2.5#4

Description:

As Consumer (UFP), the Tester requests 100% of the offered current or power under the terms of the last PDO on the UUT, and verifies that the PS_RDY message is received timely.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request for power under the conditions of the last Power Data Object, requesting 100% of the current or power offered depending on the type of the PDO.

- d) Upon receipt of the Accept message from the Provider, the Tester replies with a GoodCRC message.
- e) If the EOP of the PS_RDY message is not received within tPSTransition min (450 ms) after EOP of the above mentioned GoodCRC sent, the test fails.

TD.PD.SRC.E10. PS_RDY Fields Checks

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.2.1.1#2, 6.2.1.2#1, 6.2.1.4#1, 6.2.1.5#1, 6.2.1.6#1, 6.2.1.8#1, 6.3.6#1

Description:

As Consumer (UFP), the Tester requests 100% of the offered current or power under the terms of the last PDO on the UUT, waits for a PS_RDY message from the Provider (DFP, UUT) and verifies correct field values.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request for power under the conditions of the last Power Data Object, requesting 100% of the current or power offered depending on the type of the PDO.
- d) Upon receipt of the Accept message from the Provider, the Tester replies with a GoodCRC message.
- e) Upon receipt of the PS_DSY message, the tester verifies:
 - 1. Number of Data Objects field = 000b
 - 2. Port Power Role field = 1b (Source)
 - 3. Specification Revision field = 01b (Rev 2.0)
 - 4. Port Data Role field = 1b (DFP)
 - 5. Message Type field = 0110b (PS_RDY)
 - 6. Bit 15 = 0b (Reserved)
 - 7. Bit 4 = 0b (Reserved)
- f) The test fails if any verification is not satisfied.

TD.PD.SRC.E11. Accept Requests can be met

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.3#1, 8.3.3.2.4#1, 8.3.3.2.4#2, 8.3.3.2.4#3, 8.3.3.2.5#1, 8.3.3.2.5#2, 8.3.3.2.5#3, 8.3.3.2.5#4

Description:

As Consumer (UFP), the Tester requests 100% of the offered current or power under the terms of each PDO on the UUT, verifies that the UUT Accept the requests and the voltage transitions are correct.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message. Repeat the following steps for each of these Power Data Objects.
- The Tester sends a Request for power under the conditions of the next PDO (starting from the first PDO), requesting 100% of the current or power offered.
- If an Accept message is not received timely or a Reject message is received, the test fails.
- If a PS_RDY message is not received within tPSTransition min (450 ms) from the time the last bit of Accept message was received, the test fails.
- After PS_RDY has been received, the Tester checks the voltage on VBus is within vSrcNew (vSafe5V, within $\pm 5\%$ for fixed supply or the negotiated min, max level for variable supply or battery supply). The test fails if VBus is not valid.
- Simulate a disconnection and start test the next PDO from step a).

TD.PD.SRC.E12. Reject Requests can't be met

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.4#1, 6.3.4#7

Description:

As Consumer (UFP), the Tester requests 200% of the offered current or power under the terms of each PDO on the UUT, and verifies the request is rejected by the UUT.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message. Repeat the following steps for each of these Power Data Objects.
- c) The Tester sends a Request for power under the conditions of the next PDO (starting from the first PDO), requesting 200% of the current or power offered.
- d) If a Reject message is not received timely or an Accept message is received, the test fails.
- e) Simulate a disconnection and start test the next PDO from step a).

TD.PD.SRC.E13. Reject Request - Invalid Object Position

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.4#1, 6.3.4#7

Description:

As Consumer (UFP), the Tester intentionally sends a Request with an invalid object position, and verifies the request is rejected by the UUT.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a Request with object position field set to number of Src_PDOs + 1, or 0 if number of Src_PDOs is 7.
- d) If a Reject message is not received timely or an Accept message is received, the test fails.

TD.PD.SRC.E14. Atomic Message Sequence

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.2.1.3#2, 6.3.13#1, 6.3.13#5, 6.7.1#2, 6.7.1#6, 6.7.1#7

Description:

As Consumer (UFP), the Tester sends a GetSinkCap message in place of Request message, and verifies that the UUT correctly sends a Soft Reset to recover from this error.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the Provider, the Tester replies with a GoodCRC message.
- c) The Tester sends a GetSinkCap message to the UUT.
- d) If a Soft Reset is not received within tSoftReset max (15 ms), the test fails.
- e) Upon receipt of the Soft Reset message, the Tester resets its MessageIDCounter and RetryCounter, and replies with a GoodCRC message.
- f) The Tester sends an Accept message to the UUT.
- g) If a Source Capabilities message with a 1 message ID is not received within 310 ms after the GoodCRC EOP corresponding to the Accept message was received, the test fails.

TD.PD.SRC.E15. Give_Source_Cap

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.7#1, 8.3.3.2.6#7, 8.3.3.2.12#1, 8.3.3.2.12#2

Description:

As Consumer (UFP), the Tester verifies that the UUT correctly replies to a Get_Source_Cap message after a valid contract has been set up.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends a Get_Source_Cap message to the UUT.
- c) If a Source Capabilities Message is not received within tSenderResponse min (24 ms), the test fails. This delay is measured from the last bit of the GoodCRC message EOP corresponding to the Get_Source_Cap message to the last bit of the Source Capabilities message EOP.

TD.PD.SRC.E16. PDO Transition

Applicable to:

- PHY: BMC, FSK
- UUT: DFP

Assertions Tested:

6.3.3#1, 8.3.3.2.4#1, 8.3.3.2.4#2, 8.3.3.2.4#3, 8.3.3.2.5#1, 8.3.3.2.5#2, 8.3.3.2.5#3, 8.3.3.2.5#4

Description:

As Consumer (UFP), the Tester enumerates all possible transitions among the PDOs of the UUT, and verifies the UUT does PDO transitions correctly.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Upon receipt of the Source Capabilities message from the UUT, the Tester replies with a GoodCRC message.
- c) The Tester enumerates all possible PDO transitions among the PDOs of the UUT per the following table.

Number of PDOs in Capabilities Message						
1	2	3	4	5	6	7
1 to 1*	1 to 2	1 to 2	1 to 2	1 to 2	1 to 2	1 to 2
	2 to 1	2 to 1	2 to 1	2 to 1	2 to 1	2 to 1
		1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
		3 to 2	3 to 2	3 to 2	3 to 2	3 to 2
		2 to 3	2 to 3	2 to 3	2 to 3	2 to 3
		3 to 1	3 to 1	3 to 1	3 to 1	3 to 1
			1 to 4	1 to 4	1 to 4	1 to 4
			4 to 3	4 to 3	4 to 3	4 to 3
			3 to 4	3 to 4	3 to 4	3 to 4
			4 to 2	4 to 2	4 to 2	4 to 2
			2 to 4	2 to 4	2 to 4	2 to 4
			4 to 1	4 to 1	4 to 1	4 to 1
				1 to 5	1 to 5	1 to 5
				5 to 4	5 to 4	5 to 4
				4 to 5	4 to 5	4 to 5
				5 to 3	5 to 3	5 to 3
				3 to 5	3 to 5	3 to 5
				5 to 2	5 to 2	5 to 2
				2 to 5	2 to 5	2 to 5
				5 to 1	5 to 1	5 to 1
					1 to 6	1 to 6
					6 to 5	6 to 5
					5 to 6	5 to 6
					6 to 4	6 to 4
					4 to 6	4 to 6
					6 to 3	6 to 3
					3 to 6	3 to 6

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					6 to 2	6 to 2
					2 to 6	2 to 6
					6 to 1	6 to 1
						1 to 7
						7 to 6
						6 to 7
						7 to 5
						5 to 7
						7 to 4
						4 to 7
						7 to 3
						3 to 7
						7 to 2
						2 to 7
						7 to 1

- d) For each PDO transition, the Tester verifies a contract is established correctly and VBus is in valid range.

Sink Tests

TD.PD.SNK.E1. SinkWaitCapTimer Deadline

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.5.4.2#1

Description:

As Provider, the Tester verifies that the UUT accepts a Source Capabilities message sent at the deadline limit of tTypeCSinkWaitCap min (310 ms) or tSinkWaitCap min (2.1 s) after sourcing VBus.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester requests a HardReset, then turns Vbus off, then back on.
- c) The Tester sends a Source Capabilities message to the UUT at the deadline limit of tTypeCSinkWaitCap min (310 ms) on PHY BMC or tSinkWaitCap min (2.1 s) on PHY FSK. This delay is measured from the time VBus present to the last bit of Source Capabilities message EOP.
- d) The test passes if a GoodCRC is received.
- e) The test fails if a Hard Reset is detected when waiting the GoodCRC message.

TD.PD.SNK.E2. SinkWaitCapTimer Timeout

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.5.4.2#1, 6.5.4.2#2, 8.3.3.3.3#1

Description:

As Provider, the Tester intentionally does not send Source Capabilities message after cycling VBus, in order to force a SinkWaitCapTimer timeout on the UUT, then verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.

- b) The Tester requests a HardReset, then turns Vbus off, then back on.
- c) The Tester intentionally does not send Source Capabilities message after cycling VBus, in order to force a SinkWaitCapTimer timeout on the UUT.
- d) If a Hard Reset is detected within tTypeCSinkWaitCap min (310 ms) on PHY BMC or tSinkWaitCap min (2.1 s) on PHY FSK after VBus present, the test fails.
- e) If a Hard Reset is not detected after tTypeCSinkWaitCap max (620 ms) on PHY BMC or tSinkWaitCap min (2.5 s) on PHY FSK after VBus present, the test fails.

TD.PD.SNK.E3. Request Sent Timely

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.4.2#1, 6.4.2#3, 6.5.2#5, 8.3.3.3.3#2, 8.3.3.3.4#1, 8.3.3.3.4#2, 8.3.3.3.4#3, 8.3.3.3.5#1, 8.3.3.3.5#2

Description:

As Provider, the Tester verifies a Request message is received timely from the UUT after sending a Source Capabilities message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message.
- d) If a Request message is not received within tReceiverResponse max (15 ms), the test fails. This delay is measured from the time the last bit of Source Capabilities message EOP has been transmitted to the time the first bit of the Request message preamble has been received.

TD.PD.SNK.E4. Request Fields Checks

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.2.1.4#3, 6.4.2#2, 6.4.2#3, 6.4.2#4, 6.4.2#5, 6.4.2.1#1, 6.4.2.2#1, 6.4.2.3#1, 6.4.2.3#2, 6.4.2.3#3, 6.4.2.3#4, 6.4.2.3#5, 6.4.2.6#1, 6.4.2.6#3, 6.4.2.7#1, 6.4.2.7#2, 6.4.2.7#3, 6.4.2.7#5, 6.4.2.8#1, 6.4.2.8#2, 6.4.2.8#3, 8.3.3.3.1#2

Description:

As Provider, the Tester waits for a Request message from the UUT and verifies correct field values.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source_Capabilities message, in which the Specification Revision is set to Rev 2.0.
- d) Upon receipt of the Request message, the Tester verifies:
 1. Number of Data Objects field = 001b
 2. Message ID field = 001b
 3. Port Power Role field = 0b (Sink)
 4. Port Data Role field = 0b (UFP)
 5. Specification Revision field = 01b (Rev 2.0) or 10b (Rev 3.0) and is lower or equal to the Specification Revision in the Source_Capabilities message
 6. If Specification Revision is Rev 2.0
 - Bit 15 = 0b (Reserved)
 - Bit 4 = 0b (Reserved)
- e) For the Sink Request Data Object, the Tester verifies:
 1. Object position field is valid.
 2. The Operating Current/Power is less than or equal to the maximum current/power offered in the Source_Capabilities Message.
 3. If GiveBack flag is 0
 - The Maximum Operating Current/Power is larger than or equal to the Operating Current/Power.
 - If Capability Mismatch bit is 0, the Maximum Operating Current/Power is less than or equal to the maximum current/power offered in the Source_Capabilities Message.
 4. If GiveBack flag is 1, the Minimum Operating Current/Power is less than the Operating Current/Power.
 5. Bit 31 = 0b (Reserved)
 6. If Specification Revision is Rev 2.0
 - Bits 23..20 = 0000b (Reserved)
- f) The Tester simulates a disconnection and restart the test, but this time in step c) set the Specification Revision to Rev 3.0 and then Rev 4.0.

