

SERIAL ATTACHED SCSI (SAS) CONSORTIUM

**Clause 8 SAS SPL
Target Error Handling Test Suite
Version 0.3**

Technical Document



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MODIFICATION RECORD

- [1] August 24, 2011 (Version 0.1) DRAFT RELEASE
David Woolf: Initial draft release
- [2] August 24, 2011 (Version 0.2) DRAFT RELEASE
David Woolf: Draft release
- [3] August 15, 2006 (Version 0.21) DRAFT RELEASE
Michael Davidson: Removed References to Research Computing Center
- [4] June 27, 2011 (Version 0.3) DRAFT RELEASE
Joshua Beaudet: Fixed observable to allow for ACK/NACK a valid frame.
- [5] August 12, 2011 (Version 0.31) DRAFT RELEASE
Michael Klempa: Updated to reflect changes in SAS SPL.

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David Woolf UNH InterOperability Laboratory (UNH-IOL)

INTRODUCTION

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This particular suite of tests has been developed in junction with CATC to help implementers evaluate the functionality of their Serial Attached SCSI (SAS) products. Specifically this Test Suite is directed at verifying the Transport layer of SAS Targets and Initiators.

These tests are designed to determine if a SAS product conforms to specifications defined in *Serial Attached SCSI (SAS) standard T10/1601-D, Revision 10* (hereafter referred to as the "SAS Standard"). Successful completion of all tests contained in this suite does not guarantee that the tested device will successfully operate with other SAS products. However, when combined with satisfactory operation in the IOL's interoperability test bed, these tests provide a reasonable level of confidence that the Device Under Test (DUT) will function properly in many SAS environments.

The tests contained in this document are organized in order to simplify the identification of information related to a test, and to facilitate in the actual testing process. Tests are separated into groups, primarily in order to reduce setup time in the lab environment, however the different groups typically also tend to focus on specific aspects of device functionality. A three-number, dot-notated naming system is used to catalog the tests, where the first number always indicates the specific clause of the reference standard on which the test suite is based. The second and third numbers indicate the test's group number and test number within that group, respectively. This format allows for the addition of future tests in the appropriate groups without requiring the renumbering of the subsequent tests.

The test definitions themselves are intended to provide a high-level description of the motivation, resources, procedures, and methodologies specific to each test. Formally, each test description contains the following sections:

Purpose

The purpose is a brief statement outlining what the test attempts to achieve. The test is written at the functional level.

References

This section specifies all reference material *external* to the test suite, including the specific subclauses references for the test in question, and any other references that might be helpful in understanding the test methodology and/or test results. External sources are always referenced by a bracketed number (e.g., [1]) when mentioned in the test description. Any other references in the test description that are not indicated in this manner refer to elements within the test suite document itself (e.g., "Appendix 5.A", or "Table 5.1.1-1")

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Resource Requirements

The requirements section specifies the test hardware and/or software needed to perform the test. This is generally expressed in terms of minimum requirements, however in some cases specific equipment manufacturer/model information may be provided.

Last Modification

This specifies the date of the last modification to this test.

Test Setup

The setup section describes the initial configuration of the test environment. Small changes in the configuration should not be included here, and are generally covered in the test procedure section (next).

Procedure

The procedure section of the test description contains the systematic instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with observable results.

Observable Results

This section lists the specific observables that can be examined by the tester in order to verify that the DUT is operating properly. When multiple values for an observable are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail outcome for a particular test is generally based on the successful (or unsuccessful) detection of a specific observable.

Possible Problems

This section contains a description of known issues with the test procedure, which may affect test results in certain situations. It may also refer the reader to test suite appendices and/or other external sources that may provide more detail regarding these issues.

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REFERENCES

The following documents are referenced in this text:

- [1] T10/Project 2124-D/Rev 07 – Information technology – SAS Protocol Layer (SPL)
- [2] T10/Project 1561-D/Rev 14 – SCSI Architecture Model 3 – (SAM-3)
- [3] T10/Project 1416-D/Rev 23 – SCSI Primary Commands 3 – (SPC-3)
- [4] T10/Project 1417-D/Rev 16 – SCSI Block Command 2 – (SBC-2)
- [5] T10/Project 1434-D/Rev 09 – SCSI Stream Commands 2- (SSC-2)

GROUP 1: LINK LAYER ERROR HANDLING FOR TARGETS

Overview:

This group of tests verifies the Link and Transport layer Error Handling specifications of the SAS protocol defined in Clause 9 of the SAS Standard, for Targets.

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Test 8.1.1 - Determine if Retries Supported

Purpose: To determine if the DUT indicates support for Transport Layer Retries or not.

