

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: T10/06-019r3 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.
- Revision 2 (Jan 12, 2006)
  - Removed support for broadcast address frame.
  - Addition of support for SMP SEND BROADCAST PRIMITIVES in place of the BROADCAST FRAME. Section 4.9.8.
  - Revised SMP CONFIGURE ZONE PERMISSION to remove BATCH command and support only zone permission entry descriptors. An update to permission entry ZP[ X, Y] shall update ZP[ Y, X] automatically. Section 10.4.3.14.
- Revision 3 (Feb 1, 2006)
  - Editorial changes advised on SAS zone management conference call.
  - Removed LAST REQUEST bit from SMP CONFIGURE ZONE PERMISSION request and SMP CONFIGURE PHY ZONE request, as these contain change lists, and so sending a BROADCAST (CHANGE) notification event after each request does not significantly increase traffic as opposed to having a mechanism to identify a sequence of requests and only making a notification on the last one.
  - Rewrite definitions for access zone management bit and zoning SMP function result field responses.

Changes between r2 and r3 are indicated by red text.

## References

SAS2r02, Serial Attached SCSI - 2 (SAS-2)  
T10/05-144r9 SAS-2 Zoning  
T10/06-082r0 SAS-2 Zoning related SMP functions

## 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.

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### 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 the zone group of an initiating phy and the zone group of the destination phy.

**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 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 functions.

**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 [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

[\[New Section\]](#)

### . 4.9 Zoning

#### .. 4.9.1 Zoning overview

SAS zoning is implemented by a set of zoning expander devices that 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 zone group of a source port and the zone group of a target port. There are 128 zone groups.

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

The zone route table is an extended version of the expander route table (see 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.

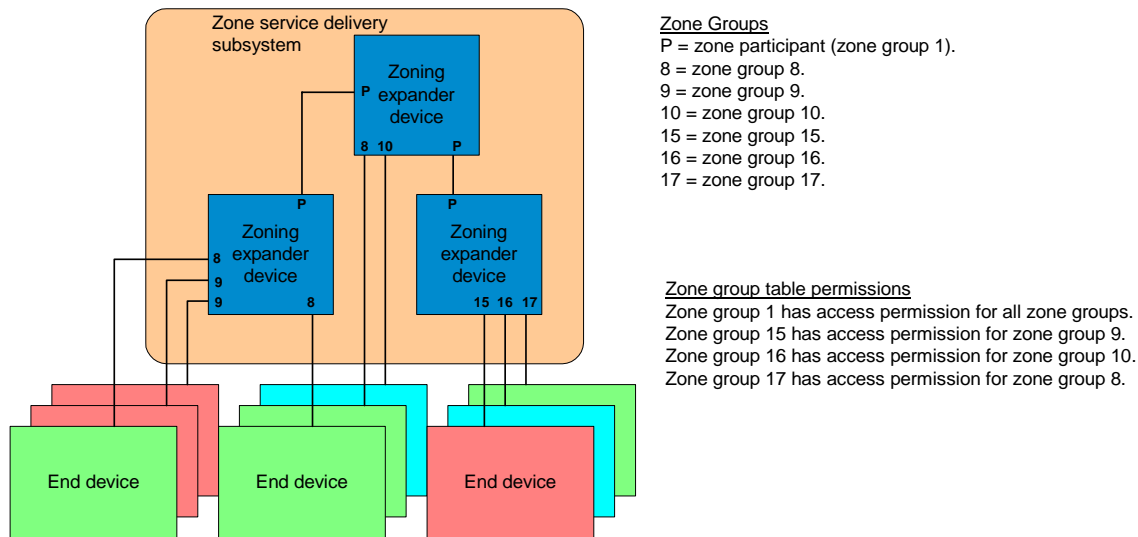


Figure 1 - ZSDS

#### .. 4.9.2 Zoning expander device requirements

A zoning expander device shall support the following attributes:

- contains an SMP initiator and SMP target (see 4.6.1);
- allows or denies connection requests following the zoning permissions;
- self-configuring;
- supports all zoning related SMP functions;
- contains a zone permission table that supports 128 zone groups (see [4.9.3.3](#)); and
- contains a zone expander zone route table (see [4.9.3.4](#)).
- sets the ZONE DEVICE bit to one in its SMP REPORT GENERAL response.

