



Serial ATA International Organization

Version 1.0
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Serial ATA Interoperability Program Revision 1.2 ULINK MOI for Device Digital Test (ASR, GTR, NCQ, SSP, IPM)

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Revision History

Revision	Date	Comments
0.1	01/19/2006	Initial draft
0.2	01/28/2006	Use new format, separate HDD/ATAPI Tests into different chapters
0.9	02/28/2006	Update version number of Drive Master 2006 Pro and SATA-IO IL Digital Scripts
1.0RC	03/02/2006	Approved by Logo Group
1.0	06/19/2006	Revision 1.0 Final for Program Rev 1.0
0.9RC	10/19/2006	Update version number of SATA-IO Digital Script which is modified according to UTD 1.1
0.9RC1	11/06/2006	Update according to MOI review
0.9RC2	01/29/2007	Add Test Procedure
0.9RC3	02/13/2007	Update according to MOI review <ul style="list-style-type: none"> Added a definition section to cover ATA/ATAPI command usage. GDR-02: Change "make sure" to say "Set SControl" and issue power cycle and confirm drive ready GDR-03: Step d: Change "appropriate" to "maximum", Step g, change to indicate 2 tracks written, one with 8K transfers, the 2nd with 1MB transfers. NCQ-04: Step d: Add text that indicates that only 2nd bullet or 3rd bullet is done, but not both. SSP-01: Step f: Change "new" to "different" SSP-02: Step f: Change to "Create Soft Media error using method from step d", Step p: Add step p: "Recover error sector by Write Sector (EXT) to the error address" SSP-06: Step i: Change "new" to "different" in first bullet, SSP-11: Step j & k: Change "new" to "different" IPM-01: Add minimum of 80% passage to confirm a IPM method is valid IPM-01 / IPM-02: Step e, bullet 1, 1st and 2nd hollow bullet: change "second until Partial" to "second or until Partial". Step f: added reference to pass/fail is in Bus Analyzer MOI. IPM-05/IPM-06: Step j: add the word "primitives" to after PMACK and PMNAK and reference to Bus Analyzer MOI for pass/fail
1.0RC	2/15/2007	Approved by Logo Group for Program Rev. 1.1
1.0	3/19/2007	Version 1.0 Final for Program Rev. 1.1
0.7	3/31/2007	<ul style="list-style-type: none"> Add the support for the changes in UTD 1.2 GTR-01: Use Read Verify Sector to replace Seek GTR-03: Perform the same data transfer size for Read-only Device as the test does for Write Capability Device SSP-01: Try more different values for Initialize Device Parameter
0.9	04/26/2007	Reviewed by Logo Group <ul style="list-style-type: none"> Update version number of Drive Master 2006 Pro and SATA-IO IL Digital Scripts
1.0RC	07/17/2007	Approved by Logo Group for Program Rev. 1.2 <ul style="list-style-type: none"> Update version number of LeCroy CATC Bus Analyzer Digital MOI
1.0	09/25/2007	Version 1.0 Final for Program Rev. 1.2

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REFERENCES

The following documents are referenced in this text:

- [1] Serial ATA Revision 2.5
- [2] Serial ATA Interoperability Program Unified Test Document Revision 1.2
- [3] Serial ATA Interoperability Program Policy Document Revision 1.2
- [4] LeCroy CATC Bus Analyzer Digital MOI Revision 1.2

DEFINITION

WRITE DMA (EXT)

WRITE DMA command for 28-bit Address HDD

WRITE DMA EXT command for 48-bit Address HDD

READ DMA (EXT)

READ DMA command for 28-bit Address HDD

READ DMA EXT command for 48-bit Address HDD

WRITE SECTOR (EXT)

WRITE SECTOR command for 28-bit Address HDD

WRITE SECTOR EXT command for 48-bit Address HDD

READ NATIVE MAX ADDRESS (EXT)

READ NATIVE MAX ADDRESS command for 28-bit Address HDD

READ NATIVE MAX ADDRESS EXT command for 48-bit Address HDD

WRITE NATIVE MAX ADDRESS (EXT)

WRITE NATIVE MAX ADDRESS command for 28-bit Address HDD

WRITE NATIVE MAX ADDRESS EXT command for 48-bit Address HDD

Test Title: SATA-IO IL HDD tests

Purpose: Verify that HDD Device Under Test meets the Digital test requirements described in Serial ATA Interoperability Program Unified Test Document Revision 1.2

Resource Requirements:

1. Windows 2000, XP, or 2003 Operating System
2. 256MB RAM or higher
3. Motherboard with SATA Controller based on the Intel ICH7R chipset
4. Minimum 64 MB video card. 128MB is recommended.
5. At least 150MB free space for system drive
6. Bus Analyzer (or Scope) for ASR/IPM tests
7. ULINK Drive Master 2006 Pro with USB key
8. ULINK Drive Master External Power Supply
9. Serial ATA cables
10. SATA HDD Device Under Test

****Optional:**

*One PCI to ATA or PCI to SATA (Depends on the system drive) add-on card
See details in Appendix B*

Hardware Equipment Model Number:

Intel ICH7R AHCI

See details in Appendix B

Software Revision Number:

ULINK Drive Master 2006 Pro: version 3.0.260

ULINK SATAIO-IL Digital Test Script: version 1.6

Last Modification: 04/26/2007

Test Setup:

1. Connect system drive to add-on controller or Parallel ATA port
2. Connect Device Under Test via Bus Analyzer or Scope to SATA port 0 on the motherboard using Serial ATA cables
3. Connect ULINK Drive Master External power supply to Parallel port or USB port
4. Connect Device Under Test to ULINK Drive Master External power supply using Serial ATA power adapter cable
5. Insert Drive Master 2006 Pro USB key into a USB port
6. Connect Bus Analyzer or Scope properly (see detail in corresponding equipment's MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

Test Procedure:

1. Start Drive Master 2006 Pro by double-clicking "Drive Master 2006 Pro" icon on the desktop or by selecting from the Start Menu:
Start / All Programs / Drive Master 2006 Pro/ Drive Master 2006 Pro
2. Wait for "Drive Master 2006" window to pop up. Click "Yes" if the current selected HBA is the one you want to use for the testing, else click No and select the matching HBA from the list.
3. Under the 'File' menu in Drive Master 2006 Pro, click 'Open' to select the script. Select "SATAILMain_Selective.ens" or "SATAILMain_Auto.ens" from the folder where the scripts are stored.
Note: It is recommended that you choose "SATAILMain_Selective.ens" to better customize your testing. See details in Appendix A.
4. Click Run button.
5. Enter Test ID number for Device Under Test, and click OK

6. Select Optional tests from the following message box and click OK.
1. NCQ; 2. SSP; 3. IPM; 4. NCQ & SSP; 5. NCQ & IPM; 6. SSP & IPM; 0. All
Note: It is recommended that you choose the default setting “0:All” to walk through all the test cases based on the features reported by the Device.
Note: For Mandatory Tests (ASR/GTR), they will always be tested. See details in Appendix A.
7. When you see the message box “Please start capture”, configure and start recording from Bus Analyzer (or Scope) according to the corresponding equipment’s MOI (e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2), then click OK
8. When you see the message box “Please stop capture”, stop recording from Bus Analyzer (or Scope) and collect the necessary test results, then click OK.
Note: The messages in Item 7 and 8 will be prompted during ASR/IPM tests.
9. Exit Drive Master 2006 Pro when tests are completed.

