Proposed Draft

Serial ATA International Organization

Version 2
May 23, 2011

Serial ATA Revision 3.1 ECN # 054

Title : Change to EMI Related Parameters: TX Rise/Fall Imbalance - Elimination, and TX Amplitude Imbalance - Margin Increase

Author Information

Author Name	Company	Email address
Daniel F. Smith	Seagate Technology, LLC	daniel.f.smith@seagate.com

Workgroup Chair Information

Workgroup (Phy, Digital, etc…)	Chairperson Name	Email address
PHY	Charles P. Hill	cphill@altaeng.com

Document History

Version	Date	Comments
1	1-May-2011	Initial Release (Rewording from obsolete ECN001 to accommodate recent changes and rewording for the new SATA 3.1 specification.)
2	23-May-2011	Added Gen3u wording for Table 38 and section 7.2.2.3.11; USM additions.

1 Introduction

1.1 Problem Statement

Seagate Technology believes 'TX Rise/Fall Imbalance', and 'TX Amplitude Imbalance', are parameters that are incorrectly applied as interoperability requirements. These parameters are typically intended as ASIC-level design criteria to try to identify possible issues of EMI radiation during the design phase of a product, not as system interoperability criteria that reject product at the industry level. When the issue of EMI arises, it is specifically dealt with on an OEM-to-OEM level, independent of any specification requirements. Because it is a complex function requiring subtle solutions, it is not a criteria that should appear in an interoperability specification where acceptance is usually based on more deterministic behavior. In short, its purpose in the spec is not truly useful and should be removed.

Because of a need for printed circuit board criteria to control trace designs in final applications, the Tx Amplitude Imbalance has been found to be a needed to control poor design practices. Therefore, this parameter is suggested as a margin increase, rather than elimination from the specification. The addition of the change for Gen3i is of particular importance to printed circuit board design criteria at 6 Gbps, where incorrect design rules will further amplify poor signal integrity due to greater amplitude imbalance effects.

1.2 Solution Summary

Seagate Technology proposes removal of the TX Rise/Fall Imbalance (and any associated text sections) from the Serial ATA Revision 3.1 specification. Seagate also proposes an increase in the margin for Tx Amplitude Imbalance, to prevent historical compliance test failures that have not proven to be interoperability issues. The Tx Amplitude Imbalance parameter is recommended to be kept as a way of preventing poor printed circuit board design practices.

Seagate believes these changes will act in a positive way by only reinforcing necessary functionality, thus, removing a burdensome process that is not needed for industry acceptance criteria.

These changes are being introduced with a firmly held belief that these parameters are overly pessimistic, constricting the SATA industry unnecessarily, even though interoperability has been proven.

1.3 Background Data

Seagate can show that agency emissions testing, performed on a mature product, could fail the above parameters by a close margin, but still pass the FCC criteria with good margin. This is not an issue of emissions compliance or interoperability with SATA OEM customers.

(FCC test report page shown below.)

emci
emc integrity incorporated

www.emcintegrity.com

Test Report Number:	**ETRA90234**
Reference Standard:	**CFR Title 47, FCC Part 15, Class B EN 55022: 2006, Class B**
Date of Test:	**18 & 19 February 2009**
Date of Report:	**2 March 2009**
Product Name:	**Barracuda 7200.12**
Model Number:	**ST31000523AS**
Serial Number:	**5VP00Q2L**
Manufacturer:	**Seagate Technology, LLC**
Representative:	**Jim Newkirk**
Report Type:	**Radiated and Conducted Emissions**
Test Result:	**Compliant**
Approved By:	Vincent W. Bost

NVLAP
NVLAP LAB CODE 200737-0

Nemko
ELA No. 215

FCC	BSMI	VCCI	MIC
319793 & 610588	SL2-IN-E-1134R	C-2697 R-2462	US0168

2 Technical Specification Changes

The proposed changes below will resolve the issues with the parameters as stated above.

2.1 Remove/Change the following parameters from "Table 36 – Transmitted Transmitter Specifications"

Remove the following:
TX Rise/Fall Imbalance. (Shown in red strikeout below.)
(Page 215 in SATA Revision 3.1 specification.)

Change the following:
TX Amplitude Imbalance: 30% for Gen2 and Gen3. (Shown in red text below.)
(Page 215 in SATA Revision 3.1 specification.)

