To: T10 Technical Committee
From: Tim Symons, PMC-Sierra (Tim_Symons@pmc-sierra.com)
Heng Liao, PMC-Sierra (liaoheng@pmc-sierra.com),
Date: December 23, 2005
Subject: T10/06-019r1 SAS-2 zoning

Revision Information

- Revision 0 (Dec 14, 2005) Revised from 05-144r9 document. Addition of short broadcast frame support, enforced symmetry of zone permission table and improved formatting.
- Revision 1 (Dec 29, 2005) Editorial update.

References

SAS2r01, Serial Attached SCSI - 2 (SAS-2)
T10/05-144r9 SAS-2 zoning

Introduction

This proposal defines the interfaces, functions and operations necessary to implement zoning for Serial Attached SCSI (SAS) systems. Conforming implementations may employ any design technique that does not violate interoperability. Where possible this standard uses existing SMP commands, employing reserved fields for zoning data requirements.

Table of contents

3 Definitions, symbols, abbreviations, keywords, and conventions 3
3.1 Definitions 3
3.2 Symbols and abbreviations 4
4. General 4
.. 4.1.3 Ports (narrow ports and wide ports) 4
. 4.9 Zoning 4
.. 4.9.1 Zoning overview 4
.. 4.9.2 Zoning expander device model overview 5
.. 4.9.3 Zone Operation 5
... 4.9.3.1 SMP zoning functions 5
... 4.9.3.2 Zone phy information 5
... 4.9.3.3 Zone permission table 6
... 4.9.3.4 Zoning expander zone route table 7
... 4.9.3.5 Zone routing 7
.. 4.9.4 Zone supervisor devices 8
... 4.9.4.1 Zone supervisor priority 8
... 4.9.4.2 Active zone supervisor 8
... 4.9.4.3 Active zone supervisor device election 8
.. 4.9.5 Access zone management 9
.. 4.9.6 Zone configuration 9
.. 4.9.6 Zoning expander phy reset event 10
.. 4.9.7 ZONE BROADCAST address frames 10
7 Link layer… 11
... 7.2.5.4 BROADCAST ..... **Error! Bookmark not defined.**
... 7.2.5.11 OPEN_REJECT 11
. 7.8 Address frames 11
.. 7.8.1 Address frames overview 11
.. 7.8.2 IDENTIFY address frame 11
.. 7.8.3 OPEN address frame 13
.. 7.8.4 ZONE BROADCAST type address frame 14
.. 7.8.5 Short ZONE BROADCAST type address frame 15
10 Application layer… 15
.. 10.4.3 SMP functions 15
... 10.4.3.2 SMP function response frame format 15
... 10.4.3.3 REPORT GENERAL function 16
... 10.4.3.5 DISCOVER function 17
... 10.4.3.13 CONFIGURE PHY ZONE function 20
... 10.4.3.14 CONFIGURE ZONE PERMISSION function 22
... 10.4.3.15 REPORT ZONE PERMISSION function 24
... 10.4.3.16 REPORT ZONE ROUTE TABLE function 25

Table of Figures

Figure 1 - ZSDS 5
Figure 2 - Figure 45 - Zone route table example 7

Table of Tables

Table 1 - Zone permission table 6
Table 2 - Routed zone group 8
Table 3 - Zone supervising priority values 9
Table 4 - Phy reset event behavior 10
Table 5 - Table 79 – BROADCAST primitives ..... **Error! Bookmark not defined.**
Table 6 - Table 82 – OPEN REJECT abandon primitives 11
Table 7 – Table 91 – ADDRESS FRAME TYPE field 11
Table 8- IDENTIFY address frame format 12
Table 9- Zone broadcast address frame support 12
Table 10 - OPEN address frame format 13
Table 11 - SMP zone function result field responses 14
Table 12 – Zone broadcast address frame format 14
Table 13 – Zone broadcast type 15
Table 14 - Short zone broadcast address frame format 15
Table 15 - REPORT GENERAL response 17
Table 16 - DISCOVER request 18
Table 17 - DISCOVER response 19
Table 18 – CONFIGURE PHY ZONE request 20
Table 19 - Phy zone configuration entry descriptor 21
Table 20 – CONFIGURE PHY ZONE response 21
Table 21 – CONFIGURE ZONE PERMISSION request 22
Table 22 - Zone permission entry descriptor format 23
Table 23 – CONFIGURE ZONE PERMISSION response 24
Table 24 – REPORT ZONE PERMISSION request 24
Table 25 – REPORT ZONE PERMISSION response 25
Table 26 –REPORT ZONE ROUTE TABLE request 26
Table 27 –REPORT ZONE ROUTE TABLE response 27
Table 28 - Zone route table entry descriptor 28

Suggested changes

3 Definitions, symbols, abbreviations, keywords, and conventions

3.1 Definitions

[Start of new definitions]

3.1.4 active zone supervisor device: The supervisor device that has been elected to configure all zoning expander zone route tables and zone permission tables in the ZSDS.

3.1.211 SMP zoning functions: SMP functions used for ZSDS configuration. (See section 9.4.3.1.)

3.1.260 zone group: A set of expander phys in a ZSDS that all have the same access permission.

3.1.261 zone permission table: The table that defines access permission between a source zone group and a destination zone group.

3.1.262 zone service delivery subsystem (ZSDS): A group of zoning expanders that cooperate to control phy access. The zone service delivery subsystem may include all or part of the service delivery subsystem. (See section 4.1.6)

3.1.263 zone supervising priority: The priority of a zone supervisor device for election to active zone supervisor device.

3.1.264 zone supervisor device: A zoning device that has its zone supervising priority greater than zero.

3.1.265 zoning device: A SAS expander device or an end device that is an SMP initiator and an SMP target and supports all SMP zoning commands.

3.1.266 zoning expander device: A SAS expander device that is an SMP initiator and an SMP target and supports all SMP zoning functions (See section 4.9.2).

[End of new definitions]

3.2 Symbols and abbreviations

[Start of new abbreviations]

Abbreviation	Meaning
ZSDS	Zone Service Delivery Subsystem

[End of new abbreviations]

…

4. General

.. 4.1.3 Ports (narrow ports and wide ports)

[Revision of existing text shown in red]

…

Phys that are able to become part of the same wide port shall set the DEVICE TYPE field, SSP INITIATOR PORT bit, STP INITIATOR PORT bit, SMP INITIATOR PORT bit, SSP TARGET PORT bit, STP TARGET PORT bit, SMP TARGET PORT bit, ~~and~~ SAS ADDRESS field, ZONE DEVICE bit and ZONE BROADCAST METHOD field in the IDENTIFY address frame (see 7.8.2) transmitted during the identification sequence to the same set of values on each phy in the wide port. Recipient wide ports are not required to check the consistency of these fields across their phys.