Test Results:

Test results can be retrieved from c:\SATAILTest\DGT according to the Test ID in log and csv format.

Measurement Tolerance: N/A

Only PASS/FAIL in Digital Test

Approximate Execution Time:

20~30 minutes

Possible Problems:

Test Title: SATA-IO IL ATAPI tests

Purpose: Verify that ATAPI Device Under Test meets the Digital test requirements described in Serial ATA Interoperability Program Unified Test Document Revision 1.2

Resource Requirements:

1. Windows 2000, XP, or 2003 Operating System
2. 256MB RAM or higher
3. Motherboard with SATA Controller based on the Intel ICH7R chipset
4. Minimum 64 MB video card. 128 MB is recommended.
5. At least 150MB free space for system drive
6. Bus Analyzer (or Scope) for ASR/IPM tests
7. ULINK Drive Master 2006 Pro with USB key
8. ULINK Drive Master External Power Supply
9. ULINK SATA-IO IL TestCD 01
10. Serial ATA cables
11. SATA ATAPI Device Under Test

****Optional:**

*One PCI to ATA or PCI to SATA (Depends on the system drive) add-on card
See details in Appendix B*

Hardware Equipment Model Number:

Intel ICH7R AHCI

See details in Appendix B

Software Revision Number:

ULINK Drive Master 2006 Pro: version 3.0.260

ULINK SATAIO-IL Digital Test Script: version 1.6

Last Modification: 04/26/2007

Test Setup:

1. Connect system drive to add-on controller or Parallel ATA port
2. Connect Device Under Test via Bus Analyzer or Scope to SATA port 0 on the motherboard using Serial ATA cables
3. Connect ULINK Drive Master External power supply to Parallel port or USB port
4. Connect Device Under Test to ULINK Drive Master External power supply using Serial ATA power adapter cable
5. Insert Drive Master 2006 Pro USB key into a USB port
6. Connect Bus Analyzer or Scope properly (see detail in the corresponding equipment's MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

Test Procedure:

1. Start Drive Master 2006 Pro by double-clicking "Drive Master 2006 Pro" icon on the desktop or by selecting from the Start Menu:
Start / All Programs / Drive Master 2006 Pro/ Drive Master 2006 Pro
2. Wait for "Drive Master 2006" window to pop up. Click "Yes" if the current selected HBA is the one you want to use for the testing, else click No and select the matching HBA from the list.
3. Under the 'File' menu in Drive Master 2006 Pro, click 'Open' to select the script. Select "SATAILMain_Selective.ens" or "SATAILMain_Auto.ens" from the folder where the scripts are stored.
Note: It is recommended that you choose "SATAILMain_Selective.ens" to better customize your testing. See details in Appendix A.
4. Click Run button.

5. Enter Test ID number for Device Under Test, and click OK
6. Select Optional tests from the following message box and click OK.
1. NCQ; 2. SSP; 3. IPM; 4. NCQ & SSP; 5. NCQ & IPM; 6. SSP & IPM; 0. All
Note: It is recommended that you choose the default setting "0:All" to walk through all the test cases based on the features reported by the Device.
Note: For Mandatory Tests (ASR/GTR), they will always be tested. See details in Appendix A.
7. When you see the message box "Please insert ULINK SATA-IO IL Test CD 01", insert the ULINK SATA-IO IL Test CD 01 and click OK.
Note: This message will be prompted during GTR/SSP test.
8. When you see the message box "Please insert Blank CD Recordable disc", insert a Blank Recordable/Rewritable CD and click OK.
Note: This message will be prompted during GTR test.
9. When you see the message box "Please start capture", configure and start recording from Bus Analyzer (or Scope) according to the corresponding equipment's MOI (e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2), then click OK
10. When you see the message box "Please stop capture", stop recording from Bus Analyzer (or Scope) and collect the necessary test results, then click OK.
Note: The messages in Item 9 and 10 will be prompted during ASR/IPM tests.
11. Exit Drive Master 2006 Pro when tests are completed.

Test Results:

Test results can be retrieved from c:\SATAILTest\DGT according to the Test ID in log and csv format.

Measurement Tolerance: N/A

Only PASS/FAIL in Digital Test

Approximate Execution Time:

20~30 minutes

Possible Problems:

For CD Write, some ATAPI devices are sensitive to CD-Recordable/Rewritable Medium. This may cause the failure of CD Write test (GTR-03 DMA Protocol Support).

Appendix A: SCRIPTS

Scripts Dependency

ULINK SATA-IO IL Digital Test Scripts v1.6 can only be run on Drive Master 2006 Pro v3.0.260. If the version number does not have the exact match, the test will exit and an error message will be shown on the log window.

Scripts Selection

ULINK SATA-IO IL Digital Test Scripts are categorized into two groups: Mandatory tests and Optional tests.

Mandatory tests: GTR and ASR. If Device Under Test doesn't support ASR, test results can be ignored.

Optional tests: NCQ, IPM, and SSP.

SATAILMain_Selective.ens involves interactive response from the tester. It requires the tester to enter input into the pop-up message box each time to continue the testing.

SATAILMain_Auto.ens will automatically select the default setting of message box in 30 seconds if there is no response from the tester. It will run all the Mandatory tests and Optional tests based on the features reported by the Device.

Appendix B: Additional Resources Details

PCI to ATA/SATA add-on controller card

If a Parallel ATA hard drive is used as system drive, connect system drive to the Parallel ATA port on the motherboard. If Parallel ATA port is not available, then use a PCI to ATA add-on controller card.

If a Serial ATA Hard Drive is used as system drive, connect system drive to a PCI to SATA add-on controller card.

ULINK SATA-IO IL TestCD 01

ULINK SATA-IO IL Test CD 01 is full-size Data CD constructed by SATA-IO COMP Data and Identification ID. It is only needed in ATAPI tests.

