



Serial ATA International Organization

Revision 1.0
27 July 2006

Serial ATA Interoperability Program Digital MOI for LeCroy SATracer Bus Analyzer

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REVISION HISTORY

Revision	Date	Comments
0.01	01/24/06	First Version describing use of LeCroy SATracer Bus Analyzer for SATA-IO Logo Digital tests.
0.02	01/26/06	Updated procedures to include the message boxes from the DriveMaster application that prompt the user to start and stop trace captures.
0.90	02/07/06	Updated procedures of test IMP-01 and IPM-02 to indicate that timing measurement should be taken from COMWAKE to COMWAKE, not COMWAKE to ALIGN.
0.91	02/07/06	Corrected references to Ulink software.
0.92	2/24/06	Enhanced pass/fail criteria for ASR-01, ASR-02, IPM-01, IPM-02. For all timing tests worst case observed result should be recorded. Included edits from Logo Task Force.
0.93	3/2/06	Added Measurement Tolerance heading to all tests.
1.0 RC	3/2/06	Approved by Logo Group to move to RC
1.0	07/27/06	Final Release

ACKNOWLEDGMENTS

The SATA-IO would like to acknowledge the efforts of the following individuals in the development of this test suite.

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INTRODUCTION

This Method of Implementation document is intended to provide a description of the motivation, resources, procedures, and methodologies specific to each test taken from the SATA-IO Interoperability Program. The tests described in this document cover the subset of SATA-IO Digital tests which require a Bus Analyzer to time between events and count individual primitives. This MOI should be used in conjunction with the MOI describing how to use the Ulink DriveMaster software to perform all of the Digital tests.

REFERENCES

The following documents are referenced in this text:

- [1] Serial ATA Revision 2.5
- [2] SATA-IO Interoperability Program Policy Document Rev 1.0
- [3] SATA-IO Interoperability Unified Test Document Rev 1.0
- [4] Ulink MOI for Digital Tests 1.0

Test Title: ASR-01 COMINIT response interval

Purpose: Verify that a device will respond to a received COMRESET signal with a COMINIT signal within 10ms.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 23, 2006

Discussion: The SATA Spec requires that a device respond to received COMRESET signal with COMINIT within 10 msec. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: The Ulink DriveMaster and LeCroy SATracer software should be running on a SATA Host system. This host system should be connected to the LeCroy SATracer Host Port I1 via a 1x SATA cable. The SATA Device Under Test should be connected to the LeCroy SATracer Device Port T1 via a 1x SATA cable. The SATA Host System should have access to the attached SATA Device.

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Bus Conditions and OOB Signals'. Drag and drop the 'Bus Condition' icon into the light blue 'Global State' field.
4. Right click the 'Bus Condition' icon and select properties. In the 'Event Properties' dialog select COMINIT/COMRESET in the OOB Signals box and deselect all channels except I1 under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click ok to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application.
7. In the Ulink DriveMaster window, start test ASR-01 by clicking 'OK' in the DriveMaster message box.
8. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
9. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace.
10. In the Ulink DriveMaster window, click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
11. In the trace displayed in the LeCroy SATracer window, identify the Frame Number for the first COMINIT sent from the Device. Next identify the Frame Number for the previous COMRESET sent from the Host System before the first COMINIT from the Device.
12. Under the 'Report' menu select 'Timing Calculations'. In the Timing Calculations dialog enter the Frame Number of the COMRESET from the Host under 'From Beginning of:' and enter the Frame Number of the COMINIT from the Device under 'To Beginning of:' Click the 'Calculate' button.
13. The 'Total Time' will display the time from the beginning of the COMRESET from the host to the beginning of the COMINIT from the device.

Observable Results: Confirm OOB sequence completion and COMINIT timing must be less than 10.003ms of COMRESET receipt from host (use trace to analyze timings). Note that this assumes the detection of COMRESET by the device is 6 OOB burst/idle cycles prior to COMRESET deassertion from host (i.e. maximum of 0.00230ms). This requirement must be verified on all 5 sequences within the trace (5 sequences is default test for Ulink tool). Since a single result is reported in the results template, the worst-case result out of all cases must be reported in the results summary (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 or 3G, 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.

