To: T10 Technical Committee
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Subject: 02-451r0 SAS bit and byte ordering overview

<u>**Revision History**</u>
Revision 0 (28 October 2002) First revision

<u>**Related Documents**</u>
sas-r02b - Serial Attached SCSI revision 2b

<u>**Overview**</u>
An endianness overview is needed (especially since SATA uses little-endian, with different byte ordering but the same bit ordering).

<u>**Suggested Changes**</u>

3.6 Bit and byte ordering

In a field consisting of more than one bit that contains a single value (e.g., a number), the least significant bit (LSB) is shown on the right and the most significant bit (MSB) is shown on the left (e.g. in a byte, bit 7 is the MSB and is shown on the left; bit 0 is the LSB and is shown on the right). The MSB and LSB are not labeled if the field consists of 8 or fewer bits.

In a field consisting of more than one byte that contains a single value (e.g., a number), the byte containing the MSB is stored at the lowest address and the byte containing the LSB is stored at the highest address (big-endian byte ordering). The MSB and LSB are labeled.

> NOTE 1 SATA numbers bits within fields the same as this standard, but uses little-endian byte ordering.

In a field consisting of more than one byte that contains multiple values (e.g., a string), there is no MSB and LSB of the field itself and thus there are no MSB and LSB labels. Each individual value has an MSB and LSB, but they are not labeled. Multiple bytes are represented with only two rows, with the non-monotonically increasing byte number indicating the presence of additional bytes.

Table 1 shows some example fields. The MSB and LSB labels that are italicized here are not normally labeled in this standard.

Table 1 — Endianness examples

Bit Byte	7	6	5	4	3	2	1	0
0	*(MSB)*	3-bit field	*(LSB)*	(MSB)				
1			12-bit field				(LSB)	1-bit field
2	(MSB)			16-bit (2 byte) field				
3								(LSB)
4	(MSB)			32-bit (4 byte) field				
7								(LSB)
8	*(MSB)*			8-bit (1 byte) field				*(LSB)*
9	*(MSB)*			64-bit (8 byte) field (e.g., containing a string)				*(LSB)*
15	*(MSB)*							*(LSB)*

A data dword consists of 32 bits. Table 2 shows a data dword containing a single value, where the MSB is on the left in bit 31 and the LSB is on the right in bit 0.

Table 2 — Data dword containing a value

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB															Value																LSB

Table 3 shows a data dword containing a string of bytes, where byte 0 (the first byte) is on the left and byte 3 (the fourth byte) is on the right. Each byte has an MSB on the left and an LSB on the right.

Table 3 — Data dword containing a string of bytes

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MSB	Byte 0 (First byte)						LSB	MSB	Byte 1 (Second byte)						LSB	MSB	Byte 2 (Third byte)						LSB	MSB	Byte 3 (Fourth byte)						LSB