Date: 7/15/08

To: T10 Committee (SCSI)

From: George Penokie (LSI)

Subject: SAS-2 SL_CC transition wording fixes

1 Overview

Some of the transitions defined in the SL_CC state machine are unclear as to the actions the state machine is required to take before making the transition. To fix this the required actions should be moved to the states overview section.

2 SAS-2 changes

2.0.1 SL state machines overview

The SL (link layer for SAS logical phys) state machines control connections, handling both connection requests (OPEN address frames), CLOSEs, and BREAKs. The SL state machines are as follows:

a) SL_RA (receive OPEN address frame) state machine (see 2.0.3); and
b) SL_CC (connection control) state machine (see 2.0.4).

All the SL state machines shall begin after receiving an Enable Disable SAS Link (Enable) message from the SL_IR state machines.

If a state machine consists of multiple states, then the initial state is as indicated in the state machine description.

Figure shows the SL state machines.SL (link layer for SAS logical phys) state machines (part 1)

Figure shows the messages sent to the SL transmitter and received from the SL receiver.SL (link layer for SAS logical phys) state machines (part 2)

2.0.2 SL transmitter and receiver

The SL transmitter receives the following messages from the SL state machines specifying primitive sequences, frames, and dwords to transmit:

a) Transmit Idle Dword;
b) Transmit SOAF/Data Dwords/EOAF;
c) Transmit OPEN_ACCEPT;
d) Transmit OPEN_REJECT with an argument indicating the specific type (e.g., Transmit OPEN_REJECT (Retry));
e) Transmit BREAK;
f) Transmit BREAK_REPLY;
g) Transmit BROADCAST; and
h) Transmit CLOSE with an argument indicating the specific type (e.g., Transmit CLOSE (Normal)).

When the SL transmitter is requested to transmit a dword from any state within any of the SL state machines, it shall transmit that dword. If there are multiple requests to transmit, then the following priority should be followed when selecting the dword to transmit:

1) BREAK_REPLY;
2) BREAK;
3) CLOSE;
4) OPEN_ACCEPT or OPEN_REJECT;
5) SOAF or data dword or EOAF; and
6) idle dword.

When there is no outstanding message specifying a dword to transmit, the SL transmitter shall transmit idle dwords.

The SL transmitter sends the following message to the SL state machines based on dwords that have been transmitted:

a) SOAF/Data Dwords/EOAF Transmitted.

The SL receiver sends the following messages to the SL state machines indicating primitive sequences and dwords received from the SP_DWS receiver (see 6.9.2):

a) SOAF Received;
b) Data Dword Received;
c) EOAF Received;
d) BROADCAST Received with an argument indicating the specific type (e.g., BROADCAST Received (Change));
e) BREAK Received;
f) BREAK_REPLY Received;
g) OPEN_ACCEPT Received;
h) OPEN_REJECT Received with an argument indicating the specific type (e.g., OPEN_REJECT Received (No Destination));
i) AIP Received;
j) CLOSE Received with an argument indicating the specific type (e.g., CLOSE Received (Normal));
k) NOTIFY Received (Power Loss Expected);
l) ERROR Received; and
m) Invalid Dword Received.

The SL receiver shall ignore all other dwords.

The SL transmitter relationship to other transmitters is defined in 4.3.2. The SL receiver relationship to other receivers is defined in 4.3.3.

2.0.3 SL_RA (receive OPEN address frame) state machine

The SL_RA state machine's function is to receive address frames and determine if each received address frame is a valid OPEN address frame. This state machine consists of one state.

This state machine receives SOAFs, dwords of an OPEN address frames, and EOAFs.

This state machine shall ignore all messages except SOAF Received, Data Dword Received, and EOAF Received.

If this state machine receives a subsequent SOAF Received message after receiving an SOAF Received message but before receiving an EOAF Received message, then this state machine shall discard the Data Dword Received messages received before the subsequent SOAF Received message.

If this state machine receives more than eight Data Dword Received messages (i.e., 32 bytes) after an SOAF Received message and before an EOAF Received message, then this state machine shall discard the address frame.

If this state machine receives an Invalid Dword Received message or an ERROR Received message after an SOAF Received message and before an EOAF Received message, then this state machine shall either:

a) ignore the invalid dword or ERROR; or
b) discard the address frame.

After receiving an EOAF Received message, this state machine shall check if the address frame is a valid OPEN address frame.