The proper configuration of zoning expander devices depends on the presence of at least one zone supervisor device (see 3.1.264) in the ZSDS. This dependency may be satisfied by including the supervisor device in one or more of the zoning expander devices in the ZSDS.

#### .. 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:

- SMP CONFIGURE PHY ZONE (see [10.4.3.13](#));
- SMP CONFIGURE ZONE PERMISSION (see [10.4.3.14](#));
- SMP REPORT ZONE PERMISSION (see [10.4.3.15](#)); and
- SMP REPORT ZONE ROUTE TABLE (see [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 [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 between 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 source 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
<b>0</b>	0	1	0	...	0	0	...	0
<b>1</b>	1	1	1	...	1	1	...	1
<b>2</b>	0	1	Reserved	...	Reserved	Reserved	...	Reserved
...	...	...	...	...	...	...	...	...
<b>7</b>	0	1	Reserved	...	Reserved	Reserved	...	Reserved
<b>8</b>	0	1	Reserved	...	Reserved	ZP[8, 8]	...	ZP[127, 8]
...	...	...	...	...	...	...	...	...
<b>127</b>	0	1	Reserved	...	Reserved	ZP[8, 127]	...	ZP[127, 127]

Note: Gray shading highlights user configurable zone groups.

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).

When a value is written to ZP[ X, Y ] then ZP[ Y, X ] is updated with the same value.

Zone group 0 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).

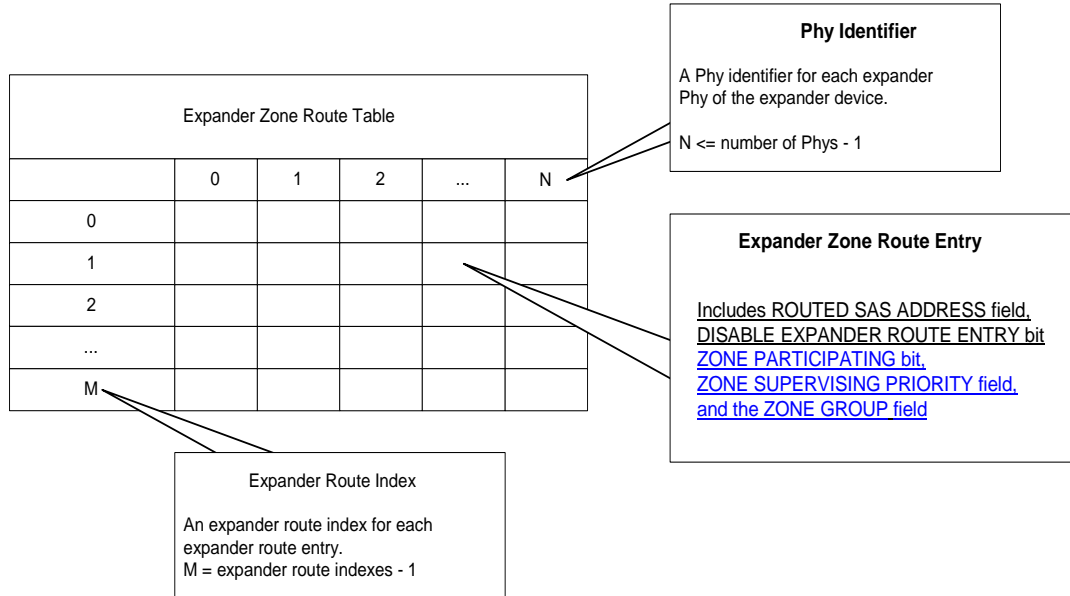
Zone group 1 shall access all other zone groups. (i.e. ZP[0.127, 1] shall be set to one).

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 zone group of the source port and the zone group of the target port. 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 initiating phy shall be set to one (see 7.2.5.11).