(titles and headers shown only as reference)

Table 36 – Transmitter Specifications

Parameter	Units	Limit	Electrical Specification					Detail Cross-Ref Section	Measurement Cross-Ref Section
			Gen1i	Gen1m	Gen2i	Gen2m	Gen3i		
~~R/F_{bal}, TX Rise/Fall Imbalance~~	~~%~~	~~Max~~	~~-~~		~~20~~		~~-~~	~~7.2.2.3.10~~	~~7.4.20~~
Amp_{bal}, TX Amplitude Imbalance	%	Max	-		30		30	7.2.2.3.11	7.4.19

Add the following:
Add into Table 38, Tx Amplitude Imbalance as 30% for Gen2u and Gen3u, as shown in the red outlined box below. (Page 219 in SerialATA_Revision_3_1_RC27April.pdf)

Table 38 – UHost Transmitted Signal Requirements

Parameter [1]	Units	Limit	Electrical Specification			Detail Cross-Ref Section [2,3]	Measurement Cross-Ref Section [2,3]
			Gen1u	Gen2u	Gen3u [3]		
Amp_{bal}, TX Amplitude Imbalance	%	Max	-	30	30	7.2.2.3.11	7.4.19

2.2 Remove/Change the following related text sections

Obsolete Sections 7.2.2.3.10 and 7.4.20, pages 240 and 329, respectively, in the SATA Revision 3.1 specification.

7.2.2.3.10 TX Rise/Fall Imbalance (Obsolete)

The match in the rise of TX+ and fall of TX- determined by the functions: absolute value (TX+,rise – TX-,fall)/average where average is (TX+,rise + TX-,fall)/2 and all rise and fall times are 20-80%. The match in the fall of TX+ and rise of TX- determined by the function: absolute value (TX+,fall – TX-,rise)/average where average is (TX+,fall + TX-,rise)/2 and all rise and fall times are 20-80%.

7.4.20 TX Rise/Fall Imbalance (Obsolete)

This parameter is a measure of the match in the simultaneous single-ended rise/fall or fall/rise times of the Transmitter. The test setup shown in Figure 163 shall be used for this measurement. This parameter shall be measured and met with both the HFTP and MFTP patterns.

In order to determine the imbalance, the single ended 20-80% rise and fall times of both TX+ and TX- shall be determined for a given pattern. Two imbalance values for that pattern are then determined by the two equations:
absolute value(TX+,rise – TX-,fall)/average, where average is (TX+,rise + TX-,fall)/2
absolute value(TX+,fall – TX-,rise)/average, where average is (TX+,fall + TX-,rise)/2
Both values for each pattern shall be less than the maximum listed in Table 37.

Make changes shown in red text to section 7.2.2.3.10 and section 7.4.19, pages 240 and 329, repsectively, in the SATA Revision 3.1 specification.

Additionally, add the further requirement for MFTP, from the Logo UTD test TSG-06, as an improvement to the measurement, to avoid issue with Tx emphasis causing errors in the Mode measurement. (See text in red, added to 7.4.19 below.)

7.2.2.3.11 TX Amplitude Imbalance (Gen2i, Gen2m, Gen2u, Gen3i, Gen3u)

The match in the amplitudes of TX+ and TX- determined by the function: absolute value (TX+ amplitude - TX- amplitude)/average where average is (TX+ amplitude + TX- amplitude)/2 and all amplitudes are determined by mode (most prevalent) voltage.

7.4.19 TX Amplitude Imbalance

This parameter is a measure of the match in the single-ended amplitudes of the TX+ and TX signals. The test setup shown Figure 163 shall be used for this measurement. This parameter shall be measured and met with both the HFTP and MFTP patterns. Clock-like patterns are used here to enable the use of standard mode-based amplitude measurements for the sole purpose of determining imbalance. Due to characteristics of the MFTP, it is required that the measurement points be taken between 0.45 to 0.55 UI of the 2nd bit within the pattern. All amplitude values for this measurement shall be the statistical mode measured at 0.5 UI, nominal, over a minimum of 10,000 UI. ~~The measurement of differential amplitude uses a different method.~~

In order to determine the amplitude imbalance, single ended mode high and mode low based amplitudes of both TX+ and TX- over 10 to 20 cycles of the clock-like pattern being used shall be determined. The amplitude imbalance value for that pattern is then determined by the equation:

absolute value(TX+ amplitude - TX- amplitude)/average
where average is (TX+ amplitude + TX- amplitude)/2

The amplitude imbalance value for each pattern shall be less than the maximum listed in Table 37.