This state machine shall accept an address frame if:

a) the ADDRESS FRAME TYPE field is set to 1h (i.e., OPEN);
b) the number of data dwords between the SOAF and EOAF is 8; and
c) the CRC field contains a good CRC.

Otherwise, this state machine shall discard the address frame. If the frame is not discarded then this state machine shall send a OPEN Address Frame Received message to the SL_CC0:Idle state and the

SL_CC1:ArbSel state with an argument that contains all the data dwords received in the OPEN address frame.

2.0.4 SL_CC (connection control) state machine

2.0.4.1 SL_CC state machine overview

The state machine consists of the following states:

a) SL_CC0:Idle (see 2.0.4.2)(initial state);
b) SL_CC1:ArbSel (see 2.0.4.3);
c) SL_CC2:Selected (see 2.0.4.4);
d) SL_CC3:Connected (see 2.0.4.5);
e) SL_CC4:DisconnectWait (see 2.0.4.6);
f) SL_CC5:BreakWait (see 2.0.4.7);
g) SL_CC6:Break (see c)); and
h) SL_CC7:CloseSTP (see 1.0.4.9).

The state machine shall start in the SL_CC0:Idle state. The state machine shall transition to the SL_CC0:Idle state from any other state after receiving an Enable Disable SAS Link (Disable) message from the SL_IR state machines (see 7.10).

The SL_CC state machine receives the following messages from the SSP link layer state machine (see 7.17.8), the STP link layer state machine, and SMP link layer state machine (see 7.19.5):

a) Request Break; and
b) Request Close.

The SL_CC state machine sends the following messages to the SSP link layer state machine, the STP link layer state machine, and SMP link layer state machine:

a) Enable Disable SSP (Enable);
b) Enable Disable SSP (Disable);
c) Enable Disable STP (Enable);
d) Enable Disable STP (Disable);
e) Enable Disable SMP (Enable); and
f) Enable Disable SMP (Disable).

The SL_CC state machine receives the following messages from the SL_IR state machines (see 7.10):

a) Enable Disable SAS Link (Enable); and
b) Enable Disable SAS Link (Disable).

Any message received by a state that is not referred to in the description of that state or in this subclause shall be ignored.

If this state machine receives an Accept_Reject Opens (Accept SSP) request, then this state machine shall set the Reject SSP Opens state machine variable to NO. If this state machine receives an Accept_Reject Opens (Reject SSP) request, then this state machine shall set the Reject SSP Opens state machine variable to YES.

If this state machine receives an Accept_Reject Opens (Accept SMP) request, then this state machine shall set the Reject SMP Opens state machine variable to NO. If this state machine receives an Accept_Reject Opens (Reject SMP) request, then this state machine shall set the Reject SMP Opens state machine variable to YES.

If this state machine receives an Accept_Reject Opens (Accept STP) request, then this state machine shall set the Reject STP Opens state machine variable to NO. If this state machine receives an Accept_Reject Opens (Reject STP) request, then this state machine shall set the Reject STP Opens state machine variable to YES.

Any detection of an internal error shall cause the SL_CC state machine to transition to the SL_CC5:BreakWait state.

The SL_CC state machine shall maintain the timers listed in table 1.

Table 1 — SL_CC timers

Timer	Initial value
Open Timeout timer	1 ms
Close Timeout timer	1 ms
Break Timeout timer	1 ms

The SL_CC state machine shall maintain the state machine variables listed in table 2.

Table 2 — SL_CC state machine variables

State machine variable	Description
Reject SSP Opens	Used to determine if the SCSI application layer is permitting SSP connection requests to be accepted on this logical phy.
Reject SMP Opens	Used to determine if the management application layer is permitting SMP connection requests to be accepted on this logical phy.
Reject STP Opens	Used to determine if the ATA application layer is permitting STP connection requests to be accepted on this logical phy.

2.0.4.2 SL_CC0:Idle state

2.0.4.2.1 State description

This state is the initial state and is the state that is used when there is no connection pending or established.

Upon entry into this state, this state shall send:

a) an Enable Disable SSP (Disable) message to the SSP link layer state machines;
b) an Enable Disable SMP (Disable) message to the SMP link layer state machines;
c) an Enable Disable STP (Disable) message to the STP link layer state machines; and
d) a Connection Closed (Transition to Idle) confirmation to the port layer.

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter (see 7.4).

If a BROADCAST Received (Change) message, BROADCAST Received (Reserved Change 0) message, or BROADCAST Received (Reserved Change 1) message is received, then this state shall send a Change Received confirmation to the management application layer.