TD.PD.SNK.E5. SenderResponseTimer Deadline - Accept

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

8.3.3.3.5#3

Description:

As Provider, the Tester verifies that the UUT accepts an Accept message sent at the deadline limit of tSenderResponse min (24 ms) after the GoodCRC message in reply to the Request message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester sends an Accept message at the deadline limit of tSenderResponse min (24 ms) after the GoodCRC message. This delay is measured from the time the last bit of the GoodCRC message has been transmitted to the time the last bit of the Accept message has been transmitted.
- f) The test passes if a GoodCRC message corresponding to the Accept message is received.
- g) The test fails if a Hard Reset is detected while waiting for the GoodCRC message.

TD.PD.SNK.E6. SenderResponseTimer Timeout - Accept

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.5.2#1, 6.5.2#2, 6.5.2#3, 8.3.3.3.4#3, 8.3.3.3.5#3, 8.3.3.3.5#7

Description:

As Provider, the Tester intentionally does not send the Accept message in reply to the Request message from the UUT, in order to force a SenderResponseTimer timeout on the UUT and verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester intentionally does not send the Accept message in reply to the Request message from the UUT, in order to force a SenderResponseTimer timeout on the UUT.
- f) If a Hard Reset is not detected within 30 ms from the time the last bit of the GoodCRC message EOP has been sent, the test fails.
- g) If a Hard Reset is detected before 24 ms from the time the last bit of the GoodCRC message EOP has been sent, the test fails.

TD.PD.SNK.E7. PStTransitionTimer Deadline

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

8.3.3.3.5#4, 8.3.3.3.6#1

Description:

As Provider, the Tester verifies that the UUT accepts a PS_RDY message sent at the deadline limit of tPSTransition min (450 ms) after the Accept message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester sends an Accept message to the UUT.
- f) The Tester sends a PS_RDY message at the deadline limit of tPSTransition min (450 ms) after the Accept message. This delay is measured from the time the last bit of the Accept message has been transmitted to the time the last bit of the PS_RDY message has been transmitted.
- g) The test passes if a GoodCRC message corresponding to the PS_RDY message is received.
- h) The test fails if a Hard Reset is detected while waiting for the GoodCRC message.

TD.PD.SNK.E8. PStransitionTimer Timeout

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.5.6.1#1, 8.3.3.3.5#4, 8.3.3.3.6#1

Description:

As Provider, the Tester intentionally does not send the PS_RDY message after the Accept message is sent to the UUT, in order to force a PStransitionTimer timeout on the UUT and verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester sends an Accept message to the UUT.
- f) The Tester intentionally does not send the PS_RDY message after the Accept message, in order to force a PStransitionTimer timeout on the UUT.
- g) If a Hard Reset is not detected within 550 ms from the time the last bit of the Accept message EOP has been sent, the test fails.
- h) If a Hard Reset is detected before 450 ms from the time the last bit of the Accept message EOP has been sent, the test fails.

TD.PD.SNK.E9. GetSinkCap in Place of Accept

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.3.13#1, 6.3.13#5, 6.7.1#2, 6.7.1#5

Description:

As Provider, the Tester intentionally sends a GetSinkCap message in place of Accept message and verifies the UUT will send a SoftReset and recover from the error.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester sends a GetSinkCap message to the UUT.
- f) If a SoftReset is not received within 15 ms after the GetSinkCap EOP was sent, the test fails.
- g) If a SoftReset is received timely, the Tester replies with an Accept message.
- h) The Tester sends Source Capabilities message to the UUT repeatedly until nCapsCount reached or a GoodCRC is received. If nCapsCount reached, the test fails.
- i) If a Request is not received timely within 30 ms after the GoodCRC EOP corresponding to Source Capabilities message was received, the test fails.

TD.PD.SNK.E10. GetSinkCap in Place of PS_RDY

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.3.13#1, 6.3.13#5, 6.7.1#2, 6.7.1#5

Description:

As Provider, the Tester intentionally sends a GetSinkCap message in place of PS_RDY message and verifies the UUT will send a Hard Reset.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester cycles VBus.
- c) The Tester sends a Source Capabilities message to the UUT.
- d) Upon receipt of a Request message from the UUT, the Tester replies with a GoodCRC message.
- e) The Tester sends an Accept message to the UUT.
- f) The Tester sends a GetSinkCap message to the UUT.
- g) If a Hard Reset is not received within 15 ms after the GetSinkCap EOP was sent, the test fails.

TD.PD.SNK.E11. PDO Transition - Deprecated

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

6.4.2#3, 7.3.6#1, 7.3.6#2, 7.3.6#3, 7.3.6#6, 7.3.8#1, 7.3.8#2, 7.3.8#3, 7.3.8#5

Description:

As Provider, the Tester verifies the UUT does PDO transitions correctly when the Tester changes its Source Capabilities.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- The Tester sends a Source Capabilities message, which only has one fixed PDO 5V 0.1A, to the UUT.
- The Tester verifies the UUT correctly sets up a contract with the Tester.
- The Tester gets Sink Capabilities of the UUT, and records the maximum voltage requested as *X*.
- If the maximum voltage requested is 5V, the Tester changes its Capabilities to one fixed PDO 5V 5A; otherwise, the Tester changes its Capabilities to two fixed PDOs, 5V 0A and XV 5A, and sends a new Source Capabilities message to the UUT.
- The Tester verifies the UUT correctly requests the 5A PDO and sets up a contract with the Tester.
- The Tester changes its Capabilities to one fixed PDO 5V 0A, and sends a new Source Capabilities message to the UUT.
- The Tester verifies the UUT correctly requests PDO 1 and 0A, and sets up a contract with the Tester.
- The Tester verifies the UUT draws no more than 25mW after the contract was set up.

TD.PD.SNK.E12. Compatibility with PD3 Source

Applicable to:

- PHY: BMC, FSK
- UUT: UFP

Assertions Tested:

Description:

As Provider, the Tester verifies the UUT request a fixed PDO when the Tester sends a Source Capabilities message as PD3 and includes PPS APDOs.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role a) to d).
- b) The Tester sends a Source Capabilities message to the UUT until it gets a GoodCRC from the UUT. In the Source Capabilities message, the Specification Revision is set to Revision 3 and 4 PDOs, 5V/9V 3A fixed PDOs and 5V/9V 3A PPS APDOs, are included.
- c) Upon receipt of the Request message, if the Specification Revision is not Revision 2, the test is not applicable and stops here.
- d) The Tester verifies the UUT requests one of the fixed PDOs.

Provider / Consumer Tests

TD.PD.PC.E1. tSrcTransition Check - Deprecated

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

8.3.3.6.3.1.3#1, 8.3.3.6.3.1.3#2, 8.3.3.6.3.1.4#1, 8.3.3.6.3.1.7#7

Description:

Initially as Consumer (UFP), the Tester verifies the UUT waiting properly before turning off VBus after a PR_Swap accepted.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- As consumer, the Tester establishes a contract with the UUT.
- If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- If a Wait message is received, **after the Tester replied the UUT's Get_Source_Cap message with a Source Capabilities message**, send PR_Swap again.
- Upon receipt of Accept message, the tester replies with a GoodCRC.
- The test fails if VBus transition begins before tSrcTransition min (25 ms). If PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it's measured from the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.
- The test fails if VBus transition is not started after rSrcTransition max (35 ms). If PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it's measured from the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.

TD.PD.PC.E2. PS_RDY Sent Timely

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

8.3.3.6.3.1.5#1, 8.3.3.6.3.1.5#2, 8.3.3.6.3.1.6#1

Description:

Initially as Consumer (UFP), the Tester verifies the UUT send PS_RDY timely after a PR_Swap accepted.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As consumer, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Wait message is received, [after the Tester replied the UUT's Get_Source_Cap message with a Source Capabilities message](#), send PR_Swap again.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.
- f) The test fails if PS_RDY is not received within tPSSourceOff min (750 ms). If PR_Swap has been sent by the UUT, this delay is measured from the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was received; otherwise, it is measured from the time last bit of the EOP of the Accept Message was received.
- g) If VBus is not turned off when PS_RDY is received, the test fails.
- h) If the UUT is not asserting Rd when PS_RDY is received, the test fails.

TD.PD.PC.E3. [PSSourceOnTimer Deadline](#)

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

6.5.6.3#1, 8.3.3.6.3.1.6#2

Description:

Initially as Consumer (UFP), after a PR_Swap accepted, the Tester sends PS_RDY at the deadline limit of tPSSourceOn min (390 ms) and verifies the UUT accept this message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As consumer, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500_ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Wait message is received, [after the Tester replied the UUT's Get_Source_Cap message with a Source Capabilities message](#), send PR_Swap again.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.
- f) Upon receipt of PS_RDY message, the tester replies with a GoodCRC.

- g) The Tester sends a PS_RDY at the deadline limit of tPSSourceOn min (390 ms) after the time the last bit of the EOP of the GoodCRC Message corresponding to the received PS_RDY Message was sent.
- h) The test passes if a GoodCRC is received.
- i) The test fails if a Hard Reset is detected when waiting the GoodCRC message.

TD.PD.PC.E4. PSSourceOnTimer Timeout

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

6.5.6.3#1, 8.3.3.6.3.1.6#2, 8.3.3.6.3.1.6#5

Description:

Initially as Consumer (UFP), after a PR_Swap accepted, the Tester intentionally does not send PS_RDY, in order to force a PSSourceOnTimer timeout on the UUT and verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As consumer, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500_ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Wait message is received, [after the Tester replied the UUT's Get_Source_Cap message](#) with a Source Capabilities message, send PR_Swap again.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.
- f) Upon receipt of PS_RDY message, the tester replies with a GoodCRC.
- g) The Tester intentionally does not send PS_RDY, in order to force a PSSourceOnTimer timeout on the UUT.
- h) If a Hard Reset is detected within tPSSourceOn min (390 ms) after the time the last bit of the EOP of the GoodCRC Message corresponding to the received PS_RDY Message was sent, the test fails.
- i) If a Hard Reset is not detected after tPSSourceOn max (480 ms) after the time the last bit of the EOP of the GoodCRC Message corresponding to the received PS_RDY Message was sent, the test fails.

TD.PD.PC.E5. tSwapSinkReady Check

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

6.5.9.2#3

Description:

Initially as Consumer (UFP), after a PR_Swap accepted, the Tester verifies the new Consumer (UUT) is ready to receive Source Capabilities message tSwapSinkReady max (15 ms) after having sent the last bit of the EOP of GoodCRC Message sent in response to the PS_RDY Message sent by the Tester indicating that its power supply is ready.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- As consumer, the Tester establishes a contract with the UUT.
- If the UUT issues a PR_Swap within 500_ms, accept it; otherwise, send a PR_Swap to the UUT.
- If a Wait message is received, [after the Tester replied the UUT's Get_Source_Cap](#) message with a Source Capabilities message, send PR_Swap again.
- Upon receipt of Accept message, the tester replies with a GoodCRC.
- Upon receipt of PS_RDY message, the tester replies with a GoodCRC.
- The Tester sends a PS_RDY to the UUT.
- The Tester sends a Source Capabilities message to the UUT tSwapSinkReady max (15 ms) after having received the last bit of the EOP of GoodCRC Message sent in response to the PS_RDY Message sent by the Tester.
- If a GoodCRC is not received, the test fails.

TD.PD.PC.E6. Externally Powered Bit Usage

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

8.2.6.2#2

Description:

Initially as Consumer (UFP), the Tester verifies that the UUT correctly checks the externally powered bit in the Source Capabilities message after receiving a PR_Swap.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As consumer, the Tester establishes a contract with the UUT.
- c) If the externally powered bit is not set in the Source Capabilities message sent by the UUT, the test is not applicable.
- d) If a Get_Sink_Cap message is received, the Tester replies with a Sink Capabilities message with externally powered bit cleared.
- e) If the UUT issues a PR_Swap within 500 ms, the test fails.
- f) The Tester sends a PR_Swap to the UUT.
- g) If a Get_Sink_Cap message was received, go to step I).
- h) If a Wait message is not received from the UUT, the test fails.
- i) If a Get_Source_Cap message is not received timely, the test fails.
- j) Upon receipt of the Get_Source_Cap message, the Tester replies with a Source Capabilities message with externally powered bit cleared.
- k) The Tester sends a PR_Swap a second time.
- l) If a Reject message is not received timely, the test fails.