References:

[1] 8.2.4.1, 9.2.7.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: Link Layer errors are handled differently depending on whether a device supports Transport Layer Retries or not. Support is indicated by the Transport Layer Retries bit in the Protocol Specific Logical Unit mode page which is accessible by the MODE SENSE command.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. The Testing Station transmits a MODE SENSE command to the DUT requesting the Protocol Specific Logical Unit Mode Page for SAS SSP in the short format.
5. Determine if the Transport Layer Retries bit is set to 1 or 0.
6. The Testing Station should transmit a Mode Select command change the setting of the Transport Layer Retries bit.

Observable Results: Determine if the DUT supports Transport Layer Retries by default, and whether Transport Layer Retries can be turned on and off by the host.

Possible Problems: This is an informative test. If the

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Test 8.1.2 - Retry Data Frames bit in XFER_RDY

Purpose: To determine if the DUT properly sets the Retry Data Frames bit depending on its support for Transport Layer Retries.

References:

[1] 8.2.4.1 b SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If a device supports Transport Layer Retries it is required to set the Retry Data Frames bit in the XFER_RDY frame to 1.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
5. The Testing Station should transmit DATA frames to the DUT to complete the command.

Observable Results: If the DUT supports Transport Layer Retries verify that it set the Retry Data Frames bit to 1 in the XFER_RDY frame. If the DUT does not support Transport Layer Retries verify that it set the Retry Data Frames bit to 0 in the XFER_RDY frame. This should be in agreement with the setting of the Transport Layer Retries bit in the Protocol Specific Logical Unit Mode Page for SAS SSP.

Possible Problems: None.

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Test 8.1.3 - Retries Enabled QUERY TASK Supported

Purpose: To determine if the DUT indicates support for Transport Layer Retries that it supports the QUERY TASK Task Management Command.

References:

[1] 8.2.4.1 c SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If a device supports Transport Layer Retries it is required to support the QUERY TASK Task Management Command. This test is only applicable if the DUT supports Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are disabled, enable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
6. The Testing Station should transmit DATA frames to the DUT to complete the command.
7. Before completing transmission of all DATA frames to the DUT the Testing Station should transmit a valid QUERY TASK Task Management Command.

Observable Results: If the DUT supports Transport Layer Retries verify that it responded to the received QUERY TASK Task Management Command with Status TASK MANAGEMENT FUNCTION SUCCEEDED.

Possible Problems: None.

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Test 8.1.4 - Retries Enabled New TPTT for all XFER_RDY in response to error

Purpose: To determine if the DUT indicates support for Transport Layer Retries that it selects a different value for TPTT in each XFER_RDY within an I_T_L_Q Nexus when that XFER_RDY is transmitted in response to an error condition.

References:

[1] 8.2.4.1 d SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If a device supports Transport Layer Retries it is required to select a new value for TPTT for each XFER_RDY frame transmitted within an I_T_L_Q Nexus when that XFER_RDY is transmitted in response to an error condition. This test is only applicable if Transport Layer Retries are enabled.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station should use a MODE SENSE command to verify that Transport Layer Retries are enabled. If Transport Layer Retries are not enabled the Testing Station should use a MODE SELECT command to enable Transport Layer Retries.
4. The Testing Station should transmit a WRITE BUFFER command to the DUT.
5. When the DUT transmits XFER_RDY the Testing Station begins transmitting DATA frames. One of the DATA frames should have a CRC error. The DUT is expected to respond with NAK.
6. The Testing Station should wait for the DUT to source a new XFER_RDY frame for the errored DATA frame.

Observable Results: Verify that the XFER_RDY frame transmitted after the DATA frame with CRC error, had a unique value for TPTT.

Possible Problems: None.

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Test 8.1.5 - Retries Enabled XFER_RDY Frame NAKed

Purpose: To determine if the DUT reacts properly if an XFER_RDY frame receives a response of NAK and Transport Layer Retries are enabled.

References:

[1] 8.2.4.4.2 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits an XFER_RDY frame and receives a NAK for that frame, the SSP target port retransmits, in the same or a new connection, the XFER_RDY frame with a different value in the TARGET PORT TRANSFER TAG field and with the RETRANSMIT bit set to one. This test is only applicable if the DUT supports Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are disabled, enable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
6. When the XFER_RDY frame is received the Testing Station will transmit NAK.

Observable Results: Verify that the DUT retransmitted the XFER_RDY frame with a new value for TPTT and the RETRANSMIT bit set to 1. The retransmission of the XFER_RDY frame may occur in the same connection as the original XFER_RDY, or in a new connection.

Possible Problems: None.

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Test 8.1.6 - Retries Enabled XFER_RDY Frame Times Out

Purpose: To determine if the DUT reacts properly if an XFER_RDY frame receives no response and Transport Layer Retries are enabled.

References:

[1] 6.17.8.6, 8.2.4.4.2, 8.2.6.3.3.5 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits an XFER_RDY frame and does not receive an ACK or NAK for that frame then the DUT should close the connection with DONE (ACK/NAK TIMEOUT) then the SSP target port should retransmit, in a new connection, the XFER_RDY frame with a different value in the TARGET PORT TRANSFER TAG field and with the RETRANSMIT bit set to one. This test is only applicable if the DUT supports Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are disabled, enable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
6. When the XFER_RDY frame is received the Testing Station will not transmit ACK or NAK.