[End of revision of existing text shown in red]

[New Section]

. 4.9 Zoning

.. 4.9.1 Zoning overview

SAS zoning is implemented by a set of zoning expander devices that cooperate to define the zoned service delivery subsystem (ZSDS). The zoning expander devices control whether a phy is permitted to open a connection to another phy. End devices may support zone features.

Every phy of a ZSDS belongs to a zone group. All phys in a wide port shall belong to the same zone group. Each zoning expander contains a zone permission table that controls whether a connection is allowed between the source and target zone group. There are 128 zone groups.

A requested connection shall only be opened if the zone permission table indicates that access between the source and target groups is allowed.

The zone route table is an extended version of the expander route table (See section 4.6.7.3) extended to include zone phy information. The zone permission table and zone route table are configured by the active zone supervisor device.

Expander devices that do not support zoning may be part of the service delivery subsystem, but remain outside the boundary of the ZSDS. All phys of the non-zoning expander belong to the zone group that attaches the non-zoning expander device to the ZSDS.

Figure 1 shows an example of a ZSDS.

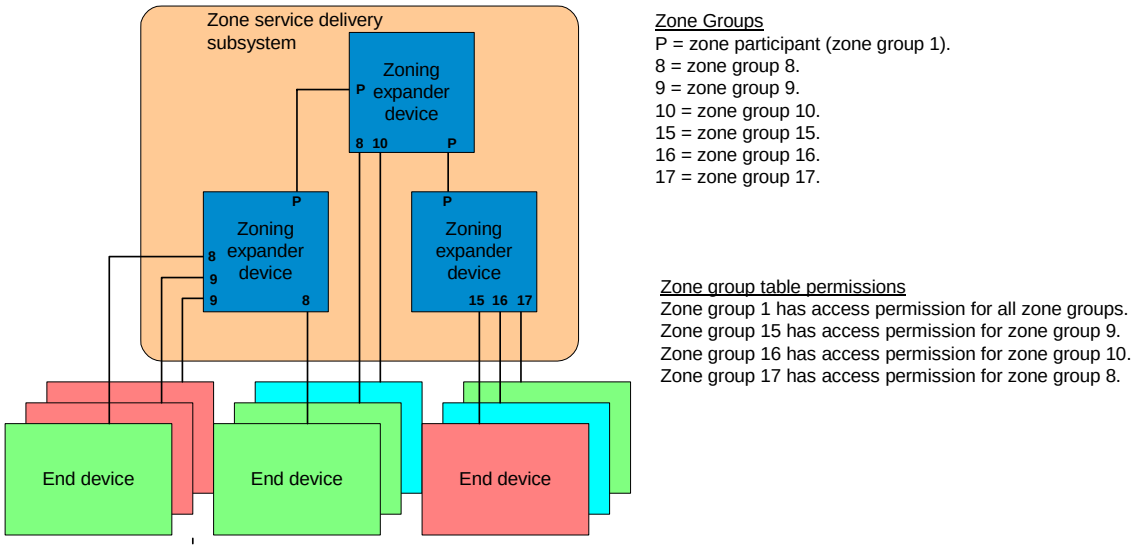

Figure 1 - ZSDS

.. 4.9.2 Zoning expander device model overview

A zoning expander device shall support the following attributes:

a) an SMP initiator and SMP target (See section 4.6.1);
b) allows or denies connection requests following the zoning permissions;
c) self-configuring;
d) process all SMP zoning functions;
e) contain a zone permission table that supports 128 zone groups (See section 4.9.3.3); and
f) contain a zone expander zone route table. (See section 4.9.3.4).

.. 4.9.3 Zone Operation

... 4.9.3.1 SMP zoning functions

SMP zoning functions are used to configure and control the ZSDS. The SMP zoning functions are:

a) SMP CONFIGURE PHY ZONE (see section 10.4.3.13) ;
b) SMP CONFIGURE ZONE PERMISSION (see section 10.4.3.14);
c) SMP REPORT ZONE PERMISSION (see section 10.4.3.15); and
d) SMP REPORT ZONE ROUTE TABLE (see section 10.4.3.16).

... 4.9.3.2 Zone phy information

Each phy of a zoning expander device shall support the following zone phy information fields:

a) ZONE PARTICIPATING bit;
b) ZONE SUPERVISING PRIORITY field; and
c) ZONE GROUP field.

The ZONE PARTICIPATING bit shall be set to one when the phy is attached to a zoning expander device. The ZONE PARTICIPATING bit may be set to one when the phy is attached to a zoning end device. The ZONE PARTICIPATING bit shall be set to zero when the phy is attached to a device that does not support zoning. This indicates the boundary of the ZSDS.

The ZONE SUPERVISING PRIORITY field indicates the active zone supervisor election priority of the device attached to the phy. (See section 4.9.4.1)

The ZONE GROUP field has a value in the range 0 to 127 that indicates the zone group that contains the phy.

... 4.9.3.3 Zone permission table

The zone permission table specifies access permission for a connection zone groups. If the zone permission table entry is set to one then connection requests shall be permitted between phys in the zone groups.

Zoning expander SMP initiator and target ports shall belong to zone group 1.

The zone permission table is shown in Table 1

Table 1 - Zone permission table

Zone group (X) / Zone group (Y)	0	1	2	...	7	8	...	127
0	0	1	0	…	0	0	…	0
1	0 [a]	1	1	…	1	1	…	1
2	0 [a]	1 [a]	Reserved	…	Reserved	Reserved	…	Reserved
…	…	…	…	…	…	…	…	…
7	0 [a]	1 [a]	Reserved [a]	…	Reserved	Reserved	…	Reserved
8	0 [a]	1 [a]	Reserved [a]	…	Reserved [a]	ZP[8, 8]	…	ZP[127, 8]
…	…	…	…	…	…	…	…	…
127	0 [a]	1 [a]	Reserved [a]	…	Reserved [a]	ZP[8, 127] [a]	…	ZP[127, 127]

[a] These fields are ignored for SMP CONFIGURE ZONE PERMISSION request but are reported in SMP REPORT ZONE PERMISSION response. ZP[X ,Y] has the same value as ZP[Y, X].

A ZP[X, Y] bit set to one specifies that zone group (X) has permission to access zone group (Y).
A ZP[X, Y] bit set to zero specifies that zone group (Y) has no access zone group (X).
.