HBA Requirement

ULINK Drive Master 2006 Pro supports the following HBAs:

1. Intel ICH4 and above, including IDE, AHCI and RAID modes
2. All the HBAs complied with standard AHCI spec.
3. Silicon Image 3124, 3132
4. Marvell 6081

To minimize the impact to Device under Test from HBAs (such as the limitations or bugs related to the specific HBAs) and maximize the automation of Digital Tests, ICH7R AHCI is currently chosen for this set of tests.

Appendix C: Test Procedure

Purpose: Describe ULINK test procedure which complies with Serial ATA Interoperability Program Unified Test Document Revision 1.2

Last Modification: 04/26/2007

GTR-01 : Software Reset

Note: Each test case will be run in 5 loops

- a. Issue the following commands
 - ATA Device:
 - READ VERIFY SECTOR(S)
 - WRITE DMA
 - READ SECTOR
 - ATAPI Device:
 - TEST UNIT READY
 - INQUIRY
 - READ CD
- b. Check if the command is completed successfully. If yes, go to item c. If not, process error handling
- c. Issue SOFTWARE RESET and make sure this command is issued successfully. If not, process error handling
- d. Wait for the signature being posted by the device in 31 seconds.
- e. When good status (no BSY/DRQ/ERR is set) is detected, check if the signature returned is correct:
 - ATA device signature: 01h, 01h, 00h, 00h
 - ATAPI device signature: 01h, 01h, 14h, EBhIf it is incorrect, the script will log "FAIL" and the current signature returned from device and the expected signature
- f. When all the test cases are passed, log "PASS"

Error handling:

Log the error information with command op-code and loop count. The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

For ATAPI read, ULINK SATAIL Test CD-01 is requested

GTR-02 : 3Gb/s Backwards Compatibility

Note: each test case will be run in 10 loops

- a. Set HBA register SCONTROL to “No speed negotiation restrictions” mode
- b. Power cycle the device and make sure the device is ready. If not, test exits
- c. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- d. Check WORD 76 Bit 1 and Bit 2
- e. If Bit 2 is not set, i.e. SATA Gen-2/3.0Gbps is not supported, test exits
- f. If Bit 2 is set, but Bit1 is not set, “FAIL” will be logged
- g. Issue COMRESET, wait for the device signature is posted
- h. When good status (no BSY/DRQ/ERR is set) is detected, check if the signature returned is correct:
 - ATA device signature: 01h, 01h, 00h, 00h
 - ATAPI device signature: 01h, 01h, 14h, EBhIf it is incorrect, the script will log “FAIL” and the current signature returned from device and the expected signature
- i. If the current HBA is Gen-2 Host, Limit speed negotiation to a rate not greater than Gen-1 communication rate, then re-do item f and g
- j. When all the test cases are passed, Log “PASS”

Error handling:

The script will do necessary recovery to make sure the failure for the current test case won't affect next test case.

GTR-03 : DMA Protocol Support

Note: each test case will be run in 5 loops

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 49 Bit 8, if it is not set to 1, the script will log “FAIL” and current value in WORD 49 and the expected value, then test exits
- c. Check WORD 53 and WORD 88 to find out the Maximum UDMA mode is supported by the device. If no UDMA mode is supported, check WORD 63 to find out the Maximum Multiword DMA mode is supported. If no Multiword DMA mode is supported, the script will log “FAIL” and current setting in WORD 88 and WORD 63, and then test exits
- d. Set maximum DMA mode the device can support by SET FEATURE command
- e. Load Write Buffer with COMP pattern
- f. For ATA device:
 - Issue Write DMA (EXT) with Random LBA and sector count is 10h (8K bytes: for test requirement of transfer size <= 8K bytes)/00h (128K bytes for 28-Bit Address device, 32M bytes for 48-Bit Address device: for test requirement of transfer size > 8K bytes)
 - Issue Read DMA (EXT) with the same Random LBA and sector count
 - If both commands complete successfully, compare the data read back from the device with the data written to the device. If data mismatch is detected, the script will log “FAIL” with LBA and sector count
 - If any command is not completed successfully, the script will log “FAIL” with LBA and sector count, and process error handling
- g. For ATAPI device:
 - Check the device capability on write
 - To simplify the test, if the device is writable, a blank CD-R or CD-RW disc (if re-writable medium is supported by the device) will be requested in this test, and the script will check the disc to make sure it is blank before the following test
 - For the device with write capability:
 - Perform the necessary preparation before the script can start CD write
 - Write the track by issuing number of WRITE 10 commands with the appropriate writable address and transfer size of 8K bytes (for test requirement of transfer size <=8K bytes)/1M bytes (for test requirement of transfer size > 8K bytes)
 - Make sure CD write is successfully completed, If not, the script will log the corresponding sense key information and process Error handling. If yes, continue to next step
 - Read the previous written track by issuing number of READ CD commands with transfer size of 8K bytes (for test requirement of transfer size <=8K bytes)/1M bytes (for test requirement of transfer size > 8K bytes), and compares User data read back from the device with the data written to the device. If data mismatch is detected, the script will log “FAIL” with LBA and Length.
 - If any command is not completed successfully, the script will log “FAIL” with the corresponding sense key information, and process error handling
 - For the device with read-only:
 - ULINK SATAL Test CD 01 is requested
 - Issue one READ CD command with Random LBA and transfer size of 8K bytes (for test requirement of transfer size <= 8K bytes)/1M bytes (for test requirement of transfer size > 8K bytes)
 - Issue the second READ CD command with the same Random LBA and transfer size

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- If both commands complete successfully, compare the data returned from two reads. If data mismatch is detected, the script will log “FAIL” with LBA and Length
- If any command is not completed successfully, the script will log “FAIL” with the corresponding sense key information, and process error handling
- Repeat the above test to achieve the same data transfer size as the test does for the device with write capability.

h. When all the test cases are passed, Log “PASS”

Error handling:

The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

GTR-04 : General SATA Support

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 93 and verify if it is zero. If not, script will log “FAIL” and the current value returned from device and the expected value
- c. Check WORD 76 Bit 1 and verify if it is one. If not, script will log “FAIL” and the current value returned from device and the expected value
- d. When both cases are passed, Log “PASS”

GTR-05 : Unrecognized FIS receipt

- a. Issue unrecognized FIS (0x88990055, 0x01, 0x02, 0x03, 0x04, 0x05, 0x06) to the device
- b. Check if R_ERR is returned from the device
- c. If R_ERR is not detected, the script will log "FAIL". If yes, the script will log "PASS"

Error handling:

The script will do necessary recovery to make sure the device is ready for the next command.

