Network Working Group
INTERNET-DRAFT

Brian Bidulock
OpenSS7 Corporation

February 21, 2004

Expires in January 2004

SS7 MTP3-User Adaptation Layer (M3UA)
Test Specifications
M3UA-TEST

<draft-bidulock-sigtran-m3ua-test-00.ps>

Status of this Memo

Copyright

Abstract

The SS7 MTP3-User Adataptation Layer (M3UA) [M3UA] specifies a protocol for supporting the transport of any SS7 MTP3-User signalling (e.g., ISUP and SCCP messages) over IP using the services of the Stream Control Transmission Protocol [RFC 2960]. Also, provision is made for protocol elements that enable a seamless operation of the MTP3-User peers in the SS7 and IP domains. This protocol would be used between a Signalling Gateway (SG) and a Media Gateway Controller (MGC) or IP-resident Database, or between two IP-based applications. It is assumed that the SG receives SS7 signalling over a standard SS7 interface using the SS7 Message Transfer Part (MTP) [Q.704, T1.111, JT-Q.704] to provide transport.

This memo specifies M3UA Validation and Compatability tests to test M3UA Signalling Gateway (SG) elements interacting with Application Server Process (ASP) elements, and between IP Signalling Points (IPSP) using the M3UA protocol [M3UA].

1. Introduction

1.1. Scope

1.2. Terminology

1.3. Abbreviations

1.4. Conventions

The keywords **MUST**, **MUST NOT**, **REQUIRED**, **SHALL**, **SHALL NOT**, **SHOULD**, **SHOULD NOT**, **RECOMMENDED**, **NOT RECOMMENDED**, **MAY**, and **OPTIONAL**, when they appear in this document,

are to be interpreted as described in RFC 2119 [RFC 2119].

2. M3UA Test Environment

Requirements for the test environment depend upon whether Validation testing or Compatability testing is to be supported by the test environment, as follows:

2.1. Validation Testing

The purpose of Validation Testing is to test a single implementation (SG, ASP or IPSP) for positive and negative test cases. Tests include generating abnormal message sequences and patterns not normally possible with a conforming implementation and, therefore, need to be generated by a specialized piece of equipment called the *Protocol Tester*. Validation Testing validates the *Implementation Under Test* against the behvaior required by standards specifications (in this case [M3UA] specifications).

Validation testing is normally performed on an implementation before engaging in Compatability testing.

For M3UA validation testing, the test environment consists of the following components:

(1) The *Implementation Under Test* (IUT). The IUT is one M3UA SG, ASP or IPSP implementation being tested. The SG IUT might have to offer interface capabilities in addition to the interface capabilities required in normal operation to permit the *SS7 MTP Simulator* to inject and collect MTP primitives to and from the M3UA SG. The ASP or IPSP IUT might have to offer interface capabilities in addition to the interface capabilities required in normal operation to permit the *SS7 MTP-User Simulator* to inject and collect MTP primitives to and from the M3UA ASP or IPSP.

(2) The *Protocol Tester* (PT). The PT is a specialized device that can form associations with the IUT and pass M3UA and SCTP messages to and from the IUT in a controlled fashion as required by the Validataion tests.

(3) The *SS7 MTP/MTP-User Simulator* (SIM). The may be part of the IUT, part of the PT or part of the test environment. It is a specialized function that can pass MTP-User primitives to and from the IUT. For M3UA SG IUT validation testing, the function provides a simulation of the MTP Level 3. For M3UA ASP or IPSP IUT validation testing, the function provides a simulation of the MTP Level 3 User.

(4) An *IP Network* (NET). A network to which both the PT and IUT are attached and across which SCTP associations can be formed.

(5) The *M3UA/SCCP Monitor* (MON). This is a function that monitors the exchange of M3UA and SCTP messages between the PT and IUT across the IP network. This function might be integrated with the PT, the IUT, or the test environment.

2.2. Compatability Testing

The purpose of Compatability Testing is to test two implementations for compatability with each other. Test cases typically only include positive test cases. Tests do not require the generation of any abnormal messages or patterns as with Validation Testing. Compatability Testing tests that two implementations can perform the required functions in a compatible fashion as dictated by the relevant standards (in this case [M3UA] specifications).

Validation testing is normally performed on an implementation before engaging in Compatability Testing.

For M3UA Compatability testing, the test environment consists of the following components:

(1) The *Implementations Under Test* (IUT). The IUT consist of one SG and one ASP implementation, or two IPSP implementations. The SG IUT might have to offer interface capabilities in addition to the interface capabilities required in normal operation to permit the *SS7 MTP Simulator* to inject and collect MTP primitives to and from the M3UA SG. The ASP or IPSP IUT might have to offer interface capabilities in addition to the interface capabilities required in normal operation to permit the *SS7 MTP-User Simulator* to inject and collect MTP primitives to and from the

(2) The *SS7 MTP/MTP-User Simulator* (SIM). The may be part of the IUT, part of the PT or part of the test environment. It is a specialized function that can pass MTP-User primitives to and from the IUT. For

M3UA SG/ASP IUT compatability testing, the function provides a simulation of the MTP Level 3 and a simulation of the MTP Level 3 User. For M3UA IPSP IUT validation testing, the function need provide only simulation of the MTP Level 3 User at each IPSP.

(3) An *IP Network* (NET). A network to which both the IUT are attached and across which SCTP associations can be formed.

(4) The *M3UA/SCCP Monitor* (MON). This is a function that monitors the exchange of M3UA and SCTP messages between IUT across the IP network. This function might be integrated with the IUT, or the test environment.