Zone group 0 is not shall not access any other group except zone group 1. (i.e. ZP[0, 0] and ZP[2.127, 0] shall be set to zero).

Zone group 1 shall access all other zone groups. (i.e. ZP[0.127, 1] shall be set to one).

Zone groups 2 through 7 are reserved zone groups. All reserved bits shall be set to zero. (i.e. ZP[2.7, 2.127] shall be set to zero).

... 4.9.3.4 Zoning expander zone route table

Zoning expander devices shall be self-configuring. Zoning expander devices in the ZSDS cooperate to complete the zone route tables. The zone route table shall contain zone phy information in addition to the expander phy information.

Figure 2 shows a representation of a zoning expander zone route table.

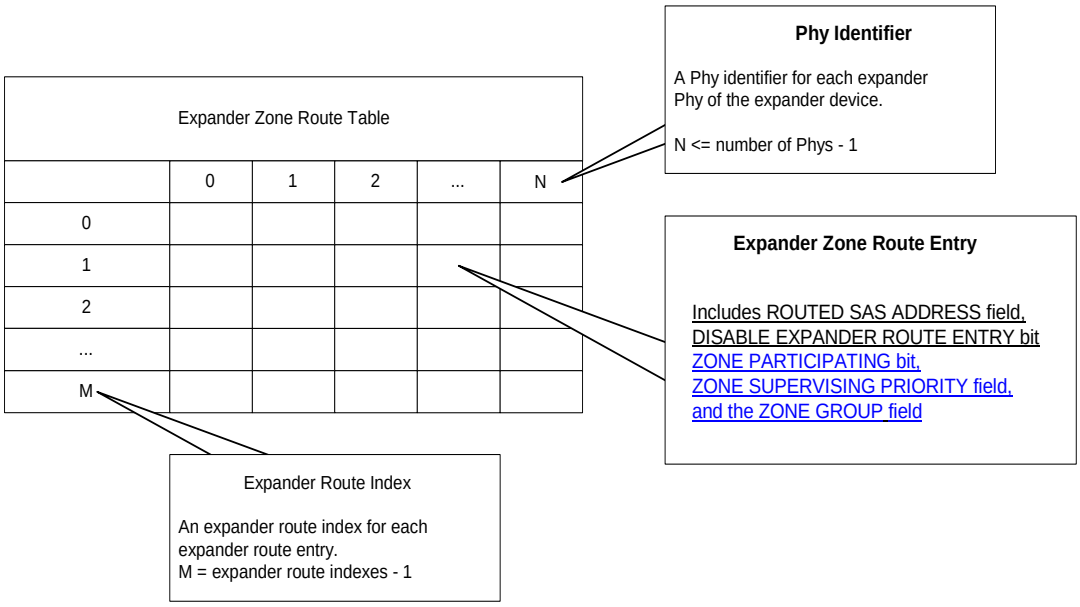

Figure 2 - Figure 45 - Zone route table example

... 4.9.3.5 Zone routing

When a zoning expander device receives an OPEN request, the zoning permission table shall check the access permission between the source zone group and the target zone group. If the zone permission table entry is set to one then access between the phys is allowed and the zoning expander shall continue with the normal ECM arbitration procedure. If the zone permission table entry is set to zero then access between the phys is not permitted and the OPEN_REJECT (ZONE VIOLATION) response shall be sent for the OPEN request and the ZONE VIOLATION bit for the source phy shall be set to one. (See section 7.2.5.11)

When an OPEN request on a phy with the ZONE PARTICIPATING bit set to zero (e.g. the initiator device resides outside the ZSDS) the zone group of the receiving phy is used for the SOURCE ZONE GROUP field.

The zoning expander device uses the rules in Table 2 to check the zone group access permission of the DESTINATION SAS ADDRESS field from the OPEN request.

Table 2 - Routed zone group

Expander routing attribute (see 4.6.7.1)	Target zone group permission
direct routing	zone group of the destination phy.
table routing	zone group stored in the zone route table for the destination SAS address.
subtractive routing	zone group of the subtractive phy.

.. 4.9.4 Zone supervisor devices

... 4.9.4.1 Zone supervisor priority

When a SAS device is attached to a phy that reports a ZONE SUPERVISING PRIORITY field value greater than zero, the device is eligible for active zone supervisor device

If a phy is attached to a device that is not a zone supervisor device then the ZONE SUPERVISING PRIORITY field shall be set to zero.

... 4.9.4.2 Active zone supervisor

There is one active zone supervisor device in a ZSDS. The zoning expander devices elect a device to be the active zone supervisor device based on the value of its ZONE SUPERVISING PRIORITY field. The highest value of all the zone supervising priority entries shall be elected to be the active zone supervisor device. If there are two or more supervisor priority entries with the same zone supervising priority value then the device with the highest SAS address shall be elected to be the active zone supervisor device.

... 4.9.4.3 Active zone supervisor device election

The active zone supervisor device election occurs after all zoning expander devices in the ZSDS complete the self-configuration process. The completion of the self-configuration process is identified when the zoning expander device sets the CONFIGURING bit from one to zero in the SMP REPORT GENERAL response the sends BROADCAST (CHANGE), (see section 4.7.1).

A zoning device shall issue SMP DISCOVER request to each phy in the ZSDS and evaluate the highest ZONE SUPERVISING PRIORITY field value (see Table 3). If the same highest value is reported by two or more phys or devices, then the highest SAS address is elected.

A zoning expander device shall set the ACTIVE ZONE SUPERVISOR PRIORITY and ACTIVE ZONE SUPERVISOR SAS ADDRESS fields to zero until the active zone supervisor election process is complete.

Table 3 indicates the significance of priority values in the ZONE SUPERVISING PRIORITY field.

Table 3 - Zone supervising priority values

ZONE SUPERVISING PRIORITY	Description
1111b	Highest priority
1110b	Second highest priority
…	…
0010b	Second lowest priority
0001b	Lowest priority
0000b	Does not participate in the election process

If all zone table entries have the zone supervising priority set to zero then the election process fails and the ACTIVE ZONE SUPERVISOR PRIORITY field and the ACTIVE ZONE SUPERVISOR SAS ADDRESS field is set to zero in the SMP REPORT GENERAL response frame.

.. 4.9.5 Access zone management

A zone supervisor device may make SMP REPORT ZONE PERMISSION and SMP REPORT ZONE ROUTE TABLE requests

A zoning device that reports a ZONE SUPERVISING PRIORITY field value greater than zero, shall set the ACCESS ZONE MANAGEMENT bit set to one in the OPEN address frame. (See section 7.8.3).