TD.PD.PC.E7. PDO Transition After PR_Swap - Deprecated

Applicable to:

- PHY: BMC
- UUT: DRP, Provider/Consumer

Assertions Tested:

6.4.2#3, 7.3.6#1, 7.3.6#2, 7.3.6#3, 7.3.6#6, 7.3.8#1, 7.3.8#2, 7.3.8#3, 7.3.8#5

Description:

Initially as Consumer (UFP), after a PR_Swap accepted, the Tester verifies the UUT performs PDO transition correctly when the Tester changes its Source Capabilities.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As consumer, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500_ms, accept it; otherwise, send a PR_Swap to the UUT.

- d) If a Wait message is received, *after the Tester replied the UUT's Get_Source_Cap message with a Source Capabilities message*, send PR_Swap again.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.
- f) Upon receipt of PS_RDY message, the tester replies with a GoodCRC.
- g) The Tester sends a PS_RDY to the UUT.
- h) The Tester set up a contract with the UUT as a source.
- i) The Tester gets Sink Capabilities of the UUT, and records the maximum voltage requested as X.
- j) If the maximum voltage requested is 5V, the Tester changes its Capabilities to one fixed PDO 5V 5A; otherwise, the Tester changes its Capabilities to two fixed PDOs, 5V 0A and XV 5A, and sends a new Source Capabilities message to the UUT.
- k) The Tester verifies the UUT correctly requests the 5A PDO and sets up a contract with the Tester.
- l) The Tester changes its Capabilities to one fixed PDO 5V 0A, and sends a new Source Capabilities message to the UUT.
- m) The Tester verifies the UUT correctly requests PDO 1 and 0A, and sets up a contract with the Tester.
- n) The Tester verifies the UUT draws no more than 25mW after the contract was set up.

Consumer / Provider Tests

TD.PD.CP.E1. PSSourceOffTimer Deadline

Applicable to:

- PHY: BMC
- UUT: DRP, Consumer/Provider

Assertions Tested:

6.5.6.2#1a, 6.5.6.2#1b

Description:

Initially as Provider (DFP), after a PR_Swap, the Tester sends PS_RDY at the deadline limit of tPSSourceOff min (750 ms) and verifies the UUT accept this message.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- As Provider, the Tester establishes a contract with the UUT.
- If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- If a Reject message is received, the test is not applicable.
- Upon receipt of Accept message, the tester replies with a GoodCRC.
- The Tester sends a PS_RDY at the deadline limit of tPSSourceOff min (750 ms). If the PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it is measured from the time the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.
- The test passes if a GoodCRC is received.
- The test fails if a Hard Reset is detected when waiting the GoodCRC message.

TD.PD.CP.E2. PSSourceOffTimer Timeout

Applicable to:

- PHY: BMC
- UUT: DRP, Consumer/Provider

Assertions Tested:

6.5.6.2#1a, 6.5.6.2#1b, 6.5.6.2#3, 8.3.3.6.3.2.3#1, 8.3.3.6.3.2.3#2, 8.3.3.6.3.2.4#1, 8.3.3.6.3.2.4#2, 8.3.3.6.3.2.7#1, 8.3.3.6.3.2.7#6

Description:

Initially as Provider (DFP), after a PR_Swap, the Tester intentionally does not send PS_RDY, in order to force a PSSourceOffTimer timeout on the UUT and verifies it is correctly implemented.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As Provider, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Reject message is received, the test is not applicable.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.
- f) The Tester intentionally does not send PS_RDY, in order to force a PSSourceOffTimer timeout on the UUT.
- g) The test fails if a Hard Reset is detected within tPSSourceOff min (750 ms). If the PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it is measured from the time the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.
- h) The test fails if a Hard Reset is not detected after tPSSourceOff max (920 ms). If the PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it is measured from the time the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.

TD.PD.CP.E3. PS_RDY Sent Timely

Applicable to:

- PHY: BMC
- UUT: DRP, Consumer/Provider

Assertions Tested:

8.3.3.6.3.1.5#1, 8.3.3.6.3.1.5#2, 8.3.3.6.3.2.6#1, 8.3.3.6.3.2.6#3, 8.3.3.6.3.2.6#4

Description:

Initially as Provider (DFP), after a PR_Swap, the Tester verifies the UUT sends PS_RDY before tPSSourceOn min and is in correct state.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As Provider, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Reject message is received, the test is not applicable.
- e) Upon receipt of Accept message, the tester replies with a GoodCRC.

- f) The Tester disables VBus, presents Rd and sends PS_RDY to the UUT.
- g) If a GoodCRC is not received timely, the test fails
- h) The test fails if the PS_RDY is not received after tPSSourceOn min (390 ms). If the PR_Swap has been sent by the UUT, this delay is measured from the time the last bit of the EOP of the Accept Message was sent; otherwise, it is measured from the time the last bit of the EOP of the GoodCRC Message corresponding to the Accept Message was sent.
- i) The test fails if VBus is not supplied when PS_RDY received.
- j) The test fails if the UUT is not presenting Rp, Rp-1.5A or Pp-3.0A.

TD.PD.CP.E4. SwapSourceStartTimer Timeout

Applicable to:

- PHY: BMC
- UUT: DRP, Consumer/Provider

Assertions Tested:

6.5.9.2#1, 6.5.9.2#2, 8.3.3.2.1#4

Description:

Initially as Provider (DFP), after a PR_Swap, the Tester verifies the new Provider (UUT) waits properly before sending the Source Capabilities message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As Provider, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Reject message is received, the test is not applicable.
- e) Upon receipt of Accept message, the Tester replies with a GoodCRC.
- f) The Tester sends a PS_RDY message to the UUT.
- g) Upon receipt of the PS_RDY message from the UUT, the Tester replies with a GoodCRC.
- h) If a Source Capabilities message is received from the UUT within tSwapSourceStart min (20 ms) from the time the last bit of GoodCRC corresponding to the RS_RDY message sent by the UUT was sent, the test fails.

TD.PD.CP.E5. PDO Transition After PR_Swap

Applicable to:

- PHY: BMC
- UUT: DRP, Consumer/Provider

Assertions Tested:

6.3.3#1, 8.3.3.2.4#1, 8.3.3.2.4#2, 8.3.3.2.4#3, 8.3.3.2.5#1, 8.3.3.2.5#2, 8.3.3.2.5#3, 8.3.3.2.5#4

Description:

Initially as Provider (DFP), after a PR_Swap, the Tester enumerates all possible transitions among the PDOs of the UUT, and verifies the UUT performs PDO transitions correctly.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) As Provider, the Tester establishes a contract with the UUT.
- c) If the UUT issues a PR_Swap within 500 ms, accept it; otherwise, send a PR_Swap to the UUT.
- d) If a Reject message is received, the test is not applicable.
- e) Upon receipt of Accept message, the Tester replies with a GoodCRC.
- f) The Tester sends a PS_RDY message to the UUT.
- g) Upon receipt the PS_RDY message from the UUT, the Tester replies with a GoodCRC.
- h) Upon receipt of the Source Capabilities message from the UUT, the Tester replies with a GoodCRC message.
- i) The Tester enumerates all possible PDO transitions among the PDOs of the UUT per the following table.

Number of PDOs in Capabilities Message						
1	2	3	4	5	6	7
1 to 1*	1 to 2	1 to 2	1 to 2	1 to 2	1 to 2	1 to 2
	2 to 1	2 to 1	2 to 1	2 to 1	2 to 1	2 to 1
		1 to 3	1 to 3	1 to 3	1 to 3	1 to 3
		3 to 2	3 to 2	3 to 2	3 to 2	3 to 2
		2 to 3	2 to 3	2 to 3	2 to 3	2 to 3
		3 to 1	3 to 1	3 to 1	3 to 1	3 to 1
			1 to 4	1 to 4	1 to 4	1 to 4
			4 to 3	4 to 3	4 to 3	4 to 3
			3 to 4	3 to 4	3 to 4	3 to 4
			4 to 2	4 to 2	4 to 2	4 to 2
			2 to 4	2 to 4	2 to 4	2 to 4
			4 to 1	4 to 1	4 to 1	4 to 1
				1 to 5	1 to 5	1 to 5
				5 to 4	5 to 4	5 to 4
				4 to 5	4 to 5	4 to 5
				5 to 3	5 to 3	5 to 3
				3 to 5	3 to 5	3 to 5

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				5 to 2	5 to 2	5 to 2
				2 to 5	2 to 5	2 to 5
				5 to 1	5 to 1	5 to 1
					1 to 6	1 to 6
					6 to 5	6 to 5
					5 to 6	5 to 6
					6 to 4	6 to 4
					4 to 6	4 to 6
					6 to 3	6 to 3
					3 to 6	3 to 6
					6 to 2	6 to 2
					2 to 6	2 to 6
					6 to 1	6 to 1
						1 to 7
						7 to 6
						6 to 7
						7 to 5
						5 to 7
						7 to 4
						4 to 7
						7 to 3
						3 to 7
						7 to 2
						2 to 7
						7 to 1

- j) The Tester verifies each time a contract is established correctly and the voltage of VBus is in valid range.

VDM Tests for UFPs and Cables

TD.PD.VDMU.E1. Fields Checks - Discover Identity

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4#7, 6.4.4.2#8, 6.4.4.2#9, 6.4.4.2#10, 6.4.4.2#11, 6.4.4.2#12, 6.4.4.2#13, 6.4.4.2.1#1, 6.4.4.2.2#1, 6.4.4.2.3#1, 6.4.4.2.4#5, 6.4.4.2.5#1, 6.4.4.2.5#3, 6.4.4.2.6#1, 6.4.4.3.1#3, 6.4.4.3.1#4, 6.4.4.3.1#5, 6.4.4.3.1#6, 6.4.4.3.1#7, 6.4.4.3.1#8, 6.4.4.3.1.1#1, 6.4.4.3.1.1#4, 6.4.4.3.1.7#2, 8.3.3.8.1.1#1, 8.3.3.8.1.1#2, 8.3.3.8.1.1#3, 8.3.3.8.1.2#1, 8.3.3.8.1.2#2, 8.3.3.8.1.3#1, 8.3.3.8.1.3#2

Description:

This test verifies that the UUT responds with a correctly formed message to a Discover Identity from the Tester.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends Discover Identity.
- c) The test is non-relevant if NAK is received, or if no response is received.
- d) Wait for the Discover Identity ACK and verify the following in the VDM Header (VDO #1):
 1. SVID = 0xFF00 (PD SID)
 2. VDM Type = 1b (Structured VDM)
 3. Structured VDM Version = 00b (Version 1.0)
 4. Bits 11-12 are 0 (reserved).
 5. Object Position = 000b
 6. Command Type = 01b (ACK)
 7. Bit 5 is 0 (reserved).
 8. Command = 0001b (Discover Identity).
- e) The test fails if any of these checks are invalid.
- f) The test fails if the Product Type declared in the ID Header (VDO #2) is Reserved (6 or 7).
- g) The test fails if the Product Type declared in the ID Header (VDO #2) is Hub (1) or Peripheral (2) and the Number of Data Objects is not exactly 4.
- h) The test fails if the Product Type declared in the ID Header (VDO #2) is Passive Cable (3), Active Cable (4) or AMA (5) and the Number of Data Objects is not exactly 5.

TD.PD.VDMU.E2. Fields Checks - Discover SVIDs

Applicable to:

- PHY: BMC
- UUT: Cable

Assertions Tested:

6.4.4.3.2#1, 6.4.4.3.2#4, 6.4.4.3.2#5, 6.4.4.3.2#6, 8.3.3.8.2.1#1, 8.3.3.8.2.1#2, 8.3.3.8.2.1#3, 8.3.3.8.2.2#1, 8.3.3.8.2.2#2, 8.3.3.8.2.3#1, 8.3.3.8.2.3#2, 8.3.3.10.2.2#1, 8.3.3.10.2.2#2, 8.3.3.10.2.3#1, 8.3.3.10.2.3#2, 8.3.3.10.11.1#5

Description:

This test verifies that the UUT responds a correctly formed message to a Discover SVIDs.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is non-relevant if modal operation is not supported, if NAK is received, or if no response is received.
- d) The Tester sends a Discover SVIDs command to the UUT.
- e) The Tester verifies the following header fields:
 1. SVID (Bits 31-16) = PD SID (0xFF00)
 2. VDM Type (Bit 15) = Structured VDM (1b)
 3. Structured VDM Version (Bits 14-13) = Version 1.0 (00b)
 4. Bits 12-11 are zero (Reserved)
 5. Object Position (Bits 10-8) = 000b
 6. Command Type (Bits 7-6) = ACK (01b)
 7. Bit 5 is zero (Reserved)
 8. Command (Bits 4-0) = Discover SVIDs (00010b)
- f) If an ODD number of SVIDs are indicated:
 1. The Tester verifies the last half of the last SVID VDO = 0x0000.
 2. The Tester verifies the first half of the last SVID VDO \neq 0x0000.
- g) If an EVEN number of SVIDs are indicated:
 1. The Tester verifies both halves of the last SVID VDO = 0x0000.

