Network Working Group
INTERNET-DRAFT

Expires in six months · December 2001

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SS7 MTP2-User Peer-to-Peer Adaptation Layer
Test Specifications
M2PA-TEST
<draft-bidulock-sigtran-m2pa-test-00.ps>

Status of this Memo

Abstract

This Internet Draft provides information for the Internet community on test cases for testing the SS7 M2P2-User Peer-to-Peer Adaptation Layer[M2PA-03] based on the conformance test specifications for SS7 MTP Level 2[Q.781].

1. Introduction

This draft provides a set of detailed test of the SS7 MTP2-User Peer-to-Peer Adaptation Layer[M2PA-03] based on the test specifications for SS7 MTP Level 2[Q.781]. These tests are intended to validate the SS7 MTP2-User Peer-to-Peer Adaptation Layer (M2PA) protocol[M2PA-03].

These tests attempt to completely validate the M2PA protocol without redundancy. Each test is described as simply as possible to check precisely the elementary function of the protocol. The tests are listed in no specific order.

2. Test Environment

2.1. Test Configurations

A single M2PA link is used in the tests. *Figure 2.1-1* and *Figure 2.1-2* show a single link between IUT and PT. In *Test Configuration 1* as shown in *Figure 2.1-1*, PT initiates the association. In *Test Configuration 2* as shown in *Figure 2.1-2*, IUT initiates the association. Test specifications in both configurations are written to test the M2PA at IUT .

```
 _________           Link 1           _________
|         |      SCTP Association    |         |
|   PT    |------------------------->|   IUT   |
|_________|                          |_________|
     NOTE:   PT initiates the association
```

Figure 2.1-1. Test Configuration 1

```
 ________              Link 1              ________
|        |          SCTP Association      |        |
|   PT   |<-------------------------------|  IUT   |
|________|                                |________|
     NOTE: IUT  initiates the association
```

Figure 2.1-2. Test Configuration 2

2.2. Recommended IUT Settings

2.2.1. Timer Values

It is recommended that the following timer values be configured at the IUT for the purposes of performing these validation tests:

T1	45 seconds
T2	5 seconds
T2l	20 seconds (not applicable)
T2h	100 seconds (not applicable)
T3	1 second
T4n	8 seconds
T4e	0.5 seconds
T5	0.1 seconds (not applicable)
T6	4 seconds
T7	1 second
T8	0.1 seconds (not applicable)

2.2.2. Buffer Threshold Values

It is recommended that the following buffer threshold values be configured at the IUT for the purpose of performing these validation tests:

N1	???
N2	127 messages

3. Tests

3.1. Link State Control - Expected signal units/orders

3.1.1. Initialization (Power-up)

These tests check that the IUT enters the correct state upon establishment of the SCTP association. Establishing the association at both peers is the equivalent to the Q.703 "Power On". The correct behavior is for both M2PA peers to send a status "Out of Service" and enter the "Out of Service" state. These test are useful both for Validation and Compatibility testing.

3.1.1.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.1-1.*

Reference: Q.781/Test 1.1

```
                    PT                        IUT

             :power on
         OUT-OF-SERVICE  ----------------->
                                             :power on
                         <-----------------  OUT-OF-SERVICE
```

Figure 3.1.1-1. Initialization (Power-up)

Test Description:

(1) The test begins with both the PT and the IUT in the "Power Off" state.

(2) The "Power On" command is issued at the PT and then the IUT.

(3) Check that the IUT sends a status "Out of Service" message enters and remains in the "Out of Service" state.

(4) Repeat the test in the opposite direction as shown below.

3.1.1.2. Reverse Direction

This is the test repeated in the opposite direction. The expected sequence of events is illustrated *Figure 3.1.1-2*.

Reference: Q.781/Test 1.1

```
                    PT                        IUT

                                             :power on
                         <-----------------  OUT-OF-SERVICE
             :power on
         OUT-OF-SERVICE  ----------------->
```

Figure 3.1.1-2. Initialization (Power-up)

Test Description:

(1) The test begins with both the PT and the IUT in the "Power Off" state.

(2) The "Power On" command is issued at the IUT and then the PT.

(3) Check that the IUT sends a status "Out of Service" message enters and remains in the "Out of Service" state.

3.1.2. Timer T2

This test validates the T2 (Not Aligned) timer and procedure at the IUT. This is the duration of time that the M2PA peer will wait to receive a status "Alignment" message after sending a status "Alignment" message.

Reference: Q.781/Test 1.2

```
                    PT                      IUT

                         <-----------------  OUT-OF-SERVICE
          OUT-OF-SERVICE  ----------------->
                                             :start
                         <-----------------  ALIGNMENT
                               !
                               !  T2         5.0 <= T2 <= 150.0
                               !
                         <-----------------  OUT-OF-SERVICE
                                             !out of service(AERM)
```

Figure 3.1.2-1. Timer T2

Test Description:

(1) The test begins with both the PT and the IUT in the "Out of Service" state.

(2) The "Start" command is issued at the IUT.

(3) Check that the IUT sends a status "Alignment" message.

(4) Check that the IUT sends a status "Out of Service" and issues an "Out of Service" indication to Level 3 with reason "Alignment Not Possible".

(5) Check that T2 is between 5.0 seconds and 150.0 seconds in duration.

(6) The IUT should stay in the "Out of Service" state.

3.1.3. Timer T3

This test validates the T3 (Aligned) timer and procedure at the IUT. This is the duration of time that the M2PA peer will wait to receive a status "Proving Normal" or status "Proving Emergency" message from the M2PA peer after sending status "Proving Normal" or status "Proving Emergency". The expected sequence of events is illustrated *Figure 3.1.3-1*.

Reference: Q.781/Test 1.3

```
                    PT                      IUT

                         <-----------------  OUT-OF-SERVICE
          OUT-OF-SERVICE  ----------------->
                                             :start
                         <-----------------  ALIGNMENT
                  :start
               ALIGNMENT  ----------------->
                         <-----------------  PROVING-NORMAL
                               !
                               !  T3         1.0 <= T3 <= 1.5
                               !
                         <-----------------  OUT-OF-SERVICE
                                             !out of service(AERM)
```

Figure 3.1.3-1. Timer T3

Test Description:

(1) The test begins with both the PT and the IUT in the "Out of Service" state.

(2) The Level 3 "Start" command is issued at the IUT.

(3) Check that the IUT sends a status "Alignment" message.

(4) Send a status "Alignment" message to the IUT.

(5) Check that the IUT response with a status "Proving Normal" message.

(6) Check that the link goes out of service for reason "Alignment Not Possible".

(7) Check that T3 is between 1.0 seconds and 1.5 seconds in duration.

3.1.4. Timer T1 & Timer T4 (Normal)

This test validates the T4(Normal) (Proving) and T1 (Aligned Ready) timers and procedures at the IUT. T4 is the duration of time that the M2PA peer will wait to complete proving. T1 is the duration that the M2PA peer will wait to receive a status "In Service" or a status "Processor Outage" message from the M2PA peer after sending a status "In Service" or status "Processor Outage" message. The expected sequence of events is illustrated *Figure 3.1.4-1*.

Reference: Q.781/Test 1.4

```
                  PT                      IUT

                      <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                          :start
                      <-----------------  ALIGNMENT
              :start
           ALIGNMENT  ----------------->
                      <-----------------  PROVING-NORMAL
      PROVING-NORMAL  ----------------->
                      <-----------------  PROVING
             PROVING  ----------------->
                            !
                            |  T4(Pn)     7.5 <= T4 <= 9.5
                            !
                      <-----------------  IN-SERVICE
                            !
                            !  T1         40.0 <= T1 <- 50.0
                            !
                      <-----------------  OUT-OF-SERVICE
                                          !out of service(T1)
```

Figure 3.1.4-1. Timer T1 & Timer T4 (Normal)

Test Description:

(1) The test begins with both the PT and the IUT in the "Out of Service" state.

(2) The Level 3 "Start" command is issued at the IUT.

(3) Check that the IUT sends a status "Alignment" message.

(4) Send a status "Alignment" message to the IUT and exchange status "Proving Normal" and proving data messages.

(5) Check that a status "In Service" message is received from the IUT within time T4.

(6) Check that T4 is between 7.5 seconds and 9.5 seconds in duration.

(7) Check that a status "Out of Service" message is received from the IUT within time T1 and that an "Out of Service" indication is given to Level 3 at the IUT with reason "T1 Timeout".

(8) Check that T1 is between 40.0 seconds and 50.0 seconds in duration.

3.1.5. Normal alignment procedure

This test case validates the normal alignment procedure at the IUT. This is a normal successful alignment procedure which results in the link going to and staying in the "In Service" state.

3.1.5.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.5-1*.

Reference: Q.781/Test 1.5

```
                PT                        IUT

                    <-----------------  OUT-OF-SERVICE
    OUT-OF-SERVICE  ----------------->
                                        :start
                    <-----------------  ALIGNMENT
            :start
         ALIGNMENT  ----------------->
                    <-----------------  PROVING-NORMAL
    PROVING-NORMAL  ----------------->
                    <-----------------  PROVING
           PROVING  ----------------->
                    <-----------------  IN-SERVICE
        IN-SERVICE  ----------------->
                                        !in service
```

Figure 3.1.5-1. Normal alignment procedure

Test Description:

(1) The test begins with the link "Out of Service".

(2) The Level 3 "Start" command is issued at the IUT and the PT.

(3) Check that the IUT sends the message sequence illustrated in *Figure 3.1.5-1*.

(4) Check that the IUT sends a status "In Service" message and indicates "In Service" to Level 3.

(5) Check that the link maintains the "In Service" state.

3.1.5.2. Reverse Direction

The equivalent Q.781 test case is normally repeated with with 2-byte LSSUs instead of 1-byte LSSUs when testing Q.703 links. Because M2PA does not have one- and two-byte LSSUs (there is just the status message), this test is not applicable. The expected sequence of events is illustrated *Figure 3.1.5-2*.

Reference: Q.781/Test 1.5

```
                PT                        IUT

                      NOT APPLICABLE
```

Figure 3.1.5-2. Normal alignment procedure

Test Description:

(1) Not applicable.

3.1.6. Normal alignment procedure - correct procedure (Data)

The test case validates the normal alignment procedure at the IUT when a DATA message is used instead of a status "In Service" to complete the alignment procedure. The expected sequence of events is illustrated *Figure 3.1.6-1*.

Reference: Q.781/Test 1.6

```
                 PT                      IUT

                    <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE -----------------> 
                                        :start
                    <-----------------  ALIGNMENT
             :start
          ALIGNMENT ----------------->
                    <-----------------  PROVING-NORMAL
     PROVING-NORMAL ----------------->
                    <-----------------  PROVING
            PROVING ----------------->
                    <-----------------  IN-SERVICE
               DATA ----------------->
                    <-----------------  ACK [    1 msgs]
                                        !in service
                                        !msu
```

Figure 3.1.6-1. Normal alignment procedure (Data)

Test Description:

(1) The test begins with the link "Out of Service".

(2) The Level 3 "Start" command is issued at the IUT and the PT.

(3) Check that the IUT sends the message sequence illustrated in *Figure 3.1.6-1*.

(4) Check that the IUT sends a status "In Service" message and indicates "In Service" to Level 3.

(5) Check that the IUT acknowledges the Data message with an Ack message.

(6) The IUT should maintain the "In Service" state.

3.1.7. Status "Alignment" received during normal proving period

This test case validates that the IUT restarts the alignment and proving procedure when receiving a status "Alignment" message in the "Proving" state. The expected sequence of events is illustrated *Figure 3.1.7-1*.