A zoning device that reports a ZONE SUPERVISING PRIORITY field of zero, shall set the ACCESS ZONE MANAGEMENT bit set to zero in the OPEN address frame. (See section 7.8.3).

When an OPEN address frame is received on a phy that has the ZONE SUPERVISING PRIORITY field set to a value greater than zero and the ZONE PARTICIPATING bit set to zero, then the zoning expander device shall respond for the ACCESS ZONE MANAGEMENT bit set to one in the OPEN address frame. (See section 7.8.3 Table 10). If the OPEN address frame is forwarded to another device then the zoning expander device shall set the ACCESS ZONE MANAGEMENT bit to one.

.. 4.9.6 Zone configuration

SMP CONFIGURE ZONE PERMISSION and SMP CONFIGURE PHY ZONE requests are used to manage the ZSDS. These requests if originated from the active zone supervisor device. If the request is made by a device that is not the active zone supervisor device, then the response shall be as defined in section 7.8.3 Table 10.

The SMP CONFIGURE ZONE PERMISSION function requests change to entries in the zone permission table. (See section 10.4.3.14). The active zone supervisor device shall send an SMP CONFIGURE ZONE PERMISSION request to all zoning expanders in the ZSDS.

The SMP CONFIGURE PHY ZONE function requests change to the zoning attributes for phys in a zoning expander device. (See section 10.4.3.13).

.. 4.9.6 Zoning expander phy reset event

After a phy reset event, such as hot swap of an end device, the zone permission table shall be maintained according to the rules defined in the phy reset event behavior table. (See Table 4)

Table 4 - Phy reset event behavior

Initial Condition	Event	New PHY ZONE Configuration
SAS device attached, phy in the SP15: SAS_PHY_Ready state, Initial phy zone configuration assigned.	Phy exits the SP15: SAS_PHY_Ready state, and later re-enters the SP15 state, receiving an IDENTIFY frame with the same SAS address as prior to the exit out of SP15: SAS_PHY_Ready state.	The zoning expander device restores the phy to the zone group that contained the phy prior to the phy exiting the SP15: SAS_PHY_Ready state.
	Phy exits the SP15: SAS_PHY_Ready state, and later re-enters the SP15 state, receiving an IDENTIFY frame with a different SAS address as prior to the exit out of SP15: SAS_PHY_Ready state.	The zoning expander device assigns the phy to zone group 0.
SATA device attached, phy in the SP22: SATA_PHY_Ready state, Initial phy zone configuration assigned.	Phy exits the SP22: SATA_PHY_Ready state, and later re-enters the SP22: SATA_PHY_Ready state without having an expander Hot-Plug Timeout timer expiration event in-between.	The zoning expander device restores the phy to the zone group that contained the phy prior to the phy exiting the SP22: SATA_PHY_Ready state.
	Phy exits the SP22: SATA_PHY_Ready state, and later re-enters the SP22: SATA_PHY_Ready state with an expander Hot-Plug Timeout timer expiration event in-between.	The zoning expander device assigns the phy to zone group 0.

.. 4.9.7 ZONE BROADCAST address frames

Zoning expander devices should propagate broadcast events using the ZONE BROADCAST address frame within the ZSDS. (i.e., the zoning expander shall generate a broadcast primitive on phys that have the ZONE PARTICIPATING bit set to zero.) The BROADCAST primitive shall be sent to devices outside the ZSDS.

The ZONE BROADCAST METHOD field in the IDENTIFY address frame (See section 7.8.2) specifies the ZONE BROADCAST address frame type supported by each zoning device. (See Table 8). The type of broadcast used for each phy connection is defined by the following rules:

1) if either the source or the target device only supports primitives then the broadcast primitive shall be used;
2) if both the source and the target devices only support 32-byte zone broadcast frames then 32-byte broadcast frames shall be used; and
3) if both the source and the target devices support 8-byte zone broadcast frames then 8-byte broadcast frames shall be used.

ZONE BROADCAST address frames shall only be sent to expander phys with zone permission to access the initiating phy. A phy that has the zone participating bit set to zero shall send the broadcast primitive.

The ZONE BROADCAST address frame shall be transmitted three times to provide redundancy against bit errors during the transmission of the broadcast frame. The reception of one ZONE BROADCAST address frame is sufficient for detection of the broadcast event.

If the zoning expander device has a queue to hold ZONE BROADCAST address frames and if the queue overflows, the BPP may remove entries from the queue and send BROADCAST primitives to all ports scheduled to receive the zone broadcast address frame. A zoning expander

device is not required to queue multiple identical ZONE BROADCAST frames for the same expander port. If a second identical ZONE BROADCAST frame is requested before the first ZONE BROADCAST frame has been transmitted, the second ZONE BROADCAST frame may be ignored.

When the BPP receives a ZONE BROADCAST address frame with SOURCE ZONE GROUP field set to one, BROADCAST primitives may be sent in place of a ZONE BROADCAST address frame.

[End of new Section]

[Start of suggested changes to existing sections]

7 Link layer…

... 7.2.5.11 OPEN_REJECT

[Start of addition to existing table]

Table 5 - Table 82 – OPEN REJECT abandon primitives

Primitive	Originator	Description
OPEN_REJECT (ZONE VIOLATION)	Zoning expander phy	The connection request is from a zone group that does not have permission to access the zone group that contains the target phy. The ZONE VIOLATION field of the phy that received the request shall be set to one. The ZONE VIOLATION field shall be reset to zero when an SMP PHY CONTROL function with an operation code of CLEAR ERROR LOG for the specified phy is received.

[End of addition to existing table]

. 7.8 Address frames

.. 7.8.1 Address frames overview

…

The ADDRESS FRAME TYPE field is defined in Table 6. This field determines the definition of the frame type dependent bytes.

