To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 29 October 2004
Subject: 04-352r0 SAS-1.1 Phy test functions for SMP

Revision history
Revision 0 (29 October 2004) First revision

Related documents
04-181r2 SAS-1.1 Phy test functions diagnostic page (Mark Evans, Maxtor)(incorporated into sas1r06)
04-222r1 SAS-1.1 More phy test functions (Rob Elliott and Steve Fairchild, HP)
sas1r06 - Serial Attached SCSI 1.1 revision 6

Overview
SAS-1.1 revision 6 includes a diagnostic page for requesting a target device start transmitting test patterns on a selected phy. A similar SMP function is proposed so the same request can be made of an expander device (or any target device implementing SMP, or even an initiator device implementing a virtual SMP function for management software).

> Editor's Note 1: a limitation of the diagnostic page structure is that it only kicks off a test function on one specified phy. In an expander, it might be desirable to run test patterns which run specific traffic on more than one phy at the same time (e.g. the PCI Express "compliance pattern"). This would require a new SMP function with a 128-bit bitmask of phys on which to run the selected pattern rather than just a phy identifier field.

Suggested changes

10.4.3.1 SMP function request frame format

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The FUNCTION field specifies which SMP function is being requested and is defined in table 1. If the value in the FUNCTION field is not supported by the SMP target port, it shall return a function result of UNKNOWN SMP FUNCTION as described in table 2.

Table 1 — SMP functions

Code	SMP function	Description	Request frame size (in bytes)	Response frame size (in bytes)	Reference
00h	REPORT GENERAL	Return general information about the device	8	32	10.4.3.3
01h	REPORT MANUFACTURER INFORMATION	Return vendor and product identification	8	64	10.4.3.4
02h	READ GPIO REGISTER	See SFF-8485			
03h - 0Fh	Reserved for general SMP input functions				
10h	DISCOVER	Return information about the specified phy	16	56	10.4.3.5
11h	REPORT PHY ERROR LOG	Return error logging information about the specified phy	16	32	10.4.3.6
12h	REPORT PHY SATA	Return information about a phy currently attached to a SATA device	16	60	10.4.3.7
13h	REPORT ROUTE INFORMATION	Return route table information	16	44	10.4.3.8
14h - 1Fh	Reserved for phy-based SMP input functions				
20h - 3Fh	Reserved for SMP input functions				
40h - 7Fh	Vendor specific				
80h - 81h	Reserved for general SMP output functions				
82h	WRITE GPIO REGISTER	See SFF-8485			
83h - 8Fh	Reserved for general SMP output functions				
90h	CONFIGURE ROUTE INFORMATION	Change route table information	44	8	10.4.3.9
91h	PHY CONTROL	Request actions by the specified phy	44	8	10.4.3.10
92h	PHY TEST FUNCTION	Request a test function by the specified phy	44	8	10.4.3.11
92h - 9Fh	Reserved for phy-based SMP output functions				
A0h - BFh	Reserved for SMP output functions				
C0h - FFh	Vendor specific				

10.4.3.2 SMP function response frame format

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The FUNCTION RESULT field is defined in table 2.

Table 2 — Function results

Code	Name	SMP function(s)	Description
00h	SMP FUNCTION ACCEPTED	All	The SMP target port supports the SMP function; the ADDITIONAL RESPONSE BYTES field contains the requested information.
01h	UNKNOWN SMP FUNCTION	Unknown	The SMP target port does not support the requested SMP function; the ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
02h	SMP FUNCTION FAILED	All	The SMP target port supports the SMP function, but the requested SMP function failed. The ADDITIONAL RESPONSE BYTES may be present but shall be ignored.
03h	INVALID REQUEST FRAME LENGTH	All	The SMP target port supports the SMP function, but the SMP request frame length was invalid (i.e., did not match the frame size defined for the function). The ADDITIONAL RESPONSE BYTES may be present but shall be ignored.