Observable Results: Verify that the DUT closed the connection with DONE ACK/NAK TIMEOUT. Verify that the DUT opened at new connection and transmitted the XFER_RDY frame with a new value for TPTT and the RETRANSMIT but set to 1.

Possible Problems: None.

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Test 8.1.7 - Retries Enabled DATA Frame NAKed

Purpose: To determine if the DUT reacts properly if a DATA frame receives a NAK response and Transport Layer Retries are enabled.

References:

[1] 8.2.4.5.2, 8.2.6.3.3.4 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a read DATA frame and receives a NAK for that frame, then the read DATA frame was not received. The SSP target port retransmits, in the same or in a new connection, all the read DATA frames since a previous time when ACK/NAK balance occurred. This test is only applicable if the DUT supports Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are disabled, enable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a READ BUFFER command to the DUT and waits for a DATA frame.
6. When the DATA frame is received the Testing Station will transmit NAK.

Observable Results: Verify that the DUT retransmitted the NAKed DATA frame either in the same or a new connection. Verify that retransmitted data frame has the Changing Data Pointer bit set, and that it is not set in any subsequent data frames in the retransmission.

Possible Problems: None.

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Test 8.1.8 - Retries Enabled DATA Frame Times Out

Purpose: To determine if the DUT reacts properly if a DATA frame receives no response and Transport Layer Retries are enabled.

References:

[1] 6.17.8.6, 8.2.4.5.2, 8.2.6.3.3.4 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a read DATA frame and does not receive an ACK or NAK for that frame then the DUT closes the connection with DONE (ACK/NAK TIMEOUT) and then retransmits, in a new connection, all the read DATA frames since a previous time when ACK/NAK balance occurred. This test is only applicable if the DUT supports Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are disabled, enable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a READ BUFFER command to the DUT and waits for a DATA frame.
6. When the DATA frame is received the Testing Station will transmit no response.

Observable Results: Verify that the DUT closes the connection with DONE (ACK/NAK TIMEOUT). Verify that the DUT opens a new SSP connection and retransmits the DATA frame on a new connection. Verify that retransmitted data frame has the Changing Data Pointer bit set, and that it is not set in any subsequent data frames in the retransmission.

Possible Problems: None.

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Test 8.1.9 - Retries Disabled XFER_RDY Frame NAKed

Purpose: To determine if the DUT reacts properly if an XFER_RDY frame receives a NAK response and Transport Layer Retries are disabled.

References:

[1] 6.17.8.6, 8.2.4.4.3, 8.2.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits an XFER_RDY frame and receives a NAK for that frame then the DUT should transmit a Response frame with CHECK CONDITION status for that command with the sense key set to ABORTED COMMAND and the additional sense code set to NAK RECEIVED. The SSP target port transmits the RESPONSE frame in the same or a new connection. This test is only applicable if the DUT does not support Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are enabled, disable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
6. When the XFER_RDY frame is received the Testing Station responds with NAK.

Observable Results: Verify that the DUT transmitted a Response frame with status CHECK CONDITION, sense key of ABORTED COMMAND, and additional sense code set to NAK RECEIVED. This Response frame may be transmitted on the same connection as the original XFER_RDY, or on a new connection.

Possible Problems: None.

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Test 8.1.10 - Retries Disabled XFER_RDY Frame Times Out

Purpose: To determine if the DUT reacts properly if an XFER_RDY frame receives no response and Transport Layer Retries are disabled.

References:

[1] 6.17.8.6, 8.2.4.4.3, 8.2.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits an XFER_RDY frame and does not receive an ACK or NAK for that frame the DUT should close the connection with DONE (ACK/NAK TIMEOUT) then send a Response, on a new connection, with CHECK CONDITION status for that command with the sense key set to ABORTED COMMAND and the additional sense code set to ACK/NAK TIMEOUT. This test is only applicable if the DUT does not support Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are enabled, disable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a WRITE BUFFER command to the DUT and waits for an XFER_RDY frame.
6. When the XFER_RDY frame is received the Testing Station will not transmit ACK or NAK.

Observable Results: Verify that the DUT closed the connection with DONE ACK/NAK TIMEOUT. Verify that the DUT opened at new connection and retransmitted a Response frame with status CHECK CONDITION, sense key of ABORTED COMMAND, and additional sense code set to ACK/NAK TIMEOUT.

Possible Problems: None.

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Test 8.1.11 - Retries Disabled DATA Frame NAKed

Purpose: To determine if the DUT reacts properly if a DATA frame receives a NAK response and Transport Layer Retries are disabled.

