Date: November 15, 2002

To: T10 Committee (SCSI)

From: George Penokie (IBM/Tivoli)

Subject: SSP Link Layer State Machine Rewrite

6.10.1 Transmission rules for SSP link layer state machine

When the SSP transmitter is requested to transmit a dword from any state within the SSP link layer state machine, it shall transmit that dword. If there are multiple requests to transmit primitives, the following priority should be followed when selecting the primitives:

1) ACK or NAK;
2) RRDY;
3) CREDIT_BLOCKED;
4) SOF, data frame, or EOF; then
5) DONE.

When the SSP transmitter has been requested to transmit a frame (i.e., SOF, the data dwords of the frame, and an EOF) and a primitive is requested to be transmitted while the frame is being transmitted, the SSP transmitter may transmit the indicated primitive by inserting the primitive between the frames' dwords. A DONE shall not be transmitted within a frame.

The SSP receiver shall detect ACK, NAK, RRDY, BREAK, DONE, and CREDIT_BLOCKED that are received during the connection (i.e., inside frames and between frames) (see 6.11.9.9).

6.10.2 Transmission rules for SAS link layer (SL) state machine

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

1) BREAK;
2) CLOSE;
3) OPEN_ACCEPT or OPEN_REJECT;
4) SOAF/OPEN address frame/EOAF; then
5) idle dword.

When the SL transmitter has been requested to transmit a OPEN address frame (i.e., SOAF, the data dwords of the OPEN address frame, and an EOAF) and a primitive is requested to be transmitted while the frame is being transmitted, the SL transmitter shall not transmit the indicated primitive by inserting the primitive between the frames' dwords.

The SL receiver shall ignore any primitive received inside an OPEN address frame. In this case, a dword shall be considered inside a frame when it is received after an SOAF and before an EOAF if the primitive is received after the 8th data dword following the SOAF.

6.10.3 Transmission rules for identification and hard reset (IR) state machine

When the IR transmitter is requested to transmit a dword from any state within the IR state machine, it shall transmit that dword. The following are primitives that may be transmitted by the IR transmitter:

a) HARD_RESET;
b) SOAF/IDENTIFY address frame/EOAF; or
c) idle dword.

When the IR transmitter has been requested to transmit an IDENTIFY address frame (i.e., SOAF, IDENTIFY address frame, and an EOAF) and a primitive is requested to be transmitted while the IDENTIFY address frame is being transmitted, the IR transmitter shall not transmit the indicated primitive by inserting the primitive between the frames' dwords.

The IR receiver shall ignore any primitive received inside an IDENTIFY address frame. In this case, a data dword shall be considered inside a frame when it is received after an SOAF and before an EOAF if the primitive is received after the 8th data dword following the SOAF.

6.11 SAS link layer state machine for initiator phys and target phys (SL)

6.11.1 Overview

The SAS link layer (SL) state machine controls connections, handling both connection requests (OPEN address frames), CLOSEs, and BREAKs. The state machine contains the following states:

a) SL0:Idle (see 6.11.2);
b) SL1:ArbSel (see 6.11.3);
c) SL2:Selected (see 6.11.4);
d) SL3:Connected (see 6.11.5);
e) SL4:DisconnectWait (see 6.11.6);
f) SL5:BreakWait (see 6.11.7); and
g) SL6:Break (see 6.11.8).

The state machine shall start in the SL0:Idle state. The state machine shall transition to the SL0:Idle state from any other state after receiving an Enable Disable SAS Link (Disable) parameter from the phy layer (see x.x.x) and sending an Enable Disable SAS Link (Disable) confirmation to the port layer.

The SL state machine receives the following requests from the port layer:

a) Open Connection;
b) Stop Arb;
c) Accept_Reject Opens (Accept); and
d) Accept_Reject Opens (Reject).

The SL state machine receives the following parameters from the SSP, STP, and SMP link layer state machines:

a) Request Break; and
b) Request Close.

The SL state machine sends the following parameters to the SSP, STP, and SMP link layer state machines:

a) Enable Disable SSP;
b) Enable Disable STP; and
c) Enable Disable SMP.

The SL state machine sends the following confirmations to the port layer:

a) Open Failed (Port Layer Request);
b) Open Failed (Open Timeout Occurred);
c) Open Failed (Break Received);
d) Open Failed (No Destination);
e) Open Failed (Bad Destination);
f) Open Failed (Wrong Destination);
g) Open Failed (Link Rate Not Supported);
h) Open Failed (Protocol Not Supported);
i) Open Failed (Retry);
j) Open Failed (STP Resources Busy);
k) Open Failed (Pathway Blocked);
l) Connection Opened (SSP, Source Opened);
m) Connection Opened (SSP, Destination Opened);
n) Connection Opened (STP, Source Opened);
o) Connection Opened (STP, Destination Opened);
p) Connection Opened (SMP, Source Opened);
q) Connection Opened (SMP, Destination Opened);

r) Connection Closed (Break Received);
s) Connection Closed (Link Broken);
t) Connection Closed (Close Timeout);
u) Connection Closed (Normal); and
v) Change Received.

The SL state machine sends no requests to the phy layer.

The SL state machine receives the following parameters from the phy layer (see x.x.x):

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

Unless otherwise stated within the state description, all disparity errors, illegal characters, and unexpected primitives (i.e., any primitive not described in the description of the SL state) received within any SL state shall be ignored and idle dwords shall be transmitted.

Any detection of an internal error shall cause the SL state machine to transition to the SL5:BreakWait state.

Figure 56 describes the SAS link layer state machine.

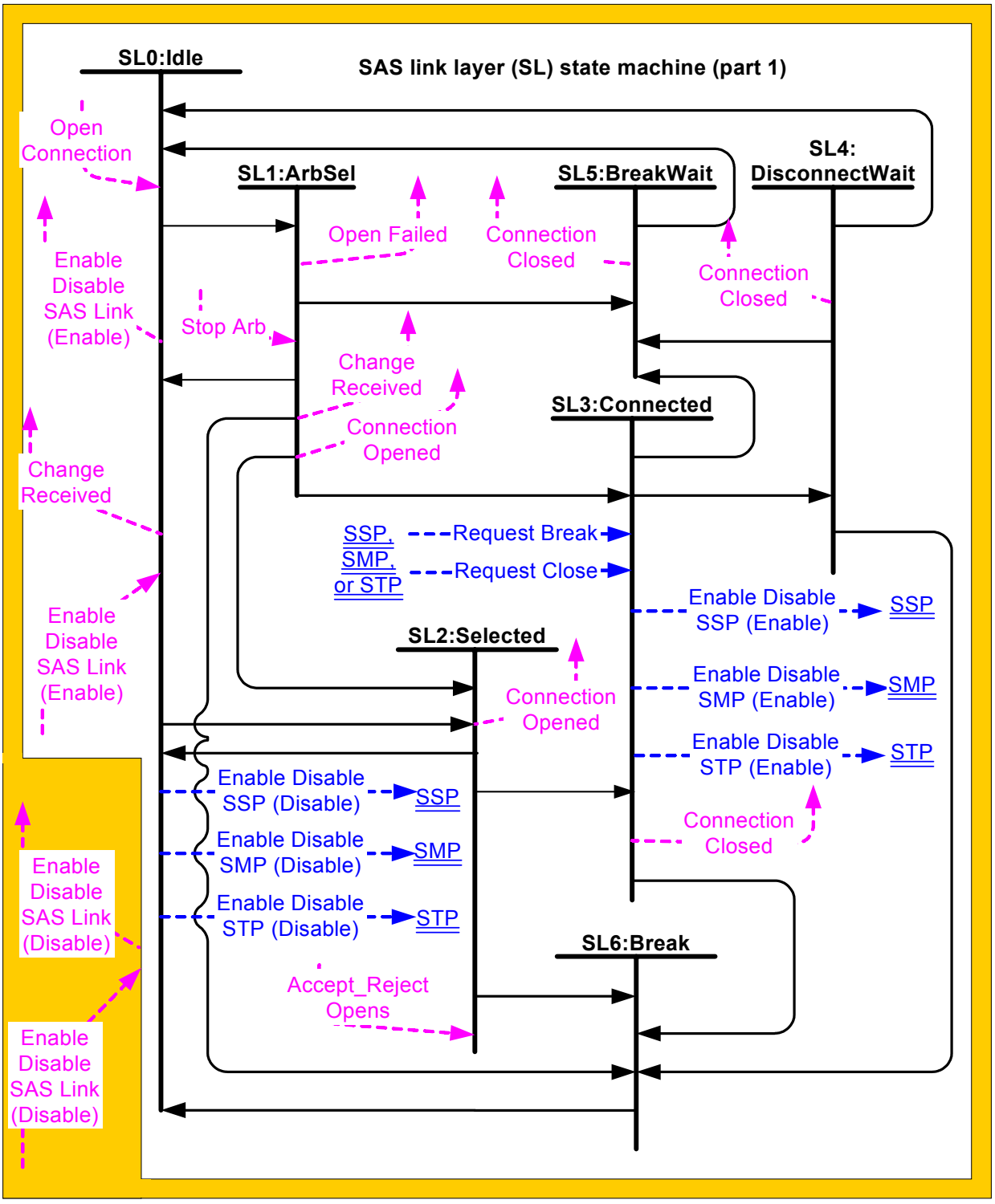

Figure 56 — SAS link layer (SL) state machine (part 1)