Reference: Q.781/Test 1.7

```
                   PT                      IUT

                     <------------------  OUT-OF-SERVICE
        OUT-OF-SERVICE  ------------------>
                                          :start
                     <------------------  ALIGNMENT
             :start
          ALIGNMENT  ------------------>
                     <------------------  PROVING-NORMAL
     PROVING-NORMAL  ------------------>
                     <------------------  PROVING
            PROVING  ------------------>
                     -----timeout------
          ALIGNMENT  ------------------>
                           !
                           !  T4(Pn)      7.5 <= T4 <= 9.5
                           !
     PROVING-NORMAL  ------------------>
                     <------------------  PROVING
            PROVING  ------------------>
                     <------------------  IN-SERVICE
```

Figure 3.1.7-1. "Alignment" during normal proving

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) When normal proving begins, wait for half the duration of T4 and then send the IUT a status "Alignment" message.

(4) Check that the IUT restarts the proving period and sends a status "In Service" message T4 after the last status "Alignment" message was sent to the IUT.

(5) Check that T4(Pn) is between 7.5 seconds and 9.5 seconds in duration.

3.1.8. Normal alignment with PO set

This case tests the normal alignment procedure where one M2PA peer is experiencing a local processor outage before and during alignment. The M2PA peers should still align and the link should go into service at Level 3.

3.1.8.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.8-1*.

Reference: Q.781/Test 1.8

```
                  PT                     IUT

                       <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE   ----------------->
                                           :set lpo
                                           :start
                       <-----------------  ALIGNMENT
              :start
           ALIGNMENT   ----------------->
                       <-----------------  PROVING-NORMAL
      PROVING-NORMAL   ----------------->
                       <-----------------  PROVING
             PROVING   ----------------->
                       <-----------------  PROCESSOR-OUTAGE
          IN-SERVICE   ----------------->
                                           !in service
```

Figure 3.1.8-1. Normal alignment with PO set

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT sends the message sequence illustrated in *Figure 3.1.8-1*.

(4) Check that the IUT sends status "Processor Outage" message and indicates "In Service" to Level 3.

(5) Check that the link maintains the "In Service" state at the IUT.

3.1.8.2. Reverse Direction

This case is the same test in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.8-2*.

Reference: Q.781/Test 1.8

```
                  PT                     IUT

                       <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE   ----------------->
            :set lpo
              :start
                                           :start
                       <-----------------  ALIGNMENT
           ALIGNMENT   ----------------->
                       <-----------------  PROVING-NORMAL
      PROVING-NORMAL   ----------------->
                       <-----------------  PROVING
             PROVING   ----------------->
                       <-----------------  IN-SERVICE
    PROCESSOR-OUTAGE   ----------------->
                                           !rpo
```

Figure 3.1.8-2. Normal alignment with PO set

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Local Processor Outage" and "Start" command at the PT and the "Start" command at the IUT.

(3) Check that the IUT sends the message sequence illustrated in *Figure 3.1.8-2*.

(4) Check that the IUT sends status "In Service" message and indicates "Remote Processor Outage" indication to Level 3.

(5) Check that the link maintains the "In Service" state at the IUT.

3.1.9. Normal alignment with PO set (Data)

This test case validates the normal alignment procedure at the IUT in the "Processor Outage" state when a Data message is used instead of an "In Service" message to complete the alignment procedure.

3.1.9.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.9-1*.

Reference: Q.781/Test 1.9

```
                PT                        IUT

                     <------------------  OUT-OF-SERVICE
    OUT-OF-SERVICE   ------------------>
                                          :set lpo
                                          :start
                     <------------------  ALIGNMENT
         ALIGNMENT   ------------------>
                     <------------------  PROVING-NORMAL
    PROVING-NORMAL   ------------------>
                     <------------------  PROVING
           PROVING   ------------------>
                     <------------------  PROCESSOR-OUTAGE
              DATA   ------------------>
```

Figure 3.1.9-1. Normal alignment with PO set (Data)

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT.

(3) Check that the IUT sends the message sequence illustrated in *Figure 3.1.9-1*.

(4) Check that the IUT sends status "Processor Outage" message and send a Data message to the IUT to complete the alignment procedure.

(5) Check that the IUT does not acknowledge the Data message.

(6) Check that the IUT maintains the "Processor Outage" state.

3.1.9.2. Reverse Direction

This is the same test in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.9-2*.

Reference: Q.781/Test 1.9

```
 ___________________________________________________________________
|                                                                   |
|                 PT                      IUT                       |
|                                                                   |
|                    <------------------  OUT-OF-SERVICE            |
|       OUT-OF-SERVICE  ------------------>                          |
|             :set lpo                                              |
|               :start                                              |
|                                         :start                    |
|                    <------------------  ALIGNMENT                 |
|            ALIGNMENT  ------------------>                          |
|                    <------------------  PROVING-NORMAL            |
|                                         :msu                      |
|       PROVING-NORMAL  ------------------>                          |
|                    <------------------  PROVING                   |
|              PROVING  ------------------>                          |
|                    <------------------  DATA [   35 bytes]        |
|     PROCESSOR-OUTAGE  ------------------>                          |
|                                         !rpo                      |
|                                                                   |
|___________________________________________________________________|
```

Figure 3.1.9-2. Normal alignment with PO set (Data)

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the PT and the "Start" command at the IUT.

(3) Provide an MSU for transmission at the IUT before the proving period ends.

(4) Check that the IUT sends the message sequence illustrated in *Figure 3.1.9-2*.

(5) Check that the IUT completes the proving process with the MSU and indicates "Remote Processor Outage" to Level 3.

(6) Check that the IUT maintains the "Processor Outage" state and does not require acknowledgment of the Data message used to complete alignment.

3.1.10. Normal alignment with PO set and cleared

This case tests that if the local processor outage condition is set and cleared before the alignment procedure starts that normal alignment is performed and no status "Processor Outage" message is sent to the M2PA peer. The expected sequence of events is illustrated *Figure 3.1.10-1*.

Reference: Q.781/Test 1.10

```
                 PT                      IUT

                    <-----------------   OUT-OF-SERVICE
     OUT-OF-SERVICE -----------------> 
                                         :set lpo
                                         :clear lpo
                                         :start
                    <-----------------   ALIGNMENT
             :start
          ALIGNMENT ----------------->
                    <-----------------   PROVING-NORMAL
     PROVING-NORMAL ----------------->
                    <-----------------   PROVING
            PROVING ----------------->
                    <-----------------   IN-SERVICE
         IN-SERVICE ----------------->
                                         !in service
```

Figure 3.1.10-1. Normal alignment with PO set and cleared

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage," "Clear Local Processor Outage" and "Start" commands at the IUT and "Start" command at the PT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.10-1*.

(4) Check that the IUT completes the alignment procedure and sends the status "In Service" message and indicates "In Service" to Level 3.

3.1.11. Set RPO when "Aligned not ready"

This test case validates the behavior of the IUT when processor outage condition is set at both the PT and the IUT. The expected sequence of events is illustrated *Figure 3.1.11-1*.

Reference: Q.781/Test 1.11

```
                 PT                      IUT

                     <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE  ----------------->
           :set lpo
                                         :set lpo
                                         :start
                     <-----------------  ALIGNMENT
             :start
          ALIGNMENT  ----------------->
                     <-----------------  PROVING-NORMAL
     PROVING-NORMAL  ----------------->
                     <-----------------  PROVING
            PROVING  ----------------->
                     <-----------------  PROCESSOR-OUTAGE
   PROCESSOR-OUTAGE  ----------------->
                                         !rpo
```

Figure 3.1.11-1. Set RPO when "Aligned Not Ready"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and PT.

(3) Check that the alignment procedure follows the sequence of events illustrated in *Figure 3.1.11-1*.

(4) Check that the IUT sends status "Processor Outage" and indicates "Remote Processor Outage" to Level 3.

3.1.12. Status "Out of Service" received when "Aligned not ready"

These test cases validate the behavior of the IUT when it receives a status "Out of Service" message in the "Aligned Not Ready" state or sends a Status "Out of Service" message when the M2PA peer is in the "Aligned Not Ready" state.

3.1.12.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.12-1*.

Reference: Q.781/Test 1.12

```
                 PT                         IUT

                     <------------------  OUT-OF-SERVICE
       OUT-OF-SERVICE  ------------------>
                                            :set lpo
                                            :start
                     <------------------  ALIGNMENT
             :start
          ALIGNMENT  ------------------>
                     <------------------  PROVING-NORMAL
       PROVING-NORMAL  ------------------>
                     <------------------  PROVING
            PROVING  ------------------>
                     <------------------  PROCESSOR-OUTAGE
              :stop
       OUT-OF-SERVICE  ------------------>
                     <------------------  OUT-OF-SERVICE
                                            !out of service(SIOS)
```

Figure 3.1.12-1. "Out of Service" when "Aligned not ready"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.1.12-1*.

(4) Check that the IUT sends a status "Processor Outage" message when it completes the initial alignment procedure and issue a Level 3 "Stop" command at the PT.

(5) Check that the IUT sends status "Out of Service" and indicates "Out of Service" to Level 3 with the reason "Received SIOS".

3.1.12.2. Reverse Direction

The test is repeated in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.12-2*.

Reference: Q.781/Test 1.12

```
                 PT                      IUT

                      <------------------  OUT-OF-SERVICE
       OUT-OF-SERVICE  ------------------>
             :set lpo
               :start
                                           :start
                      <------------------  ALIGNMENT
               :start
            ALIGNMENT  ------------------>
                      <------------------  PROVING-NORMAL
       PROVING-NORMAL  ------------------>
                      <------------------  PROVING
              PROVING  ------------------>
                      <------------------  IN-SERVICE
                                           :stop
           IN-SERVICE  ------------------>
                      <------------------  OUT-OF-SERVICE
```

Figure 3.1.12-2. "Out of Service" when "Aligned not ready"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) Check that the sequence of events follows those illustrated in *Figure 3.1.12-2*.

(4) When the IUT goes to the "In Service" state, issue the Level 3 "Stop" command at the IUT.

(5) Check that the IUT sends the status "Out of Service" message.

3.1.13. Status "Alignment" received when "Aligned not ready"

This test case validates the behavior of the IUT when it receives a status "Alignment" message in the "Aligned Not Ready" state. The expected sequence of events is illustrated *Figure 3.1.13-1*.

Reference: Q.781/Test 1.13

```
                    PT                         IUT

                         <-----------------    OUT-OF-SERVICE
        OUT-OF-SERVICE   ----------------->
                                               :set lpo
                                               :start
                         <-----------------    ALIGNMENT
                :start
             ALIGNMENT   ----------------->
                         <-----------------    PROVING-NORMAL
        PROVING-NORMAL   ----------------->
                         <-----------------    PROVING
               PROVING   ----------------->
                         <-----------------    PROCESSOR-OUTAGE
             ALIGNMENT   ----------------->
                         <-----------------    OUT-OF-SERVICE
                                               !out of service(SIO)
        OUT-OF-SERVICE   ----------------->
```

Figure 3.1.13-1. "Alignment" when "Aligned not ready"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and "Start" command at the PT.

(3) Check that the sequence of events follows the normal alignment procedure illustrated in *Figure 3.1.13-1*.

(4) When the IUT sends the status "Processor Outage" message, send a status "Alignment" message to the IUT.

(5) Check that the IUT sends the status "Out of Service" message and indicates "Out of Service" to Level 3 with reason "Received SIO".