NCQ-01 : Forced Unit Access

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 76 Bit 8, if it is cleared to zero, test exits
- c. Check Maximum Queue Depth supported by both Host and Device (WORD 75 Bit 4-0) sides in order that the tag number to be used in the following test is in the valid range (i.e. the smaller one of the above two numbers)
- d. Enable write cache if it is supported by the device
- e. Record the sector count = X and the number of IOs = Y when Maximum Flush time is detected
- f. Issue Y loops of WRITE DMA (EXT) commands with Random LBAs, Sector Count = X and data pattern 0x11
- g. Issue Y loops of READ DMA (EXT) commands with the same Random LBAs, Sector Count = X and verify that all Random locations have been written with the expected data 0x11
- h. Set FUA = 1, issue Y loops of WRITE FPDMA QUEUE commands with the same Random LBAs, Sector Count X and data pattern 0x22
- i. Wait for all the WRITE FPDMA QUEUE commands have been successfully completed
- j. Power cycle the device and make sure that the device is ready.
- k. Issue Y loops of READ DMA (EXT) commands with the same Random LBAs, Sector Count = X and verify that all Random locations have been written with the expected data 0x22
- l. If data mismatch is detected, the script will log "FAIL"; otherwise, "PASS" will be reported.
- m. If any WRITE FPDMA QUEUE command is failed, the test will log "FAIL" and process error handling

Error handling:

The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

NCQ-02 : Read Log Ext log page 10h support

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 76 Bit 8. If it is cleared to zero, test exits
- c. Check WORD 87 Bit 5. If it is cleared to zero, Log "FAIL"
- d. Issue READ LOG EXT with Page ID = 0
- e. Read WORD value at offset 20h from the returned data
- f. Check if it is 01h, if not, the script will log "FAIL";
- g. Issue READ LOG EXT with Page ID = 10h. If the command is failed, Log "FAIL"
- h. When all the test cases are passed, "PASS" will be reported.

NCQ-03 : Intermix of Legacy and NCQ commands

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 76 Bit 8. If it is cleared to zero, test exits
- c. Check Maximum Queue Depth supported by both Host and Device (WORD 75 Bit 4-0) sides in order that the tag number to be used in the following test is in the valid range (i.e. the smaller one of the above two numbers).
- d. Issue number of READ FPDMA QUEUE commands with Random LBAs
- e. Issue the following commands for each test case:
 - IDENTIFY DEVICE
 - WRITE SECTOR
 - READ DMA
- f. Check D2H Register FIS,
 - Log current Status, Error and I Bit information returned from the device.
 - Check if I Bit/ERR Bit/ABRT Bit/DRDY Bit are set to one
 - Check if BSY Bit/DRQ Bit/DF Bit is cleared to zero.
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
- g. Check if new SDB FIS is not received to make sure that command processing shall not be continued. If new SDB FIS is received, Log “FAIL”, new SDB FIS and expected SDB FIS information
- h. If the expected error is detected, issue READ LOG EXT with Page 10h
- i. If READ LOG EXT with Page 10h is successful,
 - check SDB FIS response to this command
 - Log current Status, Error, I Bit and SACTIVE in SDB FIS information returned from the device.
 - Check if DF Bit/ERR Bit/I Bit are cleared to zero
 - Check if DRDY Bit is set to one
 - Check if Reserved BIT 7 (BSY)/BIT 3 (DRQ) are cleared to zero
 - Check if SACTIVE field in SDB FIS is set to 0xFFFFFFFF
 - Check READ LOG EXT with Page 10h contents
 - Log non-Reserved fields from the returned contents
 - Check if NQ Bit is set
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
- j. If READ LOG EXT with Page 10h is failed, Log “FAIL” with Timeout or Status/Error information and process Error handling
- k. When all the test cases are passed, Log “PASS”

Error handling:

The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

NCQ-04 : Device response to malformed NCQ command

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 76 Bit 8. If it is cleared to zero, test exits
- c. Check Maximum Queue Depth supported by both Host and Device (WORD 75 Bit 4-0) sides in order that the tag number to be used in the following test is in the valid range (i.e. the smaller one of the above two numbers).
- d. Specified LBA is out of the device supported range:
 - Issue READ FPDMA QUEUE with the LBA which is out of Maximum LBA (WORD 60-61 or WORD 100-103) supported by the device, Tag Number is zero
 - Perform one of the following two checks
 - Check D2H FIS, if ERR Bit in Status is set, check the following information
 - Log current Status, Error and I Bit information returned from the device.
 - Check if I Bit/ERR Bit/DRDY Bit are set to one
 - Check if ABRT Bit or IDNF Bit is set to one
 - Check if BSY Bit/DRQ Bit/DF Bit is cleared to zero.
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
 - Check SDB FIS, if ERR Bit in Status is set, check the following information
 - Log current Status, Error and I Bit information returned from the device.
 - Check if I Bit/ERR Bit/DRDY Bit are set to one
 - Check if ABRT Bit or IDNF Bit is set to one
 - Check if BSY Bit/DRQ Bit/DF Bit is cleared to zero.
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
 - Check if new SDB FIS is not received to make sure that command processing shall not be continued. If new SDB FIS is received, Log “FAIL” and expected SDB FIS information
 - If the expected error is detected, issue READ LOG EXT with Page 10h
 - If READ LOG EXT with Page 10h is successful,
 - check SDB FIS response to this command
 - Log current Status, Error, I Bit and SACTIVE in SDB FIS information returned from the device.
 - Check if DF Bit/ERR Bit/I Bit are cleared to zero
 - Check if DRDY Bit is set to one
 - Check if Reserved BIT 7 (BSY)/BIT 3 (DRQ) are cleared to zero
 - Check if SACTIVE field in SDB FIS is set to 0xFFFFFFFF
 - Check READ LOG EXT with Page 10h contents
 - Log non-Reserved fields from the returned contents
 - Check if Tag Number is zero
 - Check if NQ Bit is cleared to zero
 - Check if LBA value in the content is the LBA issued in READ FPDMA QUEUE command
 - Check if ERR Bit is set to one
 - Check if ABRT Bit or IDNF Bit is set to one
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
 - If READ LOG EXT with Page 10h is failed, Log “FAIL” with Timeout or Status/Error information and process Error handling