When an OPEN request is received on a phy with the ZONE PARTICIPATING bit set to zero (e.g. the initiating 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**

<b>Expander routing attribute (see 4.6.7.1)</b>	<b>Target zone group permission</b>
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.

When an OPEN request is send on a phy with the ZONE PARTICIPATING bit set to zero (e.g. the target device resides outside the ZSDS) the SOURCE ZONE GROUP field and the ACCESS ZONE MANAGEMENT field shall be set to zero.

#### .. **4.9.4 Zone supervisor devices**

##### ... **4.9.4.1 Zone supervisor priority**

When a zone supervisor device reports a ZONE SUPERVISING PRIORITY field value greater than zero in the SMP REPORT GENERAL response, or a phy reports a ZONE SUPERVISING PRIORITY field value greater than zero in the SMP DISCOVER response, the zone supervisor device is eligible for active zone supervisor device.

##### ... **4.9.4.2 Active zone supervisor**

The active zone supervisor device shall be the only zone supervisor device permitted to issue SMP CONFIGURE ZONE PERMISSION request and SMP CONFIGURE PHY ZONE request. If a zone supervisor device that is not the active zone supervisor device issues an SMP CONFIGURE ZONE PERMISSION request or an SMP CONFIGURE PHY ZONE request then if the access zone management bit is set to one the function result shall be SMP FUNCTION FAILED. If the access zone management bit is set to zero than the function result shall be UNKNOWN SMP FUNCTION (see 4.9.5).

The active zone supervisor device may issue SMP REPORT ZONE PERMISSION request and SMP REPORT ZONE ROUTE TABLE request.

A zone supervisor device that is not the active zone supervisor device may issue SMP REPORT ZONE PERMISSION request and SMP REPORT ZONE ROUTE TABLE request under the following conditions;

- a) the ACCESS ZONE MANAGEMENT bit is set to one in the OPEN address frame; or
- b) the ZONE PARTICIPATING bit is set to zero and the zone supervising priority field is not zero.

In all other cases the function response shall be UNKNOWN SMP FUNCTION.

##### ... **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 and then sends BROADCAST (CHANGE) (see 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 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 in the SMP REPORT GENERAL response 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**

<b>ZONE SUPERVISING PRIORITY</b>	<b>Description</b>
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

The ACCESS ZONE MANAGEMENT bit in the OPEN address frame indicates that a supervisor zone devices has a zone supervising priority value greater than zero and may issue SMP REPORT ZONE PERMISSION and SMP REPORT ZONE ROUTE TABLE requests. If the ACCESS ZONE MANAGEMENT bit is set to one then the function result for SMP REPORT ZONE PERMISSION response and SMP REPORT ZONE ROUTE TABLE response shall be SMP FUNCTION ACCEPTED. If the ACCESS ZONE MANAGEMENT bit is set to zero then the function result shall be UNKNOWN SMP FUNCTION.

A zone supervisor device that is not the active zone supervisor device should not make SMP CONFIGURE ZONE PERMISSION or SMP CONFIGURE PHY ZONE requests. If a supervisor device that is not the active zone supervisor device makes an SMP CONFIGURE ZONE PERMISSION request or an SMP CONFIGURE PHY ZONE requests and the ACCESS ZONE MANAGEMENT bit is set to one then the function result for SMP CONFIGURE ZONE PERMISSION response or SMP CONFIGURE PHY ZONE response shall be SMP FUNCTION FAILED. If the ACCESS ZONE MANAGEMENT bit is set to zero then the function result shall be UNKNOWN SMP FUNCTION.

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 [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 [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 as if the ACCESS ZONE MANAGEMENT bit is set to one in the OPEN address frame and ignore the value of the ACCESS ZONE MANAGEMENT bit in the OPEN address frame. 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 shall be originated by the active zone supervisor device.

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

The SMP CONFIGURE PHY ZONE function requests change to the zoning attributes for phys in a zoning expander device (see [10.4.3.13](#)).

.. **4.9.7 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.

