



Serial ATA International Organization

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**Serial ATA Interoperability Program Revision 1.4
LeCroy MOI for Device Digital Tests (ASR, GTR, NCQ, SSP,
IPM, DOF)**

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Serial ATA Interoperability Program



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RECORD of CHANGES

Revision	Date	Comments
0.85	05/11/2009	Initial draft, based on MOI 1.3
0.90	05/14/2009	Minor changes from review, add change bars from 1.3 MOI
0.92	05/18/2009	Changes on GTR-02, NCQ_05, IPM_03 and IPM_11.
0.93	06/02/2009	Changes to conform to UTD 1.4 v0.933: NCQ-03, NCQ-04 (add checksum verification) SSP-12 (Check Word 86 bit 15 in IDENTIFY DEVICE (set to one) DOF-01 (run 5 times)
1.00RC	06/04/2009	Change revision to 1.00RC and remove change bars.
1.00RC2	8/27/09	Change tests SSP-11, IPM-03 and IPM-11 to informative
1.00	8/27/09	Change revision to 1.00, remove change bars.
1.08	10/6/10	Update Purpose of several tests, switch to using only 2 projects instead of 4 on IPM-03 and IPM-11, remove all informative status
1.09	10/15/10	Put Informative status back where it was, bump to 1.09.
1.091	11/2/10	Remove Informative status after Dry Run #8 results review, remove old change bars, bump to 1.091.
1.1RC	11/4/10	Remove all change bars, bump to 1.1RC.
1.1	3/3/11	Remove RC.



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INTRODUCTION

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

To verify that a Vendor's HDD SATA Gen 1, Gen 2 or Gen3 device meets the Digital test requirements described in Serial ATA Interoperability Program Rev 1.4 Version 1.0 Unified Test Document for both Mandatory and Optional testing.

Each specific test will include a brief statement outlining what the test written at a functional level attempts to achieve.

References

For each test this section may specify any additional reference material external to the test suite, including the specific sub clauses 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 A", or "Table 5.1.1-1")

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.

Common requirements for all Tests are listed below, some tests may have additional requirements which will be listed within the specific test:

Resource Requirements

- Windows XP Operating System
- LeCroy STX SATA Software Revision 3.50 or higher.
- Windows based host system with an available USB/Ethernet port
- 512MB RAM or higher
- For Gen1, Gen2 and Gen3 tests: LeCroy Sierra M6-4, Sierra M6-2 or STX-460 Protocol Bus Analyzer/Exerciser



- For Gen1 and Gen2 tests only: LeCroy Sierra M6-4, Sierra M6-2, STX-460, STX-431, STX-231 or STX-131 Protocol Bus Analyzer/Exerciser
- LeCroy SATA External Power Cable or an external power supply
- Serial ATA cables, eSATA to SATA cables if testing eSATA devices
- Vendor supplied SATA HDD/ATAPI Product Under Test (P.U.T.)
- Proper media compatible with ATAPI drives: Compatible blank RW media for read-write drives, or a known Data Disc (Read(10) compatible) for read-only drives

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 are not included, and are generally presented in the test procedure section.

Since the main test setup for all the tests are the same therefore this setup is listed in **Appendix B**

Procedure

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

Since the main test procedure for all the tests are the same therefore this procedure is listed in **Appendix B**

Observable Results

This section lists the specific observables that can be examined by the tester in order to verify that the P.U.T. 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 result

No	Test Name	Description	Result	Detail
12	IPM-02	The device exit latency (i.e. COMWAKE response) from the slumber state (Host Initiated) shall start within 10 milliseconds of COMWAKE receipt from the host.	Passed	HIPM wakeup latency is 500.453 (us).
13	IPM-04	If a device does not support host interface power management (Word 76 bit 9 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data), upon receipt of a PMREQ_P or PMREQ_S the device shall respond with a PMNAK.	Failed	Device claimed not to support power management but it returns PMACK
14	IPM-05	If a device claims support for host interface power management (Word 76 bit 9 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data), upon receipt of a PMREQ_P the device shall return at least 4 PMACK primitives and force Phy to Partial or respond with PMNAK until host sends SYNC.	N/A	Device does not support Power Management
15	IPM-06	If a device claims support for host interface power management (Word 76 bit 9 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data), upon receipt of a PMREQ_S the device shall return at least 4 PMACK primitives and force Phy to Slumber or respond with PMNAK until host sends SYNC.	N/A	Device does not support Power Management

Generally, four result categories exist:

1. **“PASSED”**: means the P.U.T. has fulfilled the required criteria via LeCroy Test Procedure.
2. **“FAILED”**: means at least one compliance criterion is not met.



3. “N/A”: means the test is not applicable to the P.U.T. and is generally derived from the list of supported features of P.U.T. in Identify Page data.
4. BLANK: means a severe error is happened during the execution of test project on LeCroy Host Emulator. This may be caused by a loose connection, power failure or similar problems. In this case, test procedure shall be repeated to obtain a reliable result. It is highly recommended to check mechanical connections before re-running the test. In some rare situations, an internal error in P.U.T. or Host Emulator Engine may lead to this problem and causes the BLANK result to be repeated in next executions. The best and most reliable solution to this problem is to switch off the P.U.T. and LeCroy Host Emulator and switch on back before retrying the test.

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.

References

The following documents are referenced in this text:

1. Serial ATA Revision 3.0
2. SATA-IO Interoperability Rev 1.4 Program Policy Document
3. SATA-IO Interoperability Rev 1.4 Version 1.01 Unified Test Document



Test Procedures



ASR-01 COMINIT Response Interval

Purpose

To verify that a device in quiescent interface state will respond to a host COMRESET signal with a COMINIT signal within 10ms.

Resource Requirements

As listed in Resource Requirements on page 6.

Last Modification

June 28, 2007

Discussion

After connecting the device, Host Emulator will issue a COMRESET to device. In the captured trace, the device response time is measured and verified.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *ASR01-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY/IDENTIFY PACKET DEVICE command is issued
- **Post process:**
 - Existing of Host side COMRESET and Device side COMINIT in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - COMINIT timing in response to COMRESET of host is verified to be within 10 milliseconds.
 - This test is repeated 5 times for consistency
 - If the above criterion is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED” and a “PASSED” result will be reported by the tool.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\Program Files\LeCroy\SATA2.xx\LOG directory and double clicking on the appropriate test for analysis.
2. Results of all 5 test runs will be reported; the value used to determine pass/fail is the worst-case value out of the 5 (i.e.: largest value).



Measurement Tolerance: +/- 13.337 ns

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to 'Auto Detect' speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to 'Auto-Detect' speed.



ASR-02 COMINIT OOB Interval

Purpose

To confirm when PHY communication is not established, the device does not initiate a new OOB (COMINIT) to the host faster than every 10 ms.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 10, 2008

Discussion

Host emulator is turned off and only the device activities are captured. In the trace, the time distance between each two consecutive COMINIT signals, sent by device, are measured. The first invalid time-period is reported in the test result. This requirement is verified on 10 total sequences.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

Two test projects are executed via LeCroy Host emulator at the highest supported speed of device and an analyzer only project is run after that. The resulting trace of analyzer project will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *ASR02-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued
 - 3) Host interface is switched off and is retained in off state for the test time
 - *ASR02-02.stc*
 - 1) An analyzer only project.
- **Post process:**
 - Existing of two Device side COMINIT in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - The time between device transmitted COMINIT signals is measured and verified to be more than 10ms each.
 - This requirement is checked in 10 total runs.
 - If the above criterion is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED” and a “PASSED” result will be reported by the tool



Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.
2. Results of all 10 test runs will be reported; the value used to determine pass/fail is the worst-case value out of the 10 (i.e.: smallest value).

Measurement Tolerance: +/- 13.337 ns

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



GTR-01 – Software Reset

Purpose

To verify that a Device will successfully respond to the toggling of the SRST bit in the Device Control register and perform the software reset protocol.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 22, 2009

Discussion

Host Emulator issues a COMRESET to P.U.T. and after getting initial RD2H, it issues an IDENTIFY/IDENTIFY PACKET DEVICE command to be sure the interface works perfect. Afterwards a Soft Reset is issued and the device response is verified from captured trace. Device response time is also checked to be within 31 seconds. The process is repeated 5 times to be certain of result persistency.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *GTR01-05.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command is issued.
 - 3) A READ SECTORS command (for ATA devices) or a READ CD command (for ATAPI devices) is issued.
 - 4) Soft reset is issued
- **Post process:**
 - Existing of both Commands and Soft Reset FISs in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - The contents of device’s response to Soft reset (i.e. the first received FIS after Soft Reset) is verified:
 - 1) Sector Count shall be ‘01’
 - 2) LBA Low shall be ‘01’
 - 3) LBA Mid + LBA Hi shall be (‘00’+‘00’ or ‘14h’+‘EBh’)



- Device latency is verified to be less than 31 seconds
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.
- This test is repeated for 5 times.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



GTR-02 – SATA Gen-3 Signaling Speed Backwards Compatibility

Purpose

To verify that a device which claims support for Serial ATA Gen-2 or above ($n \geq 2$) signaling speed (Word 76 bit 2 or above ($n \geq 2$) set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data), also supports Serial ATA signaling speed below it ($< n$) (Word 76 bit below n , i.e. ($n-1$) to 1 ($n \geq 2$) set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data) and works in all speeds properly.

Resource Requirements

As listed in Resource Requirements on page 6.

Last Modification

May 18, 2009

Discussion

An IDENTIFY/IDENTIFY PACKET DEVICE command is issued to device and support for Serial ATA Gen-2 or above signaling is checked by verifying Word 76 bit 2 or above is set. Then Host Emulator tries to establish connection to P.U.T. and executes commands at all claimed speeds (1.5GB, 3GB and 6GB). Proper command execution in all speeds is verified and Word 76 bit ($n-1$) to 1 ($n \geq 2$) is checked as test criteria. The process is repeated 10 times to be certain of result persistency and signature contents are checked to be correct at every run.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at all SATA speeds and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. To be sure of result persistency, the test is repeated for 10 times and “PASSED” result is reported only when all results were “PASSED”.

- **Test Project:**

- *GTR02-01.stc*

- 1) The Host first tries to initiate link (COMRESET signal) at 6G, and then repeats the test project at 3G and 1.5G.
- 2) This project is run for 10 times at all speeds and signature contents are checked at each run. (See post process)
- 3) An IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command is issued

- **Post process:**



- Existence of IDENTIFY DEVICE / IDENTIFY PACKET DEVICE Command in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if the command was not executed properly.
- Supported speeds in Identify page data Word 76 bit 2 and above are checked and “N/A” is reported when 3.0G and above speeds are not claimed to be supported.
- When device sends and receives frames at 3.0G and above speeds, it is expected to support all speeds below it also. If device could not send and receive frames at 1.5G when highest reported supported speed is 3G, “FAILED” is returned.
- If device could not send and receive frames at either 1.5G or 3G when highest reported supported speed is 6G, “FAILED” is returned.
- Device is expected to report all of its supported speeds in Identify page data. If device works at 1.5G or 3G speeds but does not report those speeds as supported, “FAILED” result is reported.
- The contents of device’s status FIS are verified as below and “FAILED” is returned if these contents are not matched or the OOB sequence is failed for each iteration:
 - 1) Sector Count shall be ‘01’
 - 2) LBA Low shall be ‘01’
 - 3) LBA Mid + LBA Hi shall be (‘00’+‘00’ or ‘14h’+‘EBh’)
- If Word 76 bit 3 of Identify page data is set to one, then Word 76 bits 2-1 is verified and “FAILED” is returned if either of them is cleared to zero.
- If Word 76 bit 2 of Identify page data is set to one, then Word 76 bit 1 is verified and “FAILED” is returned if it is cleared to zero.
- A “PASSED” result is reported when no problem is detected.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



GTR-03 DMA Protocol Support

Purpose

To verify that a device supports DMA and responds properly to DMA commands as well as supports DMA in Identify page data (Word 49 bit 8).

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

April 08, 2008

Discussion

After establishing connection to P.U.T., Host Emulator enables DMA mode and issues an IDENTIFY DEVICE command to check device's Identify Page data contents. Then it issues Read/Write commands to device 5 times and checks the proper execution of all commands and the contents of written/read payload.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

Four test projects are executed via LeCroy Host emulator at highest supported transfer rate and the resulting trace is captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. To be sure of result consistency, the test is repeated for 5 times and "PASSED" result is reported only when all results were "PASSED".

- **Test Project:**

- 1) *For ATA devices (Identify.stc, GTR03-01.stc)*

- 2) *Identify.stc*

- COMRESET signal is issued
- An IDENTIFY PACKET command is issued to find out which DMA mode is supported by device.