- e. Duplicate Tag value for outstanding NCQ command
- Issue number of READ FPDMA QUEUE commands with Random LBAs and valid Tag number. (If Maximum Tag range is not less than one, the valid Tag number to be used is not less than one. If Maximum Tag range is one, the valid Tag number is zero when it is available)
 - Issue READ/WRITE FPDMA QUEUE at the same Tag number = 0
 - Check D2H FIS
 - Log current Status, Error and I Bit information returned from the device.
 - Check if I Bit/ERR Bit/ABRT Bit/DRDY Bit are set to one
 - Check if BSY Bit/DRQ Bit/DF Bit is cleared to zero.
 - If any of the above setting is incorrect, log "FAIL", the current setting and the expected setting.
 - Check if new SDB FIS is not received to make sure that command processing shall not be continued. If new SDB FIS is received, Log "FAIL", new SDB FIS and expected SDB FIS information
 - If the expected error is detected, issue READ LOG EXT with Page 10h
 - If READ LOG EXT with Page 10h is successful,
 - check SDB FIS response to this command
 - Log current Status, Error, I Bit and SACTIVE in SDB FIS information returned from the device.
 - Check if DF Bit/ERR Bit/I Bit are cleared to zero
 - Check if DRDY Bit is set to one
 - Check if Reserved BIT 7 (BSY)/BIT 3 (DRQ) are cleared to zero
 - Check if SACTIVE field in SDB FIS is set to 0xFFFFFFFF
 - Check READ LOG EXT with Page 10h contents
 - Log non-Reserved fields from the returned contents
 - Check if Tag Number is zero
 - Check if NQ Bit is cleared to zero
 - Check if ERR Bit is set to one
 - Check if ABRT Bit is set to one
 - If any of the above setting is incorrect, log "FAIL", the current setting and the expected setting.
 - If READ LOG EXT with Page 10h is failed, Log "FAIL" with Timeout or Status/Error information and process Error handling
- f. Tag value is out of the device supported range
- If the Maximum Queue Depth of the Device is not less than 32, this test case exits
 - If the Maximum Queue Depth of the Device is not less than the Maximum Queue Depth of the HBA, this test case exits
 - Issue READ FPDMA QUEUE command with Tag Number = Maximum Device Queue Depth
 - Check D2H FIS
 - Log current Status, Error and I Bit information returned from the device.
 - Check if I Bit/ERR Bit/ABRT Bit/DRDY Bit are set to one
 - Check if BSY Bit/DRQ Bit/DF Bit is cleared to zero.
 - If any of the above setting is incorrect, log "FAIL", the current setting and the expected setting.
 - Check if new SDB FIS is not received to make sure that command processing shall not be continued. If new SDB FIS is received, Log "FAIL", new SDB FIS and expected SDB FIS information
 - If the expected error is detected, issue READ LOG EXT with Page 10h
 - If READ LOG EXT with Page 10h is successful,

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- check SDB FIS response to this command
 - Log current Status, Error, I Bit and SACTIVE in SDB FIS information returned from the device.
 - Check if DF Bit/ERR Bit/I Bit are cleared to zero
 - Check if DRDY Bit is set to one
 - Check if Reserved BIT 7 (BSY)/BIT 3 (DRQ) are cleared to zero
 - Check if SACTIVE field in SDB FIS is set to 0xFFFFFFFF
 - Check READ LOG EXT with Page 10h contents
 - Log non-Reserved fields from the returned contents
 - Check if Tag Number is Maximum Device Queue Depth
 - Check if NQ Bit is cleared to zero
 - Check if ERR Bit is set to one
 - Check if ABRT Bit is set to one
 - If any of the above setting is incorrect, log “FAIL”, the current setting and the expected setting.
 - If READ LOG EXT with Page 10h is failed, Log “FAIL” with Timeout or Status/Error information and process Error handling
- g. When all the test cases are passed, Log “PASS”

Error handling:

The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

NCQ-05 : DMA Setup Auto-Activate

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 76 Bit 8. If it is cleared to zero, test exits
- c. Check Maximum Queue Depth supported by both Host and Device (WORD 75 Bit 4-0) sides in order that the tag number to be used in the following test is in the valid range (i.e. the smaller one of the above two numbers).
- d. Check WORD 78 Bit 2, if it is cleared to zero, test exits
- e. Issue SET FEATURE with Feature = 10h, Sector Count = 02h
- f. Issue IDENTIFY DEVICE, check WORD 79 Bit 2, if it is cleared to zero, Log "FAIL", test exits
- g. Issue number of WRITE FPDMA QUEUE commands with Random LBAs
- h. Wait for all the commands have been successfully completed. If any command is failed, the script will log "FAIL" and process Error handling
- i. If all the test cases are passed, Log "PASS"

Error handling:

The script will do necessary recovery to make sure the current failure won't affect next command. Also the script will make sure the device is ready for the next command.

ASR-01 : COMINIT response interval

- a. A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- b. When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will continue
- c. Issue COMRESET and wait for the device being ready for communication
- d. This will be run in 5 loops, then a Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- e. User should click “OK” to move onto the next test
- f. Verify the device responding COMINIT within 10 ms by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

ASR-02 : COMINIT OOB Interval

- a. A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- b. When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will continue
- c. Put Host into Phy Offline mode and wait for 2 second
- d. A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- e. After user click “OK”, get Host back to normal communication mode
- f. Verify the device sending COMINIT repeatable and no faster than 10 ms by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

SSP-01 : Initialize Device Parameters

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 53 Bit 0, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready.
- e. Issue IDENTIFY DEVICE to ATA device, read values from WORD 54-58
- f. Issue INITIALIZE DEVICE PARAMETERS with different values, and check if this command is completed successfully with any of these different values. If not, Log “NOT TEST” and test exits
- g. Issue IDENTIFY DEVICE to ATA device, check if WORD 53 Bit 0 is set to one. If not, Log “NOT TEST” and test exits
- h. Read values from WORD 54-58 and compare it with the value in item e. If these two values are same, Log “NOT TEST” and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device, read WORD 53 Bit 0 and WORD 54-58
- k. Check if WORD 53 Bit 0 is set to one and if WORD 54-58 value is the same as the value in item h. If any of the expected value is incorrect, Log “FAIL”, the current values and the expected values. If all these values are correct, Log “PASS”
- l. Power cycle the device and make sure that the device is ready

SSP-02: Read/Write Stream Error Log

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 84 Bit 4, if it is cleared to zero, test exits
- d. Check if READ/WRITE LONG or SCT READ/WRITE LONG is supported by the device. If not, Log "NOT TEST" and test exits
- e. Power cycle the device and make sure that the device is ready.
- f. Create soft media error using the method from step d
- g. Issue CONFIGURE STREAM and READ STREAM DMA EXT at the location with ECC error
- h. Check SE Bit in Status, and Log the information if SE is cleared to zero
- i. Issue READ LOG EXT with Page ID = 22h, and check if the command is completed successfully. If not, Log "NOT TEST" and test exits
- j. Check the error count in the content, if the error count is cleared to zero, Log "NOT TEST" and test exits. If the error count is not zero, save the content.
- k. Issue CONFIGURE STREAM and READ STREAM DMA EXT at the location with ECC error
- l. Check SE Bit in Status, and Log the information if SE is cleared to zero
- m. Issue COMRESET and make sure that the device is ready
- n. Issue READ LOG EXT with Page ID = 22h, and check if the command is completed successfully. If not, Log "NOT TEST" and test exits
- o. Compare the current content with the content in item i, if mismatch is detected, Log "FAIL", current content and the expected content; if the contents match, Log "PASS"
- p. Recover the error sector by WRITE SECTOR (EXT) to the error address

