User Interface for Intel® SATA Motherboard Signal Quality Test (MSQT) Setup

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Executive Summary

This paper introduces an alternative way of how to modify and setup the AHCI registers for the SATA MSQT to decrease setup time and increase accuracy in setting bits and registers.

Different from the conventional way, this method uses a user interface which performs the registers setup without any register mapping tools such as ITP, PCIe.exe, etc.

The benefits of this method include: Fast and easy setup, automatic setup, greater accuracy in setting bits and registers, no mapping tool is required no Datasheet or PDG is needed, and it can save up to 50% of the test time.

With codes running on the background, user’s selection or instruction will be executed by the codes and perform the setups automatically. There are no more manual configurations and settings that need to be done. The only action the user needs to complete is to launch the executable file (.EXE) and select the desired test.

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**Background**

SATA MSQT has been a very crucial validation methodology to measure the signal quality of the SATA differential pairs. It has been widely adopted for SATA port testing ever since the existence of ICH5. The SATA motherboard signal quality is gauged by measuring transmissions as close as possible to the SATA connector on the motherboard. The data is captured into an eye diagram for analysis and compared against an eye diagram template that reflects the expected SATA interface characteristics for the given speed. By performing analysis in this way, worst case device and cable effects are built into the eye diagram template, thus removing characteristics of the actual cable and device which may not be worst case per the SATA Specification. Total jitter can also be used to analyze the characteristics of the SATA interface. The tests performed are transmit only and measured using a SATA Test Fixture.

Intel strongly recommends running the MSQT procedure since the SATA interface is a high-speed interface with Gen 1 and Gen 2 running at 1.5Gb/s and 3.0Gb/s respectively.

However, before running the test, there are many procedures that need to go through especially modifying all the registers to setup the test environment. These have been very troublesome and always become the show stopper. Customer will usually require an ITP or other register mapping tools to be able to access and modify the relevant registers one by one before the test can be fully executed.

**Solution**

In this whitepaper, we are going to introduce an user interface which provides the step-by-step registers setup **AUTOMATICALLY** without using any registers mapping tools. With only few clicks, the ICHx or PCH SATA Controller can be configured and easily put into Test Mode in the background. With this automatic setup, the user is not required to figure out what the base addresses are, how to add the offset, and make changes to the bits again and again. Without this program, all these tasks have to be done manually.

Using a platform featuring the Intel® EP80579 Integrated Processor as the reference, this paper will show how the program modifies the registers under your instructions in the user interface format. The source code of the
program can be proliferated further for different platforms for the SATA MSQT.

**Procedures for SATA MSQT Execution**

There are several major procedures involved to set up and run the SATA Motherboard Signal Quality Test. There are five major steps represented by the five different colors shown in Figure 1.

**Figure 1. Procedures for SATA MSQT Execution**

The *ICHx/PCH SATA Controller and Test Mode Setup* is always the most troublesome part due to the tedious registers setup. The parts of this step are detailed in Figure 2, showing how configure and set up more than 10 registers before the hooking up the SATA Test Fixture to the port under test.
Figure 2. Steps in ICHx/PCH SATA Controller and Test Mode Setup

Step 1, Enable the SATA Controller, requires several substeps to complete. These substeps are detailed in Figure 3.
Figure 3. Enable the SATA Controller

Check Base Address from PCI Dev 31, Func 0, Offset F0h

Bits [11:0] are don’t care and 000h should be used

Add Offset 3418h to Base Address

Bit 2 of the value should be 0

Base Address: FED1 C000h + 3418h = FED1 F418h

YES. SATA controller is enabled

<table>
<thead>
<tr>
<th>Base Address</th>
<th>OFFSET</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI Dev 31, Func 0, Offset F0h</td>
<td>+3418h</td>
<td>xxxx x0xx b</td>
</tr>
</tbody>
</table>
Conventional Way of SATA Controller Configuration and Test Mode Setup

Conventionally, these steps are done manually using some legacy tools:

- PCITool
- ITP-XDP
- PCI.exe
- WinMem.exe
- EFI Shell and etc

Figure 4, Figure 5 and Figure 6 show screenshots of these tools. In addition to the manual steps needed to complete the test using these tools, mathematical additions shown in Figure 3 still need to be done separately as these tools do not complete the calculations automatically.

Figure 4. PCITool in ITP-XDP
Figure 5. WinMem

![WinMem](image)

Figure 6. PCI.exe

![PCI.exe](image)

Figure 7. EFI Shell Command

```
Use `u` and `v` to change option(s). Use enter to select an option
Loading: EFI Shell [built-in]
EFI Shell version 1.62
Device mapping table

0000: [PCI 0100:00]: PCI 0100:00
0002: [PCI 0100:02]: PCI 0100:02
0004: [PCI 0100:04]: PCI 0100:04
```
User Interface of SATA Controller Configuration and Test Mode Setup

Now, with the newly introduced user interface with simplified steps, all these configurations can be done faster more and more efficiently. Compared to the conventional method of more than 10 steps, the new methodology has now simplified them to only three by using a user interface.

Figure 8. Conventional versus New

Step A – Enable the SATA Controller

Instead of going through all the conventional steps mentioned on Figure 3 to enable the SATA Controller, now the steps can easily be done with just few clicks with this user interface!

As shown Figure 9, users will just need to enter “1” to enable the SATA Controller within Intel® EP80579 Integrated Processor or the Intel® 82801GX I/O Controller Hub.
Step B – Select Ports to Run at Gen 1/Gen 2 Speed

After this step, the program will automatically complete steps 2, 3 and 4 from the manual process as shown in Figure 8.

In this screen, users can either enter “1” or “2” to select the speed to test.

Step C – Select Port to Run and Begin the Test

Next, the screen which allows users to select which port to run will pop up. For the 82801GX I/O CONTROLLER HUB, there are four SATA ports available and for the Intel® EP80579 Integrated Processor, there are two SATA ports available. Users can select which port to run by entering the port number.
and the test will begin. This step automatically runs what was manual steps 5 and 6 shown in Figure 8.

After collecting the data, users can exit this program and restart it again for other ports.

**Figure 11. Select Port to Run and Begin the Test**
Conclusion

With SATA 2.0 running at the speed of 3 Gbps, the SATA MSQT plays a vital role to ensure the signal integrity of the high speed signals. With SATA 3.0 targeted to run at 6 Gbps, this test is getting more and more significant to ensure the robustness and the validity of data. Thus, a more simplified and efficient methodology must be introduced to decrease the complexity of running the test.

As explained in the earlier chapters, the new methodology has done all that is required to effectively test the signal. By simplifying steps of configuration and creating a user friendly interface, this test is more efficient and more effective by using the user interface method.

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