- 3) *GTR03-01.stc*

- COMRESET signal is issued
- A SET FEATURE command sets transfer mode to an Ultra DMA mode which supported by device (mode 0 to mode 6). If device supports none of Ultra DMA modes then transfer mode will be set to Multiword DMA (mode 0 to mode 2).
Note: The highest supported transfer rate of the selected DMA type is selected.
- An IDENTIFY DEVICE command is issued



- A Pair of WRITE/READ DMA commands with 4KB payload are issued for five iterations, incrementing the LBA by 4KB
 - A Pair of WRITE/READ DMA commands with 16KB payload are issued for five iterations, incrementing the LBA by 16KB
- **For ATAPI devices(*GTR03-02.stc*, *GTR03-03.stc*, *GTR03-04.stc*)**
- 1) ***GTR03-02.stc***
- In a loop, TEST UNIT READY and REQUEST SENSE commands are sent until the device gets ready
 - An IDENTIFY PACKET DEVICE command is issued

Note: Project *GTR03-02.stc* is run to check whether a proper media is inserted into ATAPI device or not.

- 2) **For ATAPI devices with Read-only media inserted (*GTR03-03.stc*)**
- In a loop, TEST UNIT READY and REQUEST SENSE commands are sent until the device gets ready
 - Specified number of READ(10) (or READ CD for media that does not support Read(10)) based on track size, logical block size and transfer length are issued to read one track worth of data.
 - Another set of READ(10) (or READ CD for media that does not support Read(10)) command is issued to the same LBA as above.
 - Test is executed twice, first with minimum transfer length equal to 1 (2KB) and again with transfer length equal to 16384/Logical Block Size (16 KB).
- 3) **For ATAPI devices with Writable media inserted (*GTR03-04.stc*)**
- In a loop, TEST UNIT READY and REQUEST SENSE commands are sent until the device gets ready
 - An IDENTIFY PACKET DEVICE command is issued
 - Media is erased via a BLANK command
 - Specified number of WRITE(10) based on track size, logical block size and transfer length are issued to write one track worth of data.
 - Media is finalized by issuing SYNCHRONIZE CACHE and CLOSE TRACK/SESSION commands
 - TEST UNIT READY and REQUEST SENSE commands are sent until the device gets ready
 - Another set of READ(10) (or READ CD for media that does not support Read(10)) commands is issued to the same LBA as above.
 - Test is executed twice, first with minimum transfer length equal to 1 (2KB) and again with transfer length equal to 16384/Logical Block Size (16 KB).



- **Post process:**

- All issued Commands in the trace are checked to verify the proper execution of the test project. “ERROR” result is reported if one of the above commands was missed and/or not executed properly and/or device was not ready.
- If bit 8 of WORD 49 is not set, that means the device does not support DMA, a “N/A” is reported.
- Bits 0 to 3 of WORD 63 (Multiword DMA support) and bits 0 to 6 of WORD 88 (Ultra DMA support) are checked and “FAILED” is reported if device supports neither UDMA nor MDMA.
- The payload of each pair of READ/WRITE DMA commands are compared and “FAILED” is reported when a mismatch is found.
- For ATAPI devices that only support READ functions, the payload from each successive READ will be compared to the previous READ with the same LBA address. “FAILED” is reported when a mismatch is found.
- If no problem is detected, “PASSED” result is reported

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



GTR-04 Word 93 contents

Purpose

To verify that the entire contents of word 93 in Identify Page data is cleared to zero.

To verify that a Serial ATA device supports the 1.5Gb/s interface rate.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Host Emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and verifies the WORD 93 to be cleared zero and that Word 76 bit 1 is set to one

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *GTR04-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command for ATA devices and IDENTIFY PACKET DEVICE for ATAPI devices is issued
- **Post process:**
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE Command in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - WORD 93 of Identify Page data is verified to be ‘0’.
 - Word 76 bit 1 is verified to be set to ‘1’.
 - WORD 76-79 bit 0 is verified to be zero.
 - If above criterion is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.



Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to 'Auto Detect' speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to 'Auto-Detect' speed.



GTR-05 Unrecognized FIS receipt

Purpose

To verify that the receiver of an "unrecognized FIS" follows the link layer state machine definitions in section 9.6 of the Serial ATA Revision 2.6 specification upon receipt of an "unrecognized FIS" (return status with an R_ERR).

Resource Requirement

As listed in Resource Requirements on page 6.

October 15, 2010

Discussion

According to SATA spec, device shall respond to each received FIS with R_OK or R_ERR. The normal response to an "unrecognized FIS" is R_ERR. Host Emulator sends all possible "unrecognized FISs" to the P.U.T. and checks the device response to each one. Any FIS which is not responded by R_ERR is listed in the final report.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *GTR05-01.stc*
 - 1) COMRESET signal is issued
 - 2) 242 FISs with un-defined types are issued to device. We consider all unrecognized FISs (242 FISs) and the rest are recognized for device.
 - 3) Each FIS contains 20 Bytes starting from 0x01 to 0xFF.
- **Post process:**
 - Existing of all issued FISs in the trace is checked. "ERROR" result is reported if one of the FISs was missed.
 - Device response to all FISs is verified. R_ERR response is assumed a normal response.
 - R_OK response to an undefined FIS type is not restricted in spec; so this kind of report is assumed as fine, but is reported in final report.
 - No response to a FIS is forbidden and causes a "FAILED" in final report.
 - If no failed FIS response is detected, "PASSED" is reported in final result. The list of all FISs which are acknowledged with R_OK will also be attached in result.



Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



NCQ-01 Forced Unit Access

Purpose

To verify that the device supports the Force Unit Access (FUA) bit. For WRITE FPDMA QUEUED when the FUA bit is set to one, the data is written to the storage media before completing the command.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 10, 2008

Discussion

Host Emulator issues an IDENTIFY DEVICE command to P.U.T. to check the support for NCQ feature. Then it issues a pair of WRITE/READ FPDMA QUEUED commands to device (with FUA bit set). In the captured trace, the Read and Write payloads are compared to be the same.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the support for NCQ feature and then the pass/fail criteria.

- **Test Project:**
 - *NCQ01-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued
 - 3) A WRITE FPDMA QUEUED command with FUA bit set is issued
 - 4) A READ FPDMA QUEUED command to the same location is issued
- **Post process:**
 - Existing and complete execution of all three Commands in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above commands is missed and/or not executed completely.
 - Bit 8 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support NCQ feature.
 - The payloads of READ and WRITE commands are compared. “FAILED” result will be reported if any mismatch is found in payloads; otherwise the test would be “PASSED”.



Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



NCQ-02 Read Log Ext Log Page 10h Support

Purpose

To verify that a device supporting Native Command Queuing (Word 76 bit 8 set to one in Identify Page data) supports READ LOG EXT for log page 10h.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 22, 2009

Discussion

Host Emulator issues an IDENTIFY DEVICE command and a READ LOG EXT to P.U.T. (to get General Purpose Log Directory page). The device which supports NCQ is verified to support log page 10h in the returned General Purpose Log Directory page.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the support for NCQ feature and then the pass/fail criteria.

- **Test Project:**
 - *NCQ02-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued
 - 3) A READ LOG EXT command is issued to get the device log directory
 - 4) A READ LOG EXT for log page 10h is issued.
- **Post process:**
 - Existing and complete execution of all Commands in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above commands is missed and/or not executed completely.
 - Bit 8 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support NCQ feature.
 - Bit 5 of Word 87 of Identify Page data is checked and “Failed” is given if this bit is set to “0”
 - Receipt of data is confirmed from log page 0h.
 - The bytes at address 20h and 21h of first READ LOG EXT (log page 0h) payload are checked to be 01h and 00h;
 - Receipt of data is confirmed from log page 10h.



- If all above criteria is fulfilled, “PASSED” result is reported, otherwise the test would be “FAILED”.

Observable Results

Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



NCQ-03 Intermix of Legacy and NCQ Commands

Purpose

To verify that device stops the execution of its outstanding NCQ commands when it receives a Legacy ATA command. This test also verifies the state cleanup after issuing a READ LOG EXT with log page 10h to the device.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

June 2, 2009

Discussion

Host Emulator establishes connection with P.U.T. and checks its support for NCQ. Then it issues several READ FPDMA QUEUED commands to device until it gets sure device has an outstanding NCQ command in its queue. After then, the Host Emulator sends Legacy commands (IDENTIFY DEVICE command, a Read DMA and a PIO OUT for each test) to device and verifies the proper device response in the captured trace. At last, Host Emulator issues a READ LOG Ext with log page 10h, to check the device proper state clean up after error occurrence.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

Four test projects are executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured. Each trace is post-processed to verify of its complete execution. Support for NCQ feature is checked in first project and the pass/fail criteria of device response to different Legacy commands is verified during the post-process of trace no 2 to 4.

- **Test Projects:**
 - ***Identify.stc***
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - ***NCQ03-01.stc***
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) Some READ FPDMA QUEUED commands are issued until more than one running command remains in Host's Queue. This guarantees the existence of at least one command in device's queue.
 - 4) An IDENTIFY DEVICE command is issued.
 - 5) READ LOG EXT command is issued after device reports error
 - ***NCQ03-02.stc***
 - 1) COMRESET signal is issued.



- 2) An IDENTIFY DEVICE command is issued.
- 3) Some READ FPDMA QUEUED commands are issued until more than one running command remains in Host's Queue. This guarantees the existence of at least one command in device's queue.
- 4) A READ DMA command is issued.
- 5) READ LOG EXT command is issued after device reports error
- **NCQ03-03.stc**
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) Some READ FPDMA QUEUED commands are issued until more than one running command remains in Host's Queue. This guarantees the existence of at least one command in device's queue.
 - 4) A WRITE SECTOR command is issued.
 - 5) READ LOG EXT command is issued after device reports error
- **NCQ03-04.stc**
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) Some READ FPDMA QUEUED commands are issued until more than one running command remains in Host's Queue. This guarantees the existence of at least one command in device's queue.
 - 4) A READ LOG EXT command with log page 10h is issued.
 - 5) READ LOG EXT command is issued after device reports error
- **Post processes:**
 - **Identify.sts:**
 - Existing and complete execution of IDENTIFY DEVICE Commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if the above commands is missed and/or not executed completely.
 - Bit 8 of WORD 76 of Identify Page data is checked and "N/A" result is reported if device does not support NCQ feature.
 - **NCQ03-01.sts:**
 - Existing and complete execution of IDENTIFY DEVICE and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to Legacy command is checked that should be a RD2H with:
 - 1) ERR bit in Status register set
 - 2) DRQ bit in status register is cleared
 - 3) DF bit in status register is cleared
 - 4) DRDY bit in status register is set
 - 5) BSY bit in Status register cleared
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:
 - 1) ERR bit in Status register cleared
 - 2) DRDY bit in Status register is set



- 3) DF bit in Status register is cleared
 - 4) BSY bit in Status register is cleared
 - 5) DRQ bit in Status register is cleared
 - 6) Interrupt bit (I) cleared
 - 7) SActive Register equals to 'FFFFFFFFh'
- NQ Bit in returned log page (payload of READ LOG EXT) is verified to be set
- Checksum in returned log page (payload of READ LOG EXT) is verified to be correct.
- If any of the above criteria is not fulfilled, "FAILED" result is reported.
- **NCQ03-02.sts:**
 - Existing and complete execution of READ DMA and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to Legacy command is checked that should be a RD2H with:
 - 1) ERR bit in Status register set
 - 2) DRQ bit in status register is cleared
 - 3) DF bit in status register is cleared
 - 4) DRDY bit in status register is set
 - 5) BSY bit in Status register cleared
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:
 - 1) ERR bit in Status register cleared
 - 2) DRDY bit in Status register is set
 - 3) DF bit in Status register is cleared
 - 4) BSY bit in Status register is cleared
 - 5) DRQ bit in Status register is cleared
 - 6) Interrupt bit (I) cleared
 - 7) SActive Register equals to 'FFFFFFFFh'
 - NQ Bit in returned log page (payload of READ LOG EXT) is verified to be set
 - Checksum in returned log page (payload of READ LOG EXT) is verified to be correct.
 - If any of the above criteria is not fulfilled, "FAILED" result is reported.
- **NCQ03-03.sts:**
 - Existing and complete execution of WRITE SECTOR and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to Legacy command is checked that should be a RD2H with:
 - 1) ERR bit in Status register set
 - 2) DRQ bit in status register is cleared
 - 3) DF bit in status register is cleared
 - 4) DRDY bit in status register is set
 - 5) BSY bit in Status register cleared
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:



- 1) ERR bit in Status register cleared
 - 2) DRDY bit in Status register is set
 - 3) DF bit in Status register is cleared
 - 4) BSY bit in Status register is cleared
 - 5) DRQ bit in Status register is cleared
 - 6) Interrupt bit (I) cleared
 - 7) SActive Register equals to 'FFFFFFFFh'
- NQ Bit in returned log page (payload of READ LOG EXT) is verified to be set
 - Checksum in returned log page (payload of READ LOG EXT) is verified to be correct.
 - If any of the above criteria is not fulfilled, "FAILED" result is reported.
- **NCQ03-04.sts:**
 - Existing and complete execution of both READ LOG EXT commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to Legacy command is checked that should be a RD2H with:
 - 1) ERR bit in Status register set
 - 2) DRQ bit in status register is cleared
 - 3) DF bit in status register is cleared
 - 4) DRDY bit in status register is set
 - 5) BSY bit in Status register cleared
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:
 - 1) ERR bit in Status register cleared
 - 2) DRDY bit in Status register is set
 - 3) DF bit in Status register is cleared
 - 4) BSY bit in Status register is cleared
 - 5) DRQ bit in Status register is cleared
 - 6) Interrupt bit (I) cleared
 - 7) SActive Register equals to 'FFFFFFFFh'
 - NQ Bit in returned log page (payload of READ LOG EXT) is verified to be set
 - Checksum in returned log page (payload of READ LOG EXT) is verified to be correct.
 - If any of the above criteria is not fulfilled, "FAILED" result is reported.
 - If all four post-process phases are completed without any problem, "PASSED" result is reported.