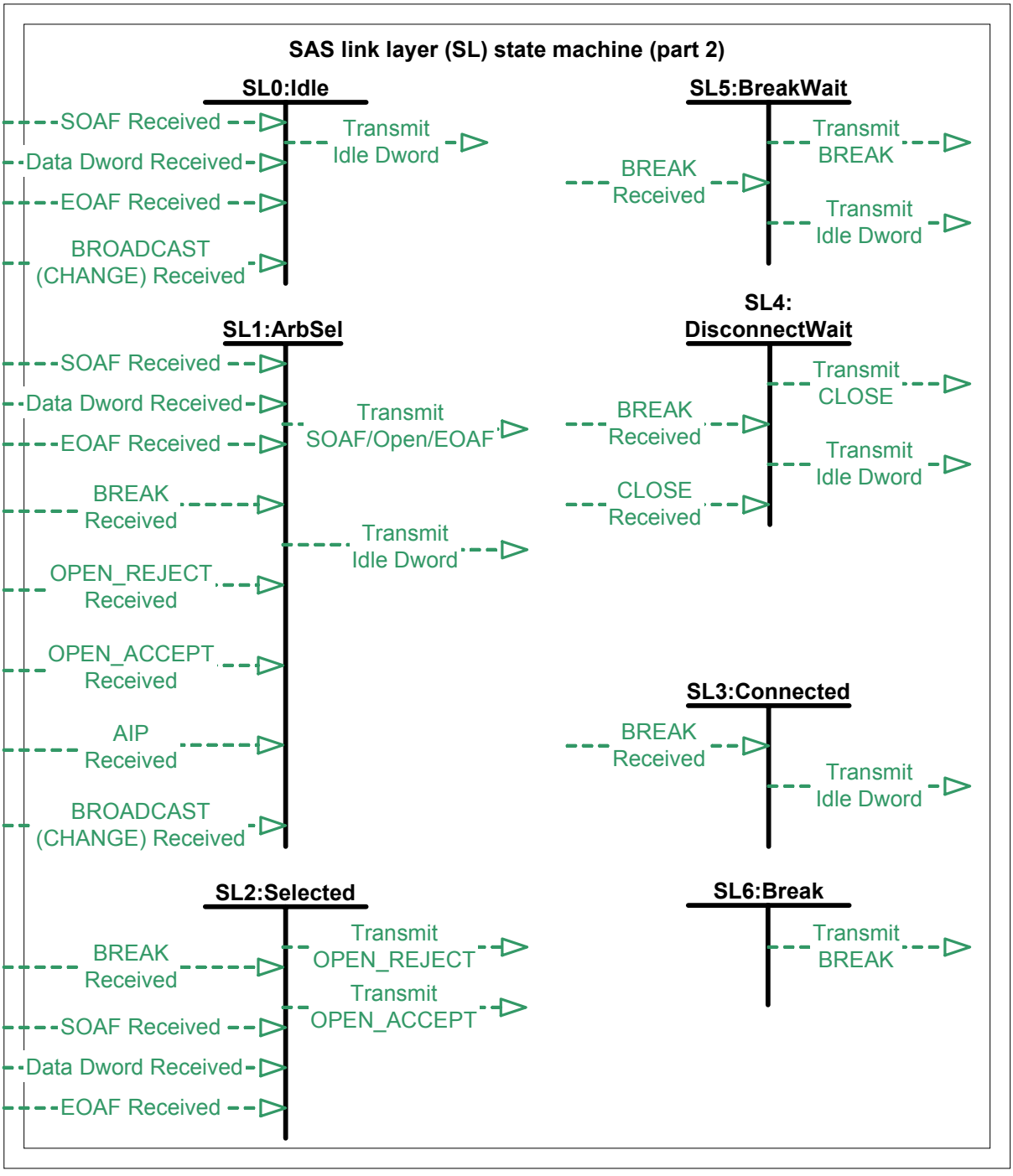

Figure 57 — SAS link layer (SL) state machine (part 2)

6.11.2 SL0:Idle state

6.11.2.1 State description

The SL0:Idle state is the initial state and is the state that is used when the SL state machine is activated and there is no active connection.

Upon entry to this state, this state shall send Enable Disable SSP (Disable), Enable Disable SMP (Disable), and Enable Disable STP (Disable) parameters to the SSP, SMP, and STP link layer state machines.

After an Enable Disable SSP Link (Enable) confirmation is received this state shall send an Enable Disable SSP Link (Enable) confirmation to the port layer.

This state shall request idle dwords be transmitted by repeatedly sending a Transmit Idle Dword parameter to the SL transmitter (see 7.3).

If a BROADCAST (CHANGE) Received parameter is received this state shall send a Change Received confirmation to the management layer.

An address frame (i.e., all the data dwords between an SOAF and EOAF) shall be discarded if any of the following conditions are true:

a) the number of data dwords between the SOAF and EOAF is not 8 data dwords; or
b) there is a CRC error.

If consecutive SOAF Received parameters are received without an intervening EOAF Received parameter (i.e., SOAF, data dwords, SOAF, data dwords, and EOAF instead of SOAF, data dwords, EOAF, SOAF, data dwords, and EOAF) then this state shall discard all data dwords between those SOAFs.

If the frame is discarded then no further action is taken by this state.

6.11.2.2 Transition SL0:Idle to SL1:ArbSel

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

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

6.11.2.3 Transition SL0:Idle to SL2:Selected

This transition shall occur after both an Enable Disable SAS Link (Enable) confirmation is received and a valid OPEN address frame is received.

A valid OPEN address frame is 8 data dwords long and has no CRC error (see 7.7.3).

6.11.3 SL1:ArbSel state

6.11.3.1 State description

This state is used to make a connection request.

This state shall:

1) request an OPEN address frame be transmitted by sending an Transmit SOAF/open/EOAF parameter to the SL transmitter with the address frame fields set to the arguments received with the Open Connection request;
2) initialize an open timeout timer to 1 ms, start the open timeout timer; and
3) request idle dwords be transmitted by repeatedly sending a Transmit Idle Dword parameter to the SL transmitter.

This state shall not respond to incoming BREAKs, OPEN_REJECTs, and OPEN_ACCEPTs until after the OPEN address frame has been transmitted.

If a BROADCAST (CHANGE) Received parameter is received this state shall send a Change Received confirmation to the management layer.

If an AIP Received parameter is received after requesting the OPEN address frame be transmitted, the open timeout timer shall be set to its initial value of 1 ms and resume counting. The state machine shall not enforce a limit on the number of AIPs received.

An address frame (i.e., all the data dwords between an SOAF and EOAF) shall be discarded if any of the following conditions are true:

a) the number of data dwords between the SOAF and EOAF is not 8 data dwords; or
b) there is a CRC error.

If consecutive SOAF Received parameters are received without an intervening EOAF Received parameter (i.e., SOAF, data dwords, SOAF, data dwords, and EOAF instead of SOAF, data dwords, EOAF, SOAF, data dwords, and EOAF) then this state shall discard all data dwords between those SOAFs.

If the frame is discarded then no further action is taken by this state relating to the invalid address frame.

6.11.3.2 Transition SL1:ArbSel to SL0:Idle

This transition shall occur after receiving an OPEN_REJECT Received parameter and after sending one of the following confirmations to the port layer:

a) If an OPEN_REJECT (NO DESTINATION) parameter is received this state shall send an Open Failed (No Destination) confirmation to the port layer;
b) If an OPEN_REJECT (BAD DESTINATION) parameter is received this state shall send an Open Failed (Bad Destination) confirmation to the port layer;
c) If an OPEN_REJECT (WRONG DESTINATION) parameter is received this state shall send an Open Failed (Wrong Destination) confirmation to the port layer;
d) If an OPEN_REJECT (LINK RATE NOT SUPPORTED) parameter is received this state shall send an Open Failed (Link Rate Not Supported) confirmation to the port layer;
e) If an OPEN_REJECT (PROTOCOL NOT SUPPORTED) parameter is received this state shall send an Open Failed (Protocol Not Supported) confirmation to the port layer;
f) If an OPEN_REJECT (RETRY) parameter is received this state shall send an Open Failed (Retry) confirmation to the port layer;
g) If an OPEN_REJECT (STP RESOURCES BUSY) parameter is received this state shall send an Open Failed (STP Resources Busy) confirmation to the port layer; or
h) If an OPEN_REJECT (PATHWAY BLOCKED) parameter is received this state shall send an Open Failed (Pathway Blocked) confirmation to the port layer.

6.11.3.3 Transition SL1:ArbSel to SL2:Selected

This transition shall occur:

a) If one or more AIP Received parameters have been received before a valid OPEN address frame is received. The incoming OPEN address frame shall then override the outgoing OPEN address frame; or
b) If no AIP Received parameters have been received before a valid OPEN address frame is received, and the arbitration fairness rules (see 7.12.3) indicate the received OPEN address frame overrides the outgoing OPEN address frame.

The arbitration fairness comparison shall use the value of the arbitration wait time argument to the Open Connection request for the outgoing OPEN address frame and the value of the ARBITRATION WAIT TIME field received in the incoming OPEN address frame.

A valid OPEN address frame is 8 data dwords long and has no CRC error (see 7.7.3).

6.11.3.4 Transition SL1:ArbSel to SL3:Connected

This transition shall occur if an OPEN_ACCEPT Received parameter is received.

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 pass the Open STP Connection argument to the SL3:Connected state. 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 pass the Open SSP Connection argument, Source Port Hashed Value argument (i.e.,

hashed value of the source port identifier), and the Destination Port Hashed Value argument (i.e., hashed value of the source destination identifier) to the SL3:Connected. 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 pass the Open SMP Connection argument, the Source Port Hashed Value argument (i.e., hashed value of the source port identifier), and the Destination Port Hashed Value argument (i.e., hashed value of the source destination identifier) to the SL3:Connected state. At this point an SMP connection has been opened between the source phy and the destination phy.