Test Title: ASR-02 COMINIT OOB interval

Purpose: Verify that a device source COMINIT signal no faster than 10ms when not connected to a host.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 23, 2006

Discussion: The SATA Spec requires that a device source a COMINIT signal with no less than 10 msec spacing when not connected to a SATA Host. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: Same as ASR-01

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Bus Conditions and OOB Signals'. Drag and drop the 'Bus Condition' icon into the light blue 'Global State' field.
4. Right click the 'Bus Condition' icon and select properties. In the 'Event Properties' dialog select COMINT/COMRESET in the OOB Signals box and select all channels under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click ok to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application then start test ASR-02 in the Ulink DriveMaster application by clicking 'OK' in the DriveMaster message box.
7. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
8. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace. Click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
9. In the trace displayed in the LeCroy SATracer window, identify the Frame Number for the first through tenth COMINIT signals sent from the device.
10. Under the 'Report' menu select 'Timing Calculations'. In the Timing Calculations dialog enter the Frame Number of two consecutive COMINIT under 'From Beginning of:' and 'To Beginning of:' click the 'Calculate' button. Repeat this for all five intervals between COMINIT signals.
11. The 'Total Time' will display the time from the beginning of the first COMINIT to the beginning of the second COMINIT from the device.

Observable Results: Verify that once host is powered off, that device sends COMINIT continuously and no faster than every 9.997ms (use trace to verify behavior and timings). Note that this accommodates the 6 OOB burst/idle cycles for the prior COMINIT deassertion from Device (i.e. maximum of 0.00230ms). This requirement must be verified against the first 10 COMINIT/COMINIT sequences within the trace, if any of the 10 sequence timings is

below 9.997ms, this denotes a failure. Since a single result is reported in the results template, the worst-case result out of all cases must be reported in the results summary (i.e. smallest value).

Measurement Tolerance: +/- 13.337 ns

Possible Problems: It is possible that the gap between COMINIT signals from the device will be longer than the time allowed by the Ulink software. The Ulink software allows approximately 2-3 seconds for the measurement to be performed. If the gap between COMINIT signals is greater than that 2-3 seconds, the Bus Analyzer trace will not contain any data to perform this test. If this occurs it is clear that the device is passing the test, however in order to obtain a measurement it may be necessary to perform the test by disconnecting the host system and powering on the device while connected only to the Bus Analyzer.

It is advisable to set the Bus Analyzer to the same speed as the device, either 1.5G or 3G, 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.

Test Title: IPM-01 Partial State exit latency

Purpose: Verify that a device will exit the Partial state within 10 microseconds of receiving COMWAKE.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 23, 2006

Discussion: The SATA Spec requires that a device exit the partial state within 10 microseconds of receiving COMWAKE from the Host. This applies whether the device supports DIPM or HIPM. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: Same as ASR-01

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Primitives'. Drag and drop the 'Primitives' icon into the light blue 'Global State' field.
4. Right click the 'Primitives' icon and select properties. In the 'Event Properties' dialog select 'PMREQ_P' and select all channels under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click ok to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application then Start test IPM-01 in the Ulink DriveMaster application by clicking 'OK' in the DriveMaster message box.
7. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
8. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace. Click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
9. In the trace displayed in the LeCroy SATracer window, identify the Frame Number for the first COMWAKE signal appearing after the PMREQ_P which the analyzer triggered on. The trigger point is indicated by a red bar next to the frame. Next identify the frame number of the first COMWAKE signal transmitted by the DUT after reception of COMWAKE.
10. Under the 'Report' menu select 'Timing Calculations'. In the Timing Calculations dialog enter the Frame Number the COMWAKE signal from the Testing Station under 'From Beginning of:' and the Frame Number of the first COMWAKE signal from the DUT under 'To Beginning of:' Click the 'Calculate' button.
11. The 'Total Time' will display the time from the reception of COMWAKE to wake sequence completion of the device.

Observable Results: Confirm Partial wake sequence completion and COMWAKE timing of being within 11.21us of COMWAKE receipt from host (use trace to analyze timings). Note that this accommodates the 6 OOB burst/idle cycles for the prior COMWAKE deassertion from the Host System (i.e. maximum of 1.21us). This requirement

must be verified against all COMWAKE/COMWAKE sequences within the trace (maximum of 10 total). Since a single result is reported in the results template, the worst-case result out of all cases must be reported in the results summary (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 or 3G, 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.

Test Title: IPM-02 Slumber State exit latency

Purpose: Verify that a device will exit the Slumber state within 10 milliseconds of receiving COMWAKE.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 23, 2006

Discussion: The SATA Spec requires that a device exit the partial state within 10 milliseconds of receiving COMWAKE from the Host. This applies whether the device supports DIPM or HIPM. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: Same as ASR-01

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Primitives'. Drag and drop the 'Primitives' icon into the light blue 'Global State' field.
4. Right click the 'Primitives' icon and select properties. In the 'Event Properties' dialog select 'PMREQ_S' and select all channels under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click ok to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application then Start test IPM-02 in the Ulink DriveMaster application by clicking 'OK' in the DriveMaster message box.
7. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
8. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace. Click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
9. In the trace displayed in the LeCroy SATracer window, identify the Frame Number for the first COMWAKE signal appearing after the PMREQ_S which the analyzer triggered on. The trigger point is indicated by a red bar next to the frame. Next identify the frame number of the first COMWAKE signal transmitted by the DUT after reception of COMWAKE.
10. Under the 'Report' menu select 'Timing Calculations'. In the Timing Calculations dialog enter the Frame Number the COMWAKE signal under 'From Beginning of:' and the Frame Number of the first COMWAKE signal from the DUT under 'To Beginning of:' Click the 'Calculate' button.
11. The 'Total Time' will display the time from the reception of COMWAKE to wake sequence completion of the device.