Observable Results

1. Click the "View" button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems



It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to 'Auto Detect' speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to 'Auto-Detect' speed.



NCQ-04 Device Response to Malformed NCQ Command

Purpose

To verify that when a NCQ supported device receives a malformed NCQ command, it transmits a Register FIS to the host with the ERR bit set to one, and the BSY bit cleared to zero in the Status register, and the 'I' bit is set to one and the ABRT or IDNF bits is set in the Error field. The state clean up is also checked to be done after transmission of READ LOG EXT to device.

Resource Requirement

As listed in Resource Requirements on page 6

Last Modification

June 2, 2009

Discussion

Host emulator establishes connection with P.U.T. and issues IDENTIFY DEVICE command to device. Then the device support for NCQ feature, Max LBA and Queue depth are read. Host Emulator issues 3 READ FPDMA QUEUED commands to device with out of range LBA, out of range tag and duplicated tag in three separate tests. Device's responses to these commands are verified to be as expected. Also the device state clean up after issuing a READ LOG EXT command is checked.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

Four test projects are executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured. Each trace is post-processed to verify of its complete execution. Support for NCQ feature is checked in first project and the pass/fail criteria of device response to different malformed NCQ commands is verified during the post-process of trace no 2 to 4.

- **Test Projects:**

- *Identify.stc*

- 1) COMRESET signal is issued.
- 2) An IDENTIFY DEVICE command is issued.

- *NCQ04-01.stc*

- 1) COMRESET signal is issued.
- 2) An IDENTIFY DEVICE command is issued.
- 3) A READ FPDMA QUEUED commands from a LBA beyond the maximum LBA number is issued.
- 4) READ LOG EXT command is issued after device reports error

- *NCQ04-02.stc*

- 1) COMRESET signal is issued.



- 2) An IDENTIFY DEVICE command is issued.
- 3) Two READ FPDMA QUEUED commands with same tag (equal to 00h) are issued.
- 4) READ LOG EXT command is issued after device reports error
- **NCQ04-03.stc**
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) If the maximum queue depth of the device is reported to be the maximum value of 32, then the test project exits without failure.
 - 4) A READ FPDMA QUEUED command with an invalid tag (a tag value more than the reported maximum queue depth) is issued
 - 5) READ LOG EXT command is issued after device reports error
- **Post processes:**
 - **Identify.sts:**
 - Existing and complete execution of IDENTIFY DEVICE Commands in the trace are checked to verify the proper execution of test project. “ERROR” result is reported if the above commands is missed and/or not executed completely.
 - Bit 8 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support NCQ feature.
 - **NCQ04-01.sts:**
 - Existing of READ FPDMA QUEUED and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. “ERROR” result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to malformed command (out of range LBA) is checked that should be one of these cases:
 - 1) A RD2H with ERR bit set, DRDY bit set and DF bit cleared in Status register, ABRT bit or IDNF set in Error register and Interrupt bit (I) set
 - 2) A RD2H with ERR bit cleared followed by a Set Device Bit FIS containing ERR bit set, BSY bit cleared, DF bit cleared and DRDY bit set in Status register, ABRT or IDNF bit set in Error field and Interrupt bit (I) set
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its content is verified to be:
 - ERR bit in Status register cleared
 - Interrupt bit (I) cleared
 - SActive Register equals to ‘FFFFFFFFh’
 - NQ Bit in returned log page (payload of READ LOG EXT) is verified to be cleared and the Tag of erring command is verified to be 00h. The checksum is also verified to be correct.
 - If any of the above criteria is not fulfilled, “FAILED” result is reported.
 - **NCQ04-02.sts:**
 - Existing and complete execution of READ DMA and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. “ERROR” result is reported if one of the above commands is missed and/or not executed completely.



- The device response to malformed command (duplicated tag) is checked that should be a RD2H with:
 - ERR bit in Status register set
 - DF bit in Status register cleared
 - DRDY in Status register set
 - BSY bit in Status register cleared
 - ABRT bit in Error register set
 - Interrupt bit (I) set
- The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:
 - ERR bit in Status register cleared
 - Interrupt bit (I) cleared
 - SActive Register equals to 'FFFFFFFFh'
- NQ Bit in returned log page (payload of READ LOG EXT) is verified to be cleared and the Tag of erring command is verified to be 00h. The checksum is also verified to be correct.
- If any of the above criteria is not fulfilled, "FAILED" result is reported.
- **NCQ04-03.sts:**
 - Existing and complete execution of READ DMA and READ LOG EXT commands in the trace are checked to verify the proper execution of test project. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - The device response to malformed command (invalid tag) is checked that should be a RD2H with:
 - ERR bit in Status register set
 - DF bit in Status register cleared
 - DRDY in Status register set
 - BSY bit in Status register cleared
 - ABRT bit in Error register set
 - Interrupt bit (I) set
 - The existence of Set Device Bit FIS after issuance of READ LOG EXT command is checked. Also its contents are checked to be:
 - ERR bit in Status register cleared
 - Interrupt bit (I) cleared
 - SActive Register equals to 'FFFFFFFFh'
 - NQ Bit in returned log page (payload of READ LOG EXT) is verified to be cleared and the Tag of erring command is verified. The checksum is also verified to be correct.
 - If any of the above criteria is not fulfilled, "FAILED" result is reported.
 - If all four post-process phases are completed without any problem, "PASSED" result is reported.



Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



NCQ-05 DMA Setup Auto-activate

Purpose

To verify that the device does not transmit a DMA Activate FIS to trigger transmission of the first Data FIS from the host, if it had previously sent a DMA Setup FIS with the Auto-Activate bit ('A') set to one.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

May 18, 2009

Discussion

Host Emulator Enables AUTO-ACTIVATE feature of the P.U.T. and issues WRITE DMA QUEUED command to it. Device response is verified from captured trace. It shall not send DMA Activate FIS for the first Data FIS if it supports and enables the Auto Activate Feature.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *NCQ05-01.stc*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) A SET FEATURE command is issued to enable using Auto Activate feature.
 - 4) Another IDENTIFY DEVICE command is issued.
 - 5) A WRITE FPDMA QUEUED command is issued

- **Post process:**
 - Existing and complete execution of all commands in the trace is verified. "ERROR" result is reported if one of the above commands is missed and/or not executed completely.
 - Bit 8 of WORD 76 of Identify Page data is checked and "N/A" result is reported if device does not support NCQ feature.
 - Word 78 Bit 2 of Identify data is checked and N/A is reported if the device does not claim to support Auto Activation feature.
 - The existence of DMA SETUP FIS and the value of "A" bit in it is verified. "A" bit is expected to be set.



- Suppression of transmitting the first DMA Activate FIS is verified in WRITE DMA QUEUED command.
- If any of the above criteria is not fulfilled, “FAILED” result is reported; otherwise the test result would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-01 Initialize Device Parameters

Purpose

TO verify that, upon receipt of a COMRESET, a device shall maintain the device settings established by the INITIALIZE DEVICE PARAMETERS command. Specifically, the values contained within Words 58:54 in IDENTIFY DEVICE data shall be maintained after a COMRESET. The value contained within Word 53 bit 0 in IDENTIFY DEVICE data shall also be maintained after a COMRESET. Note:

- a. This test is not applicable to ATAPI devices.
- b. We will attempt to vary the values in the INITIALIZE DEVICE PARAMETERS until a value other than the default value works.
- c. These are in increments of binary values.
- d. N/A should be returned if we can not find any other value then default that works

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the Device Parameters by issuing INITIALIZE DEVICE PARAMETERS command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies that the settings are preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP01-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An INITIALIZE DEVICE PARAMETERS command and IDENTIFY DEVICE command is issued.
 - 3) A COMRESET is issued.
 - 4) Another IDENTIFY DEVICE is issued.



- **Post process:**

- Existing and complete execution of all IDENTIFY DEVICE Commands in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
- Bit 6 of WORD 78 of Identify Page data in first IDENTIFY DEVICE command is checked and “N/A” result is reported if device does not support software settings preservation.
- The feature that is set by INITIALIZE DEVICE PARAMETER is checked after COMRESET to be the same as the previous value. Specifically, the values contained within WORDS 58:54 and word 53 BIT 0 in IDENTIFY DEVICE data shall be maintained after a COMRESET
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-02 Read/Write Stream Error Log

Purpose

To verify that the device, upon receipt of a COMRESET, maintains the Read Stream Error Log and Write Stream Error Log contents. Specifically, to verify that the values contained within log addresses 22:21 are maintained after a COMRESET.

Note: This test is not applicable to ATAPI devices.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 25, 2008

Discussion

Host Emulator gets the Identify Page data and then issues ATA compliant activity to cause a Stream Error. After an error is created, the Read Log Ext Page is checked to verify error has been logged. Afterwards, preservation of this information is verified by processing of the captured trace.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project (*IDENTIFY.stc*) is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace is captured; then the trace is post-processed to get some information that is used in the next project. Then the main project (*SSP02-01.stc*) is executed in the same condition and the resulting trace is captured. This trace is post-processed to verify the complete execution of the test project and to check the pass/fail criteria.

- **Test Project:**
 - *IDENTIFY.stc*
 - 1) COMRESET signal is issued
 - 2) Soft reset is issued.
 - 3) An IDENTIFY DEVICE command is issued.
 - *SSP02-01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued. WORD 78 bit 6 and WORD 84 bit 4 are checked to verify SSP and Stream commands are supported
 - 3) A Read Log Ext to Read Stream Error Log page 22h is issued to verify default value.
 - 4) A Set Features command is sent to specify length = 04h of appended data on Read and Write Long commands
 - 5) A Set Features command is sent to enable ECC



- 6) A Read Long command is sent to device with Dev/Head = 40h, Sector Count = 01h
 - 7) A Write Long command is sent to device with Dev/Head = 40h, Sector Count = 01h. Data payload is 520 bytes.
 - 8) A Configure Stream command is sent
 - 9) A Read Stream command is sent with LBA address pointed at location of ECC error
 - 10) A Read Log Ext 22h is sent.
 - Verify contents of Log page that error has occurred
 - 11) A Configure Stream command is sent
 - 12) A Read Stream command is sent with LBA address pointed at location of ECC error
 - 13) A COMRESET is sent
 - 14) A Read Log Ext 22h is sent
- **SSP02-02.stc**
- 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued. WORD 78 bit 6, WORD 84 bit 4, WORD 82 bit 0, and word 84 bit 0 are checked to verify SSP, Stream, SMART, and SMART error logging commands are supported and/or enabled.
 - 3) A Read Log Ext to Read Stream Error Log page 22h is issued to verify default value.
 - 4) A SMART Enable Operations command is sent
 - 5) A SMART Write Log with Log Address = E0h with payload configured for Write Long command is sent
 - 6) A SMART Read Log with Log Address = E0h command is sent to verify SMART Write Log was successful.
 - 7) A SMART Write Log with Log Address= E1h (SCT Data Transfer) and payload are sent
 - 8) A Configure Stream command is sent
 - 9) A Read Stream command is sent with LBA address pointed at location of ECC error
 - 10) A Read Log Ext 22h is sent.
 - Verify contents of Log page that error has occurred
 - 11) A Configure Stream command is sent
 - 12) A Read Stream command is sent with LBA address pointed at location of ECC error
 - 13) A COMRESET is sent
 - 14) A Read Log Ext 22h is sent
- **SSP02-03.stc**
- 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE command is issued. WORD 78 bit 6, WORD 84 bit 4, and WORD 120 bit 2 are checked to verify SSP, Stream, and Write Uncorrectable commands are supported
 - 3) A Read Log Ext to Read Stream Error Log page 22h is issued to verify default value.