Table 6 – Table 91 – ADDRESS FRAME TYPE field

Code	Frame Type	Description
0h	IDENTIFY	Identification sequence
1h	OPEN	Connection request
2h	BROADCAST	32-byte zone broadcasts within zones
3h	SHORT BROADCAST	8-byte zone broadcasts within zones
All others	Reserved	

.. 7.8.2 IDENTIFY address frame

…

Table 7- IDENTIFY address frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	Restricted (for OPEN address frame)	DEVICE TYPE			ADDRESS FRAME TYPE (0h)			
1	Restricted (for OPEN address frame)							
2	Reserved				SSP INITIATOR PORT	STP INITIATOR PORT	SMP INITIATOR PORT	Restricted (for OPEN address frame)
3	Reserved				SSP TARGET PORT	STP TARGET PORT	SMP TARGET PORT	Restricted (for OPEN address frame)
4	Restricted (for OPEN address frame)							
11								
12	SAS ADDRESS							
19								
20	PHY IDENTIFIER							
21	Reserved				ZONE DEVICE	ZONE BROADCAST METHOD		
22	Reserved							
27								
28	(MSB) CRC							
31								LSB)

…

A ZONE DEVICE bit set to one specifies that the device is a zoning device. A ZONE DEVICE bit set to zero specifies that the device does not support zone functions.

The ZONE BROADCAST METHOD field specifies the type of ZONE BROADCAST address frames supported by the device. (See Table 8)

…

[Revision of existing text shown in red]

See 4.1.3 for additional requirements concerning the DEVICE TYPE field, SSP INITIATOR PORT bit, STP INITIATOR PORT bit, SMP INITIATOR PORT bit, SSP TARGET PORT bit, STP TARGET PORT bit, SMP TARGET PORT bit, ~~and~~ SAS ADDRESS field, ZONE DEVICE bit and ZONE BROADCAST METHOD field.

[End of revision of existing text shown in red]

Table 8- Zone broadcast address frame support

ZONE BROADCAST METHOD field	Description
000	A zoning device that only supports BROADCAST primitives.
001	A zoning device that supports 32-byte ZONE BROADCAST address frames
010	A zoning device that supports both 32-byte ZONE BROADCAST address frames and 8-byte SHORT ZONE BROADCAST address frames
All others	Reserved

.. 7.8.3 OPEN address frame

Table 9 defines the OPEN address frame format used for connection requests.

Table 9 - OPEN address frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	INITIATOR PORT	PROTOCOL			ADDRESS FRAME TYPE (1h)			
1	FEATURES				CONNECTION RATE			
2	(MSB)	INITIATOR CONNECTION TAG						
3								(LSB)
4		DESTINATION SAS ADDRESS						
11								
12		SOURCE SAS ADDRESS						
19								
20	ACCESS ZONE MANAGEMENT	SOURCE ZONE GROUP						
21	PATHWAY BLOCK COUNT							
22	(MSB)	ARBITRATION WAIT TIME						
23								(LSB)
24		MORE COMPATIBLE FEATURES						
27								
28	(MSB)	CRC						
31								LSB)

…

An ACCESS ZONE MANAGEMENT bit set to one specifies that the OPEN request is from a zone supervisor device and shall respond as defined in Table 10. If the ACCESS ZONE MANAGEMENT bit is set to zero then all zone type SMP functions shall return a FUNCTION RESULT of UNKNOWN SMP FUNCTION.

Table 10 - SMP zone function result field responses

Active zone supervisor	OPEN address frame ACCESS ZONE MANAGEMENT bit	Zone permission table entry	DISCOVER [a]	REPORT ROUTE INFORMATION	REPORT GENERAL	REPORT MANUFACTURER INFORMATION	REPORT ZONE PERMISSION	REPORT ZONE ROUTE TABLE	CONFIGURE ZONE PERMISSION	CONFIGURE PHY ZONE
YES	1	1 or 0	SMP FUNCTION ACCEPTED							
NO	0	0 [a]	PHY VACANT		SMP FUNCTION ACCEPTED		UNKNOWN SMP FUNCTION			
NO	0	1	SMP FUNCTION ACCEPTED				UNKNOWN SMP FUNCTION			
NO	1	0 [a]	PHY VACANT		SMP FUNCTION ACCEPTED				SMP FUNCTION FAILED	
NO	1	1	SMP FUNCTION ACCEPTED						SMP FUNCTION FAILED	

a. If the NO ZONE MASK bit is set to one in the DISCOVER request frame then the zone permission table entry is ignored and the response shall report all phy connections.

The SOURCE ZONE GROUP field identifies the zone group that contains the phy making the connection request. A connection may be opened if the zone permission table indicates that the zone group of the phy attached to the destination SAS address has permission to access the source zone group (See 4.9.3.3).

…

[End of suggested changes to existing sections]

.. 7.8.4 ZONE BROADCAST type address frame

Table 11 defines the address frame format for ZONE BROADCAST address frame.

Table 11 – Zone broadcast address frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	ZONE BROADCAST TYPE			ADDRESS FRAME TYPE (2h)			
1	Reserved							
2								
3	Reserved	SOURCE ZONE GROUP						
4	Reserved							
27								
28	(MSB)	CRC						
31								(LSB)

The ZONE BROADCAST TYPE field is defined in **Table 12**.

Table 12 – Zone broadcast type

Code	BROADCAST Primitive Represented (see section 7.2.5.4)
0h	BROADCAST (CHANGE)
1h	BROADCAST (SES)
2h	BROADCAST (RESERVED1)
3h	BROADCAST (RESERVED 2)
4h	BROADCAST (RESERVED 3)
5h	BROADCAST (RESERVED 4)
6h	BROADCAST (RESERVED CHANGE 0)
7h	BROADCAST (RESERVED CHANGE 1)

The ADDRESS FRAME TYPE field shall be set to 2h. (See section 7.8.4 Table 6)

The SOURCE ZONE GROUP field specifies the zone group that contains the phy that originated the ZONE BROADCAST request. The ZONE BROADCAST shall only be sent to phys with permission to access the zone group that contains the source phy.

The CRC field is defined in 7.8.1.

.. 7.8.5 Short ZONE BROADCAST type address frame

Table 13 defines the address frame format for ZONE BROADCAST address frame.

Table 13 - Short zone broadcast address frame format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	ZONE BROADCAST TYPE			ADDRESS FRAME TYPE (3h)			
1	Reserved							
2								
3	Reserved	SOURCE ZONE GROUP						
4	(MSB)	CRC						
7								(LSB)

The ZONE BROADCAST TYPE field is defined in section 7.8.4 Table 12.

The ADDRESS FRAME TYPE field shall be set to 3h. (See section 7.8.1 Table 6)

The SOURCE ZONE GROUP is defined in section 7.8.4

The CRC field is defined in 7.8.1.

[Start of suggested changes to existing sections]

10 Application layer…

.. 10.4.3 SMP functions

…

... 10.4.3.2 SMP function response frame format

…

[Change to existing table shown in red]

Code	Name	SMP function(s)	Description
10h	PHY DOES NOT EXIST	DISCOVER, REPORT PHY ERROR LOG, REPORT PHY SATA, REPORT ROUTE INFORMATION, REPORT ZONE PERMISSION, 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, REPORT ZONE 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.