References:

[1] 8.2.4.5, 8.2.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a read DATA frame and receives a NAK for that frame the the DUT should transmit, in the same or a new connection, a Response frame with CHECK CONDITION status for that command with the sense key set to ABORTED COMMAND and the additional sense code set to NAK RECEIVED. This test is only applicable if the DUT does not support Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are enabled, disable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a READ BUFFER command to the DUT and waits for a DATA frame.
6. When the DATA frame is received the Testing Station will transmit NAK.

Observable Results: Verify that the DUT retransmitted a Response frame, either in the same or a new connection, with status of CHECK CONDITION, sense key of ABORTED COMMAND, and additional sense code of NAK RECEIVED.

Possible Problems: None.

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Test 8.1.12 - Retries Disabled DATA Frame Times Out

Purpose: To determine if the DUT reacts properly if a DATA frame receives no response and Transport Layer Retries are disabled.

References:

[1] 6.17.8.6, 8.2.4.5.2, 8.2.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a read DATA frame and does not receive an ACK or NAK for that frame then the DUT closes the connection with DONE (ACK/NAK TIMEOUT). The DUT then opens a new connection and sends a Response frame with CHECK CONDITION status for that command with the sense key set to ABORTED COMMAND and the additional sense code set to ACK/NAK TIMEOUT. This test is only applicable if the DUT does not support Transport Layer Retries.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. Determine whether Transport Layer Retries are enabled or disabled by transmitting a MODE SENSE command to the DUT. If Transport Layer Retries are enabled, disable Transport Layer Retries using a MODE SELECT command.
5. The Testing Station transmits a READ BUFFER command to the DUT and waits for a DATA frame.
6. When the DATA frame is received the Testing Station will transmit no response.

Observable Results: Verify that the DUT closes the connection with DONE (ACK/NAK TIMEOUT). Verify that the DUT then opens a new connection and transmits a Response frame with status CHECK CONDITION, sense key of ABORTED COMMAND, and additional sense code of ACK/NAK TIMEOUT.

Possible Problems: None.

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Test 8.1.13 - Response Frame NAKed

Purpose: To determine if the DUT reacts properly if a Response frame receives a NAK response.

References:

[1] 8.2.4.7, 8.2.6.3.3.7.1 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a RESPONSE frame and receives a NAK for that frame, the SSP target port retransmits, in the same or a new connection, the RESPONSE frame at least one time with the RETRANSMIT bit set to one.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT. When the Response frame is received the Testing Station transmits a NAK.

Observable Results: Verify that the DUT retransmits an identical Response frame with the Retransmit bit set to 1 in either the same or a new connection.

Possible Problems: None.

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Test 8.1.14 - Response Frame Times Out

Purpose: To determine if the DUT reacts properly if a Response frame receives no response.

References:

[1] 8.2.4.7, 8.2.6.3.3.7.1 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port transmits a RESPONSE frame and does not receive an ACK or NAK for that frame then the DUT should close the connection with DONE (ACK/NAK TIMEOUT). The DUT should then open a new SSP connection and transmit the RESPONSE frame with the RETRANSMIT bit set to one.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT. When the Response frame is received the Testing Station does not transmit any response.

Observable Results: Verify that the DUT closes the connection with DONE (ACK/NAK TIMEOUT). Verify that the DUT then opens a new connection and retransmits an identical Response frame with the Retransmit bit set to 1.

Possible Problems: None.

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Test 8.1.15 - Command with CRC Error Received

Purpose: To determine if the DUT reacts properly if a command frame is received with a CRC error.

References:

[1] 8.2.4.2 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a COMMAND frame with a CRC error, the target port is expected to transmit NAK. If an identical COMMAND subsequently is received by the target port, it should process the command.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT with a CRC Error. Wait for the DUT to respond with NAK.
4. The Testing Station transmits an identical INQUIRY Command to the DUT.

Observable Results: Verify that the DUT processes the second received INQUIRY command properly and transmits a response of status GOOD.

Possible Problems: None.

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Test 8.1.16 - Task Management Command Received for Non-Existent Command

Purpose: To determine if the DUT reacts properly if a Task Management command frame is received for a non-existent command.

References:

[1] 8.2.4.2 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a Task Management command frame for a non-existent command, the target should process the Task Management command.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station should transmit a QUERY TASK Task Management command to the DUT for a command that has not been sent.

Observable Results: Verify that the DUT processes the second received Task Management command properly and transmits a response.

Possible Problems: None.

GROUP 2: TRANSPORT LAYER ERROR HANDLING FOR TARGETS

Overview:

This group of tests verifies the Transport Layer specifications of the SAS protocol defined in Clause 9 of the SAS Standard, for Initiators.

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Test 8.2.1 - XFER_RDY Frame Received

Purpose: To determine that the DUT properly handles a received XFER_RDY frame.

References:

[1] 8.2.5.3, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: June 27, 2011

Discussion: A SAS Target does not support reception of XFER_RY frames. The SAS Target is expected to discard such a received frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command followed by an XFER_RDY frame to the DUT.