If a Transmit Broadcast request is received with any argument, then this state shall send a Transmit BROADCAST message with the same argument to the SL transmitter.

If a BREAK Received message is received and the BREAK_REPLY method of responding to received BREAK primitive sequences is enabled (see 7.13.5), then this state shall send a Transmit BREAK_REPLY message to the SL transmitter.

After this state receives an Enable Disable SAS Link (Enable) confirmation, this state shall:

a) set the Reject SSP Opens state machine variable to a vendor-specific default value (i.e., YES or NO);
b) set the Reject SMP Opens state machine variable to a vendor-specific default value (i.e., YES or NO); and
c) set the Reject STP Opens state machine variable to a vendor-specific default value (i.e., YES or NO).

If this state receives a NOTIFY Received (Power Loss Expected) message and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall send a Notify Received (Power Loss Expected) confirmation to the port layer.

2.0.4.2.2 Transition SL_CC0:Idle to SL_CC1:ArbSel

This transition shall occur after receiving both an Enable Disable SAS Link (Enable) confirmation and an Open Connection request. The Open Connection request includes these arguments:

a) initiator port bit;
b) protocol;
c) connection rate;
d) initiator connection tag.
e) destination SAS address;
f) source SAS address;
g) pathway blocked count; and
h) arbitration wait time.

2.0.4.2.3 Transition SL_CC0:Idle to SL_CC2:Selected

This transition shall occur after receiving both an Enable Disable SAS Link (Enable) confirmation and an OPEN Address Frame Received message.

2.0.4.3 SL_CC1:ArbSel state

2.0.4.3.1 State description

This state is used to make a connection request.

Upon entry into this state, this state shall:

1) request an OPEN address frame be transmitted by sending a Transmit SOAF/Data Dwords/EOAF message to the SL transmitter with the dwords containing the OPEN address frame with its fields set to the arguments received with the Open Connection request;
2) initialize and start the Open Timeout timer; and
3) request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter.

This state shall ignore OPEN_REJECT Received and OPEN_ACCEPT Received messages from the time a Transmit SOAF/Data Dwords/EOAF message is sent to the SL transmitter until an SOAF/Data Dwords/EOAF Transmitted message is received from the SL transmitter.

If a BROADCAST Received (Change) message, BROADCAST Received (Reserved Change 0) message, or BROADCAST Received (Reserved Change 1) message is received, then this state shall send a Change Received confirmation to the management application layer.

If an AIP Received message is received after requesting the OPEN address frame be transmitted, then this state shall reinitialize and restart the Open Timeout timer. The state machine shall not enforce a limit on the number of AIPs received.

If a Stop Arb request is received, then this state shall send an Open Failed (Port Layer Request) confirmation to the port layer.

If there is no response to the OPEN address frame before the Open Timeout timer expires, then this state shall send an Open Failed (Open Timeout Occurred) confirmation to the port layer.

If a BREAK Received message is received, then this state shall send an Open Failed (Break Received) confirmation to the port layer

If this state receives an OPEN_REJECT Received message listed in table 3 after transmitting the OPEN address frame, then this state shall send the corresponding Open Failed confirmation listed in table 3 to the port layer.

Table 3 — OPEN_REJECT Received message to Open Failed confirmation mapping

OPEN_REJECT Received message	Open Failed confirmation
OPEN_REJECT Received (Bad Destination)	Open Failed (Bad Destination)
OPEN_REJECT Received (Connection Rate Not Supported)	Open Failed (Connection Rate Not Supported)
OPEN_REJECT Received (Protocol Not Supported)	Open Failed (Protocol Not Supported)
OPEN_REJECT Received (Reserved Abandon 1)	Open Failed (Reserved Abandon 1)
OPEN_REJECT Received (Reserved Abandon 2)	Open Failed (Reserved Abandon 2)
OPEN_REJECT Received (Reserved Abandon 3)	Open Failed (Reserved Abandon 3)
OPEN_REJECT Received (STP Resources Busy)	Open Failed (STP Resources Busy)
OPEN_REJECT Received (Wrong Destination)	Open Failed (Wrong Destination)
OPEN_REJECT Received (Zone Violation)	Open Failed (Zone Violation)
OPEN_REJECT Received (No Destination)	Open Failed (No Destination)
OPEN_REJECT Received (Pathway Blocked)	Open Failed (Pathway Blocked)
OPEN_REJECT Received (Reserved Continue 0)	Open Failed (Reserved Continue 0)
OPEN_REJECT Received (Reserved Continue 1)	Open Failed (Reserved Continue 1)
OPEN_REJECT Received (Reserved Initialize 0)	Open Failed (Reserved Initialize 0)
OPEN_REJECT Received (Reserved Initialize 1)	Open Failed (Reserved Initialize 1)
OPEN_REJECT Received (Reserved Stop 0)	Open Failed (Reserved Stop 0)
OPEN_REJECT Received (Reserved Stop 1)	Open Failed (Reserved Stop 1)
OPEN_REJECT Received (Retry)	Open Failed (Retry)