- 4) A Write Uncorrectable EXT with Uncorrectable options = 55h command is sent
 - 5) A Configure Stream command is sent
 - 6) A Read Stream command is sent with LBA address pointed at location of uncorrectable error
 - 7) A Read Log Ext 22h is sent.
 - Verify contents of Log page that error has occurred
 - 8) A Configure Stream command is sent
 - 9) A Read Stream command is sent with LBA address pointed at location of ECC error
 - 10) A COMRESET is sent
 - 11) A Read Log Ext 22h is sent
- **Post process:**
 - Existing and complete execution of IDENTIFY DEVICE Command and existence of READ LOG EXT commands in the trace is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 4 of WORD 84 of Identify Page data is checked and “N/A” result is reported if device does not support streaming.
 - For SSP02-01, if READ LONG and WRITE LONG commands are aborted by device, test is skipped.
 - For SSP02-02, Bit 0 of WORD 82 and bit 0 of WORD 84 of Identify Page data are checked and test is skipped if device does not support SMART commands and SMART error logging
 - For SSP02-03, Bit 2 of WORD 120 of Identify Page data is checked and test is skipped if device does not support WRITE UNCORRECTABLE EXT command.
 - Complete execution of CONFIGURE STREAM, READ STREAM DMA, and all READ LOG EXT commands are checked to verify the proper execution of test project.
 - The payloads of the second and third READ LOG EXT are compared to be the same.(log page 22h)
 - If all 3 projects are skipped, “N/A” test result is reported.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.



Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to 'Auto Detect' speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to 'Auto-Detect' speed.



SSP-03 Security Mode State

Purpose

To verify that, upon receipt of a COMRESET, the device maintains the value of Security Mode. Specifically, if Security Mode is enabled (Word 85 bit 1 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET, then the mode value (Word 128 bits 3:1 in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) is maintained after a COMRESET.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Security Mode by issuing SECURITY SET PASSWORD command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace is captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP03_UTD14_01.stc*
 - 1) COMRESET signal is issued
 - 2) An IDENTIFY DEVICE/IDENTIFY PACKET DEVICE command is issued.
 - 3) For ATA devices:
 - A SECURITY SET PASSWORD command is issued if Security Mode is not enabled.
 - An IDENTIFY DEVICE command is issued.
 - READ DMA and WRITE SECTORS commands are issued to make sure the device works in SEC5 state.
 - A COMRESET is issued.
 - Another set of IDENTIFY DEVICE, and SECURITY DISABLE PASSWORD commands is issued.



- IDENTIFY DEVICE command is issued to verify that device is no longer in Security mode.
 - READ DMA and WRITE SECTORS commands are issued to make sure the device works in SEC5 state instead of SEC4 state.
- 4) For ATAPI devices:
- A SECURITY SET PASSWORD is issued if Security Mode is not enabled.
 - An IDENTIFY PACKET DEVICE command is issued.
 - An INQUIRY commands is issued to make sure the device works in SEC5 state.
 - A COMRESET is issued.
 - Another set of IDENTIFY PACKET DEVICE and SECURITY DISABLE PASSWORD commands are issued.
 - IDENTIFY PACKET DEVICE command is issued to verify that device is no longer in Security mode.
 - An INQUIRY commands is issued to make sure the device works in SEC5 state instead of SEC4 state.
- **Post process:**
 - Existing and complete executions of all IDENTIFY/IDENTIFY PACKET DEVUCE Commands and entering the security mode by device in second IDENTIFY/IDENTIFY PACKET DEVICE is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data from the first IDENTIFY/IDENTIFY PACKET DEVICE is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 1 of WORD 82 of Identify Page data from the first IDENTIFY/IDENTIFY PACKET DEVICE is checked and “N/A” result is reported if device does not support security Mode Feature set.
 - Bits 1 to 3 of WORD 128 of Identify Page data from the first IDENTIFY/IDENTIFY PACKET DEVICE are set to zero to verify device is in “Security Disabled” mode. If these bits are already set, then the device is reported as “FAILED”.
 - Bits 1 of WORD 128 is verified to be set to 1 and Bits 2-4 of WORD 128 are verified to be 0 from the second IDENTIFY/IDENTIFY PACKET DEVICE command data.
 - Bit 1 of WORD 85 of Identify Page data in third IDENTIFY/IDENTIFY PACKET DEVICE is checked to be ‘1’.
 - Bits 1 to 3 of WORD 128 of Identify Page data in the second and third IDENTIFY/IDENTIFY PACKET DEVICE are compared to be the same,
 - Bits 1 to 4 of WORD 128 of Identify Page data in the fourth IDENTIFY/IDENTIFY PACKET DEVICE are set to zero to verify device is in “Security Disabled” mode. If these bits are set to “1”, then the device is reported as “FAILED”.



- Complete execution of READ DMA, WRITE SECTORS and INQUIRY commands are checked and “FAILED” is reported if one of these commands does not complete successfully.
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-04 Set Address Max

Purpose

To verify that the device, upon receipt of a COMRESET, maintains the max address established by the SET MAX ADDRESS or SET MAX ADDRESS EXT commands. Specifically, that the values contained within Words 61:60 in Identify data and Words 103:100 (if 48-bit addressing is supported) are maintained after a COMRESET.

Note: This test is not applicable to ATAPI devices.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 10, 2008

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Max Address by issuing SET MAX ADDRESS/EXT command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

Three test projects are executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *Identify.stc*
 - 1) An IDENTIFY DEVICE command is issued to check 48-bit supporting by device.(Word 83 bit 10 set to one)
 - *SSP04-01.stc (For non 48-bit address devices)*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) READ NATIVE MAX ADDRESS, SET MAX ADDRESS and IDENTIFY DEVICE commands are issued. In SET MAX ADDRESS, the max address is set to be half of the default value.
 - 4) A COMRESET is issued.
 - 5) Another IDENTIFY DEVICE is issued.
 - 6) Issue SET MAX ADDRESS with address set back to native max capacity.



- **SSP04-02.stc (For 48-bit address devices)**
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) READ NATIVE MAX ADDRESS EXT, SET MAX ADDRESS EXT and IDENTIFY DEVICE commands are issued. In SET MAX ADDRESS EXT, the max address is set to be half of the default value.
 - 4) A COMRESET is issued.
 - 5) Another IDENTIFY DEVICE is issued.
 - 6) Issue SET MAX ADDRESS EXT with address set back to native max capacity.
- **Post process:**
 - Existing and complete execution of all IDENTIFY DEVICE Commands is checked to verify the proper execution of test project. Setting the value of SET MAX ADDRESS (EXT) properly is checked by comparing the Identify page data of the first and second IDENTIFIES command. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data from the first IDENTIFY COMMAND is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 10 of WORD 82 of Identify Page data from the first IDENTIFY COMMAND is checked and “N/A” result is reported if device does not support host protected area.
 - The value that is set by SET MAX ADDRESS (EXT) is checked in Identify Page data before and after the COMRESET to be the same. (Words 61:60 contain the same value additionally if Word 83 bit 10 is set to one, Words 103:100 contain the same value too)
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-05 Set Features – Write Cache Enable/Disable

Purpose

To verify that upon receipt of a COMRESET, the device maintains the value of write cache enable/disable. Specifically to verify that if the write cache is enabled (Word 85 bit 5 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET, the feature is still enabled after the COMRESET. If write cache is disabled (Word 85 bit 5 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be disabled after the COMRESET.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Write Cache State by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP05-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Enable/Disable Write Cache” (opposite to the default value) and an IDENTIFY DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY DEVICE command is issued.
 - Issue SET FEATURES command to restore device to default value
 - 4) For ATAPI devices:
 - An IDENTIFY PACKET DEVICE is issued.



- A SET FEATURES command with the sub command code equal to “Enable/Disable Write Cache” (opposite to the default value) and an IDENTIFY PACKET DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY PACKET DEVICE command is issued.
 - Issue SET FEATURES command to restore device to default value
- **Post process:**
 - Existing and complete execution of all IDENTIFY/ IDENTIFY PACKET DEVICE Commands is checked to verify the proper execution of test project. Enabling write cache is checked after executing the enable SET FEATURES command too. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data from the first IDENTIFY/IDENTIFY PACKET DEVICE data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 5 of WORD 82 of Identify Page data from the first IDENTIFY/IDENTIFY PACKET DEVICE data is checked and “N/A” result is reported if device does not support write cache.
 - Bit 5 of WORD 85 of Identify Page data from the second and third IDENTIFY/IDENTIFY PACKET COMMAND are compared to be the same.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-06 Set features – Set Transfer Mode

Purpose

To verify that the device, upon receipt of a COMRESET, maintains the PIO, Multi word DMA and Ultra DMA mode settings. Specifically, to verify that the values contained within Word 63 bits 10:8 (MWDMA) and Word 88 bits 14:8 (UDMA) in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE are maintained after a COMRESET.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 22, 2009

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Transfer by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET. All possible Transfer Modes are changed and verified in several steps. Project is run for 2 times, one for MWDMA and another for UDMA.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP06-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Set Transfer mode based on value in sector count” and an IDENTIFY DEVICE command are issued. The transfer mode would be selected different than default values (within supported modes), once in MWDMA and again in UDMA range.
 - A COMRESET is issued.
 - Another IDENTIFY DEVICE command is issued.
 - A READ DMA is issued to device
 - Issue a SET FEATURES command to restore default values



4) For ATAPI devices:

- An IDENTIFY PACKET DEVICE is issued.
 - A SET FEATURES command with the sub command code equal to “Set Transfer mode based on value in sector count” and an IDENTIFY PACKET DEVICE command are issued. The transfer mode would be selected different than default values (within supported modes), once in MWDMA and again in UDMA range if anyone supported.
 - A COMRESET is issued.
 - Another IDENTIFY PACKET DEVICE command is issued.
 - In a loop, TEST UNIT READY and REQUEST SENSE are issued until device has finished its reset conditions.
 - A READ(10) with DMA option set is issued
 - Issue a SET FEATURES command to restore default values
- **Post process:**
 - Bit 6 of WORD 78 of Identify Page data in first IDENTIFY/IDENTIFY PACKET DEVICE is checked and “N/A” result is reported if device does not support software settings preservation.
 - Existing and complete executions of all IDENTIFY/ IDENTIFY PACKET DEVICE and SET FEATURES Commands is checked to verify the proper execution of test project. Changing transfer mode is checked after executing the SET FEATURES command too. “ERROR” result is reported if any of the above is not executed properly.
 - Word 63 bits 10:8, Word 88 bits 14:8 from the second IDENTIFY/IDENTIFY PACKET DEVICE command data are checked to match what was commanded by the SET FEATURES command. If device values do not change after Set Features, results will “N/A”
 - “N/A” will be reported if there is no supported transfer mode for MWDMA and UDMA.
 - Word 63, bits 10:8 and Word 88 bits 14:8 from the 2nd and 3rd IDENTIFY/IDENTIFY PACKET DEVICE command data are compared to be the same for Transfer mode.
 - READ command is verified to be completed successfully. (for both MWDMA and UDMA, if supported)
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.



Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to 'Auto Detect' speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to 'Auto-Detect' speed.



SSP-07 Set features – Advanced Power Management Enable/Disable

Purpose

To verify that, upon receipt of a COMRESET, a device shall maintain the value of Advanced Power Management (APM) enable/disable and the advanced power management level. Specifically, if APM is enabled (Word 86 bit 3 set to one in IDENTIFY DEVICE data) upon receipt of a COMRESET then the feature shall be enabled after the COMRESET, and Word 91 bits 7:0 in IDENTIFY DEVICE data shall contain the value present prior to the COMRESET. If APM is disabled (Word 86 bit 3 cleared to zero in IDENTIFY DEVICE data) upon receipt of a COMRESET then the feature shall be disabled after the COMRESET. Note: This test is not applicable to ATAPI devices.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Advanced Power Management value and state by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP07-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Enable/Disable advanced power management” (opposite to the default value) and an IDENTIFY DEVICE command are issued.
 - A COMRESET is issued.