3.1.14. Set and clear LPO when "Initial alignment"

This test case validates the behavior of the IUT when it receives Level 3 "Set Local Processor Outage" and "Clear Local Processor Outage" commands in the "Initial Alignment" state. The expected sequence of events is illustrated *Figure 3.1.14-1*.

Reference: Q.781/Test 1.14

```
                 PT                      IUT

                     <-----------------  OUT-OF-SERVICE
       OUT-OF-SERVICE  ----------------->
                                         :start
                     <-----------------  ALIGNMENT
               :start
            ALIGNMENT  ----------------->
                     <-----------------  PROVING-NORMAL
                                         :set lpo
       PROVING-NORMAL  ----------------->
                     <-----------------  PROVING
              PROVING  ----------------->
                                         :clear lpo
                     <-----------------  IN-SERVICE
           IN-SERVICE  ----------------->
                                         !in service
```

Figure 3.1.14-1. Set and clear LPO when "Initial Alignment"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and PT.

(3) Issue the Level 3 "Set Local Processor Outage" command at the IUT when the IUT begins initial alignment.

(4) Issue the Level 3 "Clear Local Processor Outage" command at the IUT before the IUT completes initial alignment.

(5) Check that the IUT sends the status "In Service" message when it completes initial alignment and that the "In Service" indication is given to Level 3 at the IUT.

3.1.15. Set and clear LPO when "Aligned ready"

This test case validates the behavior of the IUT when it receives the Level 3 "Set Local Processor Outage" and "Clear Local Processor Outage" commands in the "Aligned Ready" state. The expected sequence of events is illustrated *Figure 3.1.15-1.*

Reference: Q.781/Test 1.15

```
                    PT                      IUT

                         <-----------------  OUT-OF-SERVICE
        OUT-OF-SERVICE   ----------------->
                                             :start
                         <-----------------  ALIGNMENT
                :start
             ALIGNMENT   ----------------->
                         <-----------------  PROVING-NORMAL
        PROVING-NORMAL   ----------------->
                         <-----------------  PROVING
               PROVING   ----------------->
                         <-----------------  IN-SERVICE
                                             :set lpo
            IN-SERVICE   ----------------->
                         <-----------------  PROCESSOR-OUTAGE
                                             !in service
                                             :clear lpo
                         <-----------------  PROCESSOR-OUTAGE-ENDED
```

Figure 3.1.15-1. Set and clear LPO when "Aligned ready"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at both the IUT and the PT.

(3) Check that the IUT follows the normal alignment procedure and sequence of events illustrated in *Figure 3.1.15-1*.

(4) When the IUT has completed the initial alignment procedure, issues the Level 3 "Set Local Processor Outage" command at the IUT.

(5) Check that the IUT sends a status "Processor Outage" message and indicates "In Service" to Level 3 at the IUT.

(6) Issue the Level 3 "Clear Local Processor Outage" command at the IUT.

(7) Check that the IUT sends a status "Processor Outage Ended" message and enters the "In Service" state.

3.1.16. Timer T1 in "Aligned not ready" state

This test case validates the T1 timer and procedures at the IUT when the IUT is in the "Aligned Not Ready" state. The expected sequence of events is illustrated *Figure 3.1.16-1*.

Reference: Q.781/Test 1.16

```
                PT                      IUT

                     <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                         :set lpo
                                         :start
                     <-----------------  ALIGNMENT
              :start
           ALIGNMENT  ----------------->
                     <-----------------  PROVING-NORMAL
      PROVING-NORMAL  ----------------->
                     <-----------------  PROVING
             PROVING  ----------------->
                     <-----------------  PROCESSOR-OUTAGE
                           !
                           !  T1         40.0 <= T1 <= 50.0
                           !
                     <-----------------  OUT-OF-SERVICE
                                         !out of service(T1)
```

Figure 3.1.16-1. Timer T1 in "Aligned not ready" state

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and "Start" command at the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.1.16-1* while completing the initial alignment procedure.

(4) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 with reason "T1 Timeout".

(5) Check that T1 is between 40.0 seconds and 50.0 seconds in duration.

3.1.17. No status "Alignment" sent during normal proving period

This test validates that the normal alignment procedure completes at the IUT when no status "Alignment" message is sent. The expected sequence of events is illustrated *Figure 3.1.17-1*.

Reference: Q.781/Test 1.17

```
                PT                       IUT

                    <------------------  OUT-OF-SERVICE
    OUT-OF-SERVICE  ------------------>
                                         :start
                    <------------------  ALIGNMENT
            :start
    PROVING-NORMAL  ------------------>
                    <------------------  PROVING-NORMAL
           PROVING  ------------------>
                    <------------------  PROVING
                          !
                          !  T3+T4(Pn)   7.5 <= T3+T4 <= 11.0
                          !
                    <------------------  IN-SERVICE
```

Figure 3.1.17-1. No "Alignment" during normal proving period

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at both the IUT and the PT.

(3) Respond to status "Alignment" message sent by the IUT with a status "Proving Normal" message and continue proving.

(4) Check that the IUT sends a status "In Service" message within T4(Pn) plus T3.

(5) Check that the delay from the start of the proving period to the status "In Service" message T4(Pn)+T3 is between 7.5 seconds and 11.0 seconds in duration.

3.1.18. Set and cease emergency prior to "start alignment"

This test case validates the behavior of the IUT when the Level 3 "Set Emergency" and "Clear Emergency" commands are issued prior to the Level 3 "Start" command at the IUT. The expected sequence of events is illustrated *Figure 3.1.18-1*.

Reference: Q.781/Test 1.18

```
                   PT                      IUT

                      <-----------------   OUT-OF-SERVICE
        OUT-OF-SERVICE -----------------> 
                                           :set emergency
                                           :clear emergency
                                           :start
                      <-----------------   ALIGNMENT
               :start
            ALIGNMENT -----------------> 
                      <-----------------   PROVING-NORMAL
        PROVING-NORMAL -----------------> 
                      <-----------------   PROVING
              PROVING -----------------> 
                            !
                            !  T4(Pn)      7.5 <= T4 <= 10.0
                            !
                      <-----------------   IN-SERVICE
```

Figure 3.1.18-1. Toggle emergency before "start alignment"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Emergency," "Clear Emergency" then "Start" commands at the IUT and "Start" command at the PT.

(3) Check that the sequence of events are as illustrated in *Figure 3.1.18-1*. Check that the IUT sends a status "Proving Normal" message in response to the "Alignment" message.

(4) Check that the IUT sends a status "In Service" message.

(5) Check that the IUT uses a normal proving period by timing the delay from the status "Proving Normal" message to the status "In Service" message sent by the IUT.

(6) Check that T4 is between 7.5 seconds and 10.0 seconds in duration.

3.1.19. Set emergency while in "not aligned" state

This test case validates the behavior of the IUT when the Level 3 "Set Emergency" command is issued at the IUT immediately after the Level 3 "Start" command (when the IUT is in the "Not Aligned" state). The expected sequence of events is illustrated *Figure 3.1.19-1*.

Reference: Q.781/Test 1.19

```
                 PT                      IUT

                     <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE  ----------------->
                                         :start
                     <-----------------  ALIGNMENT
                                         :set emergency
             :start
          ALIGNMENT  ----------------->
                     <-----------------  PROVING-EMERGENCY
  PROVING-EMERGENCY  ----------------->
                     <-----------------  PROVING
            PROVING  ----------------->
                           !
                           !  T4(Pe)     0.4 <= T4 <= 0.6
                           !
                     <-----------------  IN-SERVICE
```

Figure 3.1.19-1. Set emergency in "not aligned" state

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" and "Set Emergency" commands at the IUT and "Start" command at the PT.

(3) Check that the sequence of events are as illustrated in *Figure 3.1.19-1*. Check that the IUT sends a status "Proving Emergency" message in response to the "Alignment" message.

(4) Check that the IUT sends a status "In Service" message.

(5) Check that the IUT uses an emergency proving period by timing the delay from the status "Proving Emergency" message to the status "In Service" message sent by the IUT.

(6) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.20. Set emergency when "aligned"

This test case validates the response of the IUT to the Level 3 "Set Emergency" command when issued in the "Aligned" state at the IUT. The expected sequence of events is illustrated *Figure 3.1.20-1*.

Reference: Q.781/Test 1.20

```
                PT                        IUT

                     <------------------  OUT-OF-SERVICE
    OUT-OF-SERVICE   ------------------>
                                          :start
                     <------------------  ALIGNMENT
            :start
         ALIGNMENT   ------------------>
                     <------------------  PROVING-NORMAL
    PROVING-NORMAL   ------------------>
                     <------------------  PROVING
           PROVING   ------------------>
                                          :set emergency
                     <------------------  PROVING-EMERGENCY
                     <------------------  PROVING
           PROVING   ------------------>
                           !
                           !  T4(Pe)      0.4 <= T4 <= 0.6
                           !
                     <------------------  IN-SERVICE
```

Figure 3.1.20-1. Set emergency when "aligned"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) Check that the normal alignment procedure starts as illustrated in *Figure 3.1.20-1*.

(4) Before the normal proving period completes, issue the Level 3 "Set Emergency" command at the ITU.

(5) Check that the IUT sends a status "Proving Emergency" message and later follows with a status "In Service" message.

(6) Check that the IUT begins an emergency proving period by timing the delay from the status "Proving Emergency" message to the status "In Service" message.

(7) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.21. Both ends set emergency.

This test case validates the IUT behavior when the Level 3 "Set Emergency" command is issued at both ends of the link before the Level 3 "Start" command. The expected sequence of events is illustrated *Figure 3.1.21-1*.

Reference: Q.781/Test 1.21

```
                 PT                      IUT

                      <-----------------  OUT-OF-SERVICE
       OUT-OF-SERVICE  ----------------->
                                          :set emergency
                                          :start
                      <-----------------  ALIGNMENT
               :start
            ALIGNMENT  ----------------->
                      <-----------------  PROVING-EMERGENCY
    PROVING-EMERGENCY  ----------------->
                      <-----------------  PROVING
              PROVING  ----------------->
                            !
                            !  T4(Pe)     0.4 <= T4 <= 0.6
                            !
                      <-----------------  IN-SERVICE
```

Figure 3.1.21-1. Both ends set emergency

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Emergency" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT starts the emergency alignment procedure by sending a status "Proving Emergency" message.

(4) Check that the IUT follows the sequence of events as illustrated in *Figure 3.1.21-1*. Check that the IUT completes the alignment procedure and sends a status "In Service" message.

(5) Check that the IUT uses an emergency proving period by timing the delay between sending the status "Proving Normal" message and the status "In Service" message.

(6) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.22. Individual end sets emergency

This test case validates the behavior of the IUT when emergency is individually set at the PT before the initial alignment procedure begins. The expected sequence of events is illustrated *Figure 3.1.22-1*.

Reference: Q.781/Test 1.22

```
                  PT                      IUT

                      <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
          :set emerg
              :start
           ALIGNMENT  ----------------->
                                          :start
                      <-----------------  ALIGNMENT
   PROVING-EMERGENCY  ----------------->
                      <-----------------  PROVING-NORMAL
                      <-----------------  PROVING
             PROVING  ----------------->
                            !
                            !  T4(Pe)     0.4 <= T4 <= 0.6
                            !
                      <-----------------  IN-SERVICE
```

Figure 3.1.22-1. Individual end sets emergency

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Emergency" and "Start" commands at the PT and the "Start" command at the IUT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.22-1*.

(4) Check that the IUT uses the emergency proving period by timing the delay between the status "Proving Normal" message and the status "In Service" message.