SSP-03: Security Mode State

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 1, if it is cleared to zero, test exits
- d. Perform necessary process to make the device in Security Disabled mode
- e. Issue SET SECURITY PASSWORD to bring the device to SEC5
- f. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- g. Check WORD 85 Bit 1, if it is cleared to zero, Log “NOT TEST”, and test exits
- h. Check WORD 128 Bit 3:1, if it is not set to one, Log “NOT TEST”, and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 85 Bit 1, and WORD 128 Bit 3:1, if both of them are set to one, Log “PASS”, otherwise, Log “FAIL”, current settings and expected settings
- l. Perform necessary process to make the device in Security Disabled mode

SSP-04: Set Address Max

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 10, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Issue IDENTIFY DEVICE to ATA device
- f. Read value from WORD 60:61 and WORD 100:103
- g. Issue READ NATIVE MAX ADDRESS (EXT)
- h. Issue SET NATIVE MAX ADDRESS (EXT) with new volatile Address
- i. Issue IDENTIFY DEVICE to ATA device
- j. Read value from WORD 60:61 and WORD 100:103
- k. If the device only supports 28-Bit address, compare WORD 60:61 with the corresponding data in item f
If the device supports 48-Bit address, compare WORD 100:103 with the corresponding data in item f. If the capacity of device is less than 28-Bit address, compare WORD 60:61 with the corresponding data in item f
If the data keep unchanged, Log "NOT TEST", and test exits
- l. Issue COMRESET and make sure that the device is ready
- m. Issue IDENTIFY DEVICE to ATA device
- n. Read value from WORD 60:61 and WORD 100:103
- o. Compare WORD 60:61 with the corresponding data in item k, if 48-Bit address is supported, further compare WORD 100:103 with the corresponding data in item k
- p. If any mismatch is detected, Log "FAIL", current settings and expected settings. If all the data match, Log "PASS"
- q. Power cycle the device and make sure that the device is ready

SSP-05: SET FEATURES - Write Cache Enable/Disable

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 5, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- f. Check WORD 85 Bit 5, if it is set to one, issue SET FEATURE with 82h; if it is cleared to zero, issue SET FEATURE with 02h
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 85 Bit 5, and compare the current value with the one in item f. If the value keeps unchanged, Log "NOT TEST", and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 85 Bit 5, and compare the current value with the one in item h. If mismatch is detected, Log "FAIL", current setting and the expected setting. If data match, Log "PASS"

SSP-06: SET FEATURES - Set Transfer Mode

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 49 Bit 8, if it is cleared to zero, test exits
- d. Check WORD 53 Bit 2, flag if UDMA is supported
- e. Power cycle the device and make sure that the device is ready
- f. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- g. Check WORD 63 and WORD 88, get Maximum and current Multiword DMA mode, and Maximum and current UDMA mode if UDMA is supported
- h. If the support of Multiword DMA and UDMA mode are all cleared to zero, Log “NOT TEST”, and test exits
- i. If UDMA mode is supported,
 - Issue SET FEATURE with different UDMA transfer mode
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 88, if the value is the same as the value in item g., Log “NOT TEST”, and test exits
 - Issue COMRESET and make sure that the device is ready
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 88, if the value is not the same as the new transfer mode, Log “FAIL”, current setting and the expected setting
 - If the new transfer mode is kept unchanged, perform read test, and make sure the device can properly process the following test
 - For ATA device, issue READ DMA (EXT) with Random LBA
 - For ATAPI device, ULINK SATAIL Test CD 01 is requested. Issue Read CD with Random LBA
- j. Check Multiword DMA,
 - Issue SET FEATURE with different Multiword DMA transfer mode
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 63, if the value is the same as the value in item g., Log “NOT TEST”, and test exits
 - Issue COMRESET and make sure that the device is ready
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 63, if the value is not the same as the new transfer mode, Log “FAIL”, current setting and the expected setting
 - If the new transfer mode is kept unchanged, perform read test, and make sure the device can properly process the following test
 - For ATA device, issue READ DMA (EXT) with Random LBA
 - For ATAPI device, ULINK SATAIL Test CD 01 is requested. Issue Read CD with Random LBA
- k. If no failure is detected, Log “PASS”

SSP-07: SET FEATURES - Advanced Power Management Enable/Disable

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 83 Bit 3, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Check WORD 86 Bit 3, if it is set to one
 - Check WORD 91, and set the new value other than the current setting
 - Issue SET FEATURE with 05h and new APM value
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 91, if the new value is set correctly,
 - Issue COMRESET and make sure that the device is ready
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 91, if WORD 91 is not kept, Log “FAIL”, current setting and expected setting
 - Issue SET FEATURE with 85h
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 86 Bit 3, if it is set to one, Log “NOT TEST”, and test exits
 - Issue COMRESET and make sure that the device is ready
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 86 Bit 3, if it is set to one, Log “FAIL”, current setting and expected setting
- f. If WORD 86 Bit 3 is cleared to zero
 - SET FEATURE with 05h
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 86 Bit 3, if it is cleared to zero, Log “NOT TEST”, and test exits
 - Check WORD 91, verify APM level is set correctly
 - Issue COMRESET and make sure that the device is ready
 - Issue IDENTIFY DEVICE to ATA
 - Check WORD 86 Bit 3, if it is cleared to zero, Log “FAIL”, current setting and expected setting
 - If APM level is set correctly in previous step, check WORD 91, if the current setting is not the value set by SET FEATURE, Log “FAIL”, current setting and expected setting
- g. If not failure is detected, Log “PASS”

SSP-08: SET FEATURES - ReadLook-Ahead

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 6, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- f. Check WORD 85 Bit 6, if it is set to one, issue SET FEATURE with 55h; if it is cleared to zero, issue SET FEATURE with AAh
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 85 Bit 6, and compare the current value with the one in item f. If the value keeps unchanged, Log “NOT TEST”, and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 85 Bit 6, and compare the current value with the one in item h. If mismatch is detected, Log “FAIL”, current setting and expected setting. If data match, Log “PASS”