.. **4.9.8 BROADCAST events**

When a zoning expander device receives a BROADCAST primitive or an SMP SEND BROADCAST PRIMITIVE request then zoning expander devices shall process the broadcast notification and for all other ports send either;

- a) an SMP SEND BROADCAST PRIMITIVE request on ports with ZONE PARTICIPATING bit set to one and zone permission to access each of the zone groups listed in the received SMP SEND BROADCAST PRIMITIVE request; or
- b) the relevant BROADCAST primitive as defined in [7.2.5.4](#). on phys with ZONE PARTICIPATING bit set to zero and zone permission to access each of the zone groups listed in the received SMP SEND BROADCAST PRIMITIVE request.

[\[End of new Section\]](#)

[\[Start of suggested changes to existing sections\]](#)

## 7 Link layer...

### ... 7.2.5.11 OPEN\_REJECT

[Start of addition to existing table]

**Table 5 - Table 83 – 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 destination 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

...

### .. 7.8.3 OPEN address frame

Table 6 defines the OPEN address frame format used for connection requests.

**Table 6 – Table 95 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						(LSB)
3								
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						(LSB)
23								
24	MORE COMPATIBLE FEATURES							
27								
28	(MSB)	CRC						(LSB)
31								

...

An ACCESS ZONE MANAGEMENT bit set to one specifies that the OPEN request is from a zone supervisor device. If the ACCESS ZONE MANAGEMENT bit is set to zero then the request is from a

device that is not a zone supervisor device, or from a zone supervisor device with a zone supervisor priority of zero.

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).

...

## 10 Application layer...

### .. 10.4.3 SMP functions

#### ... 10.4.3.1 SMP function request frame format

...

[start of unchanged text from SAS2r2, included for context purposes only]

The FUNCTION field specifies which SMP function is being requested and is defined in table 190. 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 192.

[end of unchanged text from SAS2r2, included for context purposes only]

Table 7 - Table 190 – SMP functions (FUNCTION field)

Code	SMP function	Description	Reference
...			
02h	READ GPIO REGISTER	See SFF-8485	
03h	REPORT_ZONE_PERMISSION	Return zone permission table entries	10.4.3.15
04h – 0Fh	Reserved for general SMP input functions		
...			
13h	REPORT_ROUTE_INFORMATION	Return route table information	10.4.3.8
14h	REPORT_ZONE_ROUTE_TABLE	Return zone information about each phy	10.4.3.16
15h – 1Fh	Reserved for phy-based SMP input functions		
...			
81h	Reserved for a general SMP output function		
82h	WRITE GPIO REGISTER	See SFF-8485	
83h	CONFIGURE_ZONE_PERMISSION	Change zone permissions table	10.4.3.14
84h	Reserved for a general SMP output function		
85h	ORIGINATE_BROADCAST_PRIMITIVES	Send specified BROADCAST primitive on the phy or phys in the specified zone group or zone groups.	Defined in 06-082.r0 10.4.3.cc
86h – 8Fh	Reserved for a general SMP output functions		
...			
92h	PHY_TEST_FUNCTION	Request a test function by the specified phy	10.4.3.12
93h	CONFIGURE_PHY_ZONE	Change phy entries within a zone route table	10.4.3.13
94h – 9Fh	Reserved for phy-based SMP output functions		
...			

#### ... 10.4.3.2 SMP function response frame format

...

[Change to existing table shown in red]

**Table 8 - Table 192 – FUNCTION RESULT field**

Code	Name	SMP function(s)	Description
12h	ZONE GROUP INDEX DOES NOT EXIST	REPORT ZONE PERMISSION	The ZONE PERMISSION ENTRY descriptor indexed by the NUMBER OF ZONE ROUTE ENTRIES field in the SMP request frame does not exist (see 10.4.3.15) (i.e., the NUMBER OF ZONE PERMISSION ENTRIES field value added to the START SOURCE ZONE GROUP INDEX field value exceeds 127, the maximum number of zones, in the REPORT ZONE PERMISSION function).
13h	ZONE ROUTE INDEX DOES NOT EXIST	REPORT ZONE ROUTE INFORMATION	The ZONE ROUTE TABLE ENTRY descriptor indexed by the NUMBER OF ZONE ROUTE ENTRIES field in the SMP request frame does not exist (see 10.4.3.16) (i.e., the NUMBER OF ZONE ROUTE ENTRIES field value added to the STARTING PHY ROUTE INDEX field value exceeds 127, the maximum number of zones, in the REPORT ZONE ROUTE TABLE function).