2.3. Test Specification

Validation and Compatability tests are specified using the same test pattern. Some tests are applicable to Validation testing, some are applicable to Compatability testing, and others are applicable to both forms of testing. For test specifications that are applicable to both Validation and Compatability testing, one SP acts either as a PT (for Validation) or as the second IUT (for Compatability).

3. M3UA Test Configurations

Test configurations for Validation and Compatability testing are specified the same. The only difference between Validation and Compatability testing as applied to a specific configuration is that the SP at position "A" is always the ASP IUT; at position "B", is always the SG IUT. The SP at the other positions ("C," "D," etc.) are either the PT, for Validation testing, or other IUT, for Compatability testing.

Each test case in the test suite are applicable to one configuration. Some configurations are only applicable to SG, ASP or IPSP IUT testing. The configurations necessary to execute the entire test suite are as follows:

3.1. Test Environment #1

3.1.1. Validation

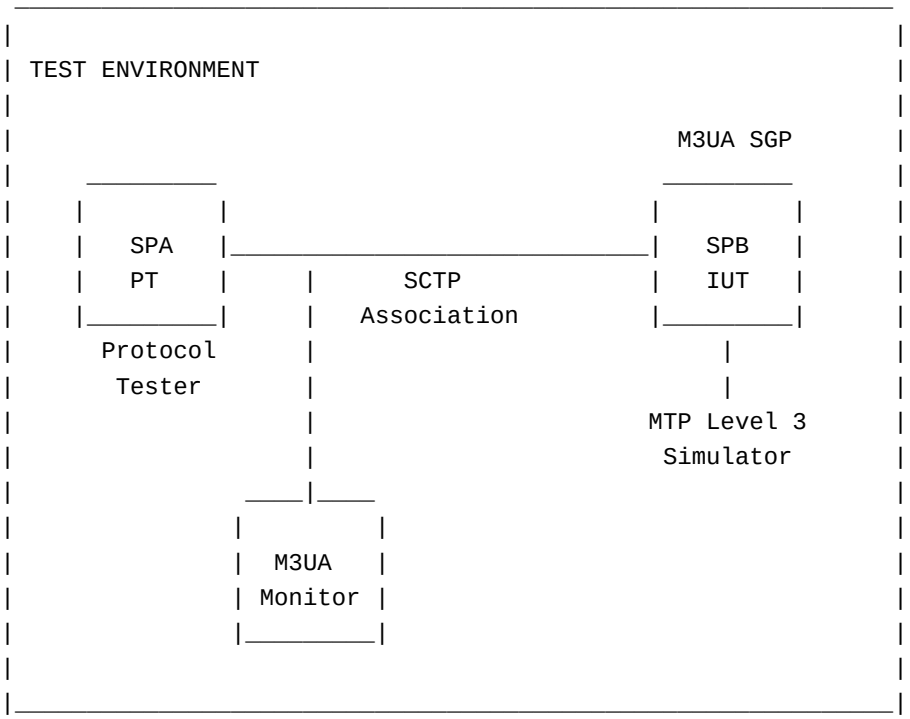


Figure 1. Environment #1(a) — SGP Validation

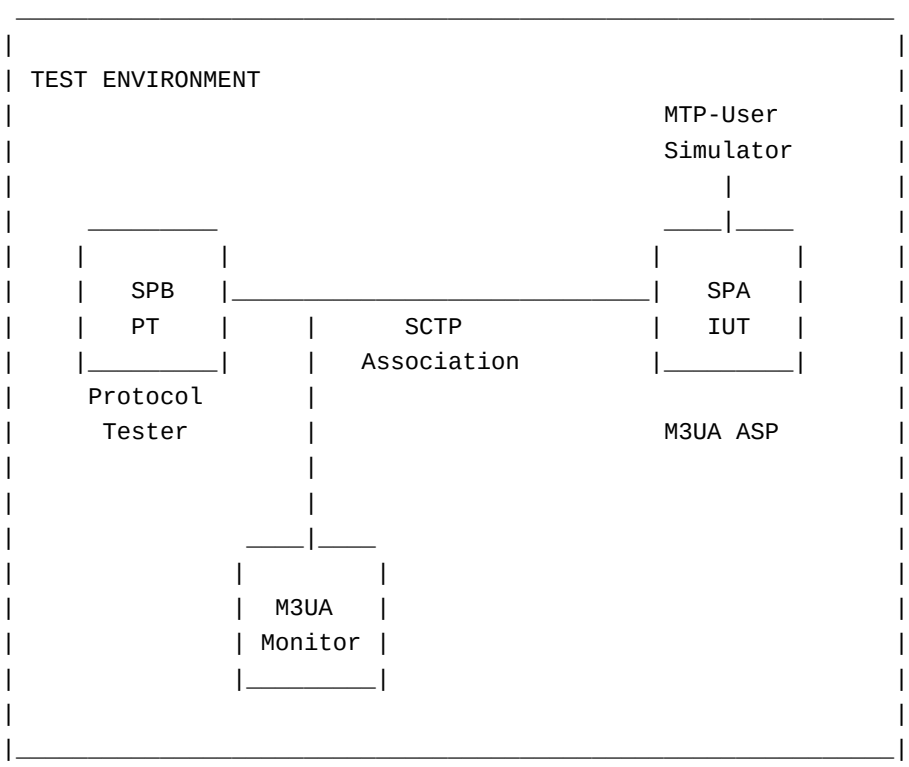


Figure 2. Environment #1(b) — ASP Validation

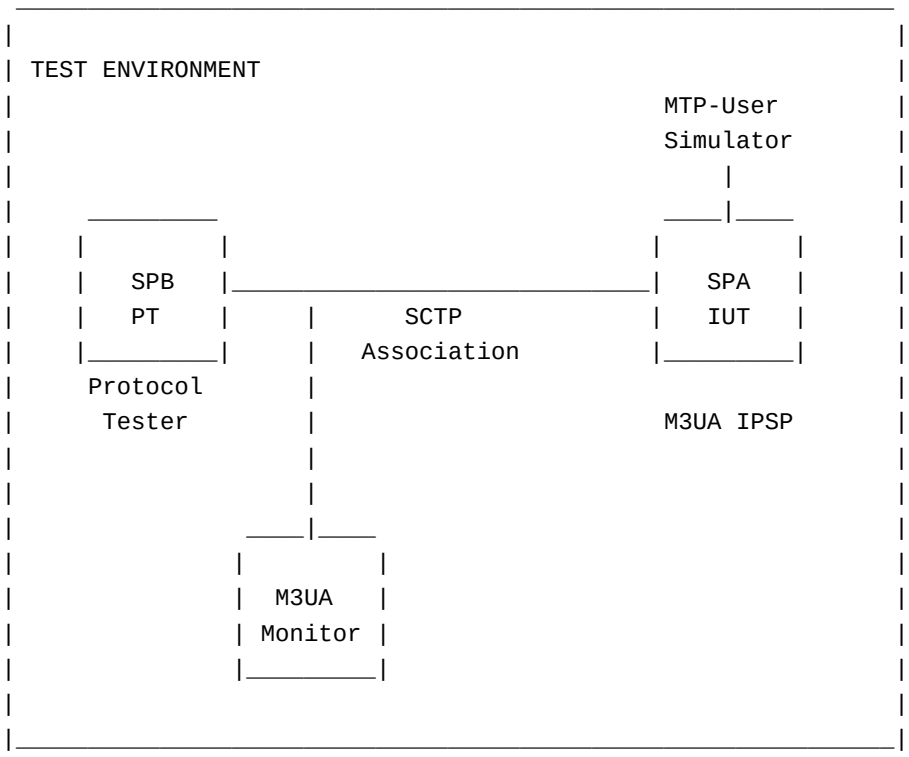


Figure 3. Environment #1(c) — IPSP Validation

3.1.2. Compatability

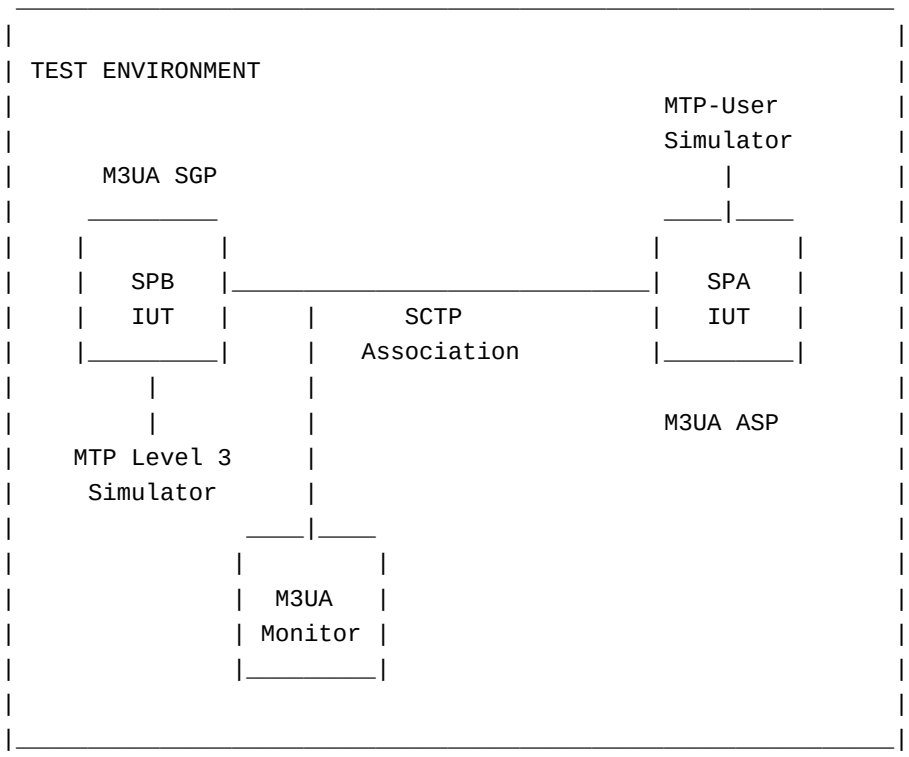


Figure 4. Environment #1(a,b) — ASP/SGP Compatability