TD.PD.VDMU.E3. Fields Checks - Discover Modes

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.3#1, 6.4.4.3.3#2, 8.3.3.8.3.1#1, 8.3.3.8.3.1#2, 8.3.3.8.3.1#3, 8.3.3.8.3.2#1, 8.3.3.8.3.2#2, 8.3.3.8.3.3#1, 8.3.3.8.3.3#2

Description:

This test verifies that the UUT responds a correctly formed message to a Discover Modes request from the Tester.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is non-relevant if modal operation is not supported, if NAK is received, or if no response is received.
- d) The Tester executes a Discover SVIDs exchange.
- e) The Tester executes a Discover Modes message for each listed SVID.
- f) The Tester verifies the following header fields:
 1. SVID (Bits 31-16) = The SVID specified in Discover Modes message.
 2. VDM Type (Bit 15) = Structured VDM (1b)
 3. Structured VDM Version (Bits 14-13) = Version 1.0 (00b)
 4. Bits 12-11 are zero (Reserved)
 5. Object Position (Bits 10-8) = 000b
 6. Command Type (Bits 7-6) = ACK (01b)
 7. Bit 5 is zero (Reserved)
 8. Command (Bits 4-0) = Discover Modes (00011b)
- g) The Tester verifies that the correct Number of Data Objects are returned.
- h) Repeat the Discover Modes command for every listed SVIDs.

TD.PD.VDMU.E4. [Fields Checks - Enter Mode](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.4#1, 6.4.4.3.4#2, 6.4.4.3.4#3, 6.4.4.3.4#4, 6.4.4.3.4#8, 6.4.4.3.4#9, 8.3.3.8.4.1#1, 8.3.3.8.4.1#2, 8.3.3.8.4.1#3, 8.3.3.8.4.2#1, 8.3.3.8.4.2#2, 8.3.3.8.4.3#1, 8.3.3.8.4.3#2

Description:

This test verifies that the UUT responds with a correctly formed message to an Enter Mode commande from the Tester.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is non-relevant if modal operation is not supported, if NAK is received, or if no response is received.
- d) The Tester executes a Discover SVIDs exchange.
- e) The Tester executes an Enter Mode for the first listed SVID for Mode 1.
- f) The Tester verifies the following header fields:
 1. SVID (Bits 31-16) = The SVID specified in Enter Mode message.
 2. VDM Type (Bit 15) = Structured VDM (1b)
 3. Structured VDM Version (Bits 14-13) = Version 1.0 (00b)
 4. Bits 12-11 are zero (Reserved)
 5. Object Position (Bits 10-8) = 001b
 6. Command Type (Bits 7-6) = ACK (01b) or NAK (10b)
 7. Bit 5 is zero (Reserved)
 8. Command (Bits 4-0) = Enter Mode (00100b)

TD.PD.VDMU.E5. [Fields Checks - Exit Mode](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.5#1, 6.4.4.3.5#3, 8.3.3.8.5.1#1, 8.3.3.8.5.1#2, 8.3.3.8.5.1#3, 8.3.3.8.5.2#1, 8.3.3.8.5.2#2, 8.3.3.8.5.3#1, 8.3.3.8.5.3#2

Description:

This test verifies that the UUT responds with a correctly formed message to an Exit Mode command from the Tester.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is non-relevant if modal operation is not supported, if NAK is received, or if no response is received.
- d) The Tester executes a Discover SVIDs exchange.
- e) The Tester executes an Exit Mode for the first listed SVID for Mode 1.
- f) The Tester verifies the following header fields:
 1. SVID (Bits 31-16) = The SVID specified in Exit Mode message.
 2. VDM Type (Bit 15) = Structured VDM (1b)
 3. Structured VDM Version (Bits 14-13) = Version 1.0 (00b)
 4. Bits 12-11 are zero (Reserved)
 5. Object Position (Bits 10-8) = 001b
 6. Command Type (Bits 7-6) = NAK (10b)
 7. Bit 5 is zero (Reserved)
 8. Command (Bits 4-0) = Exit Mode (00101b)

TD.PD.VDMU.E6. [tVDMReceiverResponse - Discover Identity](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.4#1, 6.5.11.1#6, 6.5.11.1#7, 6.6.7#1, 6.6.7#2, 6.6.7#3

Description:

This test verifies that the UUT responds timely to a Discover Identity within tVDMReceiverResponse (15 ms).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends Discover Identity.
- c) The test is inconclusive if no answer is received within tVDMReceiverResponse (15 ms) while testing a UFP, and fails in the case of a Cable UUT.
- d) If BUSY is received, the Tester resends the command up to nBusyCount (5) times with a delay of tVDMBusy (50 ms).
- e) The Tester verifies:
 1. If the UUT is Cable, it shall reply ACK.
 2. If the UUT is UFP, it shall reply ACK or NAK. The test ends if no reply is received.
- f) Repeat the command 100 times.

TD.PD.VDMU.E7. [tVDMReceiverResponse - Discover SVIDs](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.4#1, 6.5.11.1#6, 6.5.11.1#7, 6.6.7#1, 6.6.7#2, 6.6.7#3

Description:

This test verifies that the UUT responds timely to a Discover SVIDs message within tVDMReceiverResponse (15 ms).

The value of the Modal Operation field in the response to the Tester's Discover ID message is used to determine the proper use of ACK and NAK responses to the Discover SVID message.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester sends a Discover SVIDs command.
- e) The test fails if no answer is received within tVDMReceiverResponse (15 ms).
- f) If BUSY is received, the Tester resends the command up to nBusyCount (5) times with a delay of tVDMBusy (50 ms).

- g) The Tester verifies:
 - 1. If the UUT doesn't support modal operation, it shall reply NAK.
 - 2. If the UUT supports modal operation, it shall reply ACK.
- h) Repeat the command 100 times.

TD.PD.VDMU.E8. [tVDMReceiverResponse - Discover Modes](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.4#1, 6.5.11.1#6, 6.5.11.1#7, 6.6.7#1, 6.6.7#2, 6.6.7#3

Description:

This test verifies that the UUT responds timely to a Discover Modes message within tVDMReceiverResponse (15 ms).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester executes a Discover SVIDs exchange.
- e) The test is inconclusive if no reply is received timely.
- f) The Tester sends a Discover Modes command for each listed SVID if any, or 0xFF00 otherwise.
- g) The test fails if no answer is received within tVDMReceiverResponse (15 ms).
- h) If BUSY is received, the Tester resends the command up to nBusyCount (5) times with a delay of tVDMBusy (50 ms).
- i) The Tester verifies:
 - 1. If the UUT doesn't support modal operation, it shall reply NAK.
 - 2. If the UUT supports modal operation, it shall reply ACK.
- j) Repeat the command 10 times.

TD.PD.VDMU.E9. [tVDMReceiverResponse - Enter and Exit Mode](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.4#1, 6.5.11.1#6, 6.5.11.1#7, 6.6.7#1, 6.6.7#2, 6.6.7#3

Description:

This test verifies that the UUT responds appropriately to Enter Mode and Exit Mode messages, within tVDMReceiverResponse (15 ms).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester executes a Discover SVIDs exchange.
- e) The test is inconclusive if no reply is received timely.
- f) The Tester sends an Enter Mode message for every possible mode from 0 to 7 for each declared SVIDs, or 0xFF00 otherwise.
 1. The Tester verifies the UUT responds with ACK or NAK within tVDMReceiverResponse (15 ms). There is an exception though for mode 7 that must be NAKed.
 2. The test fails if the UUT responds with BUSY.
- g) The Tester sends an Exit Mode message using the same SVID and mode as Enter Mode above.
 1. The Tester verifies the UUT responds with an ACK within tVDMReceiverResponse (15 ms) if the Enter Mode was previously ACKed, or NAK otherwise. There is an exception though for mode 7 that shall either be ACKed or NAKed independently of the Enter Mode response.
 2. The test fails if the UUT responds with BUSY.
- h) Repeat the commands 10 times.

TD.PD.VDMU.E10. [Incorrect SVID - Discover Identity](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.2#5, 6.4.4.2#6, 6.4.4.2.5#4

Description:

This test verifies that the UUT responds appropriately to a Discovery Identity that replaces the normal SVID of PD SID (0xFF00) with an invalid SVID of 0xEEEE.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends Discover Identity with SVID = 0xEEEE.
- c) The Tester verifies:
 1. The UUT sends a GoodCrc in response to the message.
 2. The UUT replies Discover Identity NAK, or alternatively, ignores the message (beyond the GoodCrc response).
 3. If the UUT responds with NAK, the SVID must be set to the same SVID sent by the Tester.

TD.PD.VDMU.E11. [Incorrect SVID - Discover SVIDs](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.2#5, 6.4.4.2#6, 6.4.4.2.5#4

Description:

This test verifies that the UUT responds appropriately to a Discover SVIDs command that replaces the normal SVID of PD SID (0xFF00) with an invalid SVID of 0xEEEE.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends a Discover SVIDs command to the UUT with SVID = 0xFF00.
- c) The Tester verifies the UUT responds with NAK within tVDMReceiverResponse (15 ms), or alternatively, ignores the message (beyond the GoodCrc response).
- d) If the UUT responds with NAK, the SVID must be set to the same SVID sent by the Tester.

TD.PD.VDMU.E12. [Incorrect SVID - Discover Modes](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.2#5, 6.4.4.2#6, 6.4.4.2.5#4

Description:

This test verifies that the UUT responds appropriately to a Discover Modes command for a non-declared SVID.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester sends a Discover Modes command to the UUT with SVID = 0xFF00.
- e) The Tester verifies the UUT responds with NAK within tVDMReceiverResponse (15 ms). The UUT is also allowed to ignore the message if modal operation is not supported.
- f) If the UUT responds with NAK, the SVID must be set to the same SVID sent by the Tester.

TD.PD.VDMU.E13. [Incorrect SVID - Enter Mode](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.2#5, 6.4.4.2#6, 6.4.4.2.5#4, 6.4.4.3.4#8

Description:

This test verifies that the UUT responds appropriately to Enter Mode command when the SVID is unknown, within tVDMReceiverResponse (15 ms).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.

- d) The Tester sends an Enter Mode message to the UUT using 0xFF00 as SVID.
- e) The Tester verifies the UUT responds with NAK within tVDMReceiverResponse (15 ms). The UUT may also ignore the message if non-modal.
- f) If the UUT responds with NAK, the SVID must be set to the same SVID and Object Position sent by the Tester.

TD.PD.VDMU.E14. [Incorrect SVID - Exit Mode](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.2#5, 6.4.4.2#6, 6.4.4.2.5#4, 6.4.4.3.5#6

Description:

This test verifies that the UUT responds appropriately to Exit Mode command when the SVID is unknown, within tVDMReceiverResponse (15 ms).

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester sends an Exit Mode message using 0xFF00 as SVID.
- e) The Tester verifies the UUT responds with NAK within tVDMReceiverResponse (15 ms). The UUT may also ignore the message if non-modal.
- f) If the UUT responds with NAK, the SVID must be set to the same SVID and Object Position sent by the Tester.

TD.PD.VDMU.E15. [Applicability](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.9#1, 6.9#2, 6.9#3, 6.9#4, 6.9#5, 6.9#6, 6.9#7, 6.9#0, 6.9#13, 6.9#14, 6.9#16, 6.9#17

Description:

This test verifies that the UUT responds appropriately to valid VDM commands.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester sends Discover Identity.
- c) The Tester verifies:
 1. If the UUT is Cable, it shall reply ACK timely.
 2. If the UUT is UFP, it shall reply ACK or NAK timely. The test ends if no reply is received.
- d) The Tester sends Discover SVIDs.
- e) The Tester verifies:
 1. If the UUT doesn't support modal operation, it shall reply NAK timely.
 2. If the UUT supports modal operation, it shall reply ACK timely.
- f) The Tester sends Discover Modes for each listed SVIDs if any, or with 0xFF00 otherwise.
- g) The Tester verifies:
 1. If the UUT doesn't support modal operation, it shall reply NAK timely.
 2. If the UUT supports modal operation, it shall reply ACK timely.
- h) The Tester sends Enter Mode for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.
- i) The Tester verifies:
 1. The UUT shall reply NAK timely.
- j) The Tester sends Exit Mode for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.
- k) The Tester verifies:
 1. The UUT shall reply NAK timely, with the exception of mode 7 that can either be ACKed or NAKed.