(5) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.23. Set emergency during normal proving

This test case validates the IUT behavior when it receives a Level 3 "Set Emergency" command after it has already commenced normal proving. The expected sequence of events is illustrated *Figure 3.1.23-1*.

Reference: Q.781/Test 1.23

```
                PT                       IUT

                   <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE  ----------------->
                                       :start
                   <-----------------  ALIGNMENT
            :start
         ALIGNMENT  ----------------->
                   <-----------------  PROVING-NORMAL
     PROVING-NORMAL  ----------------->
                   <-----------------  PROVING
           PROVING  ----------------->
                                       :set emergency
                   <-----------------  PROVING-EMERGENCY
                   <-----------------  PROVING
           PROVING  ----------------->
                         !
                         !  T4(Pe)     0.4 <= T4 <= 0.6
                         !
                   <-----------------  IN-SERVICE
```

Figure 3.1.23-1. Set emergency during normal proving

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.23-1*.

(4) Before the normal proving period completes at the IUT, issue the Level 3 "Set Emergency" command at the IUT.

(5) Check that the IUT sends a status "Proving Emergency" message and continues proving.

(6) Check that the IUT sends a status "In Service" message.

(7) Check that the IUT uses an emergency proving period by timing the delay between the status "Proving Emergency" message and the status "In Service" message.

(8) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.24. No status "Alignment" sent during emergency alignment

This test case validates the response of the IUT to receiving a status "Proving Normal" without a status "Alignment" during initial alignment using an emergency proving period. The expected sequence of events is illustrated *Figure 3.1.24-1*.

Reference: Q.781/Test 1.24

```
                  PT                      IUT

                     <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                         :set emergency
                                         :start
                     <-----------------  ALIGNMENT
              :start
   PROVING-EMERGENCY  ----------------->
                     <-----------------  PROVING-EMERGENCY
                     <-----------------  PROVING
             PROVING  ----------------->
                           !
                           !  T4(Pe)     0.4 <= T4 <= 0.6
                           !
                     <-----------------  IN-SERVICE
```

Figure 3.1.24-1. No "Alignment" during emergency alignment

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Emergency" and "Start" commands at both the IUT and PT.

(3) Check that the IUT sends a status "Proving Emergency" message and starts proving.

(4) Check that the IUT completes proving and sends a status "In Service" message.

(5) Check that the IUT uses an emergency proving period by timing the delay between the status "Proving Emergency" message and the status "In Service" message.

(6) Check that T4 is between 0.4 seconds and 0.6 seconds in duration.

3.1.25. Deactivation during initial alignment

This test case validates the behavior of the IUT in response to the Level 3 "Stop" command issued during the "Initial Alignment" state at the IUT. The expected sequence of events is illustrated *Figure 3.1.25-1*.

Reference: Q.781/Test 1.25

```
                  PT                      IUT

                     <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                         :start
                     <-----------------  ALIGNMENT
                     -----timeout------
                                         :stop
                     <-----------------  OUT-OF-SERVICE
```

Figure 3.1.25-1. Deactivate during initial alignment

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT.

(3) Before timer T2 expires, issue the Level 3 "Stop" command at the IUT.

(4) Check that the IUT sends a status "Out of Service" message and stays in the "Out of Service" state.

3.1.26. Deactivation during aligned state

This test case validates the behavior of the IUT in response to the Level 3 "Stop" command issued during "Aligned" state at the IUT. The expected sequence of events is illustrated *Figure 3.1.26-1*.

Reference: Q.781/Test 1.26

```
                PT                      IUT

                    <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                        :start
                    <-----------------  ALIGNMENT
            :start
         ALIGNMENT  ----------------->
                    <-----------------  PROVING-NORMAL
                                        :stop
                    <-----------------  OUT-OF-SERVICE
```

Figure 3.1.26-1. Deactivate during aligned state

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.1.26-1*.

(4) Issue the Level 3 "Stop" command at the IUT.

(5) Check that the IUT sends a status "Out of Service" message and stays in the "Out of Service" state.

3.1.27. Deactivation during aligned not ready

This test case validates the behavior of the IUT in response to the Level 3 "Stop" command issued during the "Aligned Not Ready" state at the IUT. The expected sequence of events is illustrated *Figure 3.1.27-1*.

Reference: Q.781/Test 1.27

```
                 PT                        IUT

                       <-----------------  OUT-OF-SERVICE
       OUT-OF-SERVICE  ----------------->
                                           :set lpo
                                           :start
                       <-----------------  ALIGNMENT
               :start
            ALIGNMENT  ----------------->
                       <-----------------  PROVING-NORMAL
       PROVING-NORMAL  ----------------->
                       <-----------------  PROVING
              PROVING  ----------------->
                       <-----------------  PROCESSOR-OUTAGE
                                           :stop
                       <-----------------  OUT-OF-SERVICE
```

Figure 3.1.27-1. Deactivate during aligned not ready

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.1.27-1* and sends a status "Processor Outage" message.

(4) Issue the Level 3 "Stop" command at the IUT.

(5) Check that the IUT sends a status "Out of Service" message and stays in the "Out of Service" state.

3.1.28. Status "alignment" received during link in service

This test case validates the IUT response to receiving a status "Alignment" message in the "In Service" state. The expected sequence of events is illustrated *Figure 3.1.28-1*.

Reference: Q.781/Test 1.28

```
                 PT                        IUT

            ALIGNMENT  ----------------->
                       <-----------------  OUT-OF-SERVICE
                                           !out of service(SIO)
```

Figure 3.1.28-1. "Alignment" during link in service

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send a status "Alignment" to the IUT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 with reason "Received SIO".

3.1.29. Status "out of service" received during link in service

This test case validates the response of the IUT to sending or receiving a status "Out of Service" message in the "In Service" state.

3.1.29.1. Forward Direction

The test case is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.29-1*.

Reference: Q.781/Test 1.29

```
                 PT                      IUT

              :stop
        OUT-OF-SERVICE  ----------------->
                        <-----------------  OUT-OF-SERVICE
                                            !out of service(SIOS)
```

Figure 3.1.29-1. "Out of service" during link in service

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Stop" command at the PT and send a status "Out of Service" message to the IUT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to the Level 3 at the IUT with reason "Received SIOS".

3.1.29.2. Reverse Direction

The test case is repeated in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.29-2*.

Reference: Q.781/Test 1.29

```
                 PT                      IUT

                                            :stop
                        <-----------------  OUT-OF-SERVICE
        OUT-OF-SERVICE  ----------------->
```

Figure 3.1.29-2. "Out of service" during link in service

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Stop" command at the IUT.

(3) Check that the IUT sends a status "Out of Service" message and stays in the "Out of Service" state.

3.1.30. Deactivation during LPO

These test cases validate the response of the IUT to sending a status "Out of Service" message while in the "Processor Outage" state with LPO set, or receiving an "Out of Service" message from an M2PA peer in the "Processor Outage" state with RPO set.

3.1.30.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.30-1*.

Reference: Q.781/Test 1.30

```
                   PT                      IUT

                                           :set lpo
                       <-----------------  PROCESSOR-OUTAGE
                                           :stop
                       <-----------------  OUT-OF-SERVICE

```

Figure 3.1.30-1. Deactivation during LPO

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Issue the Level 3 "Stop" command at the IUT.

(5) Check that the IUT sends a status "Out of Service" message and stays in the "Out of Service" state.

3.1.30.2. Reverse Direction

The test is repeated in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.30-2*.

Reference: Q.781/Test 1.30

```
                   PT                      IUT

             :set lpo
     PROCESSOR-OUTAGE  ----------------->
                :stop
       OUT-OF-SERVICE  ----------------->
                       <-----------------  OUT-OF-SERVICE
                                           !rpo
                                           !out of service(SIOS)

```

Figure 3.1.30-2. Deactivation during LPO

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Stop" commands at the PT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Received SIOS".

3.1.31. Deactivation during RPO

These test cases validate the response of the IUT to sending a status "Out of Service" message while in the "Processor Outage" state with RPO set, or receiving an "Out of Service" message from an M2PA peer in the "Processor Outage" state with LPO set.

3.1.31.1. Forward Direction

The test is performed in the forward direction. The expected sequence of events is illustrated *Figure 3.1.31-1*.

Reference: Q.781/Test 1.31

```
                    PT                      IUT

      PROCESSOR-OUTAGE  ----------------->
                                            :stop
                        <-----------------  OUT-OF-SERVICE
```

Figure 3.1.31-1. Deactivation during RPO

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" command at the PT and send a status "Processor Outage" message to the IUT.

(3) Issue the Level 3 "Stop" command at the IUT.

(4) Check that the IUT sends the status "Out of Service" message and remains in the "Out of Service" state.

3.1.31.2. Reverse Direction

The test is repeated in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.31-2*.

Reference: Q.781/Test 1.31

```
                    PT                      IUT

                                            :set lpo
                        <-----------------  PROCESSOR-OUTAGE
                 :stop
        OUT-OF-SERVICE  ----------------->
```

Figure 3.1.31-2. Deactivation during RPO

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Issue the Level 3 "Stop" command at the PT and send the status "Out of Service" message.

(5) Check that the IUT does not indicate "Out of Service" until the local processor outage condition recovers.

3.1.32. Deactivation during the proving period

These test cases validate the response of the IUT to deactivation (sending or receiving a status "Out of Service" message) during the proving period.

3.1.32.1. Forward Direction

The expected sequence of events is illustrated *Figure 3.1.32-1*.

Reference: Q.781/Test 1.32

```
                 PT                          IUT

                      <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE   ----------------->
                                          :start
                      <-----------------  ALIGNMENT
             :start
          ALIGNMENT   ----------------->
                      <-----------------  PROVING-NORMAL
     PROVING-NORMAL   ----------------->
                      <-----------------  PROVING
            PROVING   ----------------->
              :stop
     OUT-OF-SERVICE   ----------------->
                      <-----------------  OUT-OF-SERVICE
                                          !out of service(AERM)
```

Figure 3.1.32-1. Deactivation during the proving period

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the IUT and the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.1.32-1*.

(4) During the proving period, issue the Level 3 "Stop" command at the PT and send status "Out of Service" to the ITU.

(5) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Alignment Not Possible".

3.1.32.2. Reverse Direction

The test is repeated in the reverse direction. The expected sequence of events is illustrated *Figure 3.1.32-2*.

Reference: Q.781/Test 1.32

```
                 PT                          IUT

     OUT-OF-SERVICE   ----------------->
             :start
                                          :start
          ALIGNMENT   ----------------->
                      <-----------------  OUT-OF-SERVICE
                      <-----------------  ALIGNMENT
     PROVING-NORMAL   ----------------->
                      <-----------------  PROVING-NORMAL
            PROVING   ----------------->
                      <-----------------  PROVING
                                          :stop
                      <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE   ----------------->
```

Figure 3.1.32-2. Deactivation during the proving period

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue the Level 3 "Start" command at the PT and the IUT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.32-2*.

(4) During the proving period, issue a Level 3 "Stop" command at the IUT.

(5) Check that the IUT sends a status "Out of Service" message and remains in the "Out of Service" state.

3.1.33. Status "Alignment" received instead of status "In Service"

This test case validates the response of the IUT to receiving a status "Alignment" message instead of a status "In Service" or "Processor Outage" message at the completion of initial alignment. The expected sequence of events is illustrated *Figure 3.1.33-1*.