SSP-09: SET FEATURES - Release Interrupt

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 7, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- f. Check WORD 85 Bit 7, if it is set to one, issue SET FEATURE with DDh; if it is cleared to zero, issue SET FEATURE with 5Dh
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 85 Bit 7, and compare the current value with the one in item f. If the value keeps unchanged, Log “NOT TEST”, and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 85 Bit 7, and compare the current value with the one in item h. If mismatch is detected, current setting and expected setting. If data match, Log “PASS”

SSP-10: SET FEATURES - Service Interrupt

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 82 Bit 8, if it is cleared to zero, test exits
- d. Power cycle the device and make sure that the device is ready
- e. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- f. Check WORD 85 Bit 8, if it is set to one, issue SET FEATURE with DEh; if it is cleared to zero, issue SET FEATURE with 5Eh
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 85 Bit 8, and compare the current value with the one in item f. If the value keeps unchanged, Log “NOT TEST”, and test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 85 Bit 8, and compare the current value with the one in item h. If mismatch is detected, current setting and expected setting. If data match, Log “PASS”

SSP-11: Set Multiple Mode

- a. Issue IDENTIFY DEVICE to ATA device
- b. Check WORD 78 Bit 6, if it is cleared to zero, test exits
- c. Check WORD 47 Bit 7:0, if it is cleared to zero, test exits
- d. Issue SET MULTIPLE MODE with the supported Multiple count
- e. Issue IDENTIFY DEVICE to ATA device
- f. Check WORD 59 Bit 8, if it is cleared to zero, test exits
- g. Power cycle the device and make sure that the device is ready
- h. Issue IDENTIFY DEVICE to ATA device
- i. Check WORD 59 Bit 7:0
- j. Issue SET MULTIPLE MODE with the different supported Multiple Count
- k. If the different supported Multiple Count is not found, Log "NOT TEST", and test exits
- l. Issue IDENTIFY DEVICE to ATA device
- m. Check WORD 59 Bit 8, if it is cleared to zero, Log "NOT TEST", and test exits
- n. Check WORD 59 Bit 7:0, if it is the same as the one in item i, Log "NOT TEST", and test exits
- o. Issue COMRESET and make sure that the device is ready
- p. Issue IDENTIFY DEVICE to ATA device
- q. Check WORD 59 Bit 8, if it is cleared to zero, Log "FAIL", current setting and expected setting.
- r. Check WORD 59 Bit 7:0, if it is not the same as the one in item n, Log "FAIL", current setting and expected setting.
- s. If no failure is detected, Log "PASS"

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

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is cleared to zero, test exits
- c. If WORD 76 Bit 9 is set to one, HIPM is supported
 - A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
 - When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
 - Issue PMREQ_P, check and log IPM status
 - If Partial state is detected, issue COMWAKE
 - The script may process necessary recovery to make sure the device is ready for next command
 - A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
 - User should click “OK” to move onto the next test
- d. Verify exit latency from Partial State is within 10 us by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

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

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is cleared to zero, test exits
- c. If WORD 76 Bit 9 is set to one, HIPM is supported
 - A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
 - When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
 - Issue PMREQ_S, check and log IPM status
 - If Slumber state is detected, issue COMWAKE
 - The script may process necessary recovery to make sure the device is ready for next command
 - A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
 - User should click “OK” to move onto the next test
- d. Verify exit latency from Slumber State is within 10 ms by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2).

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

Note: Each test case will be run in 10 loops

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is cleared to zero, test exits
- c. Power cycle the device and make sure that the device is ready
- d. Check the current speed
- e. If WORD 76 Bit 9 is set to one, HIPM is supported
 - Resume from Partial State
 - Issue PMREQ_P, check IPM status
 - If Partial state is detected, issue COMWAKE
 - The script may process necessary recovery to make sure the device is ready for next command
 - Check the current speed, if it is not the same as item d., Log “FAIL”, current setting and expected setting
 - Resume from Slumber State
 - Issue PMREQ_S, check IPM status
 - If Slumber state is detected, issue COMWAKE
 - The script may process necessary recovery to make sure the device is ready for next command
 - Check the current speed, if it is not the same as item d., Log “FAIL”, current setting and expected setting
- f. If all the test cases are passed, Log “PASS”

IPM-04: Lack of IPM support

Note: Each test case will be run in 10 loops

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is set to one, HIPM is supported, test exits.
- c. Check the device response to PMREQ_P
 - Issue PMREQ_P, check and log IPM status
 - If Partial state is detected, issue COMWAKE, and Log “FAIL”
 - The script may process necessary recovery to make sure the device is ready for next command
- d. Check the device response to PMREQ_S
 - Issue PMREQ_S, check and log IPM status
 - If Slumber state is detected, issue COMWAKE, and Log “FAIL”
 - The script may process necessary recovery to make sure the device is ready for next command
- e. If no failure is detected, Log “PASS”

IPM-05: Device response to PMREQ_P

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is cleared to zero, test exits.
- c. A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- d. When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
- e. Issue PMREQ_P, check and log IPM status
- f. If Partial state is detected, issue COMWAKE
- g. The script may process necessary recovery to make sure the device is ready for next command
- h. A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
- i. User should click “OK” to move onto the next test
- j. Verify there are at least 4 PMACK primitives or PMNAK primitive to respond PMREQ_P by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2).

IPM-06: Device response to PMREQ_S

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 76 Bit 9, if it is cleared to zero, test exits.
- c. A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
- d. When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
- e. Issue PMREQ_S, check and log IPM status
- f. If Slumber state is detected, issue COMWAKE
- g. The script may process necessary recovery to make sure the device is ready for next command
- h. A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
- i. User should click “OK” to move onto the next test
- j. Verify there are at least 4 PMACK primitives or PMNAK primitive to respond PMREQ_S by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2).