2.0.4.3.2 Transition SL_CC1:ArbSel to SL_CC0:Idle

This transition shall occur after sending an Open Failed confirmation.

2.0.4.3.3 Transition SL_CC1:ArbSel to SL_CC2:Selected

This transition shall occur after receiving a SOAF/Data Dwords/EOAF Transmitted message if:

a) one or more AIP Received messages have been received before an OPEN Address Frame Received message is received (i.e., the incoming OPEN address frame overrides the outgoing OPEN address frame); or
b) no AIP Received messages have been received before an OPEN Address Frame Received message is received, and the arbitration fairness rules (see 7.13.3) indicate the received OPEN address frame overrides the outgoing OPEN address frame.

The arbitration fairness comparison shall compare:

a) the value of the arbitration wait time argument in the Open Connection request for the outgoing OPEN address frame; and
b) the value of the ARBITRATION WAIT TIME field received in the incoming OPEN address frame.

2.0.4.3.4 Transition SL_CC1:ArbSel to SL_CC3:Connected

This transition shall occur if this state receives an SOAF/Data Dwords/EOAF Transmitted message followed by an OPEN_ACCEPT Received message.

If the PROTOCOL field in the transmitted OPEN address frame was set to STP, then this state shall send a Connection Opened (STP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open STP Connection argument. At this point an STP connection has been opened between the source phy and the destination phy.

If the PROTOCOL field in the transmitted OPEN address frame was set to SSP, then this state shall send a Connection Opened (SSP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open SSP Connection argument. At this point an SSP connection has been opened between the source phy and the destination phy.

If the PROTOCOL field in the transmitted OPEN address frame was set to SMP, then this state shall send a Connection Opened (SMP, Source Opened) confirmation to the port layer before the transition. This transition shall include an Open SMP Connection argument. At this point an SMP connection has been opened between the source phy and the destination phy.

2.0.4.3.5 Transition SL_CC1:ArbSel to SL_CC5:BreakWait

This transition shall occur after receiving a SOAF/Data Dwords/EOAF Transmitted message if a BREAK Received message has not been received and after:

a) ~~a Stop Arb request is received and after~~ sending an Open Failed (Port Layer Request) confirmation to the port layer;
b) ~~there is no response to the OPEN address frame before the Open Timeout timer expires and after~~ sending an Open Failed (Open Timeout Occurred) confirmation to the port layer; or
c) a NOTIFY Received (Power Loss Expected) message is received.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall include a Power Loss Expected argument.

2.0.4.3.6 Transition SL_CC1:ArbSel to SL_CC6:Break

This transition shall occur after:

a) receiving a SOAF/Data Dwords/EOAF Transmitted message;
b) receiving a BREAK Received message; and
c) sending an Open Failed (Break Received) confirmation to the port layer.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall include a Power Loss Expected argument.

2.0.4.4 SL_CC2:Selected state

2.0.4.4.1 State description

This state completes the establishment of an SSP, SMP, or STP connection when an incoming connection request has won arbitration by sending a Transmit OPEN_ACCEPT message, or rejects opening a connection by sending a Transmit OPEN_REJECT message to the SL transmitter.

This state shall respond to an incoming OPEN address frame using the following rules:

1) If the OPEN address frame DESTINATION SAS ADDRESS field does not match the SAS address of this port, then this state shall send a Transmit OPEN_REJECT (Wrong Destination) message to the SL transmitter (see 2.0.4.4.2);
2) If the OPEN address frame INITIATOR PORT bit, PROTOCOL field, FEATURES field, and/or INITIATOR CONNECTION TAG field are set to values that are not supported (e.g., a connection request from an SMP target port), then this state shall send a Transmit OPEN_REJECT (Protocol Not Supported) message to the SL transmitter (see 2.0.4.4.2);
3) If the OPEN address frame CONNECTION RATE field is set to a connection rate that is not supported, then this state shall send a Transmit OPEN_REJECT (Connection Rate Not Supported) message to the SL transmitter (see 2.0.4.4.2);