Reference: Q.781/Test 1.33

```
                PT                      IUT

                    <-----------------  OUT-OF-SERVICE
    OUT-OF-SERVICE  ----------------->
                                        :start
                    <-----------------  ALIGNMENT
            :start
         ALIGNMENT  ----------------->
                    <-----------------  PROVING-NORMAL
    PROVING-NORMAL  ----------------->
                    <-----------------  PROVING
           PROVING  ----------------->
                    <-----------------  IN-SERVICE
         ALIGNMENT  ----------------->
                    <-----------------  OUT-OF-SERVICE
                                        !out of service(SIO)
```

Figure 3.1.33-1. "Alignment" instead of "In Service"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue a Level 3 "Start" command at the IUT and the PT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.33-1*.

(4) When the IUT sends a status "In Service" message, send a status "Alignment" message to the IUT.

(5) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Received SIO".

3.1.34. Status "Out of Service" received instead of status "In Service"

This test case validates the response of the IUT to receiving a status "Out of Service" message instead of a status "In Service" or "Processor Outage" message at the completion of initial alignment. The expected sequence of events is illustrated *Figure 3.1.34-1*.

Reference: Q.781/Test 1.34

```
                  PT                       IUT

                      <------------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ------------------>
                                           :start
                      <------------------  ALIGNMENT
              :start
           ALIGNMENT  ------------------>
                      <------------------  PROVING-NORMAL
      PROVING-NORMAL  ------------------>
                      <------------------  PROVING
             PROVING  ------------------>
                      <------------------  IN-SERVICE
               :stop
      OUT-OF-SERVICE  ------------------>
                      <------------------  OUT-OF-SERVICE
                                           !out of service(SIOS)
```

Figure 3.1.34-1. "Out of Service" instead of "In Service"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue a Level 3 "Start" command at the IUT and the PT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.34-1*.

(4) When the IUT sends a status "In Service" message, send a status "Out of Service" message to the IUT.

(5) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Received SIOS".

3.1.35. Status "Processor Outage" received instead of "In Service"

This test case validates the response of the IUT to receiving a status "Processor Outage" message instead of a status "In Service" message at the completion of initial alignment. The expected sequence of events is illustrated *Figure 3.1.35-1*.

Reference: Q.781/Test 1.35

```
                PT                       IUT

                     <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE -----------------> 
                                         :start
                     <-----------------  ALIGNMENT
              :start
           ALIGNMENT ----------------->
                     <-----------------  PROVING-NORMAL
      PROVING-NORMAL ----------------->
                     <-----------------  PROVING
             PROVING ----------------->
                     <-----------------  IN-SERVICE
            :set lpo
    PROCESSOR-OUTAGE ----------------->
                                         !rpo
```

Figure 3.1.35-1. "Processor Outage" instead of "In Service"

Test Description:

(1) The test begins with the link in the "Out of Service" state.

(2) Issue a Level 3 "Start" command at the IUT and the PT.

(3) Check that the sequence of events follows that illustrated in *Figure 3.1.35-1*.

(4) When the IUT sends a status "In Service" message, issue a Level 3 "Set Local Processor Outage" command at the PT and send a status "Processor Outage" message to the IUT.

(5) Check that the IUT indicates "Remote Processor Outage" to Level 3 at the IUT.

3.2. Link State Control - Unexpected signal units/orders

This suite of test cases test the response of the Implementation Under Test to unexpected sequences Level 3 requests and received M2PA messages in various states. These test cases validates the robustness of the implementation in responding to unusual circumstances.

3.2.1. Unexpected signal units/orders in "Out of service" state

This case validates the response of the IUT to the receipt of unexpected Level 3 requests and receipt of unexpected M2PA messages while in the "Out of Service" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.1-1*.

Reference: Q.781/Test 2.1

```
                    PT                      IUT

                        <-----------------  OUT-OF-SERVICE
        OUT-OF-SERVICE  ----------------->
             ALIGNMENT  ----------------->
        PROVING-NORMAL  ----------------->
     PROVING-EMERGENCY  ----------------->
      PROCESSOR-OUTAGE  ----------------->
                  BUSY  ----------------->
      [INVALID-STATUS]  ----------------->
PROCESSOR-OUTAGE-ENDED  ----------------->
            IN-SERVICE  ----------------->
            BUSY-ENDED  ----------------->
                  DATA  ----------------->
                                            :stop
                                            :start
                        <-----------------  ALIGNMENT
             ALIGNMENT  ----------------->
                        <-----------------  PROVING-NORMAL
        PROVING-NORMAL  ----------------->
                        <-----------------  PROVING
               PROVING  ----------------->
                        <-----------------  IN-SERVICE
            IN-SERVICE  ----------------->
                                            !in service
```

Figure 3.2.1-1. Unexpected events in the "Out of Service" State

Test Description:

(1) The test begins with both M2PA peers in the "Out of Service" state.

(2) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Out of Service"
- Status "Alignment"
- Status "Proving Normal"
- Status "Proving Emergency"
- Status "Processor Outage"
- Status "Busy"
- Status Invalid
- Status "Processor Outage Ended"
- Status "Busy Ended"
- Status "In Service"
- Data

(3) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Stop" command

(4) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(5) The Level 3 "Start" command is then issued.

(6) Check that the link aligns normally.

(7) Check that link alignment uses normal alignment procedures.

(8) Check that the link goes in service and stays in service without local or remote processor outage indications to Level 3.

3.2.2. Unexpected signal units/orders in "Not Aligned" state

This test case validates the response of the IUT to the receipt of unexpected Level 3 requests and receipt of unexpected M2PA messages while in the "Not Aligned" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.2-1*.

Reference: Q.781/Test 2.2

```
                 PT                       IUT

                   <------------------  OUT-OF-SERVICE
     OUT-OF-SERVICE ------------------>
                                         :start
                   <------------------  ALIGNMENT
     OUT-OF-SERVICE ------------------>
   PROCESSOR-OUTAGE ------------------>
               BUSY ------------------>
   [INVALID-STATUS] ------------------>
         IN-SERVICE ------------------>
               DATA ------------------>
                                         :clear emergency
                                         :start
          ALIGNMENT ------------------>
                   <------------------  PROVING-NORMAL
     PROVING-NORMAL ------------------>
                   <------------------  PROVING
            PROVING ------------------>
                   <------------------  IN-SERVICE
         IN-SERVICE ------------------>
                                         !in service
```

Figure 3.2.2-1. Unexpected events while "not aligned"

Test Description:

(1) The test begins with both M2PA peers in the "Out of Service" state.

(2) The Level 3 "Start" command is issued to IUT to place the IUT in the "Not Aligned" state.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Out of Service"
- Status "Processor Outage"
- Status "Busy"
- Status Invalid
- Status "In Service"
- Data

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Clear Emergency" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) A status "Alignment" is then sent to the IUT.

(7) Check that the IUT aligns as usual and performs the normal alignment procedures.

(8) Check that the IUT places the link in service and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.2.3. Unexpected signal units/orders in "Aligned" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "Aligned" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.3-1*.

Reference: Q.781/Test 2.3

```
                  PT                        IUT

                     <------------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ------------------>
                                          :start
                     <------------------  ALIGNMENT
              :start
           ALIGNMENT  ------------------>
                     <------------------  PROVING-NORMAL
           ALIGNMENT  ------------------>
    PROCESSOR-OUTAGE  ------------------>
                BUSY  ------------------>
    [INVALID-STATUS]  ------------------>
          IN-SERVICE  ------------------>
PROCESSOR-OUTAGE-ENDED ------------------>
          BUSY-ENDED  ------------------>
                DATA  ------------------>
                                          :clear emergency
                                          :start
      PROVING-NORMAL  ------------------>
                     <------------------  PROVING
             PROVING  ------------------>
                     <------------------  IN-SERVICE
          IN-SERVICE  ------------------>
                                          !in service
```

Figure 3.2.3-1. Unexpected events while "aligned"

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) The IUT is brought to the "Aligned" state using normal procedures.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Alignment"
- Status "Processor Outage"
- Status "Busy"
- Status Invalid
- Status "In Service"
- Status "Processor Outage Ended"
- Status "Busy Ended"
- Data

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Clear Emergency" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) Check that the IUT aligns as usual and performs the normal alignment procedure.

(7) Check that the IUT places the link in service and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.2.4. Unexpected signal units/orders in "Proving" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "Proving" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.4-1*.

Reference: Q.781/Test 2.4

```
                     PT                      IUT

                         <------------------  OUT-OF-SERVICE
         OUT-OF-SERVICE  ------------------>
                                              :start
                         <------------------  ALIGNMENT
                 :start
              ALIGNMENT  ------------------>
                         <------------------  PROVING-NORMAL
         PROVING-NORMAL  ------------------>
                         <------------------  PROVING
PROCESSOR-OUTAGE-ENDED   ------------------>
       PROCESSOR-OUTAGE  ------------------>
             BUSY-ENDED  ------------------>
                   BUSY  ------------------>
       [INVALID-STATUS]  ------------------>
             IN-SERVICE  ------------------>
                   DATA  ------------------>
                PROVING  ------------------>
                                              :clear emergency
                                              :start
                         <------------------  IN-SERVICE
             IN-SERVICE  ------------------>
                                              !in service
```

Figure 3.2.4-1. Unexpected events while "proving"

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) The IUT is brought to the "Proving" state using normal procedures.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Processor Outage Ended"
- Status "Processor Outage"
- Status "Busy Ended"
- Status "Busy"
- Status Invalid
- Status "In Service"
- Data

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Clear Emergency" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) Check that the IUT aligns as usual and performs the normal alignment procedure.

(7) Check that the IUT places the link in service and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.2.5. Unexpected signal units/orders in "Aligned Ready" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "Aligned Ready" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.5-1*.

Reference: Q.781/Test 2.5

```
                  PT                        IUT

                      <------------------   OUT-OF-SERVICE
      OUT-OF-SERVICE  ------------------>
                                            :start
                      <------------------   ALIGNMENT
              :start
           ALIGNMENT  ------------------>
                      <------------------   PROVING-NORMAL
      PROVING-NORMAL  ------------------>
                      <------------------   PROVING
             PROVING  ------------------>
                      <------------------   IN-SERVICE
                BUSY  ------------------>
    [INVALID-STATUS]  ------------------>
                                            :set emergency
                                            :clear emergency
                                            :clear lpo
                                            :start
          IN-SERVICE  ------------------>
                                            !in service
```

Figure 3.2.5-1. Unexpected events while "aligned ready"

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) The IUT is brought to the "Aligned Ready" state using normal procedures.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Busy"
- Status Invalid

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Set Emergency" command
- Level 3 "Clear Emergency" command
- Level 3 "Clear Local Processor Outage" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) Check that the IUT aligns as usual and performs the normal alignment procedure.

(7) Check that the IUT places the link in service and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.2.6. Unexpected signal units/orders in "Aligned Not Ready" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "Aligned Not Ready" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.6-1*.

Reference: Q.781/Test 2.6

```
                 PT                      IUT

                     <-----------------  OUT-OF-SERVICE
     OUT-OF-SERVICE  ----------------->
                                         :set lpo
                                         :start
                     <-----------------  ALIGNMENT
             :start
          ALIGNMENT  ----------------->
                     <-----------------  PROVING-NORMAL
     PROVING-NORMAL  ----------------->
                     <-----------------  PROCESSOR-OUTAGE
               BUSY  ----------------->
   [INVALID-STATUS]  ----------------->
                                         :set emergency
                                         :clear emergency
                                         :set lpo
                                         :start
                     <-----------------  PROVING
            PROVING  ----------------->
         IN-SERVICE  ----------------->
                                         !in service
```

Figure 3.2.6-1. Unexpected events while "aligned not ready"

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) The IUT is brought to the "Aligned Not Ready" state using normal procedures.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Busy"
- Status Invalid

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Set Emergency" command
- Level 3 "Clear Emergency" command
- Level 3 "Set Local Processor Outage" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) Check that the IUT places the link in service.