IPM-07: Default setting for device Initiated requests

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 3, if it is cleared to zero, test exits.
- c. Power cycle the device and make sure that the device is ready
- d. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- e. Check WORD 79 Bit 3, if it is set to one, Log “FAIL”, current setting and expected setting
- f. Issue SET FEATURE with Feature 10h and Sector Count 03h
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 79 Bit 3, if it is cleared to zero, Log “WARNING”, test exits
- i. Issue COMRESET and make sure that the device is ready
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 79 Bit 3, if it is set to one, Log “FAIL”, current setting and expected setting
- l. If no failure is detected, Log “PASS”

IPM-08: Device Initiated Power Management enable/disable

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 3, if it is cleared to zero, test exits.
- c. Power cycle the device and make sure that the device is ready
- d. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- e. Check WORD 79 Bit 3, if it is set to one, Log "FAIL", current setting and expected setting
- f. Issue SET FEATURE with Feature 10h and Sector Count 03h
- g. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- h. Check WORD 79 Bit 3,
 - if it is cleared to zero, Log "FAIL"
 - If it is set to one, check if DIPM can be invoked:
 - Wait up to 10 seconds
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Wait for up to 10 second or until Partial or Slumber state is detected, then wake up the device
 - Run the above sequences for 5 loops
 - If one Partial or Slumber state is detected, this method is valid; otherwise, this method is invalid
 - Standby Immediate
 - Check WORD 82 Bit 3, if it is cleared to zero, this method is invalid, exit
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Issue STANDBY IMMEDIATE and wait for up to 10 second or until Partial or Slumber state is detected, then wake up the device, and make sure the device is in Active mode
 - Run the above sequences for 5 loops
 - If one Partial or Slumber state is detected, this method is valid; otherwise, this method is invalid
 - If fail to find the method that Partial or Slumber State will be invoked by device, Log "WARNING"
- i. Issue SET FEATURE with Feature 90h and Sector Count 03h
- j. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- k. Check WORD 79 Bit 3,
 - if it is set to one, Log "FAIL"
 - If it is cleared to zero, check if DIPM can be invoked:
 - Wait up to 10 seconds
 - Issue SET FEATURE with Feature 90h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is disabled
 - Wait for up to 10 second or until Partial or Slumber state is detected, then wake up the device
 - Run the above sequences for 5 loops
 - If one Partial or Slumber state is detected, this method is valid; otherwise, this method is invalid
 - Standby Immediate

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- Check WORD 82 Bit 3, if it is cleared to zero, this method is invalid, exit
- Issue SET FEATURE with Feature 90h and Sector Count 03h
- Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- Check WORD 79 Bit 3, make sure DIPM is disabled
- Issue STANDBY IMMEDIATE and wait for up to 10 second or until Partial or Slumber state is detected, then wake up the device, and make sure the device is in Active mode
- Run the above sequences for 5 loops
- If one Partial or Slumber state is detected, this method is valid; otherwise, this method is invalid
 - If success to find the method that Partial or Slumber State will be invoked by device, Log "FAIL"
- 1. If no failure is detected, Log "PASS"

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

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 3, if it is cleared to zero, test exits
- c. If WORD 78 Bit 3 is set to one, DIPM is supported
 - Find out the method that Partial State will be invoked by device:
 - Wait up to 10 seconds
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Wait for up to 10 second or until Partial state is detected, then wake up the device
 - Run the above sequences for 10 loops and get the Maximum value of the timer.
 - If Partial state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - Standby Immediate
 - Check WORD 82 Bit 3, if it is cleared to zero, this method is invalid, exit
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Issue STANDBY IMMEDIATE and wait for up to 10 second or until Partial state is detected, then wake up the device, and make sure the device is in Active mode
 - Run the above sequences for 10 loops and get the Maximum value of the timer
 - If Partial state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - If fail to find the method that Partial State will be invoked by device, test exits
 - A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
 - When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
 - Using the method that Partial State will be invoked by the device, check and log IPM status
 - If Partial state is detected, wake up the device, and make sure the device is in Active mode
 - The script may process necessary recovery to make sure the device is ready for next command
 - A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
 - User should click “OK” to move onto the next test
- d. Verify exit latency from Partial State is within 10 us by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2)

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

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 3, if it is cleared to zero, test exits
- c. If WORD 78 Bit 3 is set to one, DIPM is supported
 - Find out the method that Slumber State will be invoked by device:
 - Wait up to 10 seconds
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Wait for up to 10 second or until Slumber state is detected, then wake up the device
 - Run the above sequences for 10 loops and get the Maximum value of the timer
 - If Slumber state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - Standby Immediate
 - Check WORD 82 Bit 3, if it is cleared to zero, this method is invalid, exit
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Issue STANDBY IMMEDIATE and wait for up to 10 second or until Slumber state is detected, then wake up the device, and make sure the device is in Active mode
 - Run the above sequences for 10 loops and get the Maximum value of the timer
 - If Slumber state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - If fail to find the method that Slumber State will be invoked by device, test exits
 - A Message Box “Please start capture from Bus-Analyzer or Scope, then click OK!” will be prompted
 - When Bus Analyzer or Scope has set up ready, and OK is clicked by user, the script will start the following test in 10 loops
 - Using the method that Slumber State will be invoked by the device, check and log IPM status
 - If Slumber state is detected, wake up the device, and make sure the device is in Active mode
 - The script may process necessary recovery to make sure the device is ready for next command
 - A Message Box “Please stop capture from Bus-Analyzer or Scope, then click OK!” will be prompted when 10 loops are done
 - User should click “OK” to move onto the next test
- d. Verify exit latency from Slumber State is within 10 ms by checking the capture from Bus Analyzer or Scope (see detail in the corresponding equipment’s MOI, e.g. LeCroy CATC Bus Analyzer Digital MOI Revision 1.2).

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

Note: Each test case will be run in 10 loops

- a. Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
- b. Check WORD 78 Bit 3, if it is cleared to zero, test exits
- c. Power cycle the device and make sure that the device is ready
- d. Check the current speed
- e. If WORD 78 Bit 3 is set to one, DIPM is supported
 - Find out the method that Partial/Slumber State will be invoked by device:
 - Wait up to 10 seconds
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Wait for up to 10 second or until Partial/Slumber state is detected, then wake up the device
 - Run the above sequences for 10 loops and get the Maximum value of the timer
 - If Partial/Slumber state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - Standby Immediate
 - Check WORD 82 Bit 3, if it is cleared to zero, this method is invalid, exit
 - Issue SET FEATURE with Feature 10h and Sector Count 03h
 - Issue IDENTIFY DEVICE to ATA device or IDENTIFY PACKET DEVICE to ATAPI device
 - Check WORD 79 Bit 3, make sure DIPM is enabled
 - Issue STANDBY IMMEDIATE and wait for up to 10 second or until Partial/Slumber state is detected, then wake up the device, and make sure the device is in Active mode
 - Run the above sequences for 10 loops and get the Maximum value of the timer
 - If Partial/Slumber state is detected at 80% or above, this method is valid; otherwise, this method is invalid
 - If fail to find the method that Partial/Slumber State will be invoked by device, test exits
 - Resume from Partial/Slumber State
 - Using the method that Partial/Slumber State will be invoked by the device, check IPM status
 - If Partial/Slumber state is detected, wake up the device, and make sure the device is in Active mode
 - The script may process necessary recovery to make sure the device is ready for next command
 - Check the current speed, if it is not the same as item d., Log "FAIL", current setting and expected setting
- h. If all the test cases are passed, Log "PASS"