Observable Results: Confirm Slumber wake sequence completion and COMWAKE timing of being within 10.002ms of COMWAKE receipt from host (use trace to analyze timings). Note that this accommodates the 6 OOB burst/idle cycles for the prior COMWAKE deassertion from the Host System (i.e. maximum of 0.00121ms). This requirement must be verified against all COMWAKE/COMWAKE sequences within the trace (maximum of 10

total). Since a single result is reported in the results template, the worst-case result out of all cases must be reported in the results summary (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 or 3G, 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.

Test Title: IPM-05 Device Response to PMREQ_P

Purpose: Verify that a device will respond properly when a PMREQ_P primitive is received.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 24, 2006

Discussion: The SATA Spec requires that a device transmit either PMNAK or 4 PMACK primitives when a PMREQ_S primitive is received. This test applies only if the device supports HIPM. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: Same as ASR-01

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Primitives'. Drag and drop the 'Primitives' icon into the light blue 'Global State' field.
4. Right click the 'Primitives' icon and select properties. In the 'Event Properties' dialog select 'PMREQ_P' and select all channels under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click ok to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application then Start test IPM-05 in the Ulink DriveMaster application by clicking 'OK' in the DriveMaster message box.
7. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
8. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace. Click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
9. In the trace displayed in the LeCroy SATracer window, identify the Frame Number for the first PMREQ_P which the analyzer triggered on. The trigger point is indicated by a red bar next to the frame. Next identify whether PMNAK or 4 total PMACK primitives were transmitted by the device in response to the PMREQ_P.

Observable Results: Verify that PMNAK or at least 4 total PMACKs are received (use trace to verify device response)

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 or 3G, 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.

Test Title: IPM-06 Device Response to PMREQ_S

Purpose: Verify that a device will respond properly when a PMREQ_S primitive is received.

Resource Requirements:

- LeCroy SATracer SATA Protocol Analyzer
- LeCroy SATracer Software version 4.60 Build 151 or later
- Ulink DriveMaster SATA Traffic Generation Software version 3.0.210 or later
- Ulink SATA-IL Scripts version 1.2 or later
- Ulink supported Host System
- Ulink Parallel port or USB Port power supply

Last Modification: February 24, 2006

Discussion: The SATA Spec requires that a device transmit either PMNAK or 4 PMACK primitives when a PMREQ_S primitive is received. This test applies only if the device supports HIPM. Limitations on software tools require that a SATA Bus Analyzer or a DSO with sufficient bandwidth be used to perform this measurement.

Test Setup: Same as ASR-01

Test Procedure:

1. Connect the LeCroy SATracer to the Host System using a USB cable. Start the LeCroy SATracer application.
2. Wait for the Ulink DriveMaster application to prompt user to start a Bus Capture with the 'Please start capture' message box.
3. In the LeCroy SATracer window, Under the 'Setup' menu select 'Recording Options'. The 'Recording Options' dialog will open. Select the 'Event Trigger' radio button. Under the 'Recording Rules' tab select 'New Event' -> 'Primitives'. Drag and drop the 'Primitives' icon into the light blue 'Global State' field.
4. Right click the 'Primitives' icon and select properties. In the 'Event Properties' dialog select 'PMREQ_S' and select all channels under 'Channels' on the left. Close the event properties dialog.
5. Right click on 'NO ACTION' and select 'Trigger'. Click 'ok' to close the 'Recording Options' dialog.
6. Click the 'Start Recording' button in the SATracer application then Start test IPM-06 in the Ulink DriveMaster application by clicking 'OK' in the DriveMaster message box.
7. Wait for the test to complete. The 'Please Stop capture' message box will appear from the DriveMaster application.
8. In the LeCroy SATracer window, click the 'Stop Recording' button. Allow the trace to upload to the Host System. Save the trace. Click 'OK' in the DriveMaster message box to allow the DriveMaster software to move on to the next test.
9. In the trace identify the Frame Number for the first PMREQ_S which the analyzer triggered on. The trigger point is indicated by a red bar next to the frame. Next identify whether PMNAK or 4 total PMACK primitives were transmitted by the device in response to the PMREQ_S.

Observable Results: Verify that PMNAK or at least 4 total PMACKs are received (use trace to verify device response)

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 or 3G, 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.