3.2.7. Unexpected signal units/orders in "In Service" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "In Service" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.7-1*.

Reference: Q.781/Test 2.7

```
 ________________________________________________________________________
|                                                                        |
|                     PT                       IUT                       |
|                                                                        |
|       [INVALID-STATUS]  ------------------>                            |
|                                              :set emergency            |
|                                              :clear emergency          |
|                                              :clear lpo                |
|                                              :start                    |
|                                                                        |
|________________________________________________________________________|
```

Figure 3.2.7-1. Unexpected events while "in service"

Test Description:

(1) The test begins with both IUT and PT in the "In Service" state.

(2) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status Invalid

(3) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Set Emergency" command
- Level 3 "Clear Emergency" command
- Level 3 "Clear Local Processor Outage" command
- Level 3 "Start" command

(4) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(5) Check that the IUT retains the link in the in service state and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.2.8. Unexpected signal units/orders in "Processor Outage" state

This case validates the response of the IUT to the receipt of unexpected Level 3 request and receipt of unexpected M2PA messages while in the "Processor Outage" state. All of the unexpected sequences in this test case must be ignored by the IUT. The expected sequence of events is illustrated *Figure 3.2.8-1.*

Reference: Q.781/Test 2.8

```
 ________________________________________________________________________
|                                                                        |
|                     PT                       IUT                       |
|                                                                        |
|                                              :set lpo                  |
|                        <------------------  PROCESSOR-OUTAGE           |
|                   BUSY  ------------------>                            |
|       [INVALID-STATUS]  ------------------>                            |
|                                              :set emergency            |
|                                              :clear emergency          |
|                                              :start                    |
|             IN-SERVICE  ------------------>                            |
|PROCESSOR-OUTAGE-ENDED  ------------------>                             |
|            BUSY-ENDED  ------------------>                             |
|                                                                        |
|________________________________________________________________________|
```

Figure 3.2.8-1. Unexpected events while "processor outage"

Test Description:

(1) The test begins with both IUT and PT in the "In Service" state.

(2) The IUT is brought to the "Processor Outage" state using normal procedures.

(3) A sequence of unexpected M2PA messages are sent to the IUT. These unexpected messages are:

- Status "Busy"
- Status Invalid
- Status "In Service"
- Status "Processor Outage Ended"
- Status "Busy Ended"

(4) A sequence of unexpected Level 3 commands are issued at the IUT. These unexpected Level 3 commands are:

- Level 3 "Set Emergency" command
- Level 3 "Clear Emergency" command
- Level 3 "Start" command

(5) Check that the IUT ignores the unexpected M2PA messages/Level 3 commands.

(6) Check that the IUT keeps the link in service and that no local or remote processor outage indications are given to Level 3 at the IUT.

3.3. Transmission Failure

This set of test cases validate specific transmission path failures and anomalies. Specifically transmission path failures, corrupt acknowledgments and invalid sequencing. Because SCTP does not have a transmission path that is separate from a receive path, the Q.781 tests that validate response to breaking the transmission path are simulated by aborting the association. Because M2PA does not have forward sequence numbers, the Q.781 tests that validate response to abnormal forward sequence numbers are not applicable. Because M2PA does not have forward indicator bits, the Q.781 tests that validate response to abnormal forward indicator bits are simulated by invalid Ack messages.

3.3.1. Link aligned ready (Abort)

This case validates the response of the IUT to aborting the SCTP association when the IUT is in the "Aligned Ready" state. The expected sequence of events is illustrated *Figure 3.3.1-1*.

Reference: Q.781/Test 3.1

```
                  PT                      IUT

                      <------------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ------------------>
                                           :start
                      <------------------  ALIGNMENT
              :start
           ALIGNMENT  ------------------>
                      <------------------  PROVING-NORMAL
      PROVING-NORMAL  ------------------>
                      <------------------  PROVING
             PROVING  ------------------>
                      <------------------  IN-SERVICE
           :tx break
                                           !out of service(SUERM)
```

Figure 3.3.1-1. Link aligned ready (Abort)

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) Issue a Level 3 "Start" command at the IUT and the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.3.1-1*.

(4) When the IUT sends a status "In Service" message, abort the SCTP association.

(5) Check that the IUT indicates "Out of Service" to Level 3 at the IUT with reason "Excessive error rate SUERM" and stays in the "Out of Service" state.

3.3.2. Link aligned ready (Invalid Acks)

This test case validates the response of the IUT to receiving two consecutive invalid Ack messages in the "Aligned Ready" state. The expected sequence of events is illustrated *Figure 3.3.2-1*.

Reference: Q.781/Test 3.2

```
                 PT                     IUT

                ACK  ------------------>
                ACK  ------------------>
                     <------------------  OUT-OF-SERVICE
                                          !out of service(FIBR)
```

Figure 3.3.2-1. Link aligned ready (Invalid Acks)

Test Description:

(1) The test begins with both IUT and PT in the "Out of Service" state.

(2) Send two consecutive Ack messages to the IUT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Abnormal FIBR" and stays in the "Out of Service" state.

3.3.3. Link aligned not ready (Abort)

This test case validates the response of the IUT to aborting the SCTP association when the IUT is in the "Aligned Not Ready" state. The expected sequence of events is illustrated *Figure 3.3.3-1*.

Reference: Q.781/Test 3.3

```
                 PT                     IUT

                     <------------------  OUT-OF-SERVICE
     OUT-OF-SERVICE  ------------------>
                                          :set lpo
                                          :start
                     <------------------  ALIGNMENT
             :start
          ALIGNMENT  ------------------>
                     <------------------  PROVING-NORMAL
     PROVING-NORMAL  ------------------>
                     <------------------  PROVING
            PROVING  ------------------>
                     <------------------  PROCESSOR-OUTAGE
          :tx break
                                          !out of service(SUERM)
```

Figure 3.3.3-1. Link aligned not ready (Abort)

Test Description:

(1) The test begins with both PT and IUT in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.3.3-1*.

(4) When the IUT sends a status "Processor Outage" message, abort the SCTP association.

(5) Check that the IUT indicates "Out of Service" to Level 3 at the IUT with reason "Excessive Error Rate/SUERM" and stays in the "Out of Service" state.

3.3.4. Link aligned not ready (Invalid Acks)

This test case validates the response of the IUT to the receipt of two consecutive invalid Ack messages in the "Aligned Not Ready" state.

The expected sequence of events is illustrated *Figure 3.3.4-1*.

Reference: Q.781/Test 3.4

```
                  PT                        IUT

                      <-----------------  OUT-OF-SERVICE
      OUT-OF-SERVICE  ----------------->
                                          :set lpo
                                          :start
                      <-----------------  ALIGNMENT
              :start
           ALIGNMENT  ----------------->
                      <-----------------  PROVING-NORMAL
      PROVING-NORMAL  ----------------->
                      <-----------------  PROVING
             PROVING  ----------------->
                      <-----------------  PROCESSOR-OUTAGE
                 ACK  ----------------->
                 ACK  ----------------->
                      <-----------------  OUT-OF-SERVICE
                                          !out of service(FIBR)
```

Figure 3.3.4-1. Link aligned not ready (Invalid Acks)

Test Description:

(1) The test begins with both PT and IUT in the "Out of Service" state.

(2) Issue the Level 3 "Set Local Processor Outage" and "Start" commands at the IUT and the "Start" command at the PT.

(3) Check that the IUT follows the sequence of events illustrated in *Figure 3.3.4-1*.

(4) When the IUT sends a status "Processor Outage" message, send two consecutive invalid Ack messages to the IUT.

(5) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Abnormal FIBR" and remains in the "Out of Service" state.

3.3.5. Link in service (Abort)

The expected sequence of events is illustrated *Figure 3.3.5-1*.

Reference: Q.781/Test 3.5

```
                    PT                        IUT

             :tx break
                                              !out of service(SUERM)
```

Figure 3.3.5-1. Link in service (Abort)

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Abort the SCTP association.

(3) Check that the IUT indicates "Out of Service" to Level 3 at the IUT with reason "Excessive Error Rate/SUERM" and stays in the "Out of Service" state.

3.3.6. Link in service (Invalid Acks)

This test case validates the response of the IUT to two consecutive invalid Ack messages in the "In Service" state. The expected sequence of events is illustrated *Figure 3.3.6-1*.

Reference: Q.781/Test 3.6

```
                    PT                        IUT

                   ACK  ------------------>
                   ACK  ------------------>
                        <------------------  OUT-OF-SERVICE
                                              !out of service(FIBR)
```

Figure 3.3.6-1. Link in service (Invalid Acks)

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send two consecutive invalid Ack messages to the IUT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Abnormal FIBR" and stays in the "Out of Service" state.

3.3.7. Link in processor outage (Abort)

This test case validates the response of the IUT to aborting the SCTP association when the IUT is in the "Processor Outage" state. The expected sequence of events is illustrated *Figure 3.3.7-1*.

Reference: Q.781/Test 3.7

```
                    PT                        IUT

                                              :set lpo
                        <------------------  PROCESSOR-OUTAGE
             :tx break
                                              !out of service(SUERM)
```

Figure 3.3.7-1. Link in processor outage (Abort)

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issues the Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Abort the SCTP association.

(5) Check that the IUT indicates "Out of Service" to Level 3 at the IUT with reason "Excessive Error Rate/SUERM" and stays in the "Out of Service" state.

3.3.8. Link in processor outage (Invalid Acks)

This test case validates the response of the IUT to receiving two consecutive Invalid Ack messages while in the "Processor Outage" state. The expected sequence of events is illustrated *Figure 3.3.8-1*.

Reference: Q.781/Test 3.8

```
                  PT                     IUT
                                         :set lpo
                      <-----------------  PROCESSOR-OUTAGE
                 ACK  ----------------->
                 ACK  ----------------->
                      <-----------------  OUT-OF-SERVICE
                                         !out of service(FIBR)
```

Figure 3.3.8-1. Link in processor outage (Invalid Acks)

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issues a Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Send two consecutive invalid Ack messages to the IUT.

(5) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "Abnormal FIBR" and stays in the "Out of Service" state.

3.4. Processor Outage Control

3.4.1. Set and clear LPO while link in service

This test case validates the response of the IUT to a local processor outage condition and recovery with buffer clearing. The expected sequence of events is illustrated *Figure 3.4.1-1*.

Reference: Q.781/Test 4.1

```
                   PT                      IUT

                                           :msu
                                           :msu
                       <------------------ DATA [   35 bytes]
                  ACK  ------------------>
                       <------------------ DATA [   35 bytes]
                                           :set lpo
                 DATA  ------------------>
                       <------------------ PROCESSOR-OUTAGE
                                           :clear buffers
                                           :msu
                                           :clear lpo
                       <------------------ DATA [   35 bytes]
                  ACK  ------------------>
                       <------------------ PROCESSOR-OUTAGE-ENDED
```

Figure 3.4.1-1. Set and clear LPO while link in service

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send two MSUs from the IUT and then issue a Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends two Data messages and a status "Processor Outage" message.

(4) Acknowledge one data message with an Ack message at the PT and send a Data message from the PT to the IUT.

(5) Check that the IUT sends a status "Processor Outage" message.

(6) Check that the IUT does not require an acknowledgments to the second Data message by waiting longer than timer T7 at the IUT.

(7) At the IUT, issue a Level 3 "Clear Buffers" command, send an MSU, and then issue a Level 3 "Clear Local Processor Outage".