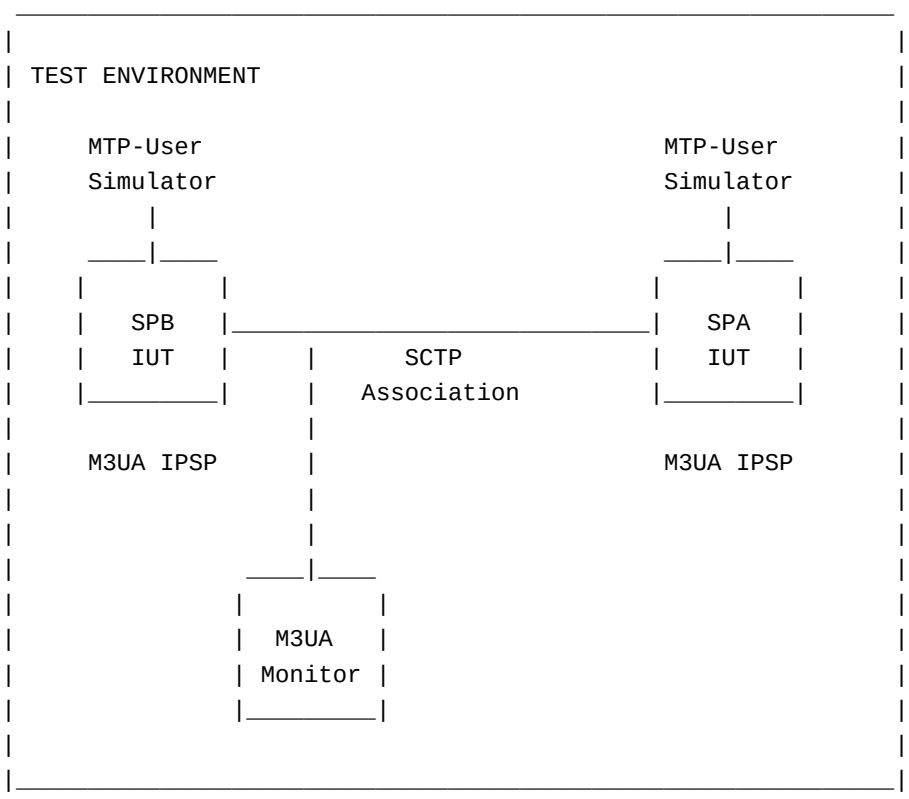


Figure 5. Environment #1(c) — IPSP Compatability

3.2. Test Environment #2

3.2.1. Validation

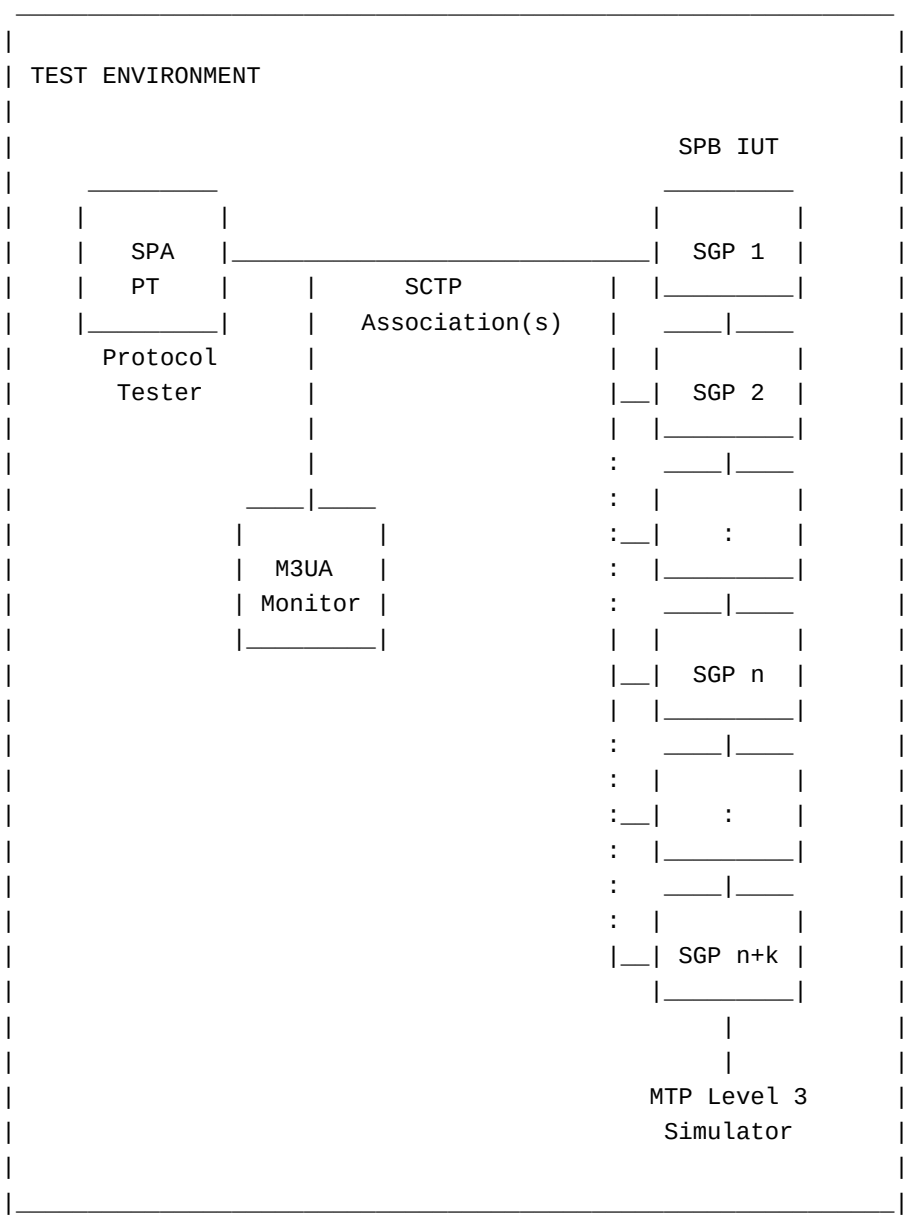


Figure 6. Environment #2(a) — SGP Validation

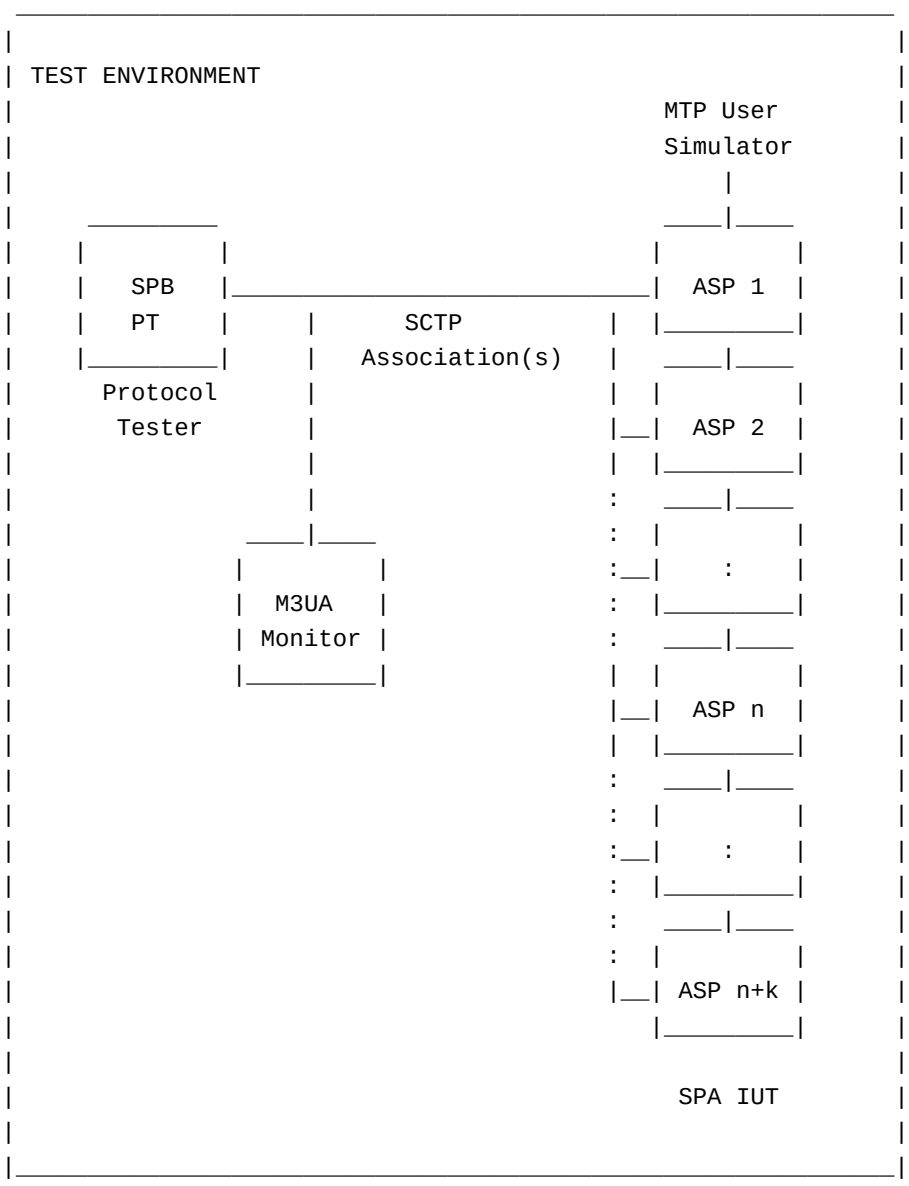


Figure 7. Environment #2(b) — ASP Validation

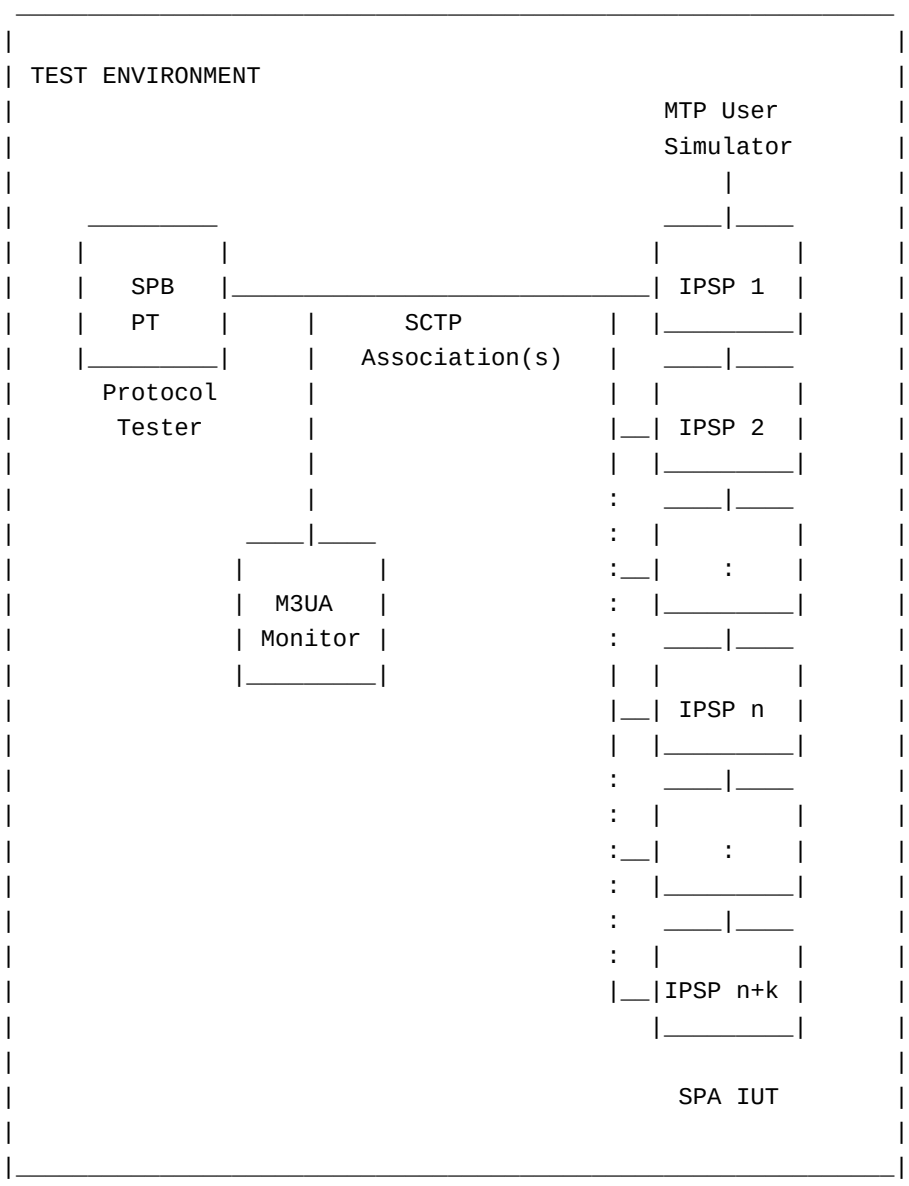
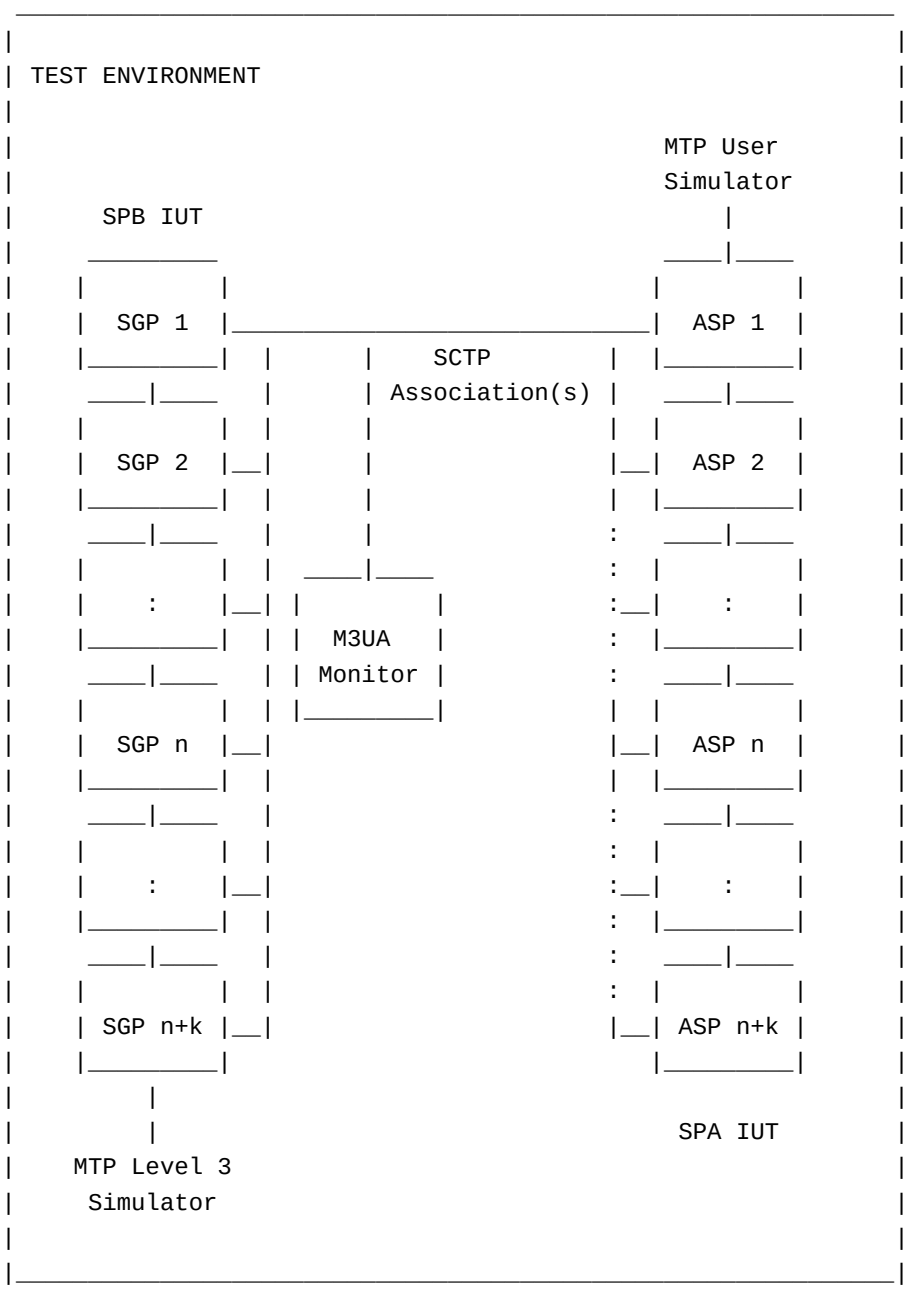