Table 2 — Function results

Code	Name	SMP function(s)	Description
10h	PHY DOES NOT EXIST	DISCOVER, REPORT PHY ERROR LOG, REPORT PHY SATA, REPORT ROUTE INFORMATION, CONFIGURE ROUTE INFORMATION, PHY CONTROL, PHY TEST FUNCTION	The phy specified by the PHY IDENTIFIER field in the SMP request frame does not exist (e.g., the value is not within the range of zero to the value of the NUMBER OF PHYS field reported in the REPORT GENERAL function). The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
11h	INDEX DOES NOT EXIST	REPORT ROUTE INFORMATION, CONFIGURE ROUTE INFORMATION	The phy specified by the PHY IDENTIFIER field in the SMP request frame does not have the table routing attribute (see 4.6.7.1), or the expander route index specified by the EXPANDER ROUTE INDEX field does not exist (i.e., the value is not in the range of 0000h to the value of the EXPANDER ROUTE INDEXES field in the REPORT GENERAL function). The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
12h	PHY DOES NOT SUPPORT SATA	REPORT PHY SATA and PHY CONTROL (TRANSMIT SATA PORT SELECTION SIGNAL)	The phy specified by the PHY IDENTIFIER field in the SMP request frame is not part of an STP target port. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
13h	UNKNOWN PHY OPERATION	PHY CONTROL	The operation specified by the PHY OPERATION field in the SMP request frame is unknown. The SMP function had no affect. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
14h	UNKNOWN PHY TEST FUNCTION	PHY TEST FUNCTION	The operation specified by the PHY TEST FUNCTION field in the SMP request frame is unknown. The SMP function had no affect. The ADDITIONAL RESPONSE BYTES field may be present but shall be ignored.
All others	Reserved		

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10.4.3.11 PHY TEST FUNCTION function [all new]

The PHY TEST FUNCTION function requests actions by the specified phy. This SMP function may implemented by any SMP target port.

Table 3 defines the request format.

Table 3 — PHY TEST FUNCTION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (92h)							
2	Reserved							
3								
4	Ignored							
7								
8	Reserved							
9	PHY IDENTIFIER							
10	PHY TEST FUNCTION							
11	PHY TEST PATTERN							
12	Reserved							
14								
15	PHY TEST PATTERN DWORD CONTROL				PHY TEST PATTERN PHYSICAL LINK RATE			
16	PHY TEST PATTERN DWORD							
19								
20	Reserved							
39								
40	(MSB)							
43	CRC							(LSB)

The SMP FRAME TYPE field shall be set to 40h.

The FUNCTION field shall be set to 92h.

The PHY IDENTIFIER field specifies the phy (see 4.2.7) to which the PHY TEST PATTERN request applies.

If the PHY IDENTIFIER field specifies the phy which is being used for the SMP connection and a phy operation of LINK RESET, HARD RESET, or DISABLE is requested, the SMP target port shall not perform the requested operation and shall return a function result of SMP FUNCTION FAILED in the response frame.

The PHY TEST FUNCTION field specifies the phy test function to be performed, and is defined in table xx. If the PHY TEST FUNCTION field specifies a phy test function that is not supported by the phy,

Table 4 — PHY TEST FUNCTION **field**

Code	Description
00h	If the selected phy is performing a phy test function, then the selected phy shall stop performing the phy test function and originate a link reset sequence. If the selected phy is not performing a phy test function, then this function has no effect on the selected phy. [a]
01h	If the selected phy is not performing a phy test function, the selected phy shall be set to transmit the phy test pattern specified by the PHY TEST PATTERN field at the physical link rate specified by the MAXIMUM PHYSICAL LINK RATE field and set to ignore its receiver. If the selected phy receives data while transmitting the pattern, then the selected phy shall ignore the received data. If the selected phy is performing a phy test function, the device server shall return a function result of PHY TEST FUNCTION IN PROGRESS in the response frame. [a]
02h - EFh	Reserved
F0h - FFh	Vendor specific
[a] If there is no SMP target port available to receive a PHY TEST FUNCTION function to stop a selected phy from performing a phy test function, then a power on may be required to cause the selected phy to stop performing the function and originate a phy reset sequence.	

If the PHY TEST FUNCTION field is set to 01h, the PHY TEST PATTERN field specifies the phy test pattern to be performed, and is defined in table xx (see 10.2.8.1). The phy test pattern shall be sent at the physical link rate specified by the PHY TEST PATTERN PHYSICAL LINK RATE field.

> Editor's Note 2: Probably move the phy test pattern table from the SSP diagnostic page description to here in the SMP function description, which is how other shared fields are handled.

The PHY TEST PATTERN PHYSICAL LINK RATE field specifies the physical link rate at which the phy test function, if any, shall be performed. Table 5 defines the values for this field.

Table 5 — Phy test pattern physical link rate

Code	Description
8h	1,5 Gbps
9h	3,0 Gbps
All others	Reserved

The PHY TEST PATTERN DWORD CONTROL field and the PHY TEST PATTERN DWORD field are defined in 10.2.8.1.

The CRC field is defined in 10.4.3.1.

Table 6 defines the response format.

Table 6 — PHY TEST FUNCTION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (92h)							
2	FUNCTION RESULT							
3	Reserved							
4	(MSB)				CRC			
7								(LSB)

The SMP FRAME TYPE field shall be set to 41h.

The FUNCTION field shall be set to 92h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The CRC field is defined in 10.4.3.2.