…

[End of change to existing table shown in red]

... 10.4.3.3 REPORT GENERAL function

…

Table 14 defines the response format.

Table 14 - REPORT GENERAL response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (00h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (08h)							
4	(MSB)	EXPANDER CHANGE COUNT						
5								(LSB)
6	(MSB)	EXPANDER ROUTE INDEXES						
7								(LSB)
8	Reserved							
9	NUMBER OF PHYS							
10	Reserved						CONFIGURING	CONFIGURABLE ROUTE TABLE
11	ACTIVE ZONE SUPERVISOR PRIORITY				ZONE SUPERVISING PRIORITY			
12		ENCLOSURE LOGICAL IDENTIFIER						
19								
20		ACTIVE ZONE SUPERVISOR SAS ADDRESS						
27								
28		Reserved						
29								
30	(MSB)	STP BUS INACTIVITY TIME LIMIT						
31								(LSB)
32	(MSB)	STP MAXIMUM CONNECT TIME LIMIT						
33								(LSB)
34	(MSB)	STP SMP I_T NEXUS LOSS TIME						
35								(LSB)
36	(MSB)	CRC						
39								(LSB)

…

The ACTIVE ZONE SUPERVISOR PRIORITY field indicates the zone supervising priority of the elected active zone supervisor device. This field shall be set to zero if there is no active zone supervisor device.

The ZONE SUPERVISING PRIORITY field indicates the supervising priority of the responding zoning expander device.

…

The ACTIVE ZONE SUPERVISOR SAS ADDRESS field indicates the SAS address of the elected active zone supervisor device. This field shall be set to zero if there is no active zone supervisor device.

…

... 10.4.3.5 DISCOVER function

…

Table 15 defines the DISCOVER request format.

Table 15 - DISCOVER request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (10h)							
2	Reserved							
3	REQUEST LENGTH (02h)							
4	Reserved							
7								
8	Reserved							NO ZONE MASK
9	PHY IDENTIFIER							
10	Reserved							
11	Reserved							
12	(MSB)			CRC				
15								(LSB)

…

When the NO ZONE MASK bit is set to one the DISCOVER response shall ignore the zone access permission and shall report all phy connections. (See section 7.8.3 Table 10). Performing SAS domain discovery with the NO ZONE MASK bit set to one returns the physical SAS topology.

When the NO ZONE MASK bit is set to zero the DISCOVER response shall only report phys that have zone access permission for phy indicated by the PHY IDENTIFIER field. (See section 7.8.3 Table 10). Performing SAS domain discovery with the NO ZONE MASK bit set to zero returns the logical SAS topology for the port performing the discovery.

…

Table 16 defines the response format.

Table 16 - DISCOVER response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (10h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (0Ch)							
4	Reserved							
8								
9	PHY IDENTIFIER							
10	Reserved							
11								
12	Reserved	ATTACHED DEVICE TYPE			Reserved			
13	Reserved				NEGOTIATED PHYSICAL LINK RATE			
14	Reserved				ATTACHED SSP INITIATOR	ATTACHED STP INITIATOR	ATTACHED SMP INITIATOR	ATTACHED SATA HOST
15	ATTACHED SATA PORT SELECTOR	Reserved			ATTACHED SSP TARGET	ATTACHED STP TARGET	ATTACHED SMP TARGET	ATTACHED SATA DEVICE
16	SAS ADDRESS							
23								
24	ATTACHED SAS ADDRESS							
31								
32	ATTACHED PHY IDENTIFIER							
33	Reserved				ATTACHED ZONE DEVICE	ATTACHED ZONE BROADCAST METHOD		
34	Reserved							
39								
40	PROGRAMMED MINIMUM PHYSICAL LINK RATE				HARDWARE MINIMUM PHYSICAL LINK RATE			
41	PROGRAMMED MAXIMUM PHYSICAL LINK RATE				HARDWARE MAXIMUM PHYSICAL LINK RATE			
42	PHY CHANGE COUNT							
43	VIRTUAL PHY	Reserved			PARTIAL PATHWAY TIMEOUT VALUE			
44	Reserved				ROUTING ATTRIBUTE			
45	Reserved	CONNECTOR TYPE						
46	CONNECTOR ELEMENT INDEX							
47	CONNECTOR PHYSICAL LINK							
48	Reserved		ZONE VIOLATION	ZONE PARTICIPATING	ZONE SUPERVISING PRIORITY			
49	Reserved	ZONE GROUP						
50	(MSB)	Vendor Specific						
51								(LSB)
52	(MSB)	CRC						
55								(LSB)

…

The ATTACHED ZONE DEVICE bit indicates the value of the ZONE DEVICE bit received in the IDENTIFY address frame (see 7.8.2) during the identification sequence.

The ATTACHED ZONE BROADCAST METHOD field indicates the value of the ZONE BROADCAST METHOD field (See Table 8) received in the IDENTIFY address frame (see 7.8.2) during the identification sequence.

A ZONE VIOLATION bit set to one indicates that the phy sent an OPEN_REJECT (ZONE VIOLATION) response to a prior DISCOVER command. (See section 7.2.5.11)

A ZONE PARTICIPATING bit set to one indicates that the phy is attached to another zoning device.

The ZONE SUPERVISING PRIORITY field indicates the zone supervisor device election priority of the phy.

The ZONE GROUP field indicates the zone group that contains the phy.

The CRC field is defined in 7.8.1.

[End of suggested changes to existing sections]

... 10.4.3.13 CONFIGURE PHY ZONE function

The CONFIGURE PHY ZONE function sets the zoning attributes for phys in the zoning expander device. This function shall be supported by all zoning devices and shall only be issued by the active zone supervisor device. The ACCESS ZONE MANAGEMENT bit in the OPEN request shall be used to determine the function result as shown in section 7.8.3 Table 10.

Table 17 defines the CONFIGURE PHY ZONE request format.

Table 17 – CONFIGURE PHY ZONE request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (93h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	Reserved							
5								
6	UPDATE COMPLETE	START PHY INDEX						
7	NUMBER OF ZONE PHY ENTRIES ((n – 11) / 2)							
8	First phy zone configuration entry descriptor (see Table 18)							
9								
…	…							
m -1	Last phy zone configuration entry descriptor (see Table 18)							
m								
	Fill bytes, if needed							
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 93h.

The REQUEST LENGTH field shall be set to ((n - 7) / 4).