6.11.3.5 Transition SL1:ArbSel to SL5:BreakWait

This transition shall occur if a BREAK Received parameter 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; or
b) there is no response to the OPEN address frame within the open timeout and after sending an Open Failed (Open Timeout Occurred) confirmation to the port layer.

6.11.3.6 Transition SL1:ArbSel to SL6:Break

This transition shall occur after:

a) receiving a BREAK Received parameter; and
b) sending an Open Failed (Break Received) confirmation to the port layer.

6.11.4 SL2:Selected state

6.11.4.1 State description

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

While in this state, the SAS port accepts opening a connection between it and the destination SAS port by by requesting an OPEN_ACCEPT be transmitted by sending a Transmit OPEN_ACCEPT parameter to the SL transmitter.

This state may reject opening a connection by requesting an OPEN_REJECT be transmitted by sending a Transmit OPEN_REJECT parameter to the SL transmitter.

6.11.4.2 Transition SL2:Selected to SL0:Idle

This transition shall occur:

1) If the OPEN address frame DESTINATION SAS ADDRESS field does not match the SAS address of this device, then after this state requests an OPEN_REJECT (WRONG DESTINATION) be transmitted by sending a Transmit OPEN_REJECT (WRONG DESTINATION) parameter to the SL transmitter;
2) If the OPEN address frame PROTOCOL field is set to a protocol that is not supported, then after this state requests an OPEN_REJECT (PROTOCOL NOT SUPPORTED) be transmitted by sending a Transmit OPEN_REJECT (PROTOCOL NOT SUPPORTED) parameter the SL transmitter; or
3) If an Accept_Reject Opens (Reject) request is received, then after this state requests an OPEN_REJECT (RETRY) be transmitted by sending a Transmit OPEN_REJECT (RETRY) parameter to the SL transmitter.

6.11.4.3 Transition SL2:Selected to SL3:Connected

If the requested protocol is SSP and the port layer has not sent an Accept_Reject Opens (Reject) request then this transition shall occur after:

a) requesting an OPEN_ACCEPT be transmitted by sending a Transmit OPEN_ACCEPT parameter to the SL transmitter; and
b) sending a Connection Opened (SSP, Destination Opened) confirmation to the port layer.

This transition shall pass the Open SSP Connection argument to the SL3:Connected state. At this point an SSP connection has been opened between the source phy and the destination phy.

If the requested protocol is SMP and the port layer has not sent an Accept_Reject Opens (Reject) request then this transition shall occur after:

a) requesting an OPEN_ACCEPT be transmitted by sending a Transmit OPEN_ACCEPT parameter to the SL transmitter; and
b) sending a Connection Opened (SMP, Destination Opened) confirmation to the port layer.

This transition shall pass the Open SMP Connection argument to the SL3:Connected state. At this point an SMP connection has been opened between the source phy and the destination phy.

If the requested protocol is STP and the port layer has not sent an Accept_Reject Opens (Reject) request then this transition shall occur after:

a) requesting an OPEN_ACCEPT be transmitted by sending a Transmit OPEN_ACCEPT parameter to the SL transmitter; and
b) sending a Connection Opened (STP, Destination Opened) confirmation to the port layer.

This transition shall pass the Open STP Connection argument to the SL3:Connected state. At this point an STP connection has been opened between the source phy and the destination phy.

6.11.4.4 Transition SL2:Selected to SL6:Break

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

6.11.5 SL3:Connected state

6.11.5.1 State description

This state enables the SSP, STP, or SMP link layer state machine to transmit dwords during a connection.

If this state is entered from SL1:ArbSel state or the SL2:Selected state with an argument of Open SMP Connection then this state shall send an Enable Disable SMP (Enable) parameter to the SMP link layer state machines (see 6.12.4).

If this state is entered from SL1:ArbSel state or the SL2:Selected state with an argument of Open SSP Connection then this state shall send an Enable Disable SSP (Enable) parameter to the SSP link layer state machines (see 6.11.9).

If this state is entered from SL1:ArbSel state or the SL2:Selected state with an argument of Open STP Connection then this state shall send an Enable Disable STP (Enable) parameter to the STP link layer state machines.

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

6.11.5.2 Transition SL3:Connected to SL4:DisconnectWait

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

6.11.5.3 Transition SL3:Connected to SL5:BreakWait

This transition shall occur if a Request Break parameter is received and a BREAK Received parameter has not been received.

6.11.5.4 Transition SL3:Connected to SL6:Break

This transition shall occur if a BREAK Received parameter is received and after this state has sent a Connection Closed (Break Received) confirmation to the port layer.

6.11.6 SL4:DisconnectWait state

6.11.6.1 State description

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

This state:

1) shall request a CLOSE be transmitted by sending a Transmit CLOSE parameter to the SL transmitter;
2) requests three idle dwords be transmitted by sending at least three Transmit Idle Dword parameters to the SL transmitter; and
3) initialize a close timeout timer to 1 ms and start the timer.

A CLOSE Received parameter may be received at any time while in this state.

6.11.6.2 Transition SL4:DisconnectWait to SL0:Idle

This transition shall occur after:

a) requesting a CLOSE be transmitted by sending a Transmit CLOSE parameter to the SL transmitter;
b) receiving a CLOSE Received parameter; and
c) sending a Connection Closed (Normal) confirmation to the port layer.

6.11.6.3 Transition SL4:DisconnectWait to SL5:BreakWait

This transition shall occur if:

a) a BREAK Received parameter has not been received;
b) no CLOSE Received parameter is received in response to a Transmit CLOSE parameter within a close timeout; and
c) after sending a Connection Closed (Close Timeout) confirmation to the port layer.

6.11.6.4 Transition SL4:DisconnectWait to SL6:Break

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

6.11.7 SL5:BreakWait state

6.11.7.1 State description

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

This state shall:

1) shall request a BREAK be transmitted by sending a Transmit BREAK parameter to the SL transmitter;
2) request six idle dwords be transmitted by sending at least six Transmit Idle Dword parameters to the SL transmitter; and
3) initialize a break timeout timer to 1 ms and start the timer.

6.11.7.2 Transition SL5:BreakWait to SL0:Idle

This transition shall occur after receiving a BREAK Received parameter or if the break timeout is exceeded. If a BREAK Received parameter is not received before the timer is exceeded, this state shall send a Connection Closed (Link Broken) confirmation to the port layer before making this transition.

6.11.8 SL6:Break state

6.11.8.1 State description

This state closes any connection and releases all resources associated with this connection.

This state shall request a BREAK be transmitted by sending a Transmit BREAK parameter to the SL transmitter.

While in this state all primitives received shall be ignored.

6.11.8.2 Transition SL6:Break to SL0:Idle

This transition shall occur after sending a Transmit BREAK parameter to the SL transmitter.

6.11.9 SSP link layer (SSP) state machines

6.11.9.1 Overview

The SSP link layer contains several state machines that run in parallel to control the flow of dwords on the link during an SSP connection. The SSP link state machines are as follows:

a) Transmit Interlocked Frame Monitor (SSP_TIM state machine);
b) Transmit Frame Credit Monitor (SSP_TCM state machine);
c) DONE Control (SSP_D state machine);
d) Transmit Frame Control (SSP_TF state machine);
e) Receive Frame Control (SSP_RF state machine);
f) Receive Frame Credit Monitor (SSP_RCM state machine);
g) Receive Interlocked Frame Monitor (SSP_RIM state machine);
h) Transmit Credit Control (SSP_TC state machine); and
i) Transmit ACK/NAK Control (SSP_TAN state machine).

All the SSP state machines shall begin after receiving an Enable Disable SSP (Enable) parameter from the SL state machine (see 6.11).

All the SSP state machines shall stop after:

a) receiving an Enable Disable SSP (Disable) parameter from the SL state machine;
b) receiving a Request Close parameter from the SSP_D1:DONE_Wait state indicating that the connection shall be closed; or
c) receiving a Request Break parameter from the SSP_D1:DONE_Wait state indicating that a BREAK shall be transmitted.

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

The SSP_TIM state machine's function is to ensure that ACKs or NAKs are received for each transmitted frame before the ACK/NAK timeout. The SSP_TIM state machine contains the SSP_TIM1:Tx_Interlock_Monitor state (see 6.11.9.2).

The SSP_TCM state machine's function is to ensure that credit is available from the originator before a frame is transmitted. The SSP_TCM state machine contains the SSP_TCM1:Tx_credit_monitor state (see 6.11.9.3).

The SSP_D state machine's function is to ensure a DONE has been received and transmitted before the SL state machine disables the SSP state machines. The SSP_D state machine contains the SSP_D1:Done_Wait state (see 6.11.9.4).

The SSP_TF state machine's function it to control the sending of requests to transmit SOF, frame dwords, EOF, and a DONE. The SSP_TF state machine contains the following states:

a) Initial state: SSP_TF1:Connected_Idle state (see 6.11.9.5);
b) SSP_TF2:Tx_Wait state (see 6.11.9.6);
c) SSP_TF3:Indicate_Frame_Tx state (see 6.11.9.7); and

d) SSP_TF4:Indicate_DONE_Tx state (see 6.11.9.8).

The SSP_RF state machine's function is to receive frames and to determine if those frames were successful or unsuccessful received. The SSP_RF state machine contains the SSP_RF1:Rcv_Frame state (see 6.11.9.9).