- Another IDENTIFY DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
- **Post process:**
 - Existing and complete execution of all IDENTIFY/ IDENTIFY PACKET Commands is checked to verify the proper execution of test project. Changing the state of advanced power management Enable/Disable is checked after executing the SET FEATURES command. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data in first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 3 of WORD 83 of Identify Page data in first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support Advanced Power Management.
 - Word 83 - bit 3, Word 86 - bit 3 and word 91 bits 7:0 in the 2nd and 3rd IDENTIFY/IDENTIFY PACKET DEVICE command data are compared to be the same for Advanced Power management.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-08 Set features – Read Look-Ahead

Purpose

To verify that, upon receipt of a COMRESET, a device shall maintain the value of look-ahead enable/disable. Specifically, if support for look-ahead is enabled (Word 85 bit 6 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be enabled after the COMRESET. If support for look-ahead is disabled (Word 85 bit 6 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be disabled after the COMRESET..

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then, it changes the device Read look-ahead state by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP08-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Enable/Disable read look ahead feature” (opposite to the default value) and an IDENTIFY DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
 - 4) For ATAPI devices:
 - An IDENTIFY PACKET DEVICE command is issued.



- A SET FEATURES command with the sub command code equal to “Enable/Disable read look ahead feature” (opposite to the default value) and an IDENTIFY PACKET DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY PACKET DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
- **Post process:**
 - Existing and complete execution of all IDENTIFY/ IDENTIFY PACKET Commands is checked to verify the proper execution of test project. Changing the state of read look-ahead feature Enable/Disable is checked after executing the SET FEATURES command. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data of the first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 6 of WORD 82 of Identify Page data the first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support Read look-Ahead feature.
 - Word 85 - bit 6 in the 2nd and 3rd IDENTIFY/IDENTIFY PACKET DEVICE command data is compared to be the same.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-09 Set features –Release Interrupt

Purpose

To verify that upon receipt of a COMRESET, a device shall maintain the value of release interrupt enable/disable. Specifically, if support for release interrupt is enabled (Word 85 bit 7 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be enabled after the COMRESET. If support for release interrupt is disabled (Word 85 bit 7 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be disabled after the COMRESET..

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Release Interrupt state by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP09-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Enable/Disable Release Interrupt” (opposite to the default value) and an IDENTIFY DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
 - 4) For ATAPI devices:
 - An IDENTIFY PACKET DEVICE command is issued.



- A SET FEATURES command with the sub command code equal to “Enable/Disable Release Interrupt” (opposite to the default value) and an IDENTIFY PACKET DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY PACKET DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
- **Post process:**
 - Existing and complete execution of all IDENTIFY/ IDENTIFY PACKET Commands are checked to verify the proper execution of test project. Changing the state of release interrupt Enable/Disable feature is checked after executing the SET FEATURES command. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data of the first IDENTIFY/IDENTIFY PACKET command data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 7 of WORD 82 of Identify Page data of the first IDENTIFY/IDENTIFY PACKET command data is checked and “N/A” result is reported if device does not support release interrupt feature.
 - Bit 7 of WORD 85 of Identify Page data of the second IDENTIFY/IDENTIFY PACKET DEVICE command data is checked to be opposite of the value obtained in the first IDENTIFY/IDENTIFY PACKET DEVICE command data and "N/A" result is reported if opposite not obtained
 - Word 85 - bit 7 of the 2nd and 3rd IDENTIFY/IDENTIFY PACKET DEVICE command data is compared to be the same
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-10 Set features – Service Interrupt

Purpose

To verify that upon receipt of a COMRESET, a device shall maintain the value of service interrupt enable/disable. Specifically, if support for service interrupt is enabled (Word 85 bit 8 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be enabled after the COMRESET. If support for service interrupt is disabled (Word 85 bit 8 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE data) upon receipt of a COMRESET then the feature shall be disabled after the COMRESET..

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

September 13, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then it changes the device Service Interrupt state by issuing SET FEATURES command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP10-01.stc*
 - 1) An IDENTIFY DEVICE command is issued.
 - 2) The default values of Identify Data Page are saved after device Power on.
 - 3) For ATA devices:
 - A SET FEATURES command with the sub command code equal to “Enable/Disable Service Interrupt” (opposite to the default value) and an IDENTIFY command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
 - 4) For ATAPI devices:
 - An IDENTIFY PACKET DEVICE command is issued.



- A SET FEATURES command with the sub command code equal to “Enable/Disable Service Interrupt” (opposite to the default value) and an IDENTIFY PACKET DEVICE command are issued.
 - A COMRESET is issued.
 - Another IDENTIFY PACKET DEVICE command is issued.
 - Issue a SET FEATURES command to restore default values
- **Post process:**
 - Existing and complete execution of all IDENTIFY/ IDENTIFY PACKET DEVICE Commands are checked to verify the proper execution of test project. Changing the state of Service Interrupt feature Enable/Disable is checked after executing the SET FEATURES command. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 6 of WORD 78 of Identify Page data of the first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support software settings preservation.
 - Bit 8 of WORD 82 of Identify Page data of the first IDENTIFY/IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support Service Interrupt feature.
 - Bit 8 of WORD 85 of Identify Page data of the second IDENTIFY/IDENTIFY PACKET DEVICE command data is checked to be opposite of the value obtained in the first IDENTIFY/IDENTIFY PACKET DEVICE command data and "N/A" result is reported if opposite not obtained
 - Word 85 - bit 8 of the 2nd and 3rd IDENTIFY/IDENTIFY PACKET DEVICE command data is compared to be the same.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-11 Set Multiple Mode

Purpose

To verify that the device, upon receipt of a COMRESET, maintains the block size established by the Set Multiple Mode command. Specifically, to verify that the value contained within Word 59 bits 8:0 of the IDENTIFY DEVICE command data shall be maintained after a COMRESET.

Note:

- a. This test is not applicable to ATAPI devices.
- b. We need to try all sector counts until a sector count other than the default value works.
- c. These are in increments of binary values.
- d. N/A should be returned if we can not find any other sector per block

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

November 2, 2010

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature. Then, it changes the device Multiple Mode Settings by issuing SET MULTIPLE MODE command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP11-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on.
 - 2) An IDENTIFY DEVICE command is issued.
 - 3) A SET MULTIPLE MODE command with sector per block different than default value (Starting with the value listed in Word 47 bits 7:0 and using decreasing the value by half until 0 is reached) and an IDENTIFY command are issued.
 - 4) A COMRESET is issued.



- 5) Another IDENTIFY DEVICE command is issued.
- 6) Issue a SET FEATURES command to restore default values.

- **Post process:**

- Existing and complete execution of all the IDENTIFY DEVICE Commands is checked to verify the proper execution of test project. Setting Multiple Mode of device is checked after executing the SET MULTIPLE MODE command too. “ERROR” result is reported if any of the above is not executed properly.
- Bit 6 of WORD 78 of Identify Page data from the first IDENTIFY DEVICE command data is checked and “N/A” result is reported if device does not support software settings preservation.
- Bit 8 of WORD 59 of Identify Page data from the first IDENTIFY DEVICE command data is checked and “N/A” result is reported if device doesn’t claim that the multiple sector setting is valid.
- Bit 7 to 0 of WORD 47 of Identify Page data from the first IDENTIFY DEVICE command data is checked and "N/A" result is reported if value is zero.
- If no non-default sector per block values is found, “N/A” result is reported.
- Word 59 - bits 8 to 0 of the 2nd and 3rd IDENTIFY DEVICE command data are compared to be the same
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



SSP-12 Write-Read-Verify

Purpose

To verify that the device, upon receipt of a COMRESET, maintains the Write-Read-Verify settings, established by the SET FEATURE command. Specifically, to verify that the values contained within Word 120 bit 1, Word 210-211 and Word 220 bits 7:0 of the IDENTIFY DEVICE command data is maintained after a COMRESET.

Note:

1. This test is not applicable to ATAPI devices.
2. We need to try all Sector Counts for mode 3 until a sector count other than the default value works.
3. N/A should be returned if we can not set any other Sector Count in Mode 3
4. We will try to change device mode to modes 0, 1 and 2. If device lets each mode to be set, we repeat the test for it as well.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

June 2, 2009

Discussion

Host Emulator issues IDENTIFY DEVICE command to P.U.T. to check the support of SSP feature and Write-Read-Verify feature. Then, it changes the device Write-Read-Verify Mode Settings by issuing SET FEATURE command with non-default settings and afterwards it issues a COMRESET. Then, from the captured trace, it verifies the settings to be preserved after issuing the COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *SSP12-01.stc*
 - 1) The default values of Identify Data Page are saved after device Power on.
 - 2) An IDENTIFY DEVICE command is issued.



- 3) A SET FEATURE command with the sub command code equal to “Enable/Disable Write-Read-Verify” with Mode 3 and Count value different than default values (Starting with the default decreased by half until 0 is reached or increasing from 1 if default value is 0) and an IDENTIFY command are issued.
- 4) A COMRESET is issued.
- 5) Another IDENTIFY DEVICE command is issued.
- 6) Steps 3-5 is repeated for other Write-Read-Verify modes if the device lets these modes to be selected
- 7) Issue a SET FEATURES command to restore default values.

- **Post process:**

- Existing and complete execution of all the IDENTIFY DEVICE and SET FEATURE Commands is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
- Bit 6 of WORD 78 of Identify Page data from the first IDENTIFY DEVICE command data is checked and “N/A” result is reported if device does not support software settings preservation.
- Bit 15 of WORD 86 of Identify Page data from the first IDENTIFY DEVICE command data is checked and “N/A” result is reported if this bit is not set.
- Bit 1 of WORD 119 of Identify Page data from the first IDENTIFY DEVICE command data is checked and “N/A” result is reported if device doesn’t claim to support Write-Read-Verify feature.
- If no non-default Write-Read-Verify settings are found, “N/A” result is reported.
- Word 120 - bits 1, Word 210-211 and Word 220 bits 7:0 (when trying Mode 3 only) of the 2nd and 3rd IDENTIFY DEVICE command data are compared to be the same
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

2. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-01: Partial State exit latency (Host-Initiated)

Purpose

To verify that the device exit latency (i.e. COMWAKE response) from the partial state starts within 10 microseconds of COMWAKE receipt from the host.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Host Emulator establishes connection with P.U.T. and checks the proper interface functionality by issuing an IDENTIFY/IDENTIFY PACKET command. Then, if device supports HIPM, Host Emulator issues PMREQ_P to device and waits for PMACK response. After a while, Host issues a Wake Up request and measures the response time from the captured trace.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

One test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace is captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *IPM01_UTD14_01.stc(HIPM Support)*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY/IDENTIFY PACKET DEVICE command is issued to verify what IPM the device supports.
 - 3) If the device supports HIPM, Partial Power Management Request (PMREQ_P) is issued to the device.
 - 4) After 100ms, Host issues COMWAKE to device.
 - 5) Measure time between Host COMWAKE and Device COMWAKE
 - 6) An IDENTIFY PACKET/ IDENTIFY PACKET DEVICE command is issued to assure the interface has woken up.
 - 7) The project is repeated 10 times.
- **Post processes:**
 - *IPM01-01.sts*
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also



the issuance of PMREQ_P primitive and COMWAKE is checked. “ERROR” result is reported if one of the above command or requests is missed and/or not executed completely.

- Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support Host-Initiated Power Management.
- In the case that no host initiated request was completed, the result will be “N/A”.
- The time from the end of the Host COMWAKE request and the end of the device COMWAKE response is verified to be within 10 milliseconds.
- If the time from the end of the Host COMWAKE request and the end of the device COMWAKE is greater than 10 milliseconds , “FAILED” result is reported
- If device does not respond to command in a non-error condition after coming out of power management state, the test result will be ‘FAILED’.

Observable Result

- Partial wake sequence completion and COMWAKE timing within 10 microseconds of COMWAKE receipt from host (use trace to analyze timing) on all 10 test iterations.

Measurement Tolerance: +/- 13.337 ns



IPM-02: Slumber State exit latency (Host-Initiated)

Purpose

To verify that the device exit latency (i.e. COMWAKE response) from the slumber state starts within 10 milliseconds of COMWAKE receipt from the host.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Host Emulator establishes connection with P.U.T. and checks the proper interface functionality by issuing an IDENTIFY/IDENTIFY PACKET command. Then, if device supports HIPM, Host Emulator issues PMREQ_S to device and waits for PMACK response. After a while, Host issues a Wake Up request and measures the response time from the captured trace.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

One test project is executed via Catalyst Host emulator at the highest supported speed of device and the resulting trace is captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *IPM02_UTD14_01.stc(HIPM Support)*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify which IPM the device supports.
 - 3) If device supports HIPM, Host issues Slumber Power Management Request (PMREQ_S) to the device.
 - 4) After 100ms, COMWAKE is issued.
 - 5) Measure time between Host COMWAKE and Device COMWAKE
 - 6) An IDENTIFY PACKET/ IDENTIFY PACKET DEVICE command is issued to assure the interface has woken up.
 - 7) The project is repeated 10 times.
- **Post processes:**
 - *IPM02-01.sts*
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also the issuance of PMREQ_S primitive and COMWAKE is checked. “ERROR” result



is reported if one of the above command or requests is missed and/or not executed completely.