Observable Results:

- Verify that the DUT responded to the received Test Unit Ready Command.
- Verify that the DUT responded to the received INQUIRY command.
- Verify that the DUT ignores the XFER_RDY frame by not responding with anything other than an ACK or NACK.

Possible Problems: None

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Test 8.2.2 - RESPONSE Frame Received

Purpose: To determine that the DUT properly handles a received RESPONSE frame.

References:

[1] 8.2.5.3, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: June 27, 2011

Discussion: A SAS Target does not support reception of XFER_RY frames. The SAS Target is expected to discard such a received frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command followed by a RESPONSE frame to the DUT.

Observable Results:

- Verify that the DUT responded to the received Test Unit Ready Command.
- Verify that the DUT responded to the received INQUIRY command.
- Verify that the DUT ignores the RESPONSE frame by not responding with anything other than an ACK or NACK.

Possible Problems: None

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Test 8.2.3 - COMMAND Frame too short to contain a LUN field

Purpose: To determine that the DUT properly handles a received COMMAND frame which is too short to contain a LUN field.

References:

- [1] 8.2.5.3 a, 8.2.6.3.2.2 SAS SPL
- [2] SAM-3 4.9

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: The LUN field is 8 bytes long. If a received SAS command frame is less than 8 bytes it is too short to contain a LUN field and the target should transmit a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command to the DUT, which is less than 64 bits long. The Testing Station waits for a RESPONSE frame from the DUT.

Observable Results: Verify that the DUT transmitted a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: None

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Test 8.2.4 - COMMAND Frame too short to contain a CDB

Purpose: To determine that the DUT properly handles a received COMMAND frame which is too short to contain a CDB.

References:

[1] 8.2.2.1, 8.2.5.3 b, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: The SAS CDB has a length 16 bytes. If a received SAS command frame is less than 16 bytes in length it is too short to contain any CDB and the target should transmit a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command to the DUT, which is less than 6 bytes long. The Testing Station waits for a RESPONSE frame from the DUT.

Observable Results: Verify that the DUT transmitted a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: None

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Test 8.2.5 - Additional CDB Length field specifies different length

Purpose: To determine that the DUT properly handles a received COMMAND frame with the Additional CDB length field specifying a length different than that of the received frame.

References:

[1] 8.2.2.1 Table 119, 8.2.5.3 b, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: The ADDITIONAL CDB LENGTH field indicates the number of dwords of additional CDB bytes included in the frame. If the ADDITIONAL CDB LENGTH field indicates that the frame is a different length than it actually is, then target should transmit a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command to the DUT with no additional CDB bytes. The ADDITIONAL CDB LENGTH field indicates that there are 20 additional dwords.

Observable Results: Verify that the DUT transmitted a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: None

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Test 8.2.6 - COMMAND Frame with Tag already used by COMMAND

Purpose: To determine that the DUT properly handles a received COMMAND frame containing a tag already used by a previous COMMAND.

References:

[1] 8.2.5.3, 8.2.3 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a COMMAND frame with a tag that is already in use for another command, the device server may return CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to OVERLAPPED COMMANDS ATTEMPTED. This is an informative test.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits a valid INQUIRY command to the DUT.
4. Without waiting for a response from the DUT to the previous command the Testing Station transmits a Test Unit Ready command to the DUT.

Observable Results: Verify that the DUT transmitted a response with status CHECK CONDITION with sense key ABORTED COMMAND and additional sense code set to OVERLAPPED COMMANDS ATTEMPTED. This is an informative test.

Possible Problems: None.

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Test 8.2.7 - COMMAND Frame with Tag already used by TASK

Purpose: To determine that the DUT properly handles a received COMMAND frame containing a tag already used by a previous TASK.

References:

[1] 8.2.5.3, 8.2.4 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a COMMAND frame with a tag that is already in use for another TASK, then the task router and task manager should return a RESPONSE frame with the RESPONSE CODE field set to OVERLAPPED TAG ATTEMPTED.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits a ABORT TASK Task Management command to the DUT.
4. Without waiting for a response form the DUT to the previous Task Management Function the Testing Station transmits a Test Unit Ready command to the DUT.

Observable Results: Verify that the DUT transmitted a response with a response code field set to OVERLAPPED TAG ATTEMPTED.

Possible Problems: None

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Test 8.2.8 - COMMAND Frame with TPTT not FFFFh

Purpose: To determine that the DUT properly handles a received COMMAND frame with an invalid TPTT.

References:

[1] 8.2.5.3, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a COMMAND frame with TPTT set to a value other than FFFFh, it may return a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME. This is an informative test.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY command to the DUT with the TPTT set to a value other than FFFFh.

Observable Results: Verify that the DUT transmitted RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: This is an informative test.