4) If the OPEN address frame PROTOCOL field is set to STP, the STP target port supports affiliations, and the source SAS address is not that of an STP initiator port with an affiliation established (see 7.18.4), then this state shall send a Transmit OPEN_REJECT (STP Resources Busy) message to the SL transmitter (see 2.0.4.4.2);
5) If the OPEN address frame PROTOCOL field is set to SSP and the Reject SSP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 2.0.4.4.2);
6) If the OPEN address frame PROTOCOL field is set to SMP and the Reject SMP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 2.0.4.4.2);
7) If the OPEN address frame PROTOCOL field is set to STP and the Reject STP Opens state machine variable is set to YES, then this state shall send a Transmit OPEN_REJECT (Retry) message to the SL transmitter (see 2.0.4.4.2);
8) If the OPEN address frame PROTOCOL field is set to SSP and the Reject SSP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (SSP, Destination Opened) confirmation to the port layer (see 2.0.4.4.3);
9) If the OPEN address frame PROTOCOL field is set to SMP and the Reject SMP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (SMP, Destination Opened) confirmation to the port layer (see 2.0.4.4.3); or
10) If the OPEN address frame PROTOCOL field is set to STP and the Reject STP Opens state machine variable is set to NO, then this state shall send a Transmit OPEN_ACCEPT message to the SL transmitter and send a Connection Opened (STP, Destination Opened) confirmation to the port layer (see 2.0.4.4.3).

If this state sends a Transmit OPEN_REJECT message to the SL transmitter, then it shall also send an Inbound Connection Rejected confirmation to the port layer.

NOTE 1 - Possible livelock scenarios occur if the BREAK_REPLY method of responding to BREAK primitive sequences is disabled and a SAS logical phy transmits BREAK to abort a connection request (e.g., if its Open Timeout timer expires). SAS logical phys should respond to OPEN Address frames faster than 1 ms to reduce susceptibility to this problem.

2.0.4.4.2 Transition SL_CC2:Selected to SL_CC0:Idle

This transition shall occur after sending a Transmit OPEN_REJECT message to the SL transmitter.

2.0.4.4.3 Transition SL_CC2:Selected to SL_CC3:Connected

This transition shall occur after sending a Connection Opened confirmation.

This transition shall include:

a) an Open SSP Connection, Open STP Connection, or Open SMP Connection argument based on the requested protocol; and
b) the received OPEN address frame.

2.0.4.4.4 Transition SL_CC2:Selected to SL_CC5:BreakWait

If the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this transition shall occur after receiving a NOTIFY Received (Power Loss Expected) message and shall include a Power Loss Expected argument.

2.0.4.4.5 Transition SL_CC2:Selected to SL_CC6:Break

This transition shall occur after a BREAK Received message is received.

2.0.4.5 SL_CC3:Connected state

2.0.4.5.1 State description

This state enables the SSP, STP, or SMP link layer state machine to transmit dwords during a connection. See 7.14 for details on rate matching during the connection.

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open SMP Connection, then this state shall send an Enable Disable SMP (Enable) message to the SMP link layer state machines (see 7.19.5).

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open SSP Connection, then this state shall send an Enable Disable SSP (Enable) message to the SSP link layer state machines (see 7.17.8).

If this state is entered from SL_CC1:ArbSel state or the SL_CC2:Selected state with an argument of Open STP Connection, then this state shall send an Enable Disable STP (Enable) message to the STP link layer state machines (see 7.18.8).

This state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword messages to the SL transmitter until the SSP, SMP, or STP link layer state machine starts transmitting.

A CLOSE Received message may be received at any time while in this state, but shall be ignored during SSP and SMP connections. If a CLOSE Received (Clear Affiliation) is received during an STP connection, then this state shall clear any affiliation (see 7.18.4).

If a Request Break message is received and a BREAK Received message has not been received, then this state shall send a Connection Closed (Break Requested) confirmation to the port layer.

If a BREAK Received message is received, then this state shall ~~send~~ send a Connection Closed (Break Received) confirmation to the port layer.

2.0.4.5.2 Transition SL_CC3:Connected to SL_CC4:DisconnectWait

This transition shall occur if a Request Close message is received.