- Bit 9 of WORD 76 Identify Page data data is checked and “N/A” result is reported if device does not support Host-Initiated Power Management.
- In the case that no host initiated request was completed, the result will be “N/A”.
- The time from the end of the Host COMWAKE request and the end of the device COMWAKE response is verified to be within 10 milliseconds.
- If the time from the end of the Host COMWAKE request and the end of the device COMWAKE is greater then 10 milliseconds , “FAILED” result is reported
- If device does not respond to command in a non-error condition after coming out of power management state, the test result will be ‘FAILED’.

Observable Result

Slumber wake sequence completion and COMWAKE timing within 10 milliseconds of COMWAKE receipt from host (use trace to analyze timings) on all 10 test iterations.

Measurement Tolerance: +/- 13.337 ns



IPM-03: Speed matching upon resume (Host-Initiated)

Purpose

To verify that the device signaling speed, upon returning from a partial or slumber state, matches the speed prior to entering the partial or slumber state.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

November 2, 2010

Discussion

Host Emulator establishes connection with P.U.T. and puts it in PM state. Then sends wake up request. Resumed interface speed is verified to be the same as initial connection speed. Captured trace is processed to verify this speed match and to be sure that no new Speed Negotiation phase was executed after wake up. This test is repeated for 10 times.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

Two test projects are executed via LeCroy Host emulator: one project for PMREQ_P and another project for PMREQ_S. For each type of power management (Partial and Slumber) the project is run with all supported speeds of device (1.5G, 3.0G and 6.0G if supported) to establish the connection. The resulting traces of both projects are captured; then, the traces are post-processed to verify the complete execution of test project and to check the pass/fail criteria. The final report is generated from the 10 iterations for each Power Management type. The test is repeated for all supported speeds. (10 times for each supported speed)

- **Test Project:**
 - ***IPM03-01.stc (For testing Partial Power Management)***
 - 1) Host power cycles the PUT and a COMRESET is issued
 - 2) Host Speed is set to all supported speeds of device.
 - 3) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports HIPM.
 - 4) If the device supports HIPM, Host issues Partial Power Management Request (PMREQ_P) to the device.
 - 5) After 100ms, Host issues COMWAKE
 - 6) Speed of response from device is checked.
 - 7) A IDENTIFY or IDENTIFY PACKET DEVICE command is issued again.



- ***IPM03-02.stc (For testing Slumber Power Management)***
 - 1) Host power cycles the PUT and a COMRESET is issued
 - 2) Host Speed is set to all supported speeds of device.
 - 3) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports HIPM.
 - 4) If the device supports HIPM, Host issues Slumber Power Management Request (PMREQ_S) to the device.
 - 5) After 100ms, Host issues COMWAKE
 - 6) Speed of response from device is checked.
 - 7) A IDENTIFY or IDENTIFY PACKET DEVICE command is issued again.

- **Post process:**
 - ***IPM03-01.stsExisting and*** complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also the issuance of PMREQ_P primitive and Wakeup request is checked. “ERROR” result is reported if one of the above command or requests is missed and/or not executed completely.
 - If no acknowledgement (PMACK or PMNAK) received from device, the sequence result will be FAILED.
 - Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
 - Acknowledge to PM request is also verified to be positive; otherwise the test iteration is considered “N/A”.
 - In the case that no host initiated request was completed, the result will be “N/A”.
 - If during the wakeup process, COMINIT/COMRESET is found from the PUT or the SPD bits have changed from default value, the test iteration is considered as FAILED, else PASSED.
 - If, in 10 iterations, there are any FAILED, the final result “FAILED” is returned, if there are any PASSED and no FAILED then final result is “PASSED”. If in 10 iterations the results are all NA then the final result “NA” is returned.

 - ***IPM03-02.stsExisting and*** complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also the issuance of PMREQ_S primitive, PM acknowledgement and Wakeup request is checked. “ERROR” result is reported if one of the above command or requests is missed and/or not executed completely.
 - If no acknowledgement (PMACK or PMNAK) received from device, the sequence result will be FAILED.
 - Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
 - Acknowledge to PM request is also verified to be positive; otherwise the test iteration is considered “N/A”.
 - In the case that no host initiated request was completed, the result will be “N/A”.



- If during the wakeup process, COMINIT/COMRESET is found from the PUT, or the SPD bits have changed from default value, the test iteration is considered as FAILED, else PASSED.
- If, in 10 iterations, there are any FAILED, the final result “FAILED” is returned, otherwise if there are any PASSED and no FAILED then final result is “PASSED”. If in 10 iterations the results are all NA, then the final result “NA” is returned.

Observable Result

The SPD field contains the same value before and after the power management sequence (HIPM support required)



IPM-04 : NAK of requests when support not indicated

Purpose

To verify that if a device does not support host interface power management (HIPM) (Word 76 bit 9 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data), then, upon receipt of a PMREQ_P or PMREQ_S, the device responds with a PMNAK.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

Oct 29, 2007

Discussion

Host emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and if device claims not to support Power Management, it issues both PM type requests and verifies device response. Device is expected to send PMNAK for both and this is verified from the captured trace.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace is captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 sequences.

- **Test Project:**
 - *IPM04-01.stc*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to validate if HIPM is supported.
 - 3) Partial Power Management Request (PMREQ_P) is issued to the device.
 - 4) If PMACK is received, a COMWAKE is issued from HOST.
 - 5) Slumber Power Management Request (PMREQ_S) is issued to the device.
 - 6) If PMACK is received, a COMWAKE is issued from HOST.
- **Post process:**
 - *IPM04-01.sts*
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also the issuances of PMREQ primitives are checked. “ERROR” result is reported if one of the above command or requests is missed and/or not executed completely.



- Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device supports Power Management.
- If device responds to PMREQ_P with PMNAK or no response received, the result would be “PASSED” else “FAILED” is returned.
- If device responds to PMREQ_S with PMNAK or no response received, the result would be “PASSED” else “FAILED” is returned.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-05 Device Response to PMREQ_P

Purpose

To verify that, if a device claims support for host interface Power Management (Word 76 bit 9 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data), then, upon receipt of a PMREQ_P, the device returns between 4 and 16 PMACK primitives and forces PHY to Partial or responds with PMNAK until host sends SYNC.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

Oct 29, 2007

Discussion

Host emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and if device claims to support Power Management, it issues PMREQ_P request and verifies device response. Device is expected to send between 4 and 16 PMACK primitives, or send PMNAK until a SYNC is received from the Host. This is verified from the captured trace.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 sequences.

- **Test Project:**
 - *IPM05-01.stc*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports HIPM.
 - 3) Partial Power Management Request (PMREQ_P) is issued to the device.

- **Post process:**
 - *IPM05-01.sts*
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace is checked to verify the proper execution of test project. Also, the issuance of PMREQ_P primitive is checked. “ERROR” result is reported if one of the above commands or requests is missed and/or not executed completely.
 - Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support Power Management.



- Acknowledge to PM request is verified to be either PMACK or PMNAK. PMACK primitive must to be repeated between 4 and 16 times. PMNAK occurs until a SYNC is received from the Host Emulator
- If greater than 16 PMACK or less than 4 PMACK primitives are sent, “FAILED” is reported.
- If any of the above criteria is not fulfilled, “FAILED” is reported; otherwise the result would be “PASSED” for all 10 sequences.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-06 Device Response to PMREQ_S

Purpose

To verify that, if a device claims support for host interface Power Management (Word 76 bit 9 set to one in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data), then, upon receipt of a PMREQ_S, the device returns between 4 and 16 PMACK primitives and forces PHY to Slumber or responds with PMNAK until host sends SYNC.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

Jan 10, 2008

Discussion

Host emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and, if device claims to support Power Management, it issues PMREQ_S request and verifies device response. Device is expected to send between 4 and 16 PMACK primitives. This is verified from the captured trace.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 times.

- **Test Project:**
 - *IPM06-01.stc*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports HIPM.
 - 3) Slumber Power Management Request (PMREQ_S) is issued to the device.
- **Post process:**
 - *IPM06-01.sts*
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace is checked to verify the proper execution of test project. Also, the issuance of PMREQ_S primitive is checked. “ERROR” result is reported if one of the above command or request is missed and/or not executed completely.
 - Bit 9 of WORD 76 of Identify Page data is checked and “N/A” result is reported if device does not support Power Management.



- Acknowledge to PM request is verified to be positive. PMACK primitive is supposed to be repeated between 4 and 16 times. PMNAK occurs until a SYNC is received from the Host Emulator
- If greater than 16 PMACK or less than 4 PMACK primitives are sent, “FAILED” is reported.
- If any of the above criteria is not fulfilled, “FAILED” is reported; otherwise the result would be “PASSED” for all 10 sequences.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-07 Default Setting for Device Initiated Requests

Purpose

To verify that support for device power management is disabled (Word 79 bit 3 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data) by default and the device does not issue Partial/Slumber requests unless this feature has been enabled by the host as a result of a SET FEATURES command.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 10, 2008

Discussion

Host emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and, if device claims to support Power Management, it checks the state of DIPM. Host Emulator enables this feature and then issues COMRESET. The default state of DIPM is verified to be disabled after COMRESET.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 times.

- **Test Project:**
 - *IPM07-01.stc*
 - 1) Power cycle the DUT.
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if device supports DIPM and is currently disabled.
 - 3) Device Initiated Power Management (DIPM) is enabled via a SET FEATURE command.
 - 4) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if device has DIPM enabled.
 - 5) COMRESET is issued to device
 - 6) Another IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify DIPM is disabled.

- **Post process:**
 - *IPM07-01.sts*



- Existing and complete execution of all IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. “ERROR” result is reported if any of the above commands is missed and/or not executed completely.
- Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support Power Management.
- “FAILED” is returned if the Device Initiated Power Management is enabled after COMRESET OR if the Device Initiated Power Management is enabled after initial power cycle; otherwise the result would be “PASSED”

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-08 Device initiated power management Enable/Disable

Purpose

To verify that support for device power management is disabled (Word 79 bit 3 cleared to zero in IDENTIFY DEVICE or IDENTIFY PACKET DEVICE command data) by default and the device does not issue Partial/Slumber requests unless this feature has been enabled by the host as a result of a SET FEATURES command.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

January 29, 2009

Discussion

Host emulator issues an IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. and if device claims to support Power Management, it checks the state of DIPM. Host Emulator enables this feature and then issues IDENTIFY/IDENTIFY PACKET DEVICE command to P.U.T. to check the state of DIPM be set and it is verified whether PMREQ_P/S is issued by device. Then HOST Emulator disables the feature again and issues IDENTIFY/IDENTIFY PACKET DEVICE command. The state of DIPM is verified to be cleared after SET FEATURE and it is checked PMREQ_P/S is not issued.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 times.

Note: Due to the procedure of this test and the number of loops, the test time could exceed 400 seconds

- **Test Project:**
 - *IPM08-01.stc*
 - 1) Power cycle the DUT
 - 2) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if device supports DIPM and is currently disabled.
 - 3) Device Initiated Power Management (DIPM) is enabled via a SET FEATURE command.
 - 4) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if device DIPM is enabled now.
 - 5) Host waits for any kind of power management for 10 seconds.



- 6) If no Power management request has been issued, a STANDBY IMMEDIATE command is issued and host waits for 10 seconds again.
- 7) Device Initiated Power Management (DIPM) is disabled via a SET FEATURE command.
- 8) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if device has DIPM disabled.
- 9) Host waits for any kind of power management from the device for 10 seconds.
- 10) If no Power management request has been issued, a STANDBY IMMEDIATE command is issued and host waits for 10 seconds again.

- **Post process:**

- *IPM08-01.sts*

- Existing and complete execution of all IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. “ERROR” result is reported if any of the above commands is missed and/or not executed completely.
- Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support Power Management.
- In the case that no device initiated request was completed for any of the test sequences when the feature is enabled, the result will be “N/A”.
- “FAILED” is returned if:
 - 1) the Device Initiated Power Management is disabled after first SET FEATURE and PMREQ_P/S does not exist OR
 - 2) enabled after the disabling Set FEATURE OR
 - 3) PMREQ_P/S exists after DIPM has been disabled;
- Otherwise the result would be “PASSED”.