The SSP_RCM state machine's function is to ensure that there was credit given to the originator for every frame that is received. The SSP_RCM state machine contains the SSP_RCM1:Rcv_Credit_Monitor state (see 6.11.9.10).

The SSP_RIM state machine's function is to inform the SSP_RF1:Rcv_Frame state when the number of ACKs and NAKs transmitted equals the number of the EOFs received. The SSP_RIM state machine contains the SSP_RIM1:Rcv_Interlock_Monitor state (see 6.11.9.11).

The SSP_TC state machine's function it to control the sending of requests to transmit an RRDY or CREDIT_BLOCKED. The SSP_TC state machine contains the following states:

a) Initial state: SSP_TC1:Idle state (see 6.11.9.12); and
b) SSP_TC2:Indicate_Credit_Tx state (see 6.11.9.13).

The SSP_TAN state machine's function is to control the sending of requests to transmit an ACK or NAK. The SSP_TAN state machine contains the following states:

a) Initial state: SSP_TAN1:Idle state (see 6.11.9.14); and
b) SSP_TAN2:Indicate_ACK/NAK_Tx state (see 6.11.9.15).

Figure 58 shows the SSP states related to frame transmission.

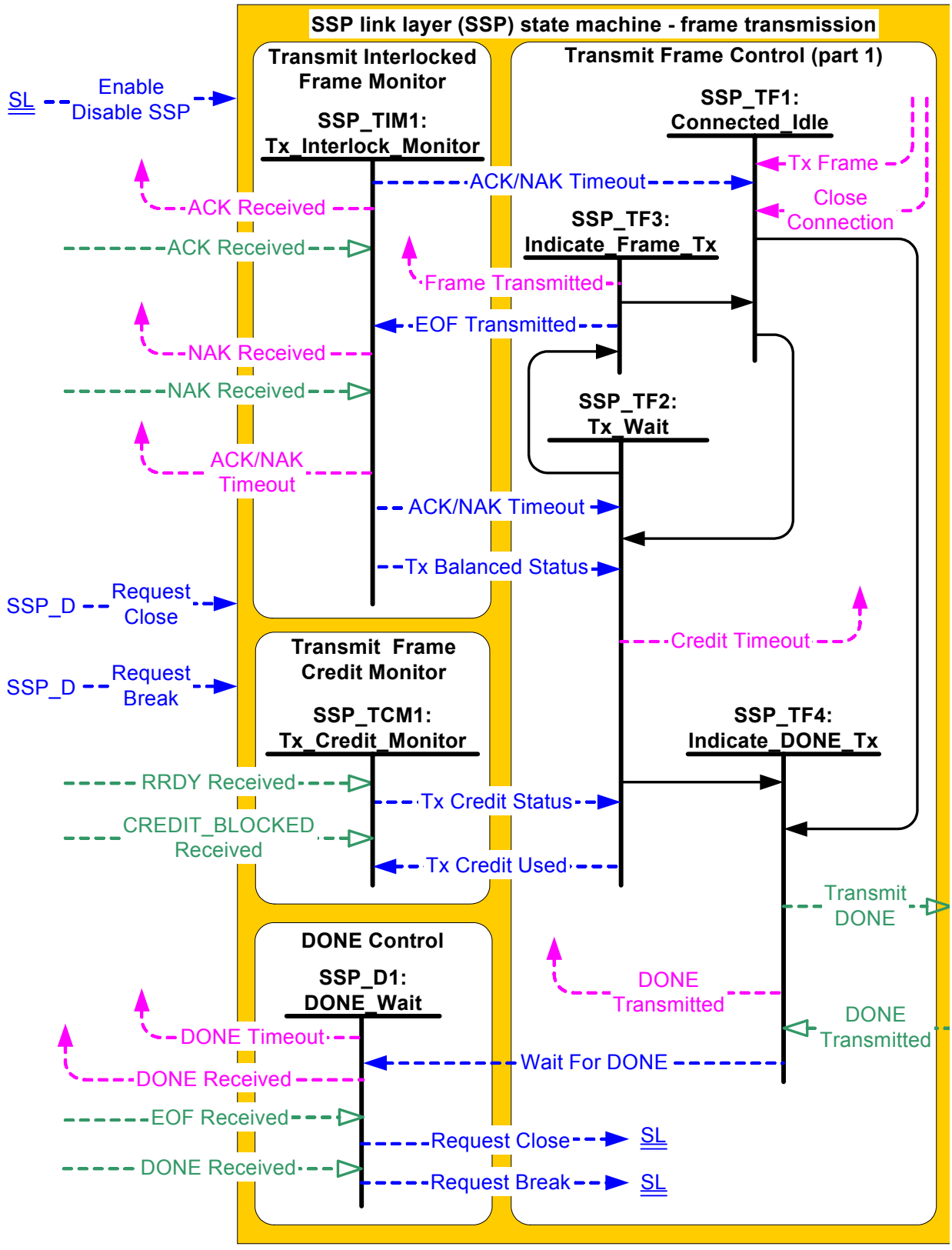

Figure 58 — SSP link layer (SSP) state machines (part 1 - frame transmission)

Figure 59 shows the SSP states related to frame reception.

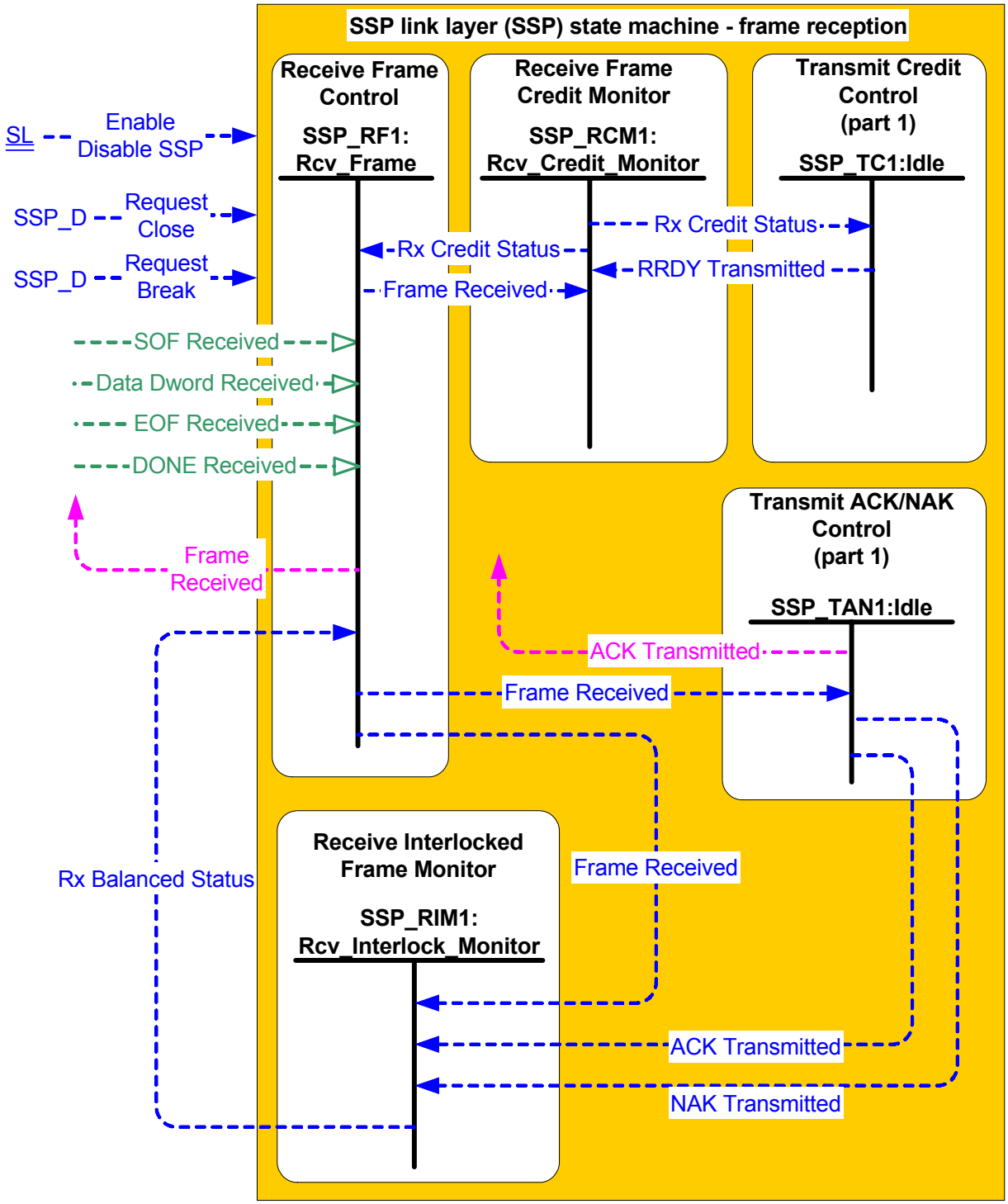

Figure 59 — SSP link layer (SSP) state machines (part 2 - frame reception)

Figure 60 shows the SSP states related to primitive transmission.