(8) Check that the IUT sends a Data message and send an Ack message to the IUT in response. Check that the IUT sends a "Processor Outage Ended" message.

(9) To ensure that the IUT is not expecting another acknowledgments, wait for longer than T7 and check that the IUT sends no further status messages and remains in the "In Service" state.

3.4.2. RPO during LPO

This test case validates the response of the IUT to receiving a status "Processor Outage" message and status "Processor Outage Ended" message while in the "Processor Outage" state with LPO set at the IUT. The expected sequence of events is illustrated *Figure 3.4.2-1*.

Reference: Q.781/Test 4.2

```
                    PT                     IUT
                                           :set lpo
                      <-----------------   PROCESSOR-OUTAGE
              set lpo:
      PROCESSOR-OUTAGE  ----------------->
                                           !rpo
            clear lpo:
PROCESSOR-OUTAGE-ENDED  ----------------->
                                           !rpr
```

Figure 3.4.2-1. RPO during LPO

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue a Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Issue a Level 3 "Set Local Processor Outage" command at the PT and send a status "Processor Outage" message to the IUT.

(5) Check that the IUT indicates "Remote Processor Outage" to Level 3 at the IUT.

(6) Issue a level 3 "Clear Local Processor Outage" command at the PT and send a status "Processor Outage Ended" message to the IUT.

(7) Check that the IUT indicates "Remote Processor Recovered" to Level 3 at the IUT.

3.4.3. Clear LPO when "Both processor outage"

This test case validates the response of the IUT to the receipt of a Level 3 "Clear Local Processor Outage" command when the IUT is in the "Processor Outage" state with both processors marked PO. The expected sequence of events is illustrated *Figure 3.4.3-1*.

Reference: Q.781/Test 4.3

```
                    PT                     IUT

                                           :set lpo
                      <-----------------   PROCESSOR-OUTAGE
              :set lpo
      PROCESSOR-OUTAGE  ----------------->
                                           !rpo
                                           :clear lpo
                      <-----------------   PROCESSOR-OUTAGE-ENDED
            :clear lpo
PROCESSOR-OUTAGE-ENDED  ----------------->
                                           !rpr
```

Figure 3.4.3-1. Clear LPO when "Both processor outage"

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Issue a Level 3 "Set Local Processor Outage" command at the IUT.

(3) Check that the IUT sends a status "Processor Outage" message.

(4) Issue a Level 3 "Set Local Processor Outage" command at the PT and send a status "Processor Outage" message to the IUT.

(5) Check that the ITU indicates "Remote Processor Outage" to Level 3 at the IUT.

(6) Issue a Level 3 "Clear Local Processor Outage" command at the IUT.

(7) Check that the IUT sends a status "Processor Ended" message.

(8) Issue a Level 3 "Clear Local Processor Outage" command at the PT and send a status "Processor Outage Ended" message to the IUT.

(9) Check that the IUT indicates "Remote Processor Recovered" to Level 3 at the IUT and remains in the "In Service" state.

3.5. SU delimitation, alignment, error detection and correction

Most of the test cases in this section are not applicable to M2PA operation.

3.5.1. More than 7 ones between MSU opening and closing flags

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.1-1*.

Reference: Q.781/Test 5.1

```
        PT                      IUT

              NOT APPLICABLE
```

Figure 3.5.1-1. Not applicable

Test Description:

(1) Not Applicable

3.5.2. Greater than maximum signal unit length

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.2-1*.

Reference: Q.781/Test 5.2

```
        PT                      IUT


              NOT APPLICABLE
```

Figure 3.5.2-1. Not applicable

Test Description:

(1) Not Applicable

3.5.3. Below minimum signal unit length

This test case validates the IUT response to a Data message with a payload below the minimum MSU length. The expected sequence of events is illustrated *Figure 3.5.3-1*.

Reference: Q.781/Test 5.3

```
 ______________________________________________________________________
|                                                                      |
|                     PT                       IUT                     |
|                                                                      |
|          1 byte   DATA  ----------------->                           |
|                                                                      |
|______________________________________________________________________|
```

Figure 3.5.3-1. Not applicable

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send a Data message with one byte of payload to the IUT.

(3) Check that the IUT does not acknowledge the Data message and remains in the "In Service" state.

3.5.4. Reception of single and multiple flags between FISUs

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.4-1*.

Reference: Q.781/Test 5.4

```
 ______________________________________________________________________
|                                                                      |
|                     PT                       IUT                     |
|                                                                      |
|                           NOT APPLICABLE                             |
|______________________________________________________________________|
```

Figure 3.5.4-1. Not applicable

Test Description:

(1) Not applicable.

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.4-2*.

Reference: Q.781/Test 5.4

```
 ______________________________________________________________________
|                                                                      |
|                     PT                       IUT                     |
|                                                                      |
|                           NOT APPLICABLE                             |
|______________________________________________________________________|
```

Figure 3.5.4-2. Not applicable

Test Description:

(1) Not applicable.

3.5.5. Reception of single and multiple flags between MSUs

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.5-1*.

Reference: Q.781/Test 5.5

```
 ______________________________________________________________________
|                                                                      |
|                     PT                       IUT                     |
|                                                                      |
|                           NOT APPLICABLE                             |
|______________________________________________________________________|
```

Figure 3.5.5-1. Not applicable

Test Description:

(1) Not applicable.

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.5.5-2*.

Reference: Q.781/Test 5.5

```
              PT                      IUT

                    NOT APPLICABLE
```

Figure 3.5.5-2. Not applicable

Test Description:

(1) Not applicable.

3.6. SUERM check

The test cases in this section are not applicable to M2PA. These tests might have corresponding tests at the SCTP layer, however, that is the topic of an SCTP test specification rather than an M2PA test specification.

3.6.1. Error rate of 1 in 256 - Link remains in service

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.6.1-1*.

Reference: Q.781/Test 6.1

```
              PT                      IUT

                    NOT APPLICABLE
```

Figure 3.6.1-1. Not applicable

Test Description:

(1) Not applicable.

3.6.2. Error rate of 1 in 254 - Link out of service

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.6.2-1*.

Reference: Q.781/Test 6.2

```
              PT                      IUT

                    NOT APPLICABLE
```

Figure 3.6.2-1. Not applicable

Test Description:

(1) Not applicable.

3.6.3. Consecutive corrupt SUs

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.6.3-1*.

Reference: Q.781/Test 6.3

```
|                                                                  |
|                    PT                        IUT                 |
|                                                                  |
|                          NOT APPLICABLE                          |
|__________________________________________________________________|
```

Figure 3.6.3-1. Not applicable

Test Description:

(1) Not applicable.

3.6.4. Time controlled break of the link

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.6.4-1*.

Reference: Q.781/Test 6.4

```
|                                                                  |
|                    PT                        IUT                 |
|                                                                  |
|                          NOT APPLICABLE                          |
|__________________________________________________________________|
```

Figure 3.6.4-1. Not applicable

Test Description:

(1) Not applicable.

3.7. AERM check

The test cases in this section are not applicable to M2PA. These test might have corresponding test at the SCTP layer, however, that is the topic of an SCTP test specification rather than an M2PA test specification.

3.7.1. Error rate below the normal threshold

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.7.1-1*.

Reference: Q.781/Test 7.1

```
|                                                                  |
|                    PT                        IUT                 |
|                                                                  |
|                          NOT APPLICABLE                          |
|__________________________________________________________________|
```

Figure 3.7.1-1. Not applicable

Test Description:

(1) Not applicable.

3.7.2. Error rate at the normal threshold

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.7.2-1*.

Reference: Q.781/Test 7.2

```
|                                                                  |
|                    PT                        IUT                 |
|                                                                  |
|                          NOT APPLICABLE                          |
|__________________________________________________________________|
```

Figure 3.7.2-1. Not applicable

Test Description:

(1) Not applicable.

3.7.3. Error rate above the normal threshold

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.7.3-1*.

Reference: Q.781/Test 7.3

```
                    PT                        IUT

                          NOT APPLICABLE
```

Figure 3.7.3-1. Not applicable

Test Description:

(1) Not applicable.

3.7.4. Error rate at the emergency threshold

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.7.4-1*.

Reference: Q.781/Test 7.4

```
                    PT                        IUT

                          NOT APPLICABLE
```

Figure 3.7.4-1. Not applicable

Test Description:

(1) Not applicable.

3.8. Transmission and reception control (Basic)

A number of test cases in this section are not applicable to M2PA. Some may be the topic of a test specification for SCTP but are not applicable to M2PA. Test cases that are applicable in this section validate the basic transmission, reception and acknowledgments of Data messages with Ack messages.

3.8.1. MSU transmission and reception

This test case validates the IUT response to the sending and receipt of Data and Ack messages. The expected sequence of events is illustrated *Figure 3.8.1-1*.

Reference: Q.781/Test 8.1

```
                    PT                        IUT

                  DATA  ------------------>
                        <------------------  ACK [     1 msgs]
                                             !msu
                                             :msu
                        <------------------  DATA [   35 bytes]
                   ACK  ------------------>
```

Figure 3.8.1-1. Data transmission and reception

Test Description:

(1) This test begins with the link in the "In Service" state.

(2) Send a Data message to the IUT.

(3) Check that the IUT sends an Ack message acknowledging the received Data message and delivers the received MSU to Level 3 at the IUT.

(4) Issue a Level 3 MSU to the IUT.

(5) Check that the IUT sends a Data message.

(6) Send an Ack message to the IUT acknowledging the data message.

(7) Check that the IUT receives the acknowledgments by waiting longer than time T7 and ensuring that the IUT stays in the "In Service" state.

3.8.2. Negative acknowledgments of an MSU

M2PA does not perform negative acknowledgments at the M2PA layer. Negative acknowledgments are performed as necessary by the underlying SCTP transport. As such, test cases involving negative acknowledgments are not applicable.

The expected sequence of events is illustrated *Figure 3.8.2-1*.

Reference: Q.781/Test 8.2

```
                    PT                        IUT

                          NOT APPLICABLE
```

Figure 3.8.2-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.3. Check RTB full

This test case validates the IUT response to an RTB full condition at the IUT. The expected sequence of events is illustrated *Figure 3.8.3-1*.

Reference: Q.781/Test 8.3

```
                PT                       IUT

                                         :msu
                                         :msu
                                         :msu
                                                 .
                                                 .
                                                 .
                                                 Ct=  254

                     <-----------------  DATA [   35 bytes]
                     <-----------------  DATA [   35 bytes]
                     <-----------------  DATA [   35 bytes]
                                                 .
                                                 .
                                                 .
                                                 Ct=  127
                ACK  ----------------->
                     <-----------------  DATA [   35 bytes]
                     <-----------------  DATA [   35 bytes]
                     <-----------------  DATA [   35 bytes]
                                                 .
                                                 .
                                                 .
                                                 Ct=  127
                ACK  ----------------->
```

Figure 3.8.3-1. Check RTB full

Test Description:

(1) This test begins with the link in the "In Service" state.

(2) Send 2 x N2 MSUs at the IUT.

(3) Check that the IUT sends N2 Data messages and then stops sending Data messages (RTB Full condition).

(4) Acknowledge the N2 Data messages in a single Ack message.

(5) Check that the IUT sends another N2 Data messages.

(6) Acknowledge the N2 Data messages in a single Ack message.

(7) Check that the IUT remains in the "In Service" state longer than time T7.

3.8.4. Single invalid Ack

This test case validates the response of the IUT to a single invalid Ack message. The expected sequence of events is illustrated *Figure 3.8.4-1*.