Observable Results

1. Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



IPM-09: Partial State exit latency (Device-Initiated)

Purpose

To verify that the device exit latency (i.e. COMWAKE response) from the partial state starts within 10 microseconds of COMWAKE receipt from the host.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Device is expected to request PM after issuing STANDBY IMMEDIATE and/or waiting 10 seconds. Device response latencies will be shown in final report.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

One test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the traces are post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 times.

- **Test Project:**
 - *IPM09_UTD14_01.stc(DIPM Support)*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE/ IDENTIFY PACKET DEVICE command is issued.
 - 3) If the device supports DIPM, Device Initiated Power Management Feature is enabled via a SET FEATURE command.
 - 4) Wait for device to send PMREQ_P for up to 10 seconds
 - 5) If device has not yet sent any PMREQ_P packets, STANDBY IMMEDIATE command is issued.
 - 6) Wait for device to send PMREQ_P for up to 10 seconds
 - 7) If PMREQ_P is received from the Device, the following is issued
 - COMWAKE is issued
 - Measure time between Host COMWAKE and Device COMWAKE
 - 8) An IDENTIFY DEVICE/ IDENTIFY PACKET DEVICE command is issued to assure the interface has woken up.

- **Post processes:**



- ***IPM09-01.sts***
 - Existing and complete execution of both IDENTIFY/IDENTIFY PACKET DEVICE commands in the trace are checked to verify the proper execution of test project. “FAILED” result is reported if the second command not executed completely.
 - Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
 - In the case that no device initiated partial request was completed for any of the test sequences, the result will be “N/A”.
 - The time from the end of the Host COMWAKE request and the end of the device COMWAKE response is verified to be within 10 microseconds.
 - If the above criterion is not fulfilled, “FAILED” result is reported.
 - If all the criteria are met in all 10 sequences, the result would be “PASSED”.

Observable Result

The Partial wake sequence completion and COMWAKE timing within 10us of COMWAKE receipt from host (use trace to analyze timing)

Measurement Tolerance: +/- 13.337 ns



IPM-10: Slumber State exit latency (Device-Initiated)

Purpose

To verify that the device exit latency (i.e. COMWAKE response) from the slumber state starts within 10 milliseconds of COMWAKE receipt from the host.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 17, 2009

Discussion

Device is expected to request PM after receiving a STANDBY IMMEDIATE command and/or waiting 10 seconds. Host waits for device PM request by holding the interface idle for 10 seconds. Device response latencies will be shown in final report.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

One test project is executed via Catalyst Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the traces are post-processed to verify the complete execution of test project and to check the pass/fail criteria. This test is repeated for 10 times.

- **Test Project:**
 - *IPM10_UTD14_01.stc (DIPM Support)*
 - 1) COMRESET signal is issued.
 - 2) An IDENTIFY DEVICE / IDENTIFY PACKET DEVICE command is issued.
 - 3) If the device supports DIPM, Device Initiated Power Management Feature is enabled via a SET FEATURE command.
 - 4) Wait for device to send PMREQ_S for up to 10 seconds
 - 5) If device has not yet sent any PMREQ_S packets, STANDBY IMMEDIATE command is issued.
 - 6) Wait for device to send PMREQ_S for up to 10 seconds
 - 7) If PMREQ_S is received from the Device, the following is issued
 - COMWAKE is issued
 - Measure time between Host COMWAKE and Device COMWAKE
 - 8) An IDENTIFY DEVICE / IDENTIFY PACKET DEVICE command is issued to assure the interface has woken up.

- **Post processes:**
 - *IPM10-01.sts*



- Existing and complete execution of both IDENTIFY DEVICE / IDENTIFY PACKET DEVICE commands in the trace are checked to verify the proper execution of test project. “FAILED” result is reported if the second command not executed completely.
- Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
- In the case that no device initiated slumber request was completed for any of the test sequences, the result will be “N/A”.
- The time from the end of the Host COMWAKE request and the end of the device COMWAKE response is verified to be within 10 milliseconds.
- If the above criterion is not fulfilled, “FAILED” result is reported.
- If all the criteria are met in all 10 sequences, the result would be “PASSED”.

Observable Result

Slumber wake sequence completion and COMWAKE timing within 10ms of COMWAKE receipt from host (use trace to analyze timings)

Measurement Tolerance: +/- 13.337 ns



IPM-11: Speed matching upon resume (Device-Initiated)

Purpose

To verify that the device signaling speed upon returning from a partial or slumber state matches the speed prior to entering the partial or slumber state.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

November 2, 2010

Discussion

Host Emulator establishes connection with P.U.T. and waits for it to request power management. Then the Host Emulator sends a wake up request. Resumed interface speed is verified to be the same as initial connection speed. Captured trace is processed to verify this speed match and to be sure that no new Speed Negotiation phase was executed after wake up.

Test Setup

Please see Appendix B

Test Procedure

Please see Appendix B

Two test projects are executed via LeCroy Host emulator: one project for PMREQ_P and another project for PMREQ_S. For each type of power management (Partial and Slumber) the project is run with all supported speeds of device (1.5G, 3.0G and 6.0G if supported) to establish the connection. The resulting traces of both projects are captured; then, the traces are post-processed to verify the complete execution of test project and to check the pass/fail criteria. The final report is generated from the 10 iterations for each Power Management type. The test is repeated for all supported speeds. (10 times for each supported speed)

- **Test Project:**
 - *IPM11-01.stc*
 - 1) Power cycle the PUT
 - 2) Host Speed is set to all supported speeds of device.
 - 3) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports DIPM.
 - 4) If the device supports DIPM, Device Initiated Power Management is activated by issuing a SET FEATURE command to the device.
 - 5) Wait for up to 10 seconds for device to initiate a PMREQ_P
 - 6) STANDBY IMMEDIATE command is issued to device
 - 7) Wait for up to 10 seconds for device to initiate a PMREQ_P
 - 8) If PMREQ_P is received from the Device, the following is done:
 - COMWAKE is issued



- Speed of response from device is checked
 - 9) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued again.
 - **IPM11-02.stc**
 - 1) Power cycle the PUT
 - 2) Host Speed is set to all supported speeds of device.
 - 3) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued to verify if the device supports DIPM.
 - 4) If the device supports DIPM, Device Initiated Power Management is activated by issuing a SET FEATURE command to the device.
 - 5) Wait for up to 10 seconds for device to initiate a PMREQ_S
 - 6) STANDBY IMMEDIATE command is issued to device
 - 7) Wait for up to 10 seconds for device to initiate a PMREQ_S
 - 8) If PMREQ_S is received from the Device, the following is done:
 - COMWAKE is issued
 - Speed of response from device is checked
 - 9) An IDENTIFY or IDENTIFY PACKET DEVICE command is issued again.
- **Post process:**
 - **IPM11-01.**
 - Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also, the issuance of PMREQ_P primitive, and COMWAKE response is checked. “FAILED” result is reported if one of the above command or requests is missed and/or not executed completely.
 - If during the wakeup process, COMINIT is found, the test iterate is considered as FAILED.
 - If after the Wakeup process, the SPD field of the SStatus register has changed, the test iteration is considered as FAILED, otherwise PASSED.
 - If, in 10 iterations, there are any FAILED, the final result “FAILED” is returned, otherwise if there are any PASSED and no FAILED then final result is “PASSED”. In the case that no device initiated request was completed for any of the test sequences, the result will be “N/A”.
 - **IPM11-02.sts**
 - Bit 3 of WORD 78 of Identify Page data is checked and “N/A” result is reported if device does not support any kind of Power Management.
 - Existing and complete execution of IDENTIFY/IDENTIFY PACKET DEVICE command in the trace are checked to verify the proper execution of test project. Also, the issuance of PMREQ_S primitive, and COMWAKE response is checked. “FAILED” result is reported if one of the above command or requests is missed and/or not executed completely.
 - If during the wakeup process, COMINIT is found, the test iteration is considered as FAILED.



- If after the Wakeup process, the SPD field of the SStatus register has changed, the test iterate is considered as FAILED, otherwise PASSED.
- If, in 10 iterations, there are any FAILED, the final result “FAILED” is returned, otherwise if there are any PASSED and no FAILED then final result is “PASSED”. If in 10 iterations the results are all NA, then the final result “NA” is returned.

Observable Result

The SPD field contains the same value before and after the power management sequence in each supported speed (HIPM support required).

NOTE – if the device does not support HIPM but does support DIPM and no request was issued by the device, then the device shall not be failed for this test requirement.



DOF-01 : Asynchronous notification

Purpose

To verify that the device, claiming to support Asynchronous Notification sends the notification to host when the feature is enabled and device needs attention.

Note: This test is not applicable to ATA devices or hosts.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

June 2, 2009

Discussion

Host Emulator issues IDENTIFY PACKET DEVICE command to P.U.T. to check the support of Asynchronous Notification feature. Then, it enables the device feature by issuing SET FEATURE command with “Sector Count = 05h, Features = 10h” and verifies the feature to be set. Then, asks User/Tester to trigger an event like ejecting the media tray and verifies the reception of notification via Set Device Bit FIS. The test verifies not receiving any such notification when the feature is disabled.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria. The final report is generated from the 5 iterations for the test.

- **Test Project:**
 - *DOF01-01.stc*
 - 1) Device is power cycled
 - 2) An IDENTIFY PACKET DEVICE command is issued.
 - 3) A SET FEATURE command is issued to enable the Asynchronous notification feature and the feature is checked to be enabled via issuing an IDENTIFY PACKET DEVICE again.
 - 4) User is asked to eject the media or tray out
 - 5) User is asked to push the tray or media in again



- *DOF01-02.stc*
 - 1) Asynchronous notification feature is disabled and checked to get disabled by issuing SET FEATURE and IDENTIFY PACKET DEVICE again.
 - 2) User is asked to eject the media or tray out
 - 3) User is asked to push the tray or media in again
- **Post process:**
 - Existing and complete execution of all the IDENTIFY PACKET DEVICE and SET FEATURE Commands is checked to verify the proper execution of test project. “ERROR” result is reported if any of the above is not executed properly.
 - Bit 5 of WORD 78 of Identify Page data from the first IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device does not support Asynchronous Notification.
 - Bit 5 of WORD 79 of Identify Page data from the first IDENTIFY PACKET DEVICE command data is checked and “FAIL” result is reported if device’s default Asynchronous Notification state is enabled.
 - Bit 5 of WORD 79 of Identify Page data from the second IDENTIFY PACKET DEVICE command data is checked and “N/A” result is reported if device doesn’t enable the Asynchronous Notification feature.
 - Existing of Set Device Bit FIS with “I” and “N” bits set to one is verified in the first trace file.
 - Bit 5 of WORD 79 of Identify Page data from the first IDENTIFY PACKET DEVICE command data of second trace file is checked and “N/A” result is reported if device doesn’t disable the Asynchronous Notification feature.
 - Not existing of Set Device Bit FIS is verified in the second trace file.
 - If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.

Possible Problems

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G, 3G or 6G, rather than setting the Bus Analyzer to ‘Auto Detect’ speed. It has been observed that the tests can be performed properly with the Bus Analyzer set to ‘Auto-Detect’ speed.



DOF-02 : Phy speed indicator

Purpose

To verify that the device sets the PHY speed indicator properly, whether it supports the current PHY speed or it doesn't.

Note: This test is not applicable to hosts.

Resource Requirement

As listed in Resource Requirements on page 6.

Last Modification

March 18, 2009

Discussion

Host Emulator establishes connection with P.U.T. at the highest supported rate and issues IDENTIFY (PACKET) DEVICE and checks Word 77 bits 1-3. It can be all zero when device does not support the speed. Otherwise, it should have a bit set to one respective to the established connection speed.

Test Setup

Please see Appendix B

Test Procedure:

Please see Appendix B

A test project is executed via LeCroy Host emulator at the highest supported speed of device and the resulting trace will be captured; then, the trace is post-processed to verify the complete execution of test project and to check the pass/fail criteria.

- **Test Project:**
 - *DOF02-01.stc*
 - 1) Host is set to establish connection with the highest supported speed of device
 - 2) An IDENTIFY (PACKET) DEVICE command is issued.
 - 3) The next lower supported speed is set and step 1 to 2 is repeated
- **Post process:**
 - Existing and complete execution of all the IDENTIFY PACKET DEVICE Commands is checked to verify the proper execution of test project. "ERROR" result is reported if any of the above is not executed properly.