TD.PD.VDMU.E16. [Interruption by PD Command](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4#10, 6.4.4.5#1, 6.4.4.5#2, 6.4.4.5#3, 6.4.4.5#4, 6.4.4.5#5, 6.4.4.5#6, 6.4.4.5#7

Description:

This test verifies that the UUT correctly supports intermingled PD messages during VDM exchanges as described in 6.4.4.5.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a valid Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester sends Discover Identity packet.
- e) The Tester waits for the related GoodCrc.
- f) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a SOP GetSinkCap packet and handles the procedure if the UUT is a UFP (no response is expected when testing a Cable).
- g) The Tester verifies:
 1. If the UUT is Cable, it shall reply ACK timely.
 2. If the UUT is UFP, the test fails if Soft Reset or Hard Reset is received.
- h) The Tester sends Discover SVIDs packet.
- i) The Tester waits for the related GoodCrc.
- j) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a SOP GetSinkCap packet and handles the procedure if the UUT is a UFP (no response is expected when testing a Cable).
- k) The Tester verifies:
 1. If the UUT is Cable, it shall reply ACK or NAK timely.
 2. If the UUT is UFP, the test fails if Soft Reset or Hard Reset is received.
- l) The Tester sends Discover Modes packet for each listed SVIDs if any, or with 0xFF00 otherwise.
- m) The Tester waits for the related GoodCrc.
- n) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a SOP GetSinkCap packet and handles the procedure if the UUT is a UFP (no response is expected when testing a Cable).
- o) The Tester verifies:
 1. If the UUT is Cable, it shall reply ACK or NAK timely.
 2. If the UUT is UFP, the test fails if Soft Reset or Hard Reset is received.
- p) The Tester sends Enter Mode packet for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.
- a) The Tester waits for the related GoodCrc.
- b) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a SOP GetSinkCap packet and handles the procedure if the UUT is a UFP (no response is expected when testing a Cable).
- c) The Tester verifies:
 1. If the UUT is Cable, it shall reply NAK timely.
 2. If the UUT is UFP, the test fails if Soft Reset or Hard Reset is received.
- d) The Tester sends Exit Mode packet for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.

- e) The Tester waits for the related GoodCrc.
- f) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a SOP GetSinkCap packet and handles the procedure if the UUT is a UFP (no response is expected when testing a Cable).
- g) The Tester verifies:
 - 1. If the UUT is Cable, it shall reply NAK timely.
 - 2. If the UUT is UFP, the test fails if Soft Reset or Hard Reset is received.

TD.PD.VDMU.E17. [Interruption by VDM Command](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4#9, 6.4.4.5#7

Description:

This test verifies that the UUT correctly aborts an ongoing VDM exchange if it is aborted by another VDM command.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a valid Discover Identity exchange.
- c) The test is inconclusive if no reply is received timely.
- d) The Tester sends Discover Identity packet and waits for the related GoodCrc.
- e) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a Discover SVIDs packet and wait for GoodCrc as well as the response.
- f) The Tester waits for the Discover SVIDs ACK. The test fails if Discover Identity ACK is received.
- g) The Tester sends Discover SVIDs packet and waits for the related GoodCrc.
- h) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a Discover Identity packet and wait for GoodCrc as well as the response.
- i) The Tester waits for the Discover Identity ACK. The test fails if Discover SVIDs ACK is received.
- j) The Tester sends Discover Modes packet for each listed SVIDs if any, or with 0xFF00 otherwise.
- k) The Tester waits for the related GoodCrc.
- l) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a Discover Identity packet and wait for GoodCrc as well as the response.
- m) The Tester waits for the Discover Identity ACK. The test fails if Discover Modes ACK is received.

- n) The Tester executes a valid Discover Modes exchange for each listed SVIDs if any, or with 0xFF00 otherwise.
- o) The Tester sends Enter Mode packet for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.
- p) The Tester waits for the related GoodCrc.
- q) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a Discover Identity packet and wait for GoodCrc as well as the response.
- r) The Tester waits for the Discover Identity ACK. The test fails if Enter Mode ACK is received.
- s) The Tester sends Exit Mode packet for each listed SVIDs if any, or with 0xFF00 otherwise, and for every non-listed modes.
- t) The Tester waits for the related GoodCrc.
- u) Immediately after the GoodCrc and with the shortest allowed delay of tInterFrameGap (25 us), the Tester sends a Discover Identity packet and wait for GoodCrc as well as the response.
- v) The Tester waits for the Discover Identity ACK. The test fails if Exit Mode ACK is received.

TD.PD.VDMU.E18. [tDRSwapHardReset](#)

Applicable to:

- PHY: BMC
- UUT: UFP

Assertions Tested:

6.4.4.3.4#16, 6.4.4.3.4#20, 6.5.10.3#1

Description:

This test verifies that the UUT issues a Hard Reset within tDRSwapHardReset if DR_Swap is sent by the Tester during modal operation.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a GetSinkCap exchange.
- c) The test is inconclusive if the UUT doesn't support Data Role Swap.
- d) The Tester executes a Discover Identity exchange.
- e) The test is non-relevant if modal operation is not supported, if NAK is received, or if no response is received.
- f) The Tester executes a Discover SVIDs exchange.
- g) The Tester executes a Discover Modes exchange for every declared SVIDs.
- h) The Tester executes an Enter Mode exchange for every declared mode of every SVIDs.
- i) If Enter Mode ACK is received, the Tester sends a DR_Swap packet.

- j) The test fails if Hard Reset is not received within tDRSwapHardReset.

TD.PD.VDMU.E19. [Version](#)

Applicable to:

- PHY: BMC
- UUT: UFP, Cable

Assertions Tested:

6.4.4.2.3#2

Description:

This test verifies that the UUT correctly handles Structured VDM Version higher than supported.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity with Structured VDM Version set to 3.
- c) The Tester checks that the UUT replies with Structured VDM Version set to the highest version number it supports, which is currently 0.

VDM Tests for DFPs

TD.PD.VDMD.E1. [tVDMSenderResponse Deadline - Discover Identity](#)

Applicable to:

- PHY: BMC
- UUT: DFP

Assertions Tested:

6.4.4.4#2, 6.5.11.1#1, 8.3.3.9.1.1#1, 8.3.3.9.1.1#2, 8.3.3.9.1.1#3, 8.3.3.9.1.2#1, 8.3.3.9.1.2#2, 8.3.3.9.3.1#1

Description:

This test verifies that the UUT accepts a Discover Identity ACK sent at the deadline limit of tVDMSenderResponse min (24 ms).

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.
- The tester sends a Discover Identity ACK after tVDMSenderResponse min (24 ms) from the reception of the Discover Identity. The delay shall be measured from the last bit of the GoodCRC to the last bit of the Discover Identity ACK.
- The test fails if a message is received from the UUT between the Discover Identity and the ACK.
- The test fails if a GoodCRC is not received timely after the ACK.
- The test fails if a Discover SVIDs command is not received within 100 ms.

TD.PD.VDMD.E2. [tVDMSenderResponse Timeout - Discover Identity](#)

Applicable to:

- PHY: BMC
- UUT: DFP

Assertions Tested:

8.3.3.9.3.1#3

Description:

This test verifies that the UUT will not accept a Discover Identity ACK sent too late.

Steps:

- Run PROC.PD.E1 Bring-up according to the UUT role.

- b) The tester sends a Discover Identity ACK after tVDMSenderResponse max exceeded by 1 ms (31 ms) from the reception of the Discover Identity. The delay shall be measured from the last bit of the GoodCrc to the last bit of the Discover Identity ACK.
- c) The test fails if a GoodCrc is not received timely after the ACK.
- d) The test fails if a Discover SVIDs command is received within 100 ms.

TD.PD.VDMD.E3. [Incorrect Fields - Discover Identity](#)

Applicable to:

- PHY: BMC
- UUT: DFP

Assertions Tested:

8.3.3.9.3.1#3

Description:

This test verifies that the UUT will not accept a Discover Identity ACK sent with incorrect fields.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The tester sends a Discover Identity ACK with the first defect listed below.
- c) The test fails if a GoodCrc is not received timely after the ACK.
- d) The test fails if a Discover SVIDs command is received within 100 ms.
- e) Repeat the test with the following defects:
 - 1. VDM Header Command = Discover Modes
 - 2. Structured VDM Version = 3
 - 3. Command Type = Initiator
 - 4. SVID = 0xEEEE
 - 5. Object Position = 7
 - 6. Product Type = Reserved (6) and no VDOs
 - 7. Product Type = Reserved (7) and no VDOs

TD.PD.VDMD.E4. [Applicability](#)

Applicable to:

- PHY: BMC
- UUT: DFP

Assertions Tested:

6.9#1, 6.9#2, 6.9#3, 6.9#4, 6.9#5, 6.9#6, 6.9#7, 6.9#0, 6.9#13, 6.9#14, 6.9#16, 6.9#17

Description:

This test verifies that the UUT responds appropriately to VDM commands.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The tester initiates a Discover Identity.
- c) The test fails if the message is not ignored or NAKed.
- d) The tester initiates a Discover SVIDs.
- e) The test fails if the message is not ignored or NAKed.
- f) The tester initiates a Discover Modes.
- g) The test fails if the message is not ignored or NAKed.
- h) The tester initiates an Enter Mode.
- i) The test fails if the message is not ignored or NAKed.
- j) The tester initiates an Exit Mode.
- k) The test fails if the message is not ignored or NAKed.

DisplayPort Alt-Mode Tests for USB UFPs

Note: DisplayPort tests below are not controlled by USB-IF. Refer to applicable VESA documents at www.vesa.org. Contact [Ellisys](#) for details on operation, source documents, etc.

TD.PD.DPU.E1. [Enter Mode ACK Response](#)

Applicable to:

- PHY: BMC
- UUT: UFP_U

Description:

The Tester verifies that the UUT properly responds to an Enter Mode command with either ACK or NAK.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role through and including Step h).
- b) The Tester sends an Enter Mode command using DP SID (0xFF01).
- c) The Tester verifies:
 1. The UUT responds with NAK or ACK.
 2. If the UUT responds with BUSY, the test fails.
 3. If the UUT responds with NAK, the UUT shall expose a USB Billboard device.
 4. If the UUT responds with ACK, this is received within tVDMEnterMode (25 ms).
 5. The UUT responds with SVIDs = DisplayPort (0xFF01) in the VDM Header.
 6. The Number of Data Objects field = 001b.

TD.PD.DPU.E2. [Status Update Command](#)

Applicable to:

- PHY: BMC
- UUT: UFP_U

Description:

The Tester sends a Status Update command to the UUT following the Enter Mode transaction and verifies a proper response from the UUT.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role through and including Step j).
- b) If the response to the Enter Mode command is NAK, the test is inconclusive.
- c) If the response to the Enter Mode command is ACK, the Tester sends a Display Port Status Update command. The Port Connected field shall be set depending on the DP Mode Port Capability field:
 1. If Port Capability is UFP_D-capable then set Port Connected to DFP_D
 2. If Port Capability is DFP_D-capable then set Port Connected to UFP_D
 3. If Port Capability is both then set Port Connected to both
- d) The Tester verifies:
 1. The UUT returns a Responder ACK within tVDMReceiverResponse (15 ms).
 2. The UUT returns Display Port Status in its VDO.
 3. The test fails if the UUT responds with NAK.
 4. The test fails if the Status Update fields are invalid (all bits are zero).

DisplayPort Alt-Mode Tests for USB DFPs

TD.PD.DPD.E1. Cable Determination

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test verifies the UUT makes an attempt to determine whether a cable is connected by checking that a Discover Identity is received from the UUT that uses SOP'.

Steps:

- a) The Tester first determines if the UUT is a DisplayPort DFP_U by running PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role. **Error! Reference source not found..** The test is not applicable if DisplayPort Enter Mode is not timely received. The Tester disconnects to restart from a clean state.
- b) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role.
- c) The Tester verifies:
 1. A Discover Identity using SOP' is received from the UUT.
- d) The test fails if a SOP message is received from the UUT before the Discover Identity SOP'.