An UPDATE COMPLETE bit set to one specifies that the current request is the last of a sequence. The zoning expander device shall issue a broadcast change notification after the CONFIGURE PHY ZONE response.

The START PHY INDEX field specifies the first phy index to be configured by the CONFIGURE PHY ZONE command.

The NUMBER OF ZONE PHY ENTRIES field specifies the number of phy zone configuration entry descriptors in the request ((n – 11) / 2). Table 18 defines the phy zone configuration entry descriptor.

Fill bytes shall be included after the last phy zone configuration entry descriptor so the CRC field is aligned on a four-byte boundary. The contents of the fill bytes are vendor specific.

The CRC field is defined in 7.8.1.

Table 18 - Phy zone configuration entry descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved			ZONE PARTICIPATING	ZONE SUPERVISING PRIORITY			
1	Reserved	ZONE GROUP						

A ZONE PARTICIPATING bit set to one indicates that the phy is attached to another zoning device. A ZONE PARTICIPATING bit set to zero indicates that the phy is not attached to a zoning device.

The ZONE SUPERVISING PRIORITY field is defined in section 10.4.3.5.

The ZONE GROUP field is defined in section 10.4.3.5.

Table 19 defines the CONFIGURE PHY ZONE response format.

Table 19 – CONFIGURE PHY ZONE response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (93h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (00h)							
4	(MSB)	CRC						
7								(LSB)

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

The FUNCTION field shall be set to 93h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to 00h.

The CRC field is defined in 7.8.1.

... 10.4.3.14 CONFIGURE ZONE PERMISSION function

The CONFIGURE ZONE PERMISSION function requests a change to the zone permissions table entries and the zoning expander device zone supervising priority. This function shall be supported by all zoning devices and shall only be issued by the active zone supervisor device. The value of the ACCESS ZONE MANAGEMENT bit in the OPEN request shall be used to determine the function result as shown in section 7.8.3 Table 10.

a) A single entry update that uses the SOURCE ZONE GROUP and the TARGET ZONE GROUP fields to identify the table entry bit to be written. The BATCH bit shall be set to zero; and

b) A batch mode that allows multiple table row entries of a zone group field to be updated. In this mode the BATCH bit shall be set to one.

A request to change zone permission to zone group 0 or zone group 1 shall return a function result of FUNCTION FAILED in the response frame.

Table 20 defines the CONFIGURE ZONE PERMISSION request format.

Table 20 – CONFIGURE ZONE PERMISSION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (83h)							
2	Reserved							
3	REQUEST LENGTH ((n - 7) / 4)							
4	Reserved							
5								
6	Reserved		SOURCE ZONE GROUP [a]					
7	GROUP PERMISSION [a]		TARGET ZONE GROUP [a]					
8	Reserved							
9	ZONE SUPERVISING PRIORITY [b]				Reserved	UPDATE PRIORITY	BATCH	UPDATE COMPLETE [c]
10	Reserved		START SOURCE ZONE GROUP INDEX [c]					
11	Reserved		NUMBER OF ZONE PERMISSION ENTRIES ((n – 15) / 16) [c]					
12	First zone permission entry descriptor (See Table 21) [c]							
27								
...	...							
n - 20	Last zone permission entry descriptor (See Table 21) [c]							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

[a] These fields are ignored if the BATCH bit is set to one

[b] This field is ignored if the UPDATE PRIORITY bit is set to zero

[c] These fields are ignored if the BATCH bit is set to zero

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

The FUNCTION field shall be set to 83h.

The REQUEST LENGTH field shall be set to ((n - 7) / 4).

The SOURCE ZONE GROUP field specifies the source zone group of the zone permission table entry.

The GROUP PERMISSION bit specifies the new access permission to be updated between the two zone groups specified in the SOURCE ZONE GROUP and TARGET ZONE GROUP fields. The TARGET ZONE GROUP field specifies the target zone group of the zone permission entry.

The ZONE SUPERVISING PRIORITY field specifies the new zone supervisor device election priority to be written to the zoning device.

When the UPDATE PRIORITY bit is set to one the device shall update its zone supervising priority to the value contained in the ZONE SUPERVISING PRIORITY field.

A BATCH bit set to zero specifies that the CONFIGURE ZONE PERMISSION request is being used in single entry update mode. A BATCH bit set to one specifies that the CONFIGURE ZONE PERMISSION request is being used in batch mode, allowing updates to multiple access permission entries.

An UPDATE COMPLETE bit set to one specifies that the current request is the last of a sequence of requests. The zoning expander device shall issue ZONE BROADCAST to affected zone groups after the CONFIGURE ZONE PERMISSION response.

The START SOURCE ZONE GROUP INDEX specifies the first source zone group to be written with the first zone permission entry descriptor. If the BATCH bit is set to zero the START ZONE ENTRY INDEX field shall be ignored.

The ZONE PERMISSION ENTRIES field specifies how many zone permission entry descriptors follow ((n – 15) / 16).

Table 21 defines the zone permission entry descriptor format.

Table 21 - Zone permission entry descriptor format

Byte\Bit	7	6	5	4	3	2	1	0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	1	0
1	ZP [15,Y]	Zone permission entries						ZP [8,Y]
…	…							…
15	ZP [127,Y]							ZP [120,Y]

The zone permission entry descriptor contains access permission for a zone group (Y) as defined in section 4.9.3 Table 1. For CONFIGURE ZONE PERMISSION request the following rules apply:

a) Zone permission entries shall be ignored for ZP[X, Y] where X < Y.
b) Zone permission entries shall be ignored for special groups ZP[1, Y] and ZP[0, Y].
c) Zone permission entries are undefined for reserved groups ZP[7..2, Y].

The CRC field is defined in 7.8.1.

Table 22 defines the CONFIGURE ZONE PERMISSION response format.

Table 22 – CONFIGURE ZONE PERMISSION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (83h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH (00h)							
4	(MSB)	CRC						
7								(LSB)

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

The FUNCTION field shall be set to 83h.

The FUNCTION RESULT field is defined in Section 10.4.3.2.

The RESPONSE LENGTH field shall be set to 00h.

The CRC field is defined in 7.8.1.

... 10.4.3.15 REPORT ZONE PERMISSION function

The REPORT ZONE PERMISSION function returns a set of zone permission table entries. This function shall be supported by all zoning devices and shall only be issued by zone supervisor devices. The value of the ACCESS ZONE MANAGEMENT bit in the OPEN request shall be used to determine the function result as shown in section 7.8.3 Table 10.