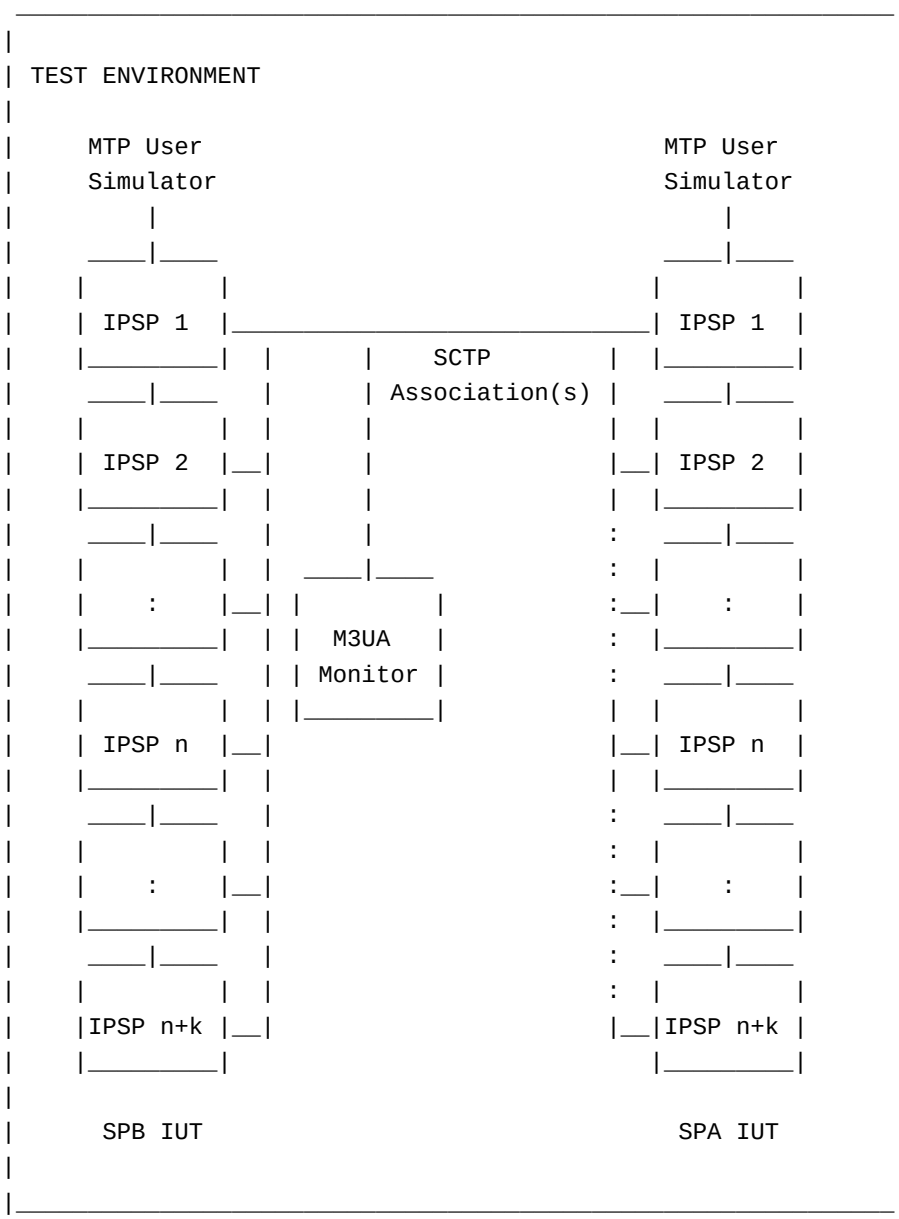
Figure 8. Environment #2(c) — IPSP Validation

3.2.2. Compatability



Note: the values “n” and “k” may be different on SPA than they are on SPB.

Figure 9. Environment #2(a,b) — ASP/SGP Compatability



Note: the values “n” and “k” may be different on SPA than they are on SPB.

Figure 10. Environment #2(c) — IPSP Compatability

4. M3UA Tests

4.1. Test Cases

4.1.1. SCTP Associations

4.1.2. Registration Procedures

4.1.3. Deregistration Procedures

4.1.4. ASP Up Procedures

4.1.5. ASP Down Procedures

4.1.6. ASP Active Procedures

4.1.7. ASP Inactive Procedures

4.1.8. Notification Procedures

4.1.9. SS7 Signalling Network Management Procedures

4.1.9.1. Audit Procedures

4.1.10. MTP Transfer Procedures

4.1.11. ASP Failure

4.1.12. Erroneous Messages

4.1.13. Unexpected Messages

5. SS7 MTP Level 3 Test Environment

The test environment for SS7 MTP Level 3 [Q.782] testing is described in the General Aspects of SS7 Testing [Q.780]. There are two types of testing that are accommodated as follows:

Validation Testing — consists of validating a single Implementation Under Test (IUT). This is peformed by connecting the IUT to a Protocol Tester (PT) within the test environment.

Validation testing is more extensive that compatability testing. This is because it is possible, with the use of the Protocol Tester (PT), to generate abnormal messages and patterns, that cannot normally be generated from an Implementation Under Test (IUT), to test the IUT response to abormal conditions.