TD.PD.DPD.E2. Discover SVIDs ACK with DP SID in Arbitrary Locations

Applicable to:

- PHY: BMC
- UUT: DFP_U

Assertions Tested:

6.5.1#6

Description:

This test verifies the UUT can recognize the DP SID in (simulated) arbitrary locations.

Steps:

- a) The Tester first determines if the UUT is a DisplayPort DFP_U by running PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role. **Error! Reference source not found..** The test is not applicable if DisplayPort Enter Mode is not timely received. The Tester disconnects to restart from a clean state.
- b) Run PROC.PD.E2 Bring-up procedure for DisplayPort step a) according to the UUT role.

- c) The Tester awaits Discover Identity from the UUT and responds appropriately with GoodCrc and Discover Identity ACK.
- d) The Tester awaits Discover SVIDs from the UUT and responds with Discover SVIDs ACK using a non-DP SVID in SVID0, and the DP SID in SVID1 (the SVID structure is properly terminated with 0x0000 in SVID2 and SVID3).
- e) The Tester verifies:
 - 1. The UUT responds with a GoodCrc within tTransmit (195us).
 - 2. The UUT progresses to sending Discover Modes within 100 ms.
 - 3. The Discover Modes from the UUT uses DP SID (0xFF01) in the VDM Header.
- f) The Tester disconnects from the UUT and repeats the steps above with the following Discover SVIDs ACK:
 - 1. Place DP SID after 10 non-DP SVIDs
 - 2. Place DP SID after 11 non-DP SVIDs
 - 3. Place DP SID after 21 non-DP SVIDs
 - 4. Place DP SID after 22 non-DP SVIDs

TD.PD.DPD.E3. [Status Update Presence](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test verifies the UUT sends a Status Update command following the Tester's Enter Mode ACK.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role.
- b) The test fails if the UUT doesn't follow the Enter Mode ACK with a Status Update command within one second.

TD.PD.DPD.E4. [Enter Mode Sequence Fails, Enter Mode NAK Response](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test verifies the UUT does not enter Display Port Alt Mode after the Tester sends an Enter Mode NAK response to the UUT's Enter Mode command. The Tester confirms Display Port Alt Mode is not entered by confirming the Status Update command is not sent.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role **Error! Reference source not found.**, with the exception that NAK is replied to DisplayPort Enter Mode.
- b) The Test fails if a Status Update command is received within one second.

TD.PD.DPD.E5. [Enter Mode Sequence Fails, Enter Mode ACK Response Not Sent](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test verifies the UUT does not enter Display Port Alt Mode after the Tester does not send an Enter Mode ACK response to the UUT's Enter Mode command. The Tester confirms Display Port Alt Mode is not entered by checking that the Status Update command is not sent.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role **Error! Reference source not found.**, with the exception that DisplayPort Enter Mode ACK is not sent.
- b) The Test fails if a Status Update command is received within one second.

TD.PD.DPD.E6. [DisplayPort Not Connected then Connected](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test verifies the UUT does not enter the DFP_U Configure State as the Tester will advertise no connected device in the Port Connected field (Bits 1-0 = 00b) of the Status Update VDO. The Tester then sends a DisplayPort Attention command to the UUT to indicate the port is connected. After this the Tester verifies the UUT responds with a DisplayPort Configure command.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role.
- b) The Tester awaits the Status Update command from the UUT.
 1. The test fails if a Status Update command is not received within 1 second.
 2. The test fails if HPD is initially high.
- c) The Tester responds with a Status Update ACK indicating no connected device in the Port Connected field (Bits 1-0 = 00b).

- d) The Tester verifies the UUT does not follow with a DisplayPort Configure command within 100 ms.
- e) The Tester sends a DisplayPort Attention message indicating that both ports are connected (Bits 1-0 = 11b) and HPD is high.
- f) The Tester verifies:
 - 1. The UUT responds appropriately with GoodCRC.
 - 2. The UUT sends a Configure command within 100 ms, to which the Tester replies Configure ACK.

TD.PD.DPD.E7. [Status Update Port Resolution](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

This test is operated only if the UUT is declaring both DFP_D and UFP_D are connected in the Port Connected field (Bits 1-0 = 11b) of the UUT's DisplayPort Status Update VDO. The Tester responds to the UUT's Status Command with a DisplayPort Status Command ACK that also declares both DFP_D and UFP_D are connected.

Note: The UUT is required to implement a vendor-dependent method to disable one function or the other, and to send a Status Update command with one and only one function supported.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role.
- b) The Tester verifies:
 - 1. The UUT follows the Enter Mode ACK with a Status Update command within 1 second. The test is not applicable if the Status Update is not received timely.
- c) The test is not applicable if the Port Connected field (Bits 1-0) doesn't declare that both DFP_D and UFP_D are connected (Bits 1-0 = 11b).
- d) The Tester sends a Status Update ACK with the Port Connected field set to both DFP_D and UFP_D (Bits 1-0 = 11b).
- e) The Tester verifies:
 - 1. The UUT sends a subsequent DisplayPort Status Update with either DFP_D connected (Bits 1-0 = 01b) or DFP_U connected (Bits 1-0 = 10b), but not both, within 3 seconds.
- f) The Tester sends a Status Update ACK with Port Connected field set to both DFP_D and UFP_D (Bits 1-0 = 11b).

TD.PD.DPD.E8. [Not Compatible Connection](#)

Applicable to:

- PHY: BMC
- UUT: DFP_U

Description:

Both sides of the connection must be compatible with each other such that the connection is not DFP_D to DFP_D or UFP_D to UFP_D.

Steps:

- a) Run PROC.PD.E2 Bring-up procedure for DisplayPort according to the UUT role.
- b) The Tester verifies:
 1. The UUT follows the Enter Mode ACK with a Status Update command within 1 second.
The test is not applicable if the Status Update is not received timely.
- c) The test is not applicable if the Port Connected field (Bits 1-0) declares that both DFP_D and UFP_D are connected (Bits 1-0 = 11b).
- d) The Tester keeps the value of the DisplayPort Status Update Port Connected field and disconnects.
- e) The Tester reconnects and runs **Error! Reference source not found. Error! Reference source not found.**, with the exception that the response to DisplayPort Discover Modes command shall indicate Port Capability with the same value as the Port Connected kept in the previous step.
- f) The test fails if the UUT follows the DisplayPort Discover Modes with a DisplayPort Enter Mode.

Consistency Tests

Vendor-Provided Information Format

Name	Description	Min	Max	Values
General				
UUT_Device_Type	UUT Type	0	5	0: Consumer Only 1: Consumer / Provider 2: Provider / Consumer 3: Provider Only 4: Dual-role Port 5: Cable
Type_C	Type-C Connector	0	1	0: No 1: Yes
Captive_Cable	Captive Cable	0	1	0: No 1: Yes
SOP* Handling				
SOP_Capable	SOP Capable	0	1	0: No 1: Yes
SOP_P_Capable	SOP' Capable	0	1	0: No 1: Yes
SOP_PP_Capable	SOP" Capable	0	1	0: No 1: Yes
SOP_P_Debug_Capable	SOP' Debug Capable	0	1	0: No 1: Yes
SOP_PP_Debug_Capable	SOP" Debug Capable	0	1	0: No 1: Yes
Source or Sink Devices				
USB_Comms_Capable	USB Communication Capable	0	1	0: No 1: Yes
DR_Swap_To_DFP_Supported	Supports DR_Swap to DFP	0	1	0: No 1: Yes
DR_Swap_To_UFP_Supported	Supports DR_Swap to UFP	0	1	0: No 1: Yes
VCONN_Swap_To_On_Supported	Supports Vconn_Swap to On	0	1	0: No 1: Yes
VCONN_Swap_To_Off_Supported	Supports Vconn_Swap to Off	0	1	0: No 1: Yes
Responds_To_Discov_SOP	Responds to Discover Identity	0	1	0: No 1: Yes
Attempts_Discov_SOP	Attempts to Discover Identity	0	1	0: No 1: Yes
Externally_Powered	Externally Powered	0	1	0: No 1: Yes
Dual-role Devices				
Accepts_PR_Swap_As_Src	Accepts Power-role Swap as Source	0	1	0: No 1: Yes
Accepts_PR_Swap_As_Snk	Accepts Power-role Swap as Sink	0	1	0: No 1: Yes
Requests_PR_Swap_As_Src	Requests Power-role Swap as Source	0	1	0: No 1: Yes
Requests_PR_Swap_As_Snk	Requests Power-role Swap as Sink	0	1	0: No 1: Yes
Source Capabilities				
PD_Power_as_Source	PD Power as Source	0	150000	1mW step
USB_Suspend_May_Be_Cleared	USB Suspend Supported	0	1	0: No 1: Yes
Rp_Value	Rp Value	0	2	0: Default USB Power 1: 1.5A @ 5V 2: 3A @ 5V
Sends_Pings	Sends Pings	0	1	0: No 1: Yes
Num_Src_PDOs	Number of Source PDOs	1	7	
Src_PDO_Supply_Type1	PDO 1 Supply Type	0	3	0: Fixed 1: Battery 2: Variable
Src_PDO_Voltage1	PDO 1 Voltage	0	1023	
Src_PDO_Min_Voltage1	PDO 1 Min Voltage	0	1023	
Src_PDO_Max_Voltage1	PDO 1 Max Voltage	0	1023	
Src_PDO_Peak_Current1	PDO 1 Peak Current	0	3	0: 100% IOC 1: 130% IOC 2: 150% IOC 3: 200% IOC
Src_PDO_Max_Current1	PDO 1 Max Current	0	1023	
Src_PDO_Max_Power1	PDO 1 Max Power	0	1023	

Name	Description	Min	Max	Values
Sink Capabilities				
PD_Power_as_Sink	PD Power as Sink	0	150000	1mW step
No_USB_Suspend_May_Be_Set	No USB Suspend May be Set	0	1	0: No 1: Yes
GiveBack_May_Be_Set	GiveBack May be Set	0	1	0: No 1: Yes
Higher_Capability_Set	Higher Capability	0	1	0: No 1: Yes
Num_Snk_PDOs	Number of Sink PDOs	1	7	
Snk_PDO_Supply_Type1	PDO 1 Supply Type	0	3	0: Fixed 1: Battery 2: Variable
Snk_PDO_Voltage1	PDO 1 Voltage	0	1023	
Snk_PDO_Min_Voltage1	PDO 1 Min Voltage	0	1023	
Snk_PDO_Max_Voltage1	PDO 1 Max Voltage	0	1023	
Snk_PDO_Op_Current1	PDO 1 Operating Current	0	1023	
Snk_PDO_Op_Power1	PDO 1 Operating Power	0	1023	
Port Structured VDM				
Structured_VDM_Version_SOP	Structed VDM Version	0	3	0: v1.0
Data_Capable_as_USB_Host_SOP	Data-capable as USB Host	0	1	0: No 1: Yes
Data_Capable_as_USB_Device_SOP	Data-capable as USB Device	0	1	0: No 1: Yes
Product_Type_SOP	Product Type	0	7	0: Undefined 1: Hub 2: Peripheral 5 : AMA
Modal_Operation_Supported_SOP	Modal Operation Supported	0	1	0: No 1: Yes
USB_VID_SOP	Vendor ID	0x0000	0xFFFF	
PID_SOP	Product ID	0x0000	0xFFFF	
bcdDevice_SOP	Device Version	0x0000	0xFFFF	
XID_SOP	Certification ID (XID)	0x00000	0xFFFFF	
Port AMA VDO				
AMA_HW_Vers	HW Version	0	15	
AMA_FW_Vers	FW Version	0	15	
AMA_SSTX1_Dir_Support	SSTX1 Dir Support	0	1	0: No 1: Yes
AMA_SSTX2_Dir_Support	SSTX2 Dir Support	0	1	0: No 1: Yes
AMA_SSRX1_Dir_Support	SSRX1 Dir Support	0	1	0: No 1: Yes
AMA_SSRX2_Dir_Support	SSRX2 Dir Support	0	1	0: No 1: Yes
AMA_VCONN_Power	Vconn Power	0	1	0: No 1: Yes
AMA_VCONN_Reqd	Vconn Required	0	1	0: No 1: Yes
AMA_VBUS_Reqd	Vbus Required	0	1	0: No 1: Yes
AMA_Superspeed_Support	SuperSpeed Support	0	7	0: USB 2.0 only 1: USB 3.1 Gen 1 2: USB 3.1 Gen 2 3: USB 2.0 Billboard Only
Port Discover SVIDs Responder VDO				
Num_SVIDs_min_SOP	SVIDs Count Min	0	24	
Num_SVIDs_max_SOP	SVIDs Count Max	0	24	
SVID_fixed_SOP	SVIDs are fixed	0	1	0: No 1: Yes
SVID1_SOP	SVID Value	0x0000	0xFFFF	
SVID1_num_modes_min_SOP	Modes Count Min	1	6	
SVID1_num_modes_max_SOP	Modes Count Max	1	6	
SVID1_modes_fixed_SOP	Modes are fixed	0	1	0: No 1: Yes
SVID1_mode1_enter_SOP	Mode 1 Enter	0	1	0: No 1: Yes
SVID1_mode1_recog_mask_SOP	Mode 1 Recognition Mask	0	0xFFFFFFFF	
SVID1_mode1_recog_value_SOP	Mode 1 Recognition Value	0	0xFFFFFFFF	