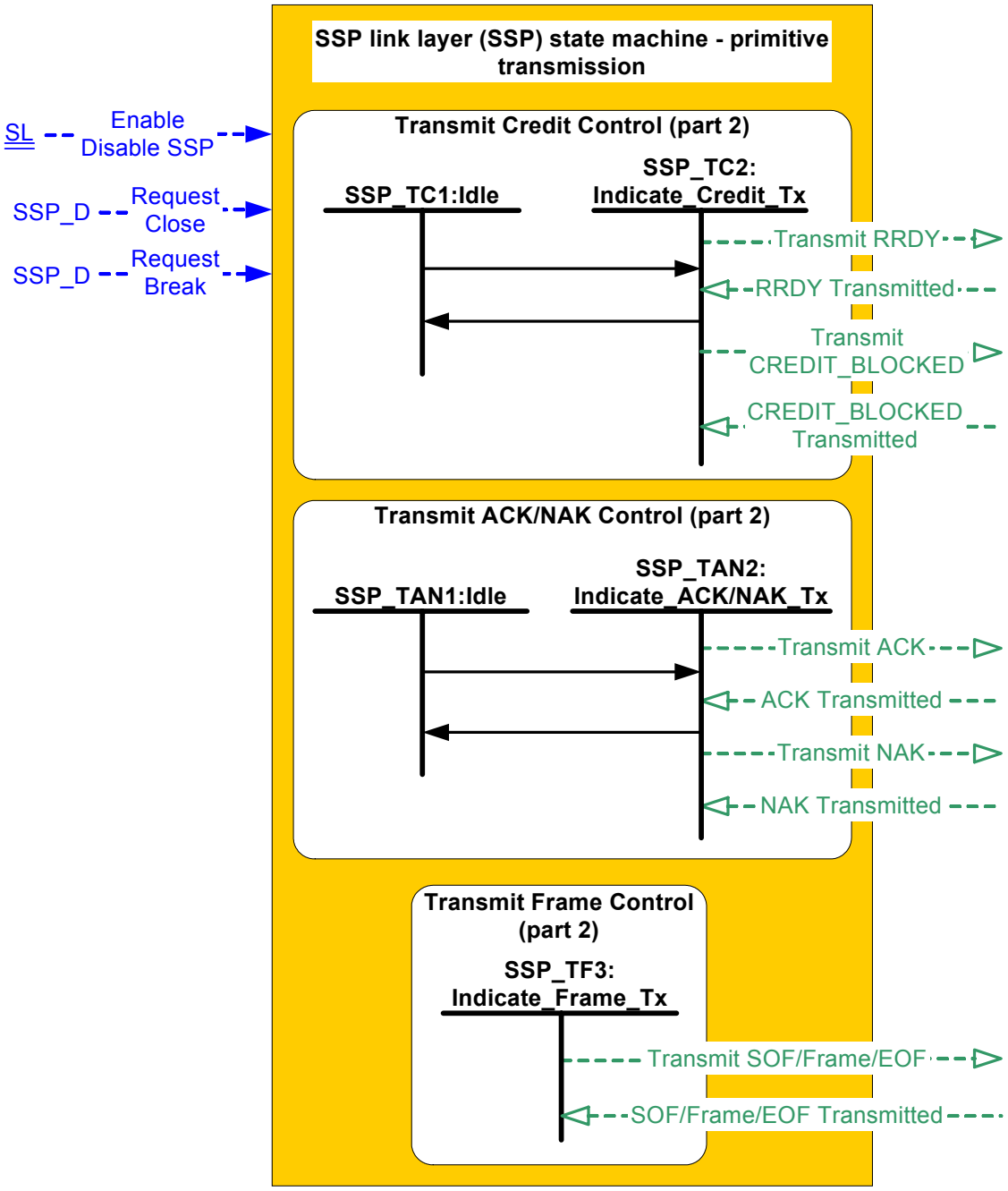

Figure 60 — SSP link layer (SSP) state machines (part 3 - primitive transmission)

6.11.9.2 SSP_TIM1:Tx_Interlock_Monitor state

This state monitors the number of frames transmitted and monitors the number of ACKs and NAKs received. This state ensures that an ACK or NAK is received for each frame transmitted and indicates a timeout if they are not.

The EOF Transmitted parameter shall be used by this state to count the number of frames transmitted.

When the number of EOF Transmitted parameters received equals the number of ACK Received and NAK Received parameters received then there is ACK/NAK balance and this state shall send the Tx Balanced Status (Balanced) parameter to the SSP_TF2:Tx_Wait state. When the number of EOF Transmitted parameters received does not equal the number of ACK Received and NAK Received parameters received then this there is ACK/NAK unbalance and this state shall send the Tx Balanced Status (Unbalanced) parameter to the SSP_TF2:Tx_Wait state.

If there is an ACK/NAK unbalance and an ACK Received parameter is received this state shall:

a) use the ACK Received parameter to count the number of ACKs and NAKs received; and
b) send an ACK Received confirmation to the port layer each time the ACK Received parameter is received.

If there is an ACK/NAK unbalance and an NAK Received parameter is received this state shall:

a) use the NAK Received parameter to count the number of ACKs and NAKs received; and
b) send an NAK Received confirmation to the port layer each time the NAK Received parameter is received.

If there is ACK/NAK balance, the ACK Received parameter and NAK Received parameter shall be ignored.

If there is ACK/NAK balance the ACK/NAK timeout timer shall be disabled.

Each time an ACK/NAK unbalance occurs, the ACK/NAK timeout timer shall be initialized to 1 ms and shall start timing. The timer shall be re-initialized to 1 ms each time an ACK or NAK is counted. If the timer expires, this state shall send the ACK/NAK Timeout confirmation to the port layer and to the following states:

a) SSP_TF1:Connected_Idle; and
b) SSP_TF2:Tx_Wait state.

When the SSP_TIM state machine receives an Enable Disable SSP (Enable) parameter, Request Close parameter, or Request Break parameter the number of frames transmitted shall be set to the number of ACKs and NAKs received.

6.11.9.3 SSP_TCM1:Tx_credit_monitor state

This state shall keep track of the number of transmit frame credits received versus the number of transmit frame credits used. This state adds transmit frame credit for each RRDY Received parameter received and subtracts transmit frame credit for each Tx Credit Used parameter received. This state shall remember any CREDIT_BLOCKED Received parameter that is received.

When transmit frame credit is available, this state shall send the Tx Credit Status (Credit Available) parameter to the SSP_TF2:Tx_Wait state.

When transmit frame credit is not available and credit is not blocked, this state shall send the Tx Credit Status (Credit Not Available) parameter to the SSP_TF2:Tx_Wait state.

When transmit frame credit is not available and credit is blocked, this state shall send the Tx Credit Status (Credit Blocked) parameter to the SSP_TF2:Tx_Wait state.

When the SSP_TCM state machine receives an Enable Disable SSP (Enable) parameter, Request Close parameter, or Request Break parameter transmit frame credit shall be set to not available and credit shall not be blocked.

6.11.9.4 SSP_D1:DONE_Wait state

6.11.9.4.1 State description

This state ensures that a DONE is received and transmitted before the connection is closed. The DONE may be transmitted and received in any order.

If the DONE Received parameter has been received before the Wait For DONE Parameter is received, this state shall send the Request Close parameter to the SL state machine (see 6.11) and all the SSP state machines.

If the DONE Received parameter has not been received when the Wait For DONE Parameter is received, this state shall initialize the DONE timeout timer to 1 ms. If the Wait For DONE (Close Connection) parameter or the Wait for DONE (Credit Timeout) parameter was received, the DONE timeout timer shall be re-initialized to 1 ms each time the EOF Received parameter is received. If the Wait For DONE (ACK/NAK Timeout) parameter was received the DONE timeout timer shall not be re-initialized.

If the DONE Received parameter is received before the DONE timeout timer expires, this state shall send the Request Close parameter to the SL state machine and all the SSP state machines.

If the DONE Received parameter is not received before the DONE timeout timer expires, this state shall:

a) send a DONE Timeout confirmation to the port layer; and
b) send a Request Break parameter to the SL state machine and all the SSP state machines.

Any time a DONE received parameter is received this state shall send a DONE Received confirmation to the port layer. This confirmation informs the port layer that the SSP transmitter is going to close the connection within 1 ms.

6.11.9.5 SSP_TF1:Connected_idle state

6.11.9.5.1 State description

This state waits for a request from the port layer to transmit a frame or to close the connection.

6.11.9.5.2 Transition SSP_TF1:Connected_Idle to SSP_TF2:Tx_Wait

This transition shall occur after a Tx Frame request is received or a Close Connection request is received.

If a Tx Frame (Balanced) request was received this transition shall pass a Transmit Balanced Frame argument to the Tx_Wait state.

If a Tx Frame (Nonbalanced) request was received this transition shall pass a Transmit Unbalanced Frame argument to the Tx_Wait state.

If a Close Connection request was received this transition shall pass a Close Connection argument to the Tx_Wait state.

6.11.9.5.3 Transition SSP_TF1:Connected_Idle to SSP_TF4:Indicate_Done_Tx

This transition shall occur if an ACK/NAK Timeout parameter is received. This transition shall pass an ACK/NAK Timeout argument to the Tx_Wait state.

6.11.9.6 SSP_TF2:Tx_Wait state

6.11.9.6.1 State description

This state monitors the Tx Balanced Status parameter and the Tx Credit Status parameter to ensure that frames are transmitted and connections are closed at the proper time.

If this state is entered from the SSP_TF1:Connected_Idle state with an argument of Transmit Balanced Frame or Transmit Nonbalanced Frame, and:

a) if the last Tx Credit Status parameter received had an argument of Not Available this state shall initialize the Credit timeout timer to 1 ms; or
b) if the last Tx Credit Status parameter had an argument other than Not Available this state shall disable the Credit timeout timer.