Reference: Q.781/Test 8.4

```
                PT                      IUT

               ACK  ----------------->
                                        :msu
                    <-----------------  DATA [   35 bytes]
               ACK  ----------------->
              DATA  ----------------->
                    <-----------------  ACK [    1 msgs]
                                        !msu
```

Figure 3.8.4-1. Single invalid Ack

Test Description:

(1) This test begins with the link in the "In Service" state.

(2) Send an invalid Ack message to the IUT.

(3) Send an MSU at the IUT.

(4) Check that the IUT sends a Data message.

(5) Acknowledge the Data message with an Ack message to the IUT

(6) Send an Data message to the IUT.

(7) Check that the IUT acknowledges the Data message with an Ack message and delivers an MSU to Level 3 at the IUT.

3.8.5. Duplicated FSN

Because M2PA does not transmit sequence numbers between peers at the M2PA layer (there are only sequence numbers sent between peers at the SCTP layer), tests concerning abnormal forward sequence numbers are not applicable.

The expected sequence of events is illustrated *Figure 3.8.5-1*.

Reference: Q.781/Test 8.5

```
                PT                      IUT

                      NOT APPLICABLE
```

Figure 3.8.5-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.6. Erroneous retransmission - Single MSU

Retransmission of DATA messages is performed by SCTP for M2PA and as such the related Q.781 tests are not applicable.

The expected sequence of events is illustrated *Figure 3.8.6-1*.

Reference: Q.781/Test 8.6

```
                PT                      IUT

                      NOT APPLICABLE
```

Figure 3.8.6-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.7. Erroneous retransmission - Multiple FISUs

Retransmission of DATA messages is performed by SCTP for M2PA and as such the related Q.781 tests are not applicable.

The expected sequence of events is illustrated *Figure 3.8.7-1*.

Reference: Q.781/Test 8.7

```
                 PT                      IUT

                        NOT APPLICABLE
```

Figure 3.8.7-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.8. Single FISU with corrupt FIB

The expected sequence of events is illustrated *Figure 3.8.8-1*.

Reference: Q.781/Test 8.8

```
                 PT                      IUT

                        NOT APPLICABLE
```

Figure 3.8.8-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.9. In Service prior to RPO being set

The expected sequence of events is illustrated *Figure 3.8.9-1*.

Reference: Q.781/Test 8.9

```
                 PT                      IUT

           :set lpo
   PROCESSOR-OUTAGE  ------------------>
                                         !rpo
               DATA  ------------------>
                     <------------------ ACK [     1 msgs]
                                         !msu
               DATA  ------------------>
                     <------------------ ACK [     1 msgs]
                                         !msu
```

Figure 3.8.9-1. In service prior to RPO being set

Test Description:

(1) The test beings with the link in the "In Service" state.

(2) Issue a Level 3 "Set Local Processor Outage" command at the PT and send a status "Processor Outage" message to the IUT.

(3) Check that the IUT indicates "Remote Processor Outage" to Level 3 at the IUT.

(4) Send two consecutive Data messages to the IUT.

(5) Check that the IUT acknowledges both Data messages with an Ack and that two MSUs are delivered to Level 3 at the IUT.

3.8.10. Abnormal BSN - single MSU

Because M2PA does not transmit sequence numbers between peers at the M2PA layer (there are only sequence numbers sent between peers at the SCTP layer), tests concerning abnormal forward sequence numbers are not applicable.

The expected sequence of events is illustrated *Figure 3.8.10-1*.

Reference: Q.781/Test 8.10

```
PT                        IUT

          NOT APPLICABLE
```

Figure 3.8.10-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.11. Abnormal BSN - two consecutive FISUs

Because M2PA does not transmit sequence numbers between peers at the M2PA layer (there are only sequence numbers sent between peers at the SCTP layer), tests concerning abnormal forward sequence numbers are not applicable.

The expected sequence of events is illustrated *Figure 3.8.11-1*.

Reference: Q.781/Test 8.11

```
PT                        IUT

          NOT APPLICABLE
```

Figure 3.8.11-1. Not Applicable

Test Description:

(1) Not applicable.

3.8.12. Excessive delay of acknowledgments

This test case validates the IUT response to a excessively delayed acknowledgment. The expected sequence of events is illustrated *Figure 3.8.12-1*.

Reference: Q.781/Test 8.12

```
                    PT                        IUT

                                              :msu
                        <-----------------   DATA [   35 bytes]
                              !
                              !  T7           0.5 <= T7 <= 2.0
                              !
                        <-----------------   OUT-OF-SERVICE
                                              !out of service(T7)
```

Figure 3.8.12-1. Excessive delay of acknowledgments

Test Description:

(1) This test case begins with the link in the "In Service" state.

(2) Send an MSU from the IUT.

(3) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 at the IUT with reason "T7 Timeout" and that the link remains in the "Out of Service" state.

(4) Check that the T7 is between 0.5 seconds and 2.0 seconds in duration.

3.8.13. Level 3 Stop command

This test case validates the response of the IUT to the Level 3 "Stop" command while in the "In Service" state.

The expected sequence of events is illustrated *Figure 3.8.13-1*.

Reference: Q.781/Test 8.13

```
                    PT                        IUT

                                              :stop
                        <-----------------   OUT-OF-SERVICE
```

Figure 3.8.13-1. Level 3 Stop command

Test Description:

(1) This test begins with the link in the "In Service" state.

(2) Issue the Level 3 "Stop" command at the IUT.

(3) Check that the IUT sends a status "Out of Service" message and remains in the "Out of Service" state.

3.9. Transmission and Reception Control (PCR)

M2PA does not perform Preventative Cyclic Retranmission and, therefore, the test cases in this section are not applicable to M2PA.

3.9.1. MSU transmission and reception

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.1-1*.

Reference: Q.781/Test 9.1

```
 ____________________________________________________________________
|                                                                    |
|                    PT                        IUT                   |
|                                                                    |
|                          NOT APPLICABLE                            |
|____________________________________________________________________|
```

Figure 3.9.1-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.2. Priority control

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.2-1*.

Reference: Q.781/Test 9.2

```
 ____________________________________________________________________
|                                                                    |
|                    PT                        IUT                   |
|                                                                    |
|                          NOT APPLICABLE                            |
|____________________________________________________________________|
```

Figure 3.9.2-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.3. Forced retransmission with the value N1

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.3-1*.

Reference: Q.781/Test 9.3

```
 ____________________________________________________________________
|                                                                    |
|                    PT                        IUT                   |
|                                                                    |
|                          NOT APPLICABLE                            |
|____________________________________________________________________|
```

Figure 3.9.3-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.4. Forced retransmission with the value N2

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.4-1*.

Reference: Q.781/Test 9.4

```
 ____________________________________________________________________
|                                                                    |
|                    PT                        IUT                   |
|                                                                    |
|                          NOT APPLICABLE                            |
|____________________________________________________________________|
```

Figure 3.9.4-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.5. Forced retransmission cancel

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.5-1*.

Reference: Q.781/Test 9.5

```
                PT                       IUT

                      NOT APPLICABLE
```

Figure 3.9.5-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.6. Reception of forced retransmission

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.6-1*.

Reference: Q.781/Test 9.6

```
                PT                       IUT

                      NOT APPLICABLE
```

Figure 3.9.6-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.7. MSU transmission while RPO set

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.7-1*.

Reference: Q.781/Test 9.7

```
                PT                       IUT

                      NOT APPLICABLE
```

Figure 3.9.7-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.8. Abnormal BSN - Single MSU

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.8-1*.

Reference: Q.781/Test 9.8

```
                PT                       IUT

                      NOT APPLICABLE
```

Figure 3.9.8-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.9. Abnormal BSN - Two MSUs

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.9-1*.

Reference: Q.781/Test 9.9

```
PT                          IUT

        NOT APPLICABLE
```

Figure 3.9.9-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.10. Unexpected FSN

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.10-1*.

Reference: Q.781/Test 9.10

```
PT                          IUT

        NOT APPLICABLE
```

Figure 3.9.10-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.11. Excessive delay of acknowledgments

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.11-1*.

Reference: Q.781/Test 9.11

```
PT                          IUT

        NOT APPLICABLE
```

Figure 3.9.11-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.12. FISU with FSN expected for MSU

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.12-1*.

Reference: Q.781/Test 9.12

```
PT                          IUT

        NOT APPLICABLE
```

Figure 3.9.12-1. Not Applicable

Test Description:

(1) Not applicable.

3.9.13. Level 3 Stop command

This test case is not applicable to M2PA. The expected sequence of events is illustrated *Figure 3.9.13-1*.

Reference: Q.781/Test 9.13

```
                 PT                        IUT

                       NOT APPLICABLE
```

Figure 3.9.13-1. Not Applicable

Test Description:

(1) Not applicable.

3.10. Congestion Control

3.10.1. Congestion abatement

This test case validates the response of the IUT to the Level 3 "Congestion" and "Congestion Ceases" conditions. The expected sequence of events is illustrated *Figure 3.10.1-1*.

Reference: Q.781/Test 10.1

```
                 PT                        IUT

                                           :make cong discard
                     <-----------------    BUSY
                                           :clear congestion
                     <-----------------    BUSY-ENDED
```

Figure 3.10.1-1. Congestion abatement

Test Description:

(1) This test begins with the link in the "In Service" state.

(2) Generate a local Level 3 "Congestion" condition at the IUT.

(3) Check that the IUT sends a status "Busy" message.

(4) Generate a local Level 3 "Congestion Ceases" condition at the IUT.

(5) Check that the IUT sends a status "Busy Ended" message.

3.10.2. Timer T7

This test case validates timer T7 and procedures at the ITU. The expected sequence of events is illustrated *Figure 3.10.2-1*.

Reference: Q.781/Test 10.2

```
 ___________________________________________________________________
|                                                                   |
|                  PT                     IUT                        |
|                                                                   |
|                                         :msu                      |
|                     <-----------------  DATA [   35 bytes]        |
|                BUSY -----------------> |
|                           !                                       |
|                           !  T7                                   |
|                           !                                       |
|                 ACK ----------------->                            |
|                                                                   |
|___________________________________________________________________|
```

Figure 3.10.2-1. Timer T7

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send an MSU at the IUT.

(3) Wait for less than T7 and then acknowledge the Data message to the IUT with an Ack message.

(4) Check that the IUT sends no further status messages and remains in the "In Service" state.

3.10.3. Timer T6

This case validates timer T6 and procedures at the IUT. The expected sequence of events is illustrated *Figure 3.10.3-1*.

Reference: Q.781/Test 10.3

```
 ___________________________________________________________________
|                                                                   |
|                  PT                     IUT                        |
|                                                                   |
|                                         :msu                      |
|                     <-----------------  DATA [   35 bytes]        |
|                BUSY ----------------->                            |
|                           !                                       |
|                           !  T6         3.0 <= T6 <= 6.0          |
|                           !                                       |
|                     <-----------------  OUT-OF-SERVICE            |
|                                         !out of service(T6)       |
|                                                                   |
|___________________________________________________________________|
```

Figure 3.10.3-1. Timer T6

Test Description:

(1) The test begins with the link in the "In Service" state.

(2) Send an MSU at the IUT.

(3) Send a status "Busy" messages to the IUT.

(4) Check that the IUT sends a status "Out of Service" message and indicates "Out of Service" to Level 3 with reason "T6 Timeout" and remains in the "Out of Service" state.

(5) Check that T6 is between 3.0 seconds and 6.0 seconds in duration.

Security Considerations

There are no security considerations for this draft.

Acknowledgments

References

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This Internet Draft expires June 2002.

List of Illustrations

Table of Contents

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