2.0.4.5.3 Transition SL_CC3:Connected to SL_CC5:BreakWait

This transition shall occur after:

a) ~~after~~ sending a Connection Closed (Break Requested) confirmation to the port layer; or
b) ~~after~~ a NOTIFY Received (Power Loss Expected) message is received, if the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port)

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall include a Power Loss Expected argument.

2.0.4.5.4 Transition SL_CC3:Connected to SL_CC6:Break

This transition shall occur after sending a Connection Closed (Break Received) confirmation to the port layer.

2.0.4.5.5 Transition SL_CC3:Connected to SL_CC7:CloseSTP

This transition shall occur if a CLOSE Received message is received during an STP connection.

2.0.4.6 SL_CC4:DisconnectWait state

2.0.4.6.1 State description

This state closes the connection and releases all resources associated with the connection.

Upon entry into this state, this state shall:

1) send a Transmit CLOSE (Normal) message or Transmit CLOSE (Clear Affiliation) message to the SL transmitter (see 7.18.6); and
2) initialize and start the Close Timeout timer.

A CLOSE Received message may be received at any time while in this state. If a CLOSE Received (Clear Affiliation) is received during an STP connection, then this state shall clear any affiliation (see 7.18.4).

NOTE 2 - Possible livelock scenarios occur if the BREAK_REPLY method of responding to received BREAK primitive sequences is disabled and a SAS logical phy transmits BREAK to break a connection (e.g., if its Close Timeout timer expires). SAS logical phys should respond to CLOSE faster than 1 ms to reduce susceptibility to this problem.

If a CLOSE Received message is received, then this state shall send a Connection Closed (Normal) confirmation to the port layer.

If a BREAK Received message is received, then this state shall send a Connection Closed (Break Received) confirmation to the port layer.

If a BREAK Received message has not been received and no CLOSE Received message is received in response to a Transmit CLOSE message before the Close Timeout timer expires then this state shall send a Connection Closed (Close Timeout) confirmation to the port layer.

2.0.4.6.2 Transition SL_CC4:DisconnectWait to SL_CC0:Idle

This transition shall occur after~~:~~

a) ~~sending a Transmit CLOSE message to the SL transmitter;~~
b) ~~receiving a CLOSE Received message; and~~
c) sending a Connection Closed (Normal) confirmation to the port layer.

2.0.4.6.3 Transition SL_CC4:DisconnectWait to SL_CC5:BreakWait

This transition shall occur:

a) if a NOTIFY Received (Power Loss Expected) message is received or; ~~if:~~
a) ~~a BREAK Received message has not been received;~~
b) ~~no CLOSE Received message is received in response to a Transmit CLOSE message before the Close Timeout timer expires; and~~
c) after sending a Connection Closed (Close Timeout) confirmation to the port layer.

If a NOTIFY Received (Power Loss Expected) message was received and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port), then this state shall include a Power Loss Expected argument.

2.0.4.6.4 Transition SL_CC4:DisconnectWait to SL_CC6:Break

This transition shall occur after ~~receiving a BREAK Received message and after~~ sending a Connection Closed (Break Received) confirmation to the port layer.

2.0.4.7 SL_CC5:BreakWait state

2.0.4.7.1 State description

This state closes the connection if one is established and releases all resources associated with the connection.

Upon entry into this state, this state shall:

1) send a Transmit BREAK message to the SL transmitter; and
2) initialize and start the Break Timeout timer.

If this state:

a) is entered with a Power Loss Expected argument; or
b) receives a NOTIFY Received (Power Loss Expected) message and the SAS port that contains this state machine supports NOTIFY (Power Loss Expected) (e.g., the SAS port is an SSP target port),

then this state shall send a Notify Received (Power Loss Expected) confirmation to the port layer.

If a BREAK Received message is received and the BREAK_REPLY method of responding to received BREAK primitive sequences is enabled (see 7.13.5), then this state shall send a Transmit BREAK_REPLY message to the SL transmitter.

NOTE 3 - Some SAS logical phys compliant with previous versions of this standard send a Transmit OPEN_REJECT (Retry) message to the SL transmitter in response to each OPEN Address Frame Received message received while in this state.

2.0.4.7.2 Transition SL_CC5:BreakWait to SL_CC0:Idle

This transition shall occur after:

a) receiving a BREAK_REPLY Received message if the BREAK_REPLY method of responding to received BREAK primitive sequences is enabled (see 7.13.5);
b) receiving a BREAK Received message if the BREAK_REPLY method of responding to received BREAK primitive sequences is disabled (see 7.13.5); or
c) the Break Timeout timer expires.