6.11.9.6.2 Transition SSP_TF2:Tx_Wait to SSP_TF3:Indicate_Frame_Tx

This transition shall occur if this state was entered from the SSP_TF1:Connected_Idle state with an argument of Transmit Balanced Frame if:

a) the last Tx Balanced Status parameter received had an argument of Balanced; and
b) the last Tx Credit Status parameter received had an argument of Credit Available.

This transition shall occur if this state was entered from the SSP_TF1:Connected_Idle state with an argument of Transmit Nonbalanced Frame if the last Tx Credit Status parameter received had an argument of Credit Available.

This transition shall occur after sending a Tx Credit Used parameter to the SSP_TCM1:Tx_Credit_Monitor state.

6.11.9.6.3 Transition SSP_TF2:Tx_Wait to SSP_TF4:Indicate_Done_Tx

This transition shall pass a Connection Closed argument to the Indicate_Done_Tx state if this state was entered from the SSP_TF1:Connected_Idle state with an argument of Close Connection and the last Tx Balanced Status parameter received had an argument of Balanced.

This transition shall pass a Credit Timeout argument to the Indicate_Done_Tx state if this state was entered from the SSP_TF1:Connected_Idle state with an argument of Transmit Balanced Frame or Transmit Nonbalanced Frame and the last Tx Credit Status parameter received had an argument of Blocked.

This transition shall pass a Credit Timeout argument to the Indicate_Done_Tx state if:

a) this state was entered from the SSP_TF1:Connected_Idle state with an argument of Transmit Balanced Frame or Transmit Nonbalanced Frame;
b) the Credit timeout timer expires before a Tx Credit Status (Available) parameter is received; and
c) the last Tx Balanced Status parameter received had an argument of Balanced or a Tx Balanced Status (Balanced) is received before a ACK/NAK Timeout parameter is received.

This transition shall pass an ACK/NAK Timeout argument to the Indicate_Done_Tx state if an ACK/NAK Timeout parameter is received.

6.11.9.7 SSP_TF3:Indicate_Frame_Tx state

6.11.9.7.1 State description

This state shall request a frame transmission by sending a Transmit SOF/frame/EOF parameter to the SSP transmitter. Each time a Transmit SOF/frame/EOF parameter is sent to the SSP transmitter, one SOF/frame/EOF is transmitted.

In this state receiving an SOF/frame/EOF Transmitted parameter indicates that the frame has been transmitted.

6.11.9.7.2 Transition SSP_TF3:Indicate_Frame_Tx to SSP_TF1:Connected_idle

This transition shall occur after:

a) receiving an SOF/frame/EOF Transmitted parameter;
b) sending an EOF Transmitted parameter to the SSP_TIM1:Tx_Interlock_Monitor; and
c) sending a Frame Transmitted confirmation to the port layer.

6.11.9.8 SSP_TF4:Indicate_Done_Tx state

This state shall request a DONE be transmitted by sending one of the following Transmit DONE parameters to a SSP transmitter:

a) Transmit DONE (CLOSE CONNECTION) parameter if this state was entered from the Tx_Wait state with an argument of Close Connection;
b) Transmit DONE (ACK/NAK TIMEOUT) parameter if this state was entered from the Tx_Wait state or the Connected_Idle state with an argument of ACK/NAK Timeout; or
c) Transmit DONE (CREDIT TIMEOUT) parameter if this state was entered from the Tx_Wait state with an argument of Credit Timeout.

After a DONE transmitted parameter is received this state shall send the DONE Transmitted confirmation to the port layer and send the:

a) Wait For DONE (Close Connection) parameter if this state was entered from the Tx_Wait state with an argument of Close Connection;
b) Wait For DONE (ACK/NAK Timeout) parameter if this state was entered from the Tx_Wait state or the Connected_Idle state with an argument of ACK/NAK Timeout; or
c) parameter if this state was entered from the Tx_Wait state with an argument of Credit Timeout.

6.11.9.9 SSP_RF1:Rcv_Frame state

This state:

a) checks the frame to determine if the frame should be accepted or discarded by the link:
b) checks the frame to determine if an ACK or NAK should be transmitted; and
c) sends a Received Frame confirmation to the port layer.

The frame (i.e., all the dwords between an SOF and EOF) shall be discarded if any of the following conditions are true:

a) the number of data dwords between the SOF and EOF is less than 7;
b) the number of data dwords after the SOF is greater than 263 data dwords;
c) the Rx Credit Status (Credit Exhausted) parameter is received; or
d) the DONE Received parameter is received.

If consecutive SOF Received parameters are received without an intervening EOF Received parameter (i.e., SOF, data dwords, SOF, data dwords, and EOF instead of SOF, data dwords, EOF, SOF, data dwords, and EOF) then this state shall discard all dwords between those SOFs.

If the frame is discarded then no further action is taken by this state. If the frame is not discarded then this state shall:

a) send a Frame Received parameter to the SSP_RCM1:Rcv_Credit_Monitor state; and
b) send a Frame Received parameter to the SSP_RIM1:Rcv_Interlock_Monitor state;

If the frame CRC is good and the frame contained no invalid data dwords, this state shall send the Frame Received (Successful) parameter to the SSP_TAN1:Idle state and:

a) if the last Rx Credit Status parameter received had an argument of Credit Extended send the Frame Received (ACK/NAK Balanced) confirmation to the port layer; or
b) if the last Rx Credit Status parameter received had an argument of Credit Exhausted send a Frame Received (ACK/NAK Unbalanced) confirmation to the port layer.

If the frame CRC is bad or the frame contained invalid data dwords, this state shall send the Frame Received (Unsuccessful) parameter to the SSP_TAN1:Idle state.

6.11.9.10 SSP_RCM1:Rcv_Credit_Monitor state

This state monitors the receiver's resources and keeps track of the number of RRDYs transmitted versus the number of frames received.

Any time resources are released or become available this state shall send the Rx Credit Status (Available) parameter to the SSP_TC1:Idle state. This state shall only send the Rx Credit Status (Available) parameter

to the SSP_TC1:Idle state after frame receive resources become available. The specifications for when or how resources become available is outside the scope of this standard.

This state may send the Rx Credit Status (Blocked) parameter to the SSP_TC1:Idle state indicating that no more credit is going to be sent during this connection. After sending the Rx Credit Status (Blocked) parameter to the SSP_TC1:Idle state, this state shall not send the Rx Credit Status (Available) parameter to the SSP_TC1:Idle state for the duration of the current connection. The Rx Credit Status (Blocked) parameter should be sent to the SSP_TC1:Idle state when no further credit is going to become available within a credit timeout (i.e., less than 1 ms).

This state shall indicate through the Rx Credit Status parameter only the amount of resources available to handle received frames (e.g., if this state has resources for 5 frames the maximum number of Rx Credit Status requests with the Available argument outstanding is 5).

This state shall use the RRDY Transmitted parameter to keep track of the number of RRDYs transmitted. This state shall use the Frame Received parameter to keep a track of the number of frames received.

Any time the number of RRDY Transmitted parameters received exceeds the number of Frame Received parameters received this state shall send a Rx Credit Status (Credit Extended) parameter to the SSP_RF1:Rcv_Frame state.

Any time the number of RRDY Transmitted parameters received equals the number of Frame Received parameters received this state shall send a Rx Credit Status (Credit Exhausted) parameter to the SSP_RF1:Rcv_Frame state.

If this state receives an Enable Disable SSP (Enable) parameter, Request Close parameter, or Request Break parameter the frame receive resources shall be initialized to the no credit value for the current connection.

6.11.9.11 SSP_RIM1:Rcv_Interlock_Monitor state

This state monitors the number of frames received versus the number of ACKs and NAKs transmitted.

This state shall use the ACK Transmitted parameter and the NAK Transmitted parameter from the SSP_TAN1:Idle state to keep track of the number of ACKs and NAKs transmitted. This state shall use the Received Frame parameter from the SSP_RF1:Rcv_Frame state to keep a track of the number of frames received.

Any time the number of the ACK Transmitted parameters and the number of NAK Transmitted parameters received equals the number of Received Frames parameters received this state shall send the Rx Balanced Status (Balanced) parameter to the SSP_RF1:Rcv_Frame state.

Any time the number of the ACK Transmitted parameters and the number of NAK Transmitted parameters received does not equal the number of Received Frames parameters received this state shall send the Rx Balanced Status (Unbalanced) parameter to the SSP_RF1:Rcv_Frame state.

When the SL state machine sends the Enable Disable SSP (Enable) parameter the number of the ACKs and NAKs transmitted shall be set to the number of frames received.

6.11.9.12 SSP_TC1:Idle state

6.11.9.12.1 State description

This state waits for a Rx Credit Status parameter to be received.

When this state is entered from the SSP_TC2:Indicate_Credit_Tx state with an argument of RRDY Transmitted it shall send an RRDY Transmitted parameter to the SSP_RCM1:Rcv_Credit_Monitor.

6.11.9.12.2 Transition SSP_TC1:Idle to SSP_TC2:Indicate_Credit_Tx

This transition shall pass a Transmit RRDY argument to the Indicate_Credit_Tx state if a Rx Credit Status (Available) parameter was received.

This transition shall pass a Transmit CREDIT_BLOCKED argument to the Indicate_Credit_Tx state if a Rx Credit Status (Blocked) parameter was received.

6.11.9.13 SSP_TC2:Indicate_Credit_Tx state

6.11.9.13.1 State description

If this state is entered into from the SSP_TC1 state with an argument of Transmit RRDY, this state shall request a single RRDY be transmitted by sending a Transmit RRDY parameter to the SSP transmitter.