- Bit 1-3 of WORD 77 of Identify Page data is checked and “N/A” result is reported if device keeps these bits cleared at various speeds.
- Bit 3 of WORD 77 of Identify Page data is verified to be set when Gen3 speed is established. Meanwhile, Bit 1 and 2 shall be cleared. Bit 2 and Bit 1 should be checked for Gen2 and Gen1 speeds in the same way as well.
- If any of the above criteria is not fulfilled, “FAILED” result will be reported, otherwise the test would be “PASSED”.

Observable Results

Click the “View” button to see a report of the test. A failing test may be viewed by going to the C:\program files\lecroy\sata protocol suite\LOG\ directory and double clicking on the appropriate test for analysis.



Appendix A

Test Selection

The Interoperability Logo tests are categorized in two groups - the mandatory tests and the optional or feature dependent tests.

The mandatory tests are most GTR tests and most ASR tests, and the LeCroy SATA compliance test suite uses its integrated host emulator and performs all the tests.

The optional tests are the NCQ, IPM, and SSP tests and the LeCroy SATA compliance test suite uses its integrated host emulator and performs all the tests.

Appendix B

SATA I/O Digital Compliance Test Setup & Procedure

Last Modification

January 29, 2009

Discussion

The testing uses an on board host emulator and follows the Serial ATA Interoperability Program Unified Test Document Revision 1.4. A trace file of every test is captured so that any failures can be analyzed.

Test Setup:

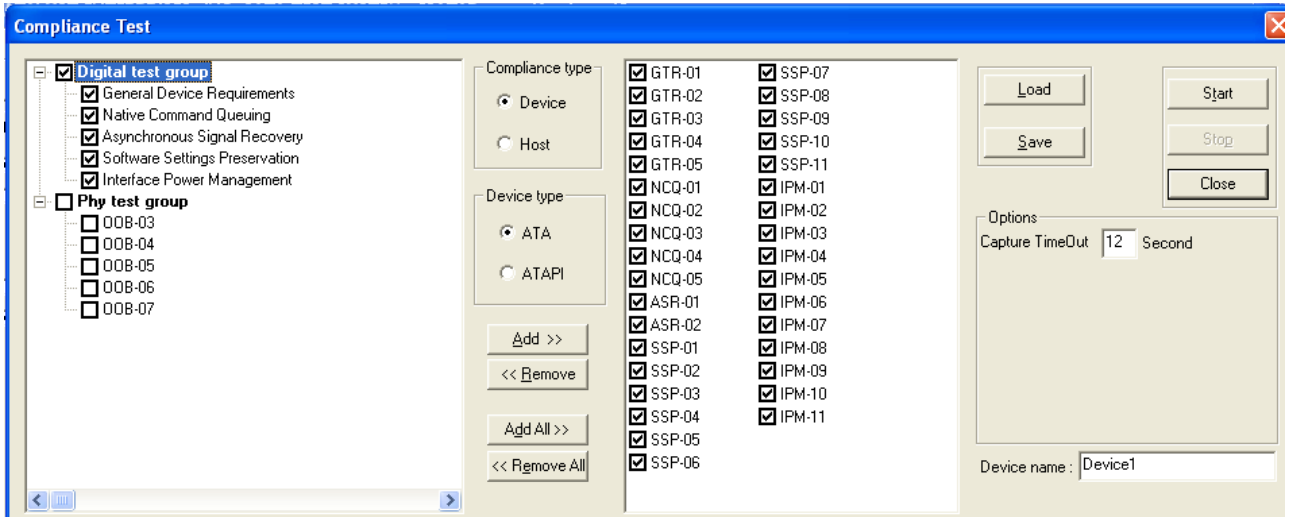
1. Prepare a host system with specified Windows OS.
2. Connect the Sierra M6-4, Sierra M6-2, STX-460/431/231/131 to the host system running LeCroy STX Software via either the USB or Ethernet interface.
3. Connect the Vendor's SATA HDD/ATAPI P.U.T. to the Sierra M6-4, Sierra M6-2, STX-460/431/231/131 Device/Target Port1, using the serial ATA cable.
4. Connect the P.U.T. power connector to external power supply or the STX power source using Serial ATA power adapter cable or LeCroy External Power Cable.

Test Procedure:

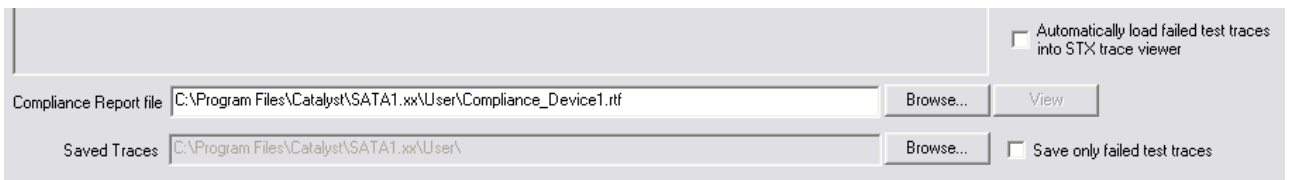
1. Start LeCroy SATA Software Revision 3.50 (or later version) by double-clicking the SATA Protocol Suite icon on the desktop, or by selecting from the Start Menu: Start/All Programs/LeCroy/SATA Protocol Suite/SATA Protocol Suite.
2. Wait for "Device Selection Dialog Box" window to pop up, and then click "USB" under local devices and click "OK".
If the host systems has previously made the same connection to the STX box it will use the same settings and will not ask for any options.
3. Wait for the "Select Device Dialog Box" to pop up and click "OK".
4. Under the 'tools' menu, select the compliance test option under the drop down. Wait for the "Compliance Test" Dialog Box to pop up.



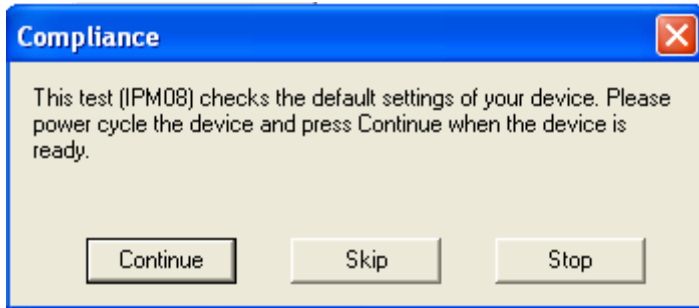
5. Select compliance type, Device compliance or Host compliance.
6. Select the device type, ATA or ATAPI if you have selected Device compliance.
7. Click the Compliance test group box and then click the “Add All” (or add your desired test) button. The selected tests may be saved and recalled for future tests.



8. Select other options as desired, such as the folder location you like to save the test results and if you like to save all tests or just the failed tests, etc...
9. Set the Device name text box. Given name is used in compliance report.



10. Click the “Start” button to start the test suite. Please note that the display for the first result will be after the test has been completed, therefore it may take a few seconds before the screen is updated.
11. Wait for finishing of the test process. Please note that some tests require user interaction. In these cases follow the direction on the display as it appears.



12. Click the “View” button to see a report of the tests. A failing test may be viewed by going to the C:\Program Files\Catalyst\SATA2.xx\USER directory and double clicking on the appropriate test for analysis. See “observable result” section on page 6 of this document for more details about used terminology in output compliance report.

Test Report

Test results can be retrieved from C:\Program Files\Catalyst\SATA2.xx\User\Compliance Test.rtf. Individual failing test traces may be retrieved from C:\Program Files\Catalyst\SATA2.xx\USER and then viewed for analysis of the failure.

Approximate Execution Time:

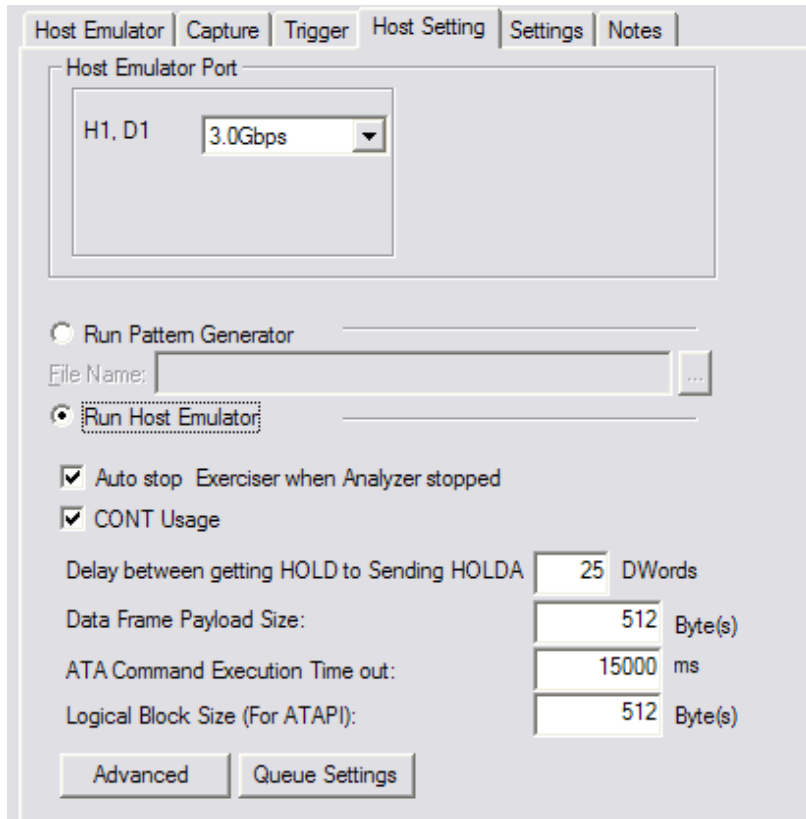
15~25 minutes

Appendix C: Tests Verified Manually

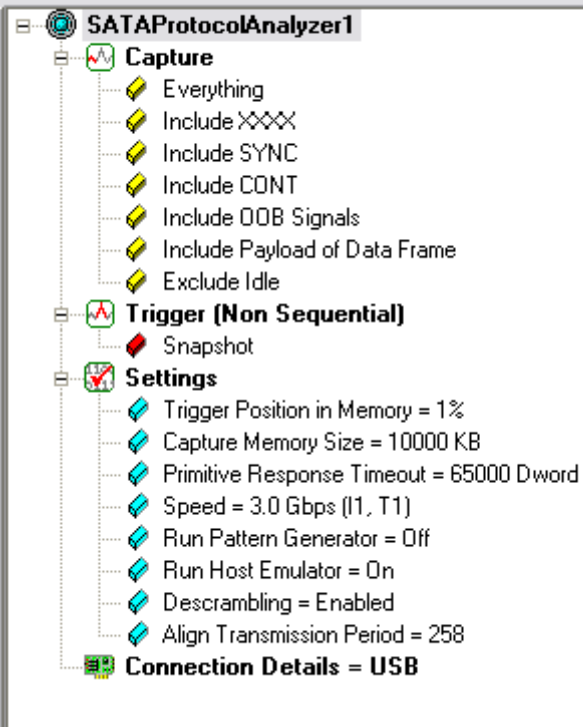
1. GTR-01 (Software release 2.81) Verification of a “FAILED” Test
 - a. The above software release had a signature value that was unintentionally not changed and could cause a false failure. If a device FAILED GTR-01, then one could open the trace in the program’s User directory to see if the Register Device to Host contents had Dev= A0 or 10, Status =50, Error=01, LBA Low=01, Sec Count=01, LBA Hi + LBA Mid = (00 +00) or (14h + EBh). If it had this contents, then the results are a PASS, anything else results in a FAIL.
2. SSP-02 (Software Release 2.81) Manual Test of SSP-02
 - a. The test is not applicable to ATAPI devices and the device must claim to support streaming, Word 78 bit 6 and Word 84 bit 4.
 - b. The test for SSP-02 could not be incorporated into the software automatically prior to the Interop Workshop therefore for software release 2.81 it needs to be created manually, the proper settings need to be adjusted, the project executed and the results analyzed. On higher versions of software like 3.x this procedure has been automated and already included. This procedure assumes that the user can create and is familiar

with a Host Emulator / Analyzer Project as described in the User Manual. Screen-shots have been provided to aid in quick development of the procedure.

Host and Capture Settings



Project Tree



Post Processing

If the device does not support streaming one will see an Error or Abort in the Read Log command. Expanding the ATA command will show something similar to the following:

FIS Type	Status (H)	Error (H)
0x34 : Register Device to Host	51	04

(partial representation.)

For passing the SSP test, please refer to the post processing section for SSP-02. A quick summary of the passing results are:

Check the log page values for 22:21

Perform an ATA Command

Read the new log values verify they changed

Perform a reset and compare that the log values are the same.