Table 23 defines the REPORT ZONE PERMISSION request format.

Table 23 – REPORT ZONE PERMISSION request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (03h)							
2	Reserved							
3	REQUEST LENGTH (01h)							
4	Reserved							
5								
6	START SOURCE ZONE GROUP INDEX							
7	NUMBER OF ZONE PERMISSION ENTRIES							
8	(MSB)	CRC						
11								(LSB)

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

The FUNCTION field shall be set to 03h.

The REQUEST LENGTH field shall be set to 01h.

The START SOURCE ZONE GROUP INDEX field specifies the first source zone group being requested.

The NUMBER OF ZONE PERMISSION ENTRIES field specifies the number of zone permission entries being requested.

The CRC field is defined in 7.8.1.

Table 24 defines the REPORT ZONE PERMISSION response format.

Table 24 – REPORT ZONE PERMISSION response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (03h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	Reserved							
5								
6	START SOURCE ZONE GROUP INDEX							
7	Reserved		NUMBER OF ZONE PERMISSION ENTRIES ((n – 11) / 16)					
8	First ZONE PERMISSION entry descriptor (See Table 21)							
23								
…	…							
n - 19	Last ZONE PERMISSION entry descriptor (See Table 21)							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 03h.

The FUNCTION RESULT field is defined in section 10.4.3.2.

The RESPONSE LENGTH field shall be set to ((n - 7) / 4).

The START ZONE ENTRY INDEX field indicates the first source zone group being returned in the first zone permission table entry descriptor.

The NUMBER OF ZONE PERMISSION ENTRIES field indicates the number of zone permission entry descriptors being returned ((n – 11) / 16).

Table 21 defines the zone permission entry descriptor format. If the phy indexed by the PHY IDENTIFIER field does not exist then response shall return a function result of PHY DOES NOT EXIST in the response frame. (See section 10.4.3.2).

The CRC field is defined in 7.8.1.

... 10.4.3.16 REPORT ZONE ROUTE TABLE function

The REPORT ZONE ROUTE TABLE request requires a zoning expander device to respond with zone information about each phy. This function shall be supported by all zoning devices and shall

only be issued by zone supervisor devices. The value of the ACCESS ZONE MANAGEMENT bit in the OPEN request shall be used to determine the function result as shown in section 7.8.3 Table 10.

Table 25 defines the REPORT ZONE ROUTE TABLE request format.

Table 25 –REPORT ZONE ROUTE TABLE request

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (40h)							
1	FUNCTION (14h)							
2	REQUEST LENGTH (02h)							
3								
4	NUMBER OF ZONE ROUTE TABLE ENTRIES							
5	PHY IDENTIFIER							
6	(MSB)	STARTING PHY ROUTE INDEX						
7								(LSB)
8		Reserved						
11								
12	(MSB)	CRC						
15								(LSB)

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

The FUNCTION field shall be set to 14h.

The REQUEST LENGTH field shall be set to 02h.

The NUMBER OF ZONE ROUTE TABLE ENTRIES field specifies the number of zone route table entries requested starting from the value specified by the STARTING PHY ROUTE INDEX field for the phy specified by the PHY IDENTIFIER field.

The PHY IDENTIFIER field specifies the phy for which the expander zone route entries are being requested.

The STARTING PHY ROUTE INDEX field specifies the first phy route entry of the zone route table descriptor entry being requested.

The CRC field is defined in 7.8.1.

The REPORT ZONE ROUTE TABLE response provides zone information about each phy. This function shall be supported by all zoning devices. The value of the ACCESS ZONE MANAGEMENT bit in the OPEN request shall be used to determine the function result as shown in section 7.8.3 Table 10.

Table 26 defines the REPORT ZONE ROUTE TABLE response format.

Table 26 –REPORT ZONE ROUTE TABLE response

Byte\Bit	7	6	5	4	3	2	1	0
0	SMP FRAME TYPE (41h)							
1	FUNCTION (14h)							
2	FUNCTION RESULT							
3	RESPONSE LENGTH ((n - 7) / 4)							
4	NUMBER OF ZONE ROUTE TABLE ENTRIES ((n – 15) / 12)							
5	PHY IDENTIFIER							
6	(MSB)	STARTING PHY ROUTE INDEX						
7								(LSB)
8	Reserved							
11								
12	First ZONE ROUTE TABLE entry descriptor (see Table 27)							
23								
…	…							
n - 15	Last ZONE ROUTE TABLE entry descriptor (see Table 27)							
n - 4								
n - 3	(MSB)	CRC						
n								(LSB)

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

The FUNCTION field shall be set to 14h.

The FUNCTION RESULT field is defined in 10.4.3.2.

The RESPONSE LENGTH field shall be set to ((n - 7) / 4).

The NUMBER OF ZONE ROUTE TABLE ENTRIES field indicates the number of zone route table entry descriptors being returned ((n – 15) / 12).

The PHY IDENTIFIER field indicates the phy for which the expander zone route entry is being returned.

The STARTING PHY ROUTE INDEX field indicates the first phy route entry of the zone route table descriptor entry being returned.

Table 27 defines the ZONE ROUTE TABLE ENTRY DESCRIPTOR format. If the zone route table entry does not exist for the phy indexed by the PHY IDENTIFIER field then response shall return a function result of INDEX DOES NOT EXIST in the response frame. (See section 10.4.3.2).

The CRC field is defined in section 7.8.1.

Table 27 - Zone route table entry descriptor

Byte\Bit	7	6	5	4	3	2	1	0
0	DISABLE EXPANDER ROUTE ENTRY	ATTACHED DEVICE TYPE			Reserved			
1	Reserved			ZONE PARTICIPATING	ZONE SUPERVISING PRIORITY			
2	Reserved	ZONE GROUP						
3	Reserved							
4	ROUTED SAS ADDRESS							
11								

A DISABLE EXPANDER ROUTE ENTRY bit set to one indicates that ECM shall not use the expander zone route entry to route connection requests. (See section 4.6.7.3).

A DISABLE EXPANDER ROUTE ENTRY bit set to zero indicates that the ECM shall use the expander zone route entry to route connection requests.

The ATTACHED DEVICE TYPE field is defined in section 10.4.3.5.

The ZONE PARTICIPATING bit indicates that the phy is attached to another zoning device.

The ZONE SUPERVISING PRIORITY field is defined in section 10.4.3.5.

The ZONE GROUP field is defined in section 10.4.3.5.

The ROUTED SAS ADDRESS field contains the routed SAS address for the expander zone route entry being returned. (See section 4.6.7.3).