If this state is entered into from the SSP_TC1 state with an argument of CREDIT_BLOCKED, this state shall request a single CREDIT_BLOCKED by sending a Transmit CREDIT_BLOCKED parameter to the SSP transmitter.

6.11.9.13.2 Transition SSP_TC2:Indicate_Credit_Tx to SSP_TC1:Idle

This transition shall occur after receiving an RRDY Transmitted parameter or the CREDIT_BLOCKED Transmitted parameter.

6.11.9.14 SSP_TAN1:Idle state

6.11.9.14.1 State description

This state waits for a Frame Received parameter from the SSP_RF1:Rcv_Frame state.

When this state is entered into from the SSP_TAN2:Indicate_ACK/NAK_Tx state with an ACK Transmitted argument this state shall:

a) send an ACK Transmitted parameter to the SSP_RIM1:Rcv_Interlock_Monitor state: and
b) send an ACK Transmitted confirmation to the port layer.

When this state is entered into from the SSP_TAN2:Indicate_ACK/NAK_Tx state with a NAK Transmitted argument it shall send a NAK Transmitted parameter to the SSP_RIM1:Rcv_Interlock_Monitor state.

6.11.9.14.2 Transition SSP_TAN1:Idle to SSP_TAN2:Indicate_ACK/NAK_Tx

This transition shall pass a Transmit ACK argument to the Indicate_ACK/NAK_Tx state if a Frame Received (Successful) parameter was received.

This transition shall pass a Transmit NAK argument to the Indicate_ACK/NAK_Tx state if a Frame Received (Unsuccessful) parameter was received.

If multiple Frame Received (Unsuccessful) parameters and Frame Received (Successful) parameters are received, then the order in which the Transmit ACK arguments and Transmit NAK arguments are passed to the Indicate_ACK/NAK_Tx state shall be the same order as the Frame Received (Unsuccessful) parameters and Frame Received (Successful) parameters were received.

6.11.9.15 SSP_TAN2:Indicate_ACK/NAK_Tx state

6.11.9.15.1 State description

If this state is entered into from the SSP_TAN1 state with an argument of Transmit ACK, this state shall request a single ACK be transmitted by sending a Transmit ACK parameter to the SSP transmitter.

If this state is entered into from the SSP_TAN1 state with an argument of Transmit NAK, this state shall request a single NAK be transmitted by sending a Transmit NAK parameter to the SSP transmitter.

6.11.9.15.2 Transition SSP_TAN2:Indicate_ACK/NAK_tx to SSP_TAN1:Idle

This transition shall occur after receiving an ACK Transmitted parameter or the NAK Transmitted parameter.

6.12 SMP link layer

6.12.1 SMP frame transmission

Inside an SMP connection, the source device transmits a single SMP_REQUEST frame and the destination device responds with a single SMP_RESPONSE frame (see 9.4).

Frames are surrounded by SOF and EOF as shown in figure 61. There is no acknowledgement of SMP frames with ACK and NAK. There is no credit exchange with RRDY.

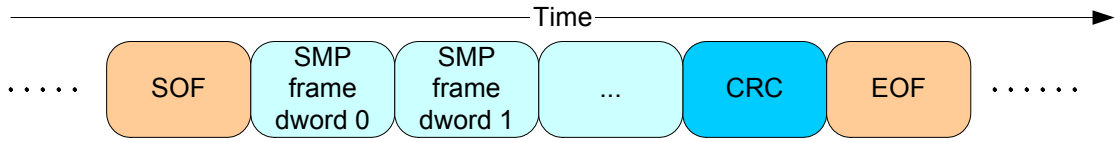

Figure 61 — SMP frame transmission

The last data dword after the SOF prior to the EOF always contains a CRC (see 7.4). The link layer shall check that the number of data dwords between the SOF and the EOF is at least 2 data dwords and that the CRC is valid.

6.12.2 SMP flow control

By accepting an SMP connection, the destination device acknowledges it is ready to receive one SMP_REQUEST frame.

When the source device transmits one SMP_REQUEST frame, it shall be ready to receive one SMP_RESPONSE frame.

6.12.3 Preparing to close an SMP connection

After receiving the SMP_RESPONSE frame, the source device shall transmit a CLOSE to close the connection. The source device may leave the connection open to run loopback tests (see 7.10).

After receiving a CLOSE, the destination device shall reply with a CLOSE.

See 7.12.7 for details on closing connections.

6.12.4 SMP link layer (SMP) state machines

6.12.4.1 Overview

The SMP link layer state machines run in parallel to control the flow of dwords during an SMP connection. The SMP link state machines are as follows:

a) SMP Initiator Link (SMP_IL) - in SMP initiator devices;
b) SMP Target Link (SMP_TL) - in SMP target devices;
a) SAS phy receiver (SMP_R); and
b) SAS phy transmitter (SMP_T).

The SMP state machines shall begin on receipt of an Enable SMP parameter from the SL state machine (see 6.11).

All the state machines within SMP shall stop after:

a) the SMP_IL state machine sends a Request Close or Request Break parameter to the SL state machine;
b) the SMP_TL state machine sends a Request Close or Request Break parameter to the SL state machine; or
c) receiving a BREAK.

If a state machine consists of multiple states the initial state is noted in state machine description in this subclause.

The SMP_IL state machine's function is to transmit an SMP request frame and then receive the corresponding response frame. The SMP_IL state machine contains the following states:

a) Initial state: SMP_IL1:Command_idle (see 6.12.4.2);
b) SMP_IL2:Indicate_frame_tx (see 6.12.4.2.2);
c) SMP_IL3:Rcv_response_frame (see 6.12.4.2.3).

The SMP_TL state machine's function is to receive an SMP request frame and then transmit the corresponding SMP response frame. The SMP_TL state machine contains the following states:

a) Initial state:SMP_TL1:Wait_orginate_frame state (see 6.12.4.3.1); and
b) SMP_TL2:Wait_transmit_frame state (see 6.12.4.3.2).

The SMP_R state machine's function is to receive primitives and frames for the SMP_IL or SMP_TL state machine. The SMP_R state machine contains the SMP_R1:Receive state (see 6.12.4.4).

The SMP_T state machine's function is to transmit primitives and frames for the SMP_IL or SMP_TL state machine. The SMP_T state machine contains the SMP_T1:Transmit state (see 6.12.4.5).

Figure 62 shows the SMP state machines implemented by initiator devices.

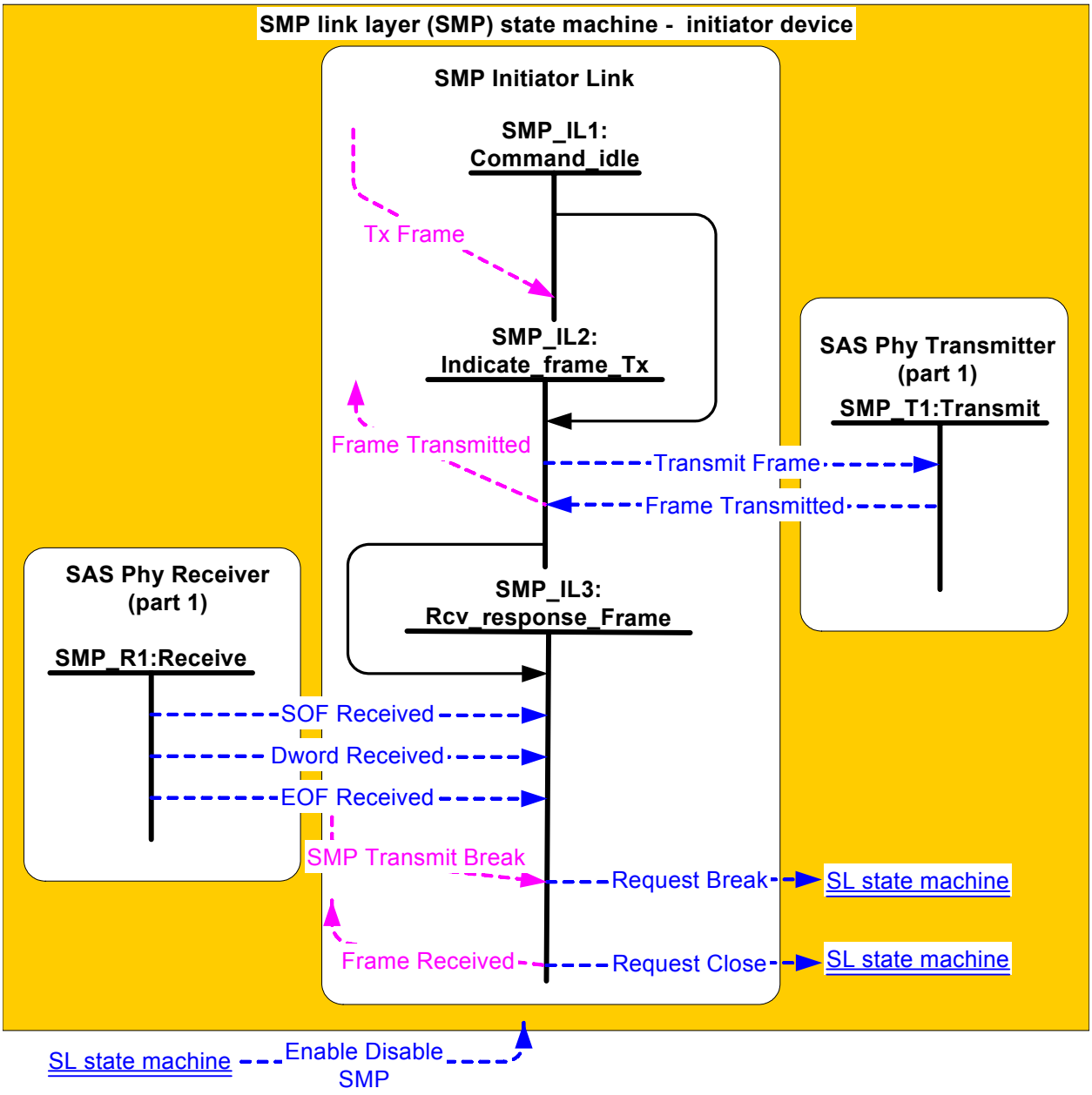

Figure 62 — SMP link layer (SMP) state machines – initiator device

Figure 63 shows the SMP state machines implemented by target devices.