Name	Description	Min	Max	Values
Cable Structured VDM				
Structured_VDM_Version	Structured VDM Version	0	3	0: v1.0
Data_Capable_as_USB_Host	Data-capable as USB Host	0	1	0: No 1: Yes
Data_Capable_as_USB_Device	Data-capable as USB Device	0	1	0: No 1: Yes
Product_Type	Product Type	0	7	3: Passive Cable 4 : Active Cable
Modal_Operation_Supported	Modal Operation Supported	0	1	0: No 1: Yes
USB_VID	Vendor ID	0x0000	0xFFFF	
PID	Product ID	0x0000	0xFFFF	
bcdDevice	Device Version	0x0000	0xFFFF	
XID	Certification ID (XID)	0x00000	0xFFFFF	
Cable VDO				
Cable_HW_Vers	HW Version	0	15	
Cable_FW_Vers	FW Version	0	15	
Type_C_to_Type_A_B_C	Type-C to Type-A/B/C	0	3	0: Type-A 1: Type-B 2: Type-C
Type_C_to_Plug_Receptacle	Type-C to Plug/Receptacle	0	1	0: No 1: Yes
Cable_Latency	Latency	0	15	1: < 10 ns 2: 10 ns - 20 ns 3: 20 ns - 30 ns 4: 30 ns - 40 ns 5: 40 ns - 50 ns 6: 50 ns - 60 ns 7: 60 ns - 70 ns 8: 1000 ns 9: 2000 ns 10: 3000 ns
Cable_Termination_Type	Termination Type	0	3	0: Passive, Vconn optional 1: Passive, Vconn required 2: Mixed, Vconn required 3: Active, Vconn required
Cable_SSTX1_Dir_Support	SSTX1 Dir Support	0	1	0: No 1: Yes
Cable_SSTX2_Dir_Support	SSTX2 Dir Support	0	1	0: No 1: Yes
Cable_SSRX1_Dir_Support	SSRX1 Dir Support	0	1	0: No 1: Yes
Cable_SSRX2_Dir_Support	SSRX2 Dir Support	0	1	0: No 1: Yes
Cable_VBUS_Current	Vbus Current	0	1	0: No 1: Yes
VBUS_through_cable	Vbus Through	0	1	0: No 1: Yes
Cable_SOP"__controller	SOP" Controller	0	1	0: No 1: Yes
Cable_Superspeed_Support	SuperSpeed Support			
Cable Discover SVIDs Responder VDO				
Cable_num_SVIDs_min	SVIDs Count Min	0	24	
Cable_num_SVIDs_max	SVIDs Count Max	0	24	
SVID_fixed	SVIDs are fixed	0	1	0: No 1: Yes
SVID1	SVID Value	0x0000	0xFFFF	
SVID1_num_modes_min	Modes Count Min	1	6	
SVID1_num_modes_max	Modes Count Max	1	6	
SVID1_modes_fixed	Modes are fixed	0	1	0: No 1: Yes
SVID1_mode1_enter	Mode 1 Enter	0	1	0: No 1: Yes
SVID1_mode1_recog_mask	Mode 1 Recognition Mask	0	0xFFFFFFFF	
SVID1_mode1_recog_value	Mode 1 Recognition Value	0	0xFFFFFFFF	

Name	Description	Min	Max	Values
DisplayPort Alt-Mode				
DP_Modes_Count	Modes Count	1	6	
DP_Mode1_Port_Cap	Mode 1 Port Capability	0	3	
DP_Mode1_Support_DpV13	Mode 1 Supports DP v1.3	0	1	0: No 1: Yes
DP_Mode1_Support_UsbGen2	Mode 1 Supports USB Gen 2	0	1	0: No 1: Yes
DP_Mode1_Receptacle	Mode 1 Receptacle Indication	0	1	0: No 1: Yes
DP_Mode1_Usb20_Not_Used	Mode 1 USB 2.0 Not Required	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_A_Supported	Mode 1 DFP Pins A Supported	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_B_Supported	Mode 1 DFP Pins B Supported	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_C_Supported	Mode 1 DFP Pins C Supported	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_D_Supported	Mode 1 DFP Pins D Supported	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_E_Supported	Mode 1 DFP Pins E Supported	0	1	0: No 1: Yes
DP_Mode1_Dfp_D_F_Supported	Mode 1 DFP Pins F Supported	0	1	0: No 1: Yes
DP_Mode1_Ufp_D_A_Supported	Mode 1 UFP Pins A Supported	0	1	0: No 1: Yes
DP_Mode1_Ufp_D_B_Supported	Mode 1 UFP Pins B Supported	0	1	0: No 1: Yes
DP_Mode1_Ufp_D_C_Supported	Mode 1 UFP Pins C Supported	0	1	0: No 1: Yes
DP_Mode1_Ufp_D_D_Supported	Mode 1 UFP Pins D Supported	0	1	0: No 1: Yes
DP_Mode1_Ufp_D_E_Supported	Mode 1 UFP Pins E Supported	0	1	0: No 1: Yes

TD.PD.VNDI.E1. VDM Identity

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.1.1#2, 6.4.4.3.1.1#3, 6.4.4.3.1.1#5, 6.4.4.3.1.4#1, 6.4.4.3.1.4#2, 6.4.4.3.1.4#3, 6.4.4.3.1.4#4, 6.4.4.3.1.4#5, 6.4.4.3.1.4#6, 6.4.4.3.1.4#7, 6.4.4.3.1.6#1, 6.4.4.3.1.7#1, 6.4.4.3.1.8#1, 6.4.4.3.1.9#1, 6.4.4.3.1.9#2, 6.4.4.3.1.9#3, 6.4.4.3.1.10#1, 6.4.4.3.1.10#2, 6.4.4.3.1.10#3, 6.4.4.4#3

Description:

This test verifies that the VDM Information common to all cables and UFPs is as specified in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Discover Identity exchange.
- c) If the UUT is a UFP and if Responds_To_Discover_SOP is set to No, the Tester checks that the UUT doesn't reply to Discover Identity or replies NAK. The test stops here in this case.
- d) For all devices, the Tester checks in the VDM Header consistency of:
 1. Structured_VDM_Version(_SOP)
- e) For all devices, the Tester checks in the ID Header consistency of:
 1. Product_Type(_SOP)
 2. USB_VID(_SOP)
 3. Modal_Operation_Supported(_SOP)

4. Data_Capable_as_USB_Host(_SOP)
5. Data_Capable_as_USB_Device(_SOP)
- f) For all devices, the Tester checks in the Cert Stat VDO consistency of:
 1. EID(_SOP)
- g) For all devices, the Tester checks in the Product VDO consistency of:
 1. PID(_SOP)
 2. bcdDevice(_SOP)
- h) For Cables, the Tester checks in the Cable VDO consistency of:
 1. Cable_HW_Vers
 2. Cable_FW_Vers
 3. Type_C_to_Type_A_B_C
 4. Type_C_to_Plug_Receptacle
 5. Cable_Latency
 6. Cable_Termination_Type
 7. Cable_SSTX1_Dir_Support
 8. Cable_SSTX2_Dir_Support
 9. Cable_SSRX1_Dir_Support
 10. Cable_SSRX2_Dir_Support
 11. Cable_VBUS_Current
 12. VBUS_through_cable
 13. Cable_SOP"_controller
 14. Cable_Superspeed_Support
- i) For Alt Mode Adapters, the Tester checks in the AMA VDO consistency of:
 1. AMA_HW_Vers
 2. AMA_FW_Vers
 3. AMA_SSTX1_Dir_Support
 4. AMA_SSTX2_Dir_Support
 5. AMA_SSRX1_Dir_Support
 6. AMA_SSRX2_Dir_Support
 7. AMA_VCONN_power
 8. AMA_VCONN_reqd
 9. AMA_VBUS_reqd
 10. AMA_Superspeed_Support

TD.PD.VNDI.E2. [VDM SVIDs](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.2#2, 6.4.4.3.2#3

Description:

This test verifies that the advertised SVIDs are as specified in the vendor-supplied information.

Steps:

- a) The test is not relevant if the UUT is a UFP and if Responds_To_Discov_SOP is set to No.
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) The Tester executes a Discover Identity exchange.
- d) The Tester executes a Discover SVIDs exchange.
- e) If Modal_Operation_Supported(_SOP) is set to No, Discover SVIDs shall return NAK and the test ends.
- f) The Tester verifies that:
 1. The returned SVID count is greater or equal to (Cable_)num_SVIDs_min(_SOP) and lesser or equal to (Cable_)num_SVIDs_max(_SOP).
 2. The returned SVIDs are all listed in the vendor-supplied information.

TD.PD.VNDI.E3. [VDM Modes](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Assertions Tested:

6.4.4.3.3#2

Description:

This test verifies that the advertised modes are as specified in the vendor-supplied information, and verifies as well that modes can be entered as specified.

Steps:

- a) The test is not relevant if the UUT is a UFP and if Responds_To_Discov_SOP is set to No.
- b) Run PROC.PD.E1 Bring-up according to the UUT role.

- c) The Tester executes a Discover Identity exchange.
- d) The Tester executes a Discover SVIDs exchange.
- e) If Modal_Operation_Supported(_SOP) is set to No, Discover SVIDs shall return NAK and the test ends.
- f) The Tester executes a Discover Modes exchange for the first SVID.
- g) The Tester verifies that the returned modes count is greater or equal to the corresponding SVIDx_num_modes_min(_SOP) and lesser or equal to SVIDx_num_modes_max(_SOP).
- h) For each mode:
 - 1. The Tester executes Enter Mode.
 - If SVIDx_modes_fixed(_SOP), the test fails if the result is different than declared in SVIDx_modeY_enter(_SOP).
 - If not SVIDx_modes_fixed(_SOP), the test fails if the result is different than (mode & SVIDx_modeY_recog_mask(_SOP)) == SVIDx_modeY_recog_value(_SOP).
 - 2. The Tester executes Exit Mode.
- i) The Tester repeats these steps for all SVIDs.

TD.PD.VNDI.E4. [SOP* Handling](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP, DFP

Assertions Tested:

5.6.1.2.1#1, 5.6.1.2.1#2, 5.6.1.2.1#3, 5.6.1.2.1#4, 5.6.1.2.1#5, 5.6.1.2.2#1, 5.6.1.2.2#3, 5.6.1.2.2#4, 5.6.1.2.3#1, 5.6.1.2.3#2, 5.6.1.2.3#3, 5.6.1.2.3#4, 5.6.1.2.3#5, 5.6.1.2.3#6

Description:

This test verifies the UUT handles the SOP* as specified in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Transmit a Discover Identity message with SOP. Check that GoodCRC is received timely if SOP_Capable, and not received otherwise.
- c) Transmit a Discover Identity message with SOP'. Check that GoodCRC is received timely if SOP_P_Capable and UUT is DFP, and not received otherwise.
- d) Transmit a Discover Identity message with SOP". Check that GoodCRC is received timely if SOP_PP_Capable and UUT is DFP, and not received otherwise.
- e) Transmit a Discover Identity message with SOP'_Debug. Check that GoodCRC is received timely if SOP_P_Debug_Capable, and not received otherwise.

- f) Transmit a Discover Identity message with SOP"_Debug. Check that GoodCrc is received timely if SOP_PP_Debug_Capable, and not received otherwise.