...  
[End of change to existing table shown in red]

**10.4.3.3 REPORT GENERAL function**

Table 9 defines the response format.

**Table 9 – Table 194 - REPORT GENERAL response**

Byte\Bit	7	6	5	4	3	2	1	0
...	...							
10	ZONE DEVICE	Reserved				CONFIGURING	CONFIGURABLE ROUTE TABLE	
11	ACTIVE ZONE SUPERVISOR PRIORITY				ZONE SUPERVISING PRIORITY			
12	ENCLOSURE LOGICAL IDENTIFIER							
19	ENCLOSURE LOGICAL IDENTIFIER							
20	ACTIVE ZONE SUPERVISOR SAS ADDRESS							
27	ACTIVE ZONE SUPERVISOR SAS ADDRESS							
...	...							

The ZONE DEVICE bit shall be set to one if the device supports zoning (see 4.9). If the expander device does not support zoning, the ZONE DEVICE bit shall be set to zero.

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 10 defines the DISCOVER request format.

**Table 10 – Table 197 - DISCOVER request**

Byte\Bit	7	6	5	4	3	2	1	0
...	...							
8	Reserved							NO ZONE MASK
...	...							

...

When the NO ZONE MASK bit is set to one and the ACCESS ZONE MANAGEMENT bit is set to one in the OPEN address frame, the DISCOVER response shall report all phy connections. 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 or the ACCESS ZONE MANAGEMENT bit is set to one in the OPEN address frame, the DISCOVER response shall only report phys that have zone access permission to the phy indicated in the PHY IDENTIFIER field. All other phys shall return PHY VACANT in the FUNCTION RESULT field of the response. 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 11 defines the response format.

**Table 11 – Table 198 - DISCOVER response**

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

...

A ZONE VIOLATION bit set to one indicates that the phy sent an OPEN\_REJECT (ZONE VIOLATION) response to a prior DISCOVER command (see [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.

...

[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 **should** only be issued by the active zone supervisor device. **When a CONFIGURE PHY ZONE request is received the SOURCE**

SAS ADDRESS field in the OPEN request shall be verified to match the SAS address of the active zone supervisor device.

When a CONFIGURE PHY ZONE function is completed a BROADCAST (CHANGE) shall be sent on all phys.

Table 12 defines the CONFIGURE PHY ZONE request format.

**Table 12 – 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	Reserved	START PHY INDEX							
7	NUMBER OF ZONE PHY ENTRIES $((n - 11) / 2)$								
8	First phy zone configuration entry descriptor (see Table 13)								
9									
...	...								
m - 1	Last phy zone configuration entry descriptor (see Table 13)								
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  $((n - 7) / 4)$ .

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 13 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 13 - 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 specifies that the phy is attached to another zoning device. A ZONE PARTICIPATING bit set to zero specifies 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 14 defines the CONFIGURE PHY ZONE response format.

**Table 14 – 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						(LSB)	
7									

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

The FUNCTION field shall be set to 93h.

The FUNCTION RESULT field shall contain SMP FUNCTION ACCEPTED if the request is originated by the active zone supervisor device. If the request is not from the active zone supervisor device then the FUNCTION RESULT field shall be set as defined in [4.9.5](#).

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 for a zone group. This function shall be supported by all zoning devices and **should** only be issued by the active zone supervisor device. **When a CONFIGURE PHY PERMISSION request is received the SOURCE SAS ADDRESS field in the OPEN request shall be verified to match the SAS address of the active zone supervisor device.**

**When a CONFIGURE PHY PERMISSION function is completed a BROADCAST (CHANGE) shall be sent on all phys.**

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 15 defines the CONFIGURE ZONE PERMISSION request format.