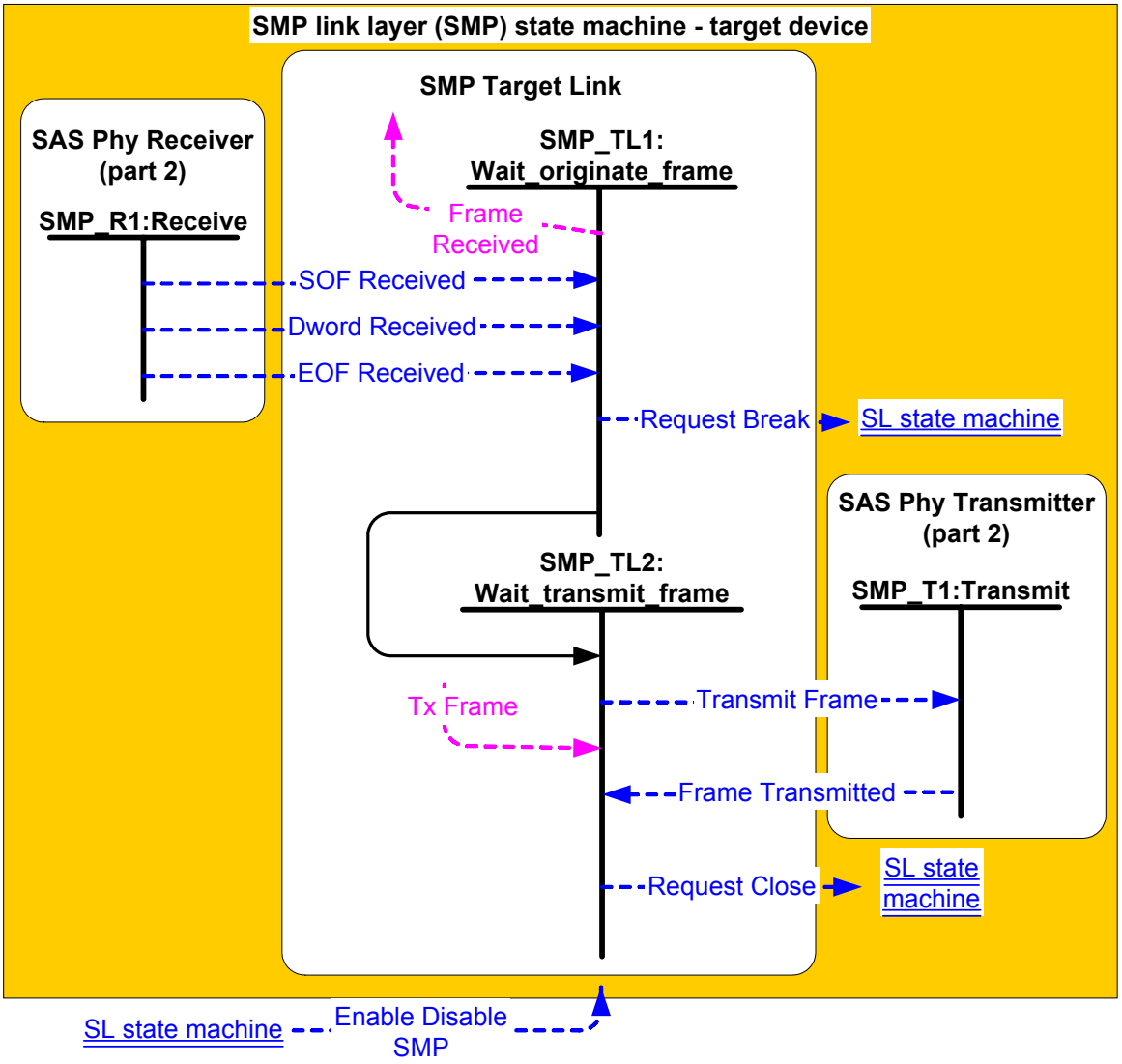

Figure 63 — SMP link layer (SMP) state machines – target device

6.12.4.2 SMP Initiator Link state machine

6.12.4.2.1 SMP_IL1:Command_idle state

6.12.4.2.1.1 State description

This state is the default state entered when an SMP connection is established.

6.12.4.2.1.2 Transition SMP_IL1:Command_idle to SMP_IL2:Indicate_frame_tx

This transition shall occur when a Tx Frame (SMP) request is received.

6.12.4.2.2 SMP_IL2:Indicate_frame_tx state

6.12.4.2.2.1 State description

This state sends a Transmit Frame parameter to the SMP_T state machine indicating that an SMP frame be transmitted.

After the Frame Transmitted parameter is received, this state shall send a Frame Transmitted confirmation to the port layer.

6.12.4.2.2.2 Transition SMP_IL2:Indicate_frame_tx to SMP_IL3:Rcv_response_frame

This transition shall occur after sending a Frame Transmitted confirmation to the port layer.

6.12.4.2.3 SMP_IL3:Rcv_response_frame state

6.12.4.2.3.1 State description

This state checks the SMP response frame and determines if the SMP response frame was successfully received (e.g., no CRC error).

If the SMP response frame is received with a CRC error, this state shall send a Frame Received (SMP Failure) confirmation to the port layer.

If the number of data dwords between the SOF and EOF of the SMP response frame is less than 2, or the number of data dwords after an SOF is greater than 258 data dwords, this state shall send a Frame Received (SMP Failure) confirmation to the port layer. If the SMP response frame is received with no CRC error and the SMP response frame is valid, the rcv_response_frame state shall:

a) send a Frame Received (SMP) confirmation to the port layer; and
b) send a Request Close parameter to the SL state machine (see 6.11) indicating that a CLOSE shall be transmitted.

If a SMP Transmit Break request is received the rcv_response_frame state shall send a Request Break parameter to the SL state machine indicating that a BREAK shall be transmitted.

6.12.4.3 SMP Target Link state machine

6.12.4.3.1 SMP_TL1:Wait_originate_frame state

6.12.4.3.1.1 State description

This state checks the originate SMP frame and determines if the SMP frame was successfully received (e.g., no CRC error).

a) If the SMP originate frame is received with a CRC error the wait_originate_frame state shall
b) send a Request Break parameter to the SL state machine (see 6.11) indicating that a BREAK shall be transmitted.

If the number of data dwords between the SOF and EOF is less than 8, or the number of data dwords after the SOF is greater than 258, the wait_originate_frame state shall send a Request Break parameter to the SL state machine indicating that a BREAK shall be transmitted.

6.12.4.3.1.2 Transition SMP_TL1:Wait_originate_frame to SMP_TL2:Wait_transmit_frame

This transition shall occur after the wait_originate_frame state determines the received SMP originate frame is accepted and after the rcv_response_frame state sends a Frame Received (SMP) confirmation to the port layer.

An SMP originate frame shall be accepted if the number of data dwords between the SOF and EOF is greater than or equal to 2 and less than or equal to 258; and the CRC is valid.

6.12.4.3.2 SMP_TL2:Wait_transmit_frame state

6.12.4.3.2.1 State description

This state, after receiving a Transmit Frame (SMP) request from the port layer, sends a Transmit Frame parameter to the transmit state indicating that an SMP response frame is to be transmitted.

After the Frame Transmitted parameter is received, the indicate_frame_tx state shall send a Request Close parameter to the SL state machine (see 6.11) indicating that a CLOSE shall be transmitted.

6.12.4.4 SMP_R state machine

This state receives frames and primitives.

As a result of receiving an SOF this state shall send an SOF Received parameter to the following states:

a) SMP_TL1:Wait_originate_frame state; and
b) SMP_IL3:Rcv_response_frame state.

As a result of receiving an EOF this state shall send an EOF Received parameter to the following states:

a) SMP_TL1:Wait_originate_frame state; and
b) SMP_IL3:Rcv_response_frame state.

As a result of receiving a data dword after an SOF before an EOF, this state shall send a Dword Received parameter to the following states:

a) SMP_TL1:Wait_originate_frame state; and
b) SMP_IL3:Rcv_response_frame state.

6.12.4.5 SMP_T state machine

This state transmits an SMP frame when it receive a Transmit Frame parameter from the Originate SMP Frame state machine or the SMP Frame Response state machine.

In the absence of any transmit requests, this state shall request idle dwords be transmitted by repeatedly sending Transmit Idle Dword parameters to the SMP transmitter and ALIGNs as necessary.

On reception of Transmit Frame parameter, this state shall request a SOF be transmitted, the dwords of the frame be transmitted, and an EOF be transmitted by sending a Transmit SOF/frame/EOF parameter to the SMP transmitter.

The transmit state shall send an Frame Transmitted parameter to the Originate SMP Frame state machine and the SMP Frame Response state machine each time an EOF is transmitted.