TD.PD.VNDI.E5. [Source Capabilities](#)

Applicable to:

- PHY: BMC, FSK
- UUT: Source

Assertions Tested:

6.4.1.1.1#1, 6.4.1.2#1, 6.4.1.2#2, 6.4.1.2#3, 6.4.1.2#4, 6.4.1.2#5, 6.4.1.2#6, 6.4.1.2#7, 6.4.1.2#8,
6.4.1.2.3#1, 6.4.1.2.3#2, 6.4.1.2.3.2#1, 6.4.1.2.3.2#2, 6.4.1.2.3#3, 6.4.1.2.3.3#1, 6.4.1.2.3.4#1,
6.4.1.2.3.5#1, 6.4.1.2.3.5#2

Description:

This test verifies the returned Source Capabilities match vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) In addition to emulating a UFP, the Tester will also present Ra and will reply to SOP' Discover Identity as Passive Cable with Vbus Current Handling Capability set to 5A.
- c) The Tester waits the Source Capabilities (without replying GoodCrc to it) and then checks that:
 1. The Number of Data Objects equals Num_Src_PDOs
- d) For the first PDO, the Tester checks consistency of:
 1. USB_Comms_Capable
 2. Externally_Powered
 3. USB_Suspend_May_Be_Cleared
 4. Accepts_PR_Swap_As_Src
 - If Accepts_PR_Swap_As_Src, the Dual-Role Power bit must be set and the DUT must reply Accept or Wait to PR_Swap.
 - If not Accepts_PR_Swap_As_Src and if the Dual-Role Power is set, the DUT must reply Reject to PR_Swap.
 - If Accepts_PR_Swap_As_Src or if Accepts_PR_Swap_As_Snk, then the Dual-Role Power bit must be set.
 - If not Accepts_PR_Swap_As_Src and if not Accepts_PR_Swap_As_Snk, then the Dual-Role Power bit must not be set.
 5. DR_Swap_To_UFP_Supported
 - If DR_Swap_To_UFP_Supported, the Dual-Role Data bit must be set and the DUT must reply Accept or Wait to DR_Swap.

- If not DR_Swap_To_UFP_Supported and if the Dual-Role Data bit is set, the DUT must reply Reject to DR_Swap.
 - If DR_Swap_To_UFP_Supported or if DR_Swap_To_DFP_Supported, then the Dual-Role Data bit must be set.
 - If not DR_Swap_To_UFP_Supported and if not DR_Swap_To_DFP_Supported, then the Dual-Role Data bit must not be set.
- e) For each PDO, the Tester checks consistency of:
1. Src_PDO_Supply_TypeN
 2. If Fixed:
 - Src_PDO_VoltageN
 - Src_PDO_Peak_CurrentN
 - Src_PDO_Max_CurrentN
 3. If Battery:
 - Src_PDO_MinVoltageN
 - Src_PDO_MaxVoltageN
 - Src_PDO_Max_PowerN
 4. If Variable:
 - Src_PDO_MinVoltageN
 - Src_PDO_MaxVoltageN
 - Src_PDO_Max_CurrentN
- f) The Tester checks that no PDO is above PD_Power_as_Source.
- g) The Tester checks that PDOs meeting the requirements of the Power Rules are available according to PD_Power_as_Source.
- h) The Tester checks that the UUT advertises Rp according to Rp_Value.

TD.PD.VNDI.E6. [Sink Capabilities](#)

Applicable to:

- PHY: BMC, FSK
- UUT: Sink

Assertions Tested:

6.3.8#1, 6.4.1.3#1, 6.4.1.3#2, 6.4.1.3#3, 6.4.1.3#4, 6.4.1.3#5, 6.4.1.3#6, 6.4.1.3#7, 6.4.1.3.1#2, 6.4.1.3.1#4, 6.4.1.3.1.1#1, 6.4.1.3.1.2#1, 6.4.1.3.1.3#1, 6.4.1.3.1.4#1, 6.4.1.3.1.5#1, 6.4.1.3.1.5#2, 6.4.1.3.2#1, 6.4.1.3.2#2, 6.4.1.3.2#3, 6.4.1.3.3#1, 6.4.1.3.3#2, 6.4.1.3.3#3

Description:

This test verifies the returned Sink Capabilities match vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Get Sink Cap exchange.
- c) The Tester checks that:
 1. The Number of Data Objects equals Num_Snk_PDOs - number of PPS APDOs in the VIF
- d) For the first PDO, the Tester checks consistency of:
 1. USB_Comms_Capable
 2. Externally_Powered
 3. Higher_Capability_Set
 4. Accepts_PR_Swap_As_Snk
 - If Accepts_PR_Swap_As_Snk, the Dual-Role Power bit must be set and the DUT must reply Accept or Wait to PR_Swap.
 - If not Accepts_PR_Swap_As_Snk and if the Dual-Role Power is set, the DUT must reply Reject to PR_Swap.
 - If Accepts_PR_Swap_As_Src or if Accepts_PR_Swap_As_Snk, then the Dual-Role Power bit must be set.
 - If not Accepts_PR_Swap_As_Src and if not Accepts_PR_Swap_As_Snk, then the Dual-Role Power bit must not be set.
 5. DR_Swap_To_DFP_Supported
 - If DR_Swap_To_DFP_Supported, the Dual-Role Data bit must be set and the DUT must reply Accept or Wait to DR_Swap.
 - If not DR_Swap_To_DFP_Supported and if the Dual-Role Data bit is set, the DUT must reply Reject to DR_Swap.
 - If DR_Swap_To_UFP_Supported or if DR_Swap_To_DFP_Supported, then the Dual-Role Data bit must be set.
 - If not DR_Swap_To_UFP_Supported and if not DR_Swap_To_DFP_Supported, then the Dual-Role Data bit must not be set.
- e) For each PDO, the Tester checks consistency of:
 1. Snk_PDO_Supply_TypeN
 2. If Fixed:
 - Snk_PDO_VoltageN
 - Snk_PDO_Op_CurrentN
 3. If Battery:
 - Snk_PDO_MinVoltageN
 - Snk_PDO_MaxVoltageN
 - Snk_PDO_Op_PowerN
 4. If Variable:
 - Snk_PDO_MinVoltageN

- Snk_PDO_MaxVoltageN
- Snk_PDO_Op_CurrentN

f) The Tester checks that there is at least one PDO requiring PD_Power_as_Sink.

TD.PD.VNDI.E7. [Dual Role Devices - Accepts PR_Swap as Source](#)

Applicable to:

- PHY: BMC, FSK
- UUT: Dual Role Device

Assertions Tested:

6.3.3#2, 6.3.4#2, 6.3.10#1, 6.3.10#2, 6.4.1.2.3.1#1, 6.4.1.2.3.1#2

Description:

This test verifies that the UUT will accept PR_Swap as source as indicated in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Establish a power contract.
- c) If the Source requests Sink Capabilities, return 5V 3A, 9V 3A, 15V 3A, 20V 5A.
- d) The Tester executes a PR_Swap exchange.
- e) If a Wait response is received, the Tester shall wait 100 ms (tSinkRequest) before retrying the PR_Swap request. During this delay, the Tester shall accept a Vconn_Swap request from the UUT.
- f) If Accepts_PR_Swap_As_Src is set to false, the test fails if the response is Accept.
- g) If Accepts_PR_Swap_As_Src is set to true:
 1. If the source capabilities indicate External Power set to false, the test fails if the response is not Accept.

TD.PD.VNDI.E8. [Dual Role Devices - Accepts PR_Swap as Sink](#)

Applicable to:

- PHY: BMC
- UUT: Dual Role Device

Assertions Tested:

6.3.3#2, 6.3.4#2, 6.3.10#1, 6.3.10#2, 6.4.1.2.3.1#1, 6.4.1.2.3.1#2

Description:

This test verifies that the UUT will accept PR_Swap as sink as indicated in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role, with the exception that Externally Powered bit shall be set to false.
- b) Establish a power contract.
- c) The Tester executes PR_Swap.
- d) If a Wait response is received, the Tester shall wait 100 ms (tSinkRequest) before retrying the PR_Swap request. During this delay, the Tester shall accept a Vconn_Swap request from the UUT.
- e) The test fails if the response is not as indicated in Accepts_PR_Swap_As_Snk.

TD.PD.VNDI.E9. [Dual Role Devices - Requests PR_Swap as Source](#)

Applicable to:

- PHY: BMC
- UUT: Dual Role Device

Description:

This test verifies that the UUT will request PR_Swap as source as indicated in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) Establish a power contract.
- c) The Tester replies capabilities mismatch to the Source Capabilities.
- d) The Tester waits the Get Sink Cap and replies 5V 6A. The first PDO is set as follow:
 1. Data Role Swap bit cleared
 2. USB Communication Capable bit cleared
 3. Externally Powered bit set
 4. Higher capability bit cleared
 5. Dual Role Power bit set
- e) The test fails if the message is not received within 500 ms if Requests_PR_Swap_As_Src. If not Requests_PR_Swap_As_Src, the test ends with pass in case of timeout.
- f) If Get Source Cap is requested, the Tester replies 5V 3A, 9V 3A, 15V 3A, 20V 5A. The first PDO is set as follow:
 1. Data Role Swap bit cleared

2. USB Communication Capable bit cleared
 3. Externally Powered bit set
 4. USB Suspend bit set
 5. Dual Role Power bit set
- g) If Requests_PR_Swap_As_Src:
1. The test fails if PR_Swap is not received within 500 ms.
- h) If not Requests_PR_Swap_As_Src:
1. The test fails if PR_Swap is received within 500 ms.

TD.PD.VNDI.E10. [Dual Role Devices - Requests PR_Swap as Sink](#)

Applicable to:

- PHY: BMC
- UUT: Dual Role Device

Description:

This test verifies that the UUT will request PR_Swap as sink as indicated in the vendor-supplied information.

Steps:

- a) Run PROC.PD.E1 Bring-up according to the UUT role.
- b) The Tester executes a Source Cap exchange and declares 5V 0.5A PDO as follow:
 1. Data Role Swap bit cleared
 2. USB Communication Capable bit cleared
 3. Externally Powered bit cleared
 4. USB Suspend bit set
 5. Dual Role Power bit set
- c) The Tester executes a GetSourceCap exchange.
- d) If GetSinkCap is requested, the Tester returns a PDO with the highest power discovered in the GetSourceCap, and the bits set as follow:
 1. Data Role Swap bit cleared
 2. USB Communication Capable bit cleared
 3. Externally Powered bit cleared
 4. Higher capability bit cleared
 5. Dual Role Power bit set
- e) If Requests_PR_Swap_As_Sink:
 1. The Tester waits PR_Swap and replies Accept.
 2. The test fails if the message is not received within 500 ms.

- f) If not Requests_PR_Swap_As_Sink:
 - 1. The test fails if PR_Swap is received within 500 ms.

TD.PD.VNDI.E11. [DisplayPort Alt-Mode - Modes](#)

Applicable to:

- PHY: BMC
- UUT: Cable, UFP

Description:

This test verifies that the advertised DisplayPort modes are as specified in the vendor-supplied information.

Steps:

- a) The test is not relevant if the UUT is a UFP and if Responds_To_Discov_SOP is set to No, or if DP_Modes_Count is equal to 0.
- b) Run PROC.PD.E1 Bring-up according to the UUT role.
- c) The Tester executes a Discover Identity exchange.
- d) The Tester executes a Discover SVIDs exchange.
- e) The Tester executes a Discover Modes exchange for the DisplayPort SVID.
- f) The Tester verifies that the returned modes count is equal to DP_Modes_Count.
- g) For each mode, the Tester checks the consistency of:
 - 1. DP_ModeN_Port_Cap
 - 2. DP_ModeN_Support_DpV13
 - 3. DP_ModeN_Support_UsbGen2
 - 4. DP_ModeN_Receptacle
 - 5. DP_ModeN_Usb20_Not_Used
 - 6. DP_ModeN_Dfp_D_A_Supported
 - 7. DP_ModeN_Dfp_D_B_Supported
 - 8. DP_ModeN_Dfp_D_C_Supported
 - 9. DP_ModeN_Dfp_D_D_Supported
 - 10. DP_ModeN_Dfp_D_E_Supported
 - 11. DP_ModeN_Dfp_D_F_Supported
 - 12. DP_ModeN_Ufp_D_A_Supported
 - 13. DP_ModeN_Ufp_D_B_Supported
 - 14. DP_ModeN_Ufp_D_C_Supported
 - 15. DP_ModeN_Ufp_D_D_Supported
 - 16. DP_ModeN_Ufp_D_E_Supported