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Test 8.2.9 - TASK Frame too short

Purpose: To determine that the DUT properly handles a received TASK frame which is too short.

References:

[1] 8.2.5.3, 8.2.2.2, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: The Task Management Function Information Unit has a length 27 bytes. If a received SAS Task Management command frame is less than 27 bytes in length it is too short and the target should transmit a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an ABORT TASK Task Management command to the DUT, which is 12 bytes long, with the Tag of the Task to be managed being cut off. The Testing Station waits for a RESPONSE frame from the DUT.

Observable Results: Verify that the DUT transmitted a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: None

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Test 8.2.10 - TASK MANAGEMENT Frame with Tag already used by COMMAND

Purpose: To determine that the DUT properly handles a received TASK MANAGEMENT frame containing a tag already used by a previous COMMAND.

References:

[1] 8.2.5.3, 8.2.4 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a TASK frame with a tag that is already in use for a command or another task management function, then the task router and task manager(s) return a RESPONSE frame with the RESPONSE CODE field set to OVERLAPPED TAG ATTEMPTED.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits a valid INQUIRY command to the DUT.
4. Without waiting for a response from the DUT to the previous command the Testing Station transmits a ABORT TASK Task Management command to the DUT using the same tag as the INQUIRY command.

Observable Results: Verify that the DUT transmitted a response frame with the Response Code field set to OVERLAPPED TAG ATTEMPTED.

Possible Problems: None.

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Test 8.2.11 - TASK MANAGEMENT Frame with Tag already used by another TASK

Purpose: To determine that the DUT properly handles a received TASK MANAGEMENT frame containing a tag already used by a previous COMMAND.

References:

[1] 8.2.5.3, 8.2.4 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a TASK frame with a tag that is already in use for a command or another task management function, then the task router and task manager(s) return a RESPONSE frame with the RESPONSE CODE field set to OVERLAPPED TAG ATTEMPTED.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits a valid INQUIRY command to the DUT. Allow the DUT to transmit a response.
4. Without waiting for a response from the DUT to the previous command the Testing Station transmits 2 ABORT TASK Task Management commands to the DUT each using the same tag, but a tag different than was used with the previous INQUIRY command.

Observable Results: Verify that the DUT transmitted a response frame with the Response Code field set to OVERLAPPED TAG ATTEMPTED.

Possible Problems: None.

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Test 8.2.12 - TASK MANAGEMENT Frame with Unknown LUN

Purpose: To determine that the DUT properly handles a received TASK MANAGEMENT frame containing unknown LUN.

References:

[1] 8.2.5.3, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a TASK frame with an unknown logical unit number, the ST_TFR state machine returns a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INCORRECT LOGICAL UNIT NUMBER.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits a valid INQUIRY command to the DUT. Allow the DUT to transmit a response.
4. Without waiting for a response from the DUT to the previous command the Testing Station transmits a ABORT TASK Task Management command to the DUT using an unknown LUN.

Observable Results: Verify that the DUT transmitted a response frame with the Response Code field set to INCORRECT LOGICAL UNIT NUMBER.

Possible Problems: None.

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Test 8.2.13 - TASK Frame with TPTT not FFFFh

Purpose: To determine that the DUT properly handles a received TASK frame with an invalid TPTT.

References:

[1] 8.2.5.3, 8.2.6.3.2.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a COMMAND frame or TASK frame with a target port transfer tag set to a value other than FFFFh, the ST_TFR state machine may return a RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT.
4. Without waiting for a response to the command, the Testing Station transmits an ABORT TASK Task Management command to the DUT with the TPTT set to a value other than FFFFh.

Observable Results: Verify that the DUT transmitted RESPONSE frame with the DATAPRES field set to RESPONSE_DATA and the RESPONSE CODE field set to INVALID FRAME.

Possible Problems: None.

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Test 8.2.14 - DATA Frame with Unknown Tag

Purpose: To determine that the DUT properly handles a received DATA frame with an unknown tag.

References:

[1] 8.2.5.3, 8.2.6.3.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a DATA frame or TASK frame with an unknown tag, the ST_TFR state machine should discard the frame. The DUT should not transmit any response to the received frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT.
4. The Testing Station transmits a WRITE BUFFER Command to the DUT.
5. After receiving XFER_RDY from the DUT the Testing Station should transmit DATA frames to complete the command. One extra DATA frame should be sent with an unknown tag.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status GOOD and that it did not transmit ACK or NAK to the received DATA frame with an unknown tag. The DUT may transmit R_RDY in response to the received DATA frame with an unknown tag.

Possible Problems: None.

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Test 8.2.15 - DATA Frame with no outstanding XFER_RDY

Purpose: To determine that the DUT properly handles a received DATA frame which does not contain first burst data and for which there is no outstanding XFER_RDY.