**Table 15 – 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							
8								
9	ZONE SUPERVISING PRIORITY <sup>a</sup>				Reserved	UPDATE PRIORITY	Reserved	
10	Reserved	START SOURCE ZONE GROUP INDEX						
11	Reserved		NUMBER OF ZONE PERMISSION ENTRIES $((n - 15) / 16)$					
12	First zone permission entry descriptor (See Table 16)							
27								
...	...							
n - 20	Last zone permission entry descriptor (See Table 16)							
n - 4								
n - 3	(MSB)	CRC						(LSB)
n								

<sup>a</sup> This field is ignored if the UPDATE PRIORITY 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 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.

The START SOURCE ZONE GROUP INDEX specifies the first source zone group to be written with the first zone permission entry descriptor.

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

Table 16 defines the zone permission entry descriptor format.

**Table 16 - 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]							ZP [8,Y]	
...	Zone permission entries							...	
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:

- Zone permission entries shall be ignored for special groups ZP[1, Y] and ZP[0, Y];
- Zone permission entries are undefined for reserved groups ZP[7..2, Y]; and
- Zone permission entries ZP[ X, Y ] shall apply the same value to ZP[ Y, X].

The CRC field is defined in 7.8.1.

**Table 17** defines the CONFIGURE ZONE PERMISSION response format.

**Table 17 – 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						(LSB)	
7									

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

The FUNCTION field shall be set to 83h.

The FUNCTION RESULT field shall contain SMP FUNCTION ACCEPTED if the request is originated by the active zone supervisor device. If the request is not from the active zone supervisor device then the function shall fail and the FUNCTION RESULT field shall be set as defined in [4.9.5](#).

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 should only be issued by the active zone supervisor device with zone supervisor priority greater than zero.

Table 18 defines the REPORT ZONE PERMISSION request format.

**Table 18 – 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 zone group of the first zone permission entry table 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 19 defines the REPORT ZONE PERMISSION response format.

**Table 19 – 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 16)							
23								
...	...							
n - 19	Last ZONE PERMISSION entry descriptor (See Table 16)							
n - 4								
n - 3	(MSB)		CRC				(LSB)	
n								

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

The FUNCTION field shall be set to 03h.

The FUNCTION RESULT field shall contain SMP FUNCTION ACCEPTED if the ACCESS ZONE MANAGEMENT field in the OPEN request is greater than zero. If the ACCESS ZONE MANAGEMENT field in the OPEN request is zero then the FUNCTION RESULT field shall be set as defined in [4.9.5](#).

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

The START ZONE ENTRY INDEX field indicates the zone group of the first zone permission entry 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 16 defines the zone permission entry descriptor format. If the zone permission entry indexed from the START SOURCE ZONE GROUP INDEX field does not exist then response shall return a function result of ZONE GROUP INDEX DOES NOT EXIST in the response frame (see [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 **should only be issued by a zone supervisor device with zone supervisor priority greater than zero.**

Table 20 defines the REPORT ZONE ROUTE TABLE request format.

**Table 20 –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						(LSB)
7								
8								
11	Reserved							
12	(MSB)	CRC						(LSB)
15								

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.

Table 21 defines the REPORT ZONE ROUTE TABLE response format.

**Table 21 –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						(LSB)
7								
8	Reserved							
11								
12	First ZONE ROUTE TABLE entry descriptor (see Table 22)							
23								
...	...							
n - 15	Last ZONE ROUTE TABLE entry descriptor (see Table 22)							
n - 4								
n - 3	(MSB)	CRC						(LSB)
n								

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

The FUNCTION field shall be set to 14h.

The FUNCTION RESULT field shall contain SMP FUNCTION ACCEPTED if the ACCESS ZONE MANAGEMENT field in the OPEN request is greater than zero. If the ACCESS ZONE MANAGEMENT field in the OPEN request is zero then the FUNCTION RESULT field shall be set as defined in [4.9.5](#).

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 22 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 ZONE ROUTE INDEX DOES NOT EXIST in the response frame (see [10.4.3.2](#)).

The CRC field is defined in section 7.8.1.

**Table 22 - 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 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 4.6.7.3).