References:

[1] 8.2.5.3, 8.2.6.3.2 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: June 27, 2011

Discussion: If an SSP target port receives a write DATA frame that does not contain first burst data and for which there is no XFER_RDY frame outstanding (i.e., it has received all requested write data), the ST_TFR state machine discards the frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT.
4. The Testing Station transmits a WRITE BUFFER Command to the DUT.
5. After receiving XFER_RDY from the DUT the Testing Station should transmit DATA frames to complete the command. One extra DATA frame should be sent with a valid tag.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status GOOD and that it did not transmit any response, other than an ACK or NACK, to the received extra DATA frame.

Possible Problems: None.

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Test 8.2.16 - DATA Frame with unknown TPTT

Purpose: To determine that the DUT properly handles a received DATA frame which contains an unknown TPTT.

References:

[1] 8.2.5.3, 8.2.6.3.3 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port is using target port transfer tags and receives a write DATA frame with an unknown target port transfer tag, the ST_TFR state machine discards the frame. This test is only applicable if a device is using Target Port Transfer Tags. If a target device is using Target Port Transfer Tags it will set the TPTT field in the XFER_RDY frame it transmits in response to a received WRITE BUFFER command.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT.
4. The Testing Station transmits a WRITE BUFFER Command to the DUT.
5. Wait for an XFER_RDY frame from the DUT, if the DUT sets the TPTT field in the XFER_RDY frame this test is applicable to the device.
6. After receiving XFER_RDY from the DUT the Testing Station should transmit DATA frames to complete the command. One extra DATA frame should be sent with an unknown TPTT.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status GOOD and that it did not transmit any response, other than an ACK or NACK, to the received extra DATA frame with the unknown TPTT.

Possible Problems: This test is only applicable if a device is using Target Port Transfer Tags.

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Test 8.2.17 - DATA Frame with wrong offset received with Retries Disabled

Purpose: To determine that the DUT properly handles a received DATA frame which contains an incorrect data offset field when transport layer retries are disabled.

References:

[1] 8.2.5.3, 8.2.6.3.3.6.1, 8.2.3 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If transport layer retries are disabled and an SSP target port receives a write DATA frame with a data offset that was not expected, the ST_TTS state machine discards the frame and the device server terminates the command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to DATA OFFSET ERROR.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. The Testing Station transmits a MODE SENSE command to the DUT requesting the Protocol Specific Logical Unit Mode Page for SAS SSP in the short format.
5. Determine if the Transport Layer Retries bit is set to 1 or 0. If the Transport Layer Retries bit is set to 0 than Transport Layer Retries are disabled and the test is applicable to the device.
6. The Testing Station transmits a WRITE BUFFER Command to the DUT.
7. After receiving XFER_RDY from the DUT the Testing Station should transmit DATA frames to complete the command. One of the DATA frames should be sent with an incorrect data offset field.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status CHECK CONDITION with the sense key set to ABORTED COMMAND and the additional sense code set to DATA OFFSET ERROR.

Possible Problems: It is important to verify that Transport Layer Retries are disabled.

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Test 8.2.18 - DATA Frame with Excess Data Received

Purpose: To determine that the DUT properly handles a received DATA frame which contains excess data.

References:

[1] 8.2.5.3, 8.2.6.3.3.6.1, 8.2.3 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a write DATA frame with more write data than expected (i.e., the write DATA frame contains data in excess of that requested by an XFER_RDY frame or, for first burst data, indicated by the FIRST BURST LENGTH field in the Disconnect-Reconnect mode page), the ST_TTS state machine discards the frame and the device server terminates the command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to TOO MUCH WRITE DATA.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. The Testing Station transmits a WRITE BUFFER Command to the DUT.
5. After receiving XFER_RDY from the DUT the Testing Station should transmit a DATA frame with more data than was requested in the XFER_RDY frame from the DUT.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status CHECK CONDITION with the sense key set to ABORTED COMMAND and the additional sense code set to TOO MUCH WRITE DATA.

Possible Problems: None.

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Test 8.2.19 - DATA Frame with Zero Data Received

Purpose: To determine that the DUT properly handles a received DATA frame which contains no data.

References:

[1] 8.2.5.3, 8.2.6.3.3.6.1, 8.2.3 SAS SPL

Resource Requirements: SAS Protocol Analyzer and Generator.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a write DATA frame with zero bytes, the ST_TTS state machine discards the frame and the device server terminates the command with CHECK CONDITION status with the sense key set to ABORTED COMMAND and the additional sense code set to INFORMATION UNIT TOO SHORT.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station transmits an INQUIRY Command to the DUT and waits for response.
4. The Testing Station transmits a WRITE BUFFER Command to the DUT.
5. After receiving XFER_RDY from the DUT the Testing Station should transmit a DATA frame with no data.

Observable Results: Verify that the DUT transmitted a RESPONSE to the command with status CHECK CONDITION with the sense key set to ABORTED COMMAND and the additional sense code set to INFORMATION UNIT TOO SHORT.

Possible Problems: None.

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Test 8.2.20 - Retries Enabled DATA frame with CRC Error Received

Purpose: To determine if the DUT reacts properly if a DATA frame is received with a CRC error when Retries are enabled.

References:

[1] 8.2.4.5.2, 8.2.4.5.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a DATA frame with a CRC error, it can either wait for the SAS initiator to retransmit the frame, or specifically ask for the frame to be retransmitted with a new XFER_RDY frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

7. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
8. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
9. The Testing Station should use a MODE SENSE command to verify that Transport Layer Retries are enabled. If Transport Layer Retries are not enabled the Testing Station should use a MODE SELECT command to enable Transport Layer Retries.
10. The Testing Station should transmit a WRITE BUFFER command to the DUT.
11. When the DUT transmits XFER_RDY the Testing Station begins transmitting DATA frames. One of the DATA frames should have a CRC error. The DUT is expected to respond with NAK.
12. The Testing Station should retransmit the DATA frame from the relative offset of the last received XFER_RDY frame.
13. If the DUT sources a new XFER_RDY frame for the errored DATA frame the Testing Station should abandon retransmission and send the DATA frames again with the new TPTT in the new XFER_RDY frame.

Observable Results: Verify that the WRITE BUFFER completed with status GOOD.

Possible Problems: None.

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Test 8.2.21 - Retries Disabled DATA frame with CRC Error Received

Purpose: To determine if the DUT reacts properly if a DATA frame is received with a CRC error when Retries are disabled.

References:

[1] 8.2.4.5.2, 8.2.4.5.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a DATA frame with a CRC error, it can either wait for the SAS initiator to retransmit the frame, or specifically ask for the frame to be retransmitted with a new XFER_RDY frame.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station should use a MODE SENSE command to verify that Transport Layer Retries are enabled. If Transport Layer Retries are not enabled the Testing Station should use a MODE SELECT command to enable Transport Layer Retries.
4. The Testing Station should transmit a WRITE BUFFER command to the DUT.
5. When the DUT transmits XFER_RDY the Testing Station begins transmitting DATA frames. One of the DATA frames should have a CRC error. The DUT is expected to respond with NAK.

Observable Results: Verify that the DUT transmitted a RESPONSE frame with status CHECK CONDITION.

Possible Problems: None.

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Test 8.2.22 - Retries Enabled Duplicate DATA frame Received

Purpose: To determine if the DUT reacts properly if a duplicate DATA frame is received when Retries are enabled.

References:

[1] 8.2.4.5.2, 8.2.4.5.3 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: If an SSP target port receives a duplicate DATA frame the command should still complete normally if Retries are enabled.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station should use a MODE SENSE command to verify that Transport Layer Retries are enabled. If Transport Layer Retries are not enabled the Testing Station should use a MODE SELECT command to enable Transport Layer Retries.
4. The Testing Station should transmit a WRITE BUFFER command to the DUT.
5. When the DUT transmits XFER_RDY the Testing Station begins transmitting DATA frames. During the transmission, the Testing Station will retransmit DATA frames to one XFER_RDY command, after sending DONE ACK/NAK timeout to mimic a missing ACK from the DUT. The Testing Station completes all DATA transmissions to the DUT.

Observable Results: Verify that the WRITE BUFFER completed with status GOOD.

Possible Problems: None.

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Test 8.2.23 - Initiator Response Timeout Expired

Purpose: To determine if the DUT reacts properly if the Initiator Response Timeout expires without receiving DATA from a received command.

References:

[1] 8.2.6.3.1 SAS Standard

Resource Requirements: SAS Protocol Analyzer and Generator. SAS Target.

Last Modification: August 24, 2011

Discussion: The Initiator Response Timeout can be set in the Protocol –Specific Port mode page of a target. If this timeout expires before command completion a target device should issue a response of CHECK CONDITION to the command.

Test Setup: The DUT and the Testing Station are physically connected.

Test Procedure:

1. The Testing Station is instructed to start and complete a phy Reset sequence followed by an Identify sequence with the DUT.
2. The Testing Station transmits a Test Unit Ready Command to the DUT. The Testing Station waits for RESPONSE from the DUT.
3. The Testing Station should use a MODE SENSE command to verify that Transport Layer Retries are enabled. If Transport Layer Retries are not enabled the Testing Station should use a MODE SELECT command to enable Transport Layer Retries.
4. The Testing Station should use a MODE SENSE command to determine if the Initiator Response Timeout is set to 2 seconds. If not, the Testing Station should use a MODE SELECT command to set the Initiator Timeout Response to 2 seconds.
5. The Testing Station should transmit a WRITE BUFFER command to the DUT.
6. The Testing Station should not transmit any DATA to the DUT.

Observable Results: Verify that the DUT responded to the received command with a SCSI RESPONSE with status CHECK CONDITION only after the Initiator Response Timeout expired.

Possible Problems: None.