Compatability Testing — consists of testing the compatability of one Implementation Under Test (IUT) with another. This is performed by connecting the IUT together within the test environment.

Compatability testing is less extensive than validation testing. This is because it is not normally possible to generate abnormal test message and patterns with an implementation that conforms to validation testing. However, compatability tests are better at testing the interoperability of two implementations.

6. SS7 MTP Level 3 Test Configurations

This section details the Validation and Compatability test configurations used for testing M3UA SG and ASP for SS7 MTP Level 3 conformance.

6.1. Validation Test Configuration

Validation testing consists of validating a single Implementation Under Test (IUT) for SS7 MTP Level 3 conformance. Several test configurations can be used with M3UA Signalling Gateways (SG) and Application Service Processes (ASP) as follows[1]:

6.1.1. SS7 Validation Test Configuration

6.1.1.1. Configuration A

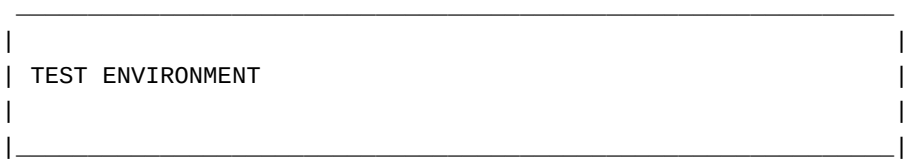


Figure 11. SS7 Validation Test Configuration A

6.1.1.2. Configuration B

Figure 12. SS7 Validation Test Configuration B

6.1.1.3. Configuration C

Figure 13. SS7 Validation Test Configuration C

6.1.1.4. Configuration D

Figure 14. SS7 Validation Test Configuration D

Figure 14 illustrates the Validation Test configuration. As described in the SS7 Test Specifications [Q.780], the SS7 Level 3 validation test environment consists of the following components:

(1) The *Protocol Tester* (PT) performing validation tests at position "B", "C", etc.

(2) The *Implementation Under Test* (IUT) that is being validated at position "A".

(3) One or more *SS7 Signalling Links* [Q.703] between the PT at position "B", "C", etc., and the IUT at "A".

(4) The **Simulator of Upper Levels** attached to the IUT at position "A".

For this configuration, the interface between the Implementation Under Test (IUT) and the *Simulator of Upper Levels* is that described in the SS7 Test Specifications [Q.780] §6.3. This is the normal configuration for SS7 MTP Level 3 testing [Q.782] and is not modified by this memo. Normal MTP Level 3 testing **SHOULD** be performed on the M3UA SG before validation or compatability tests in the other configurations described in this

memo.

6.1.2. SG Validation Test Configuration

6.1.2.1. Configuration A

Figure 15. SG Validation Test Configuration A

Applicable Test Cases:

- 8.1 Signalling traffic flow control — Reception of a TFC (ALL)
- 8.2 Signalling traffic flow control — Reception of a UPU (SEP)
- 8.3 Signalling traffic flow control — Sending of a UPU (SEP)

6.1.2.2. Configuration B

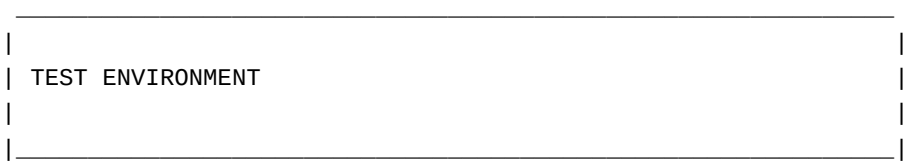


Figure 16. SG Validation Test Configuration B

Applicable Test Cases:

- 5. Forced rerouting (Multiple SG only)
- 6. Controlled rerouting (Multiple SG only)

6.1.2.3. Configuration C

Figure 17. SG Validation Test Configuration C

Applicable Test Cases:

- 8.2 Signalling traffic flow control — Sending of TFCs (STP)

6.1.2.4. Configuration D

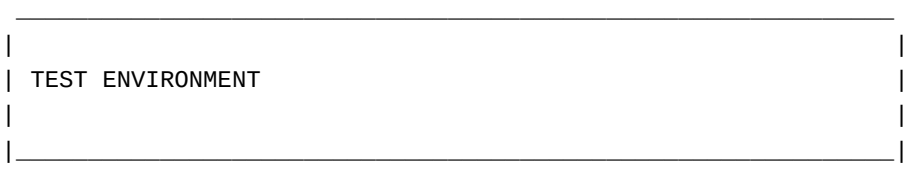


Figure 18. SG Validation Test Configuration D

Applicable Test Cases:

- 9.2.1 Signalling route management — Broadcast of TFPs — One one linkset failure (STP)
- 9.2.2 Signalling route management — Broadcast of TFPs — One on multiple failures (STP)
- 9.5.1 Signalling route management — Broadcast of TFAs — On one linkset recovery (STP)
- 9.5.2 Signalling route management — Broadcast of TFAs — Various reasons (STP)

Figure 18 illustrates the Validation Test configuration. As described in the SS7 Test Specification [Q.780], the SS7 MTP Level 3 validation test environment consists of the following components:

(1) The *Protocol Tester* (PT) performing validation tests at position "B".

(2) The *Implementation Under Test* (IUT) that is being validated at position "A".

(3) One or more *SS7 Signalling Links* [Q.703] between the PT at position "B" and the IUT at position "A".

(4) A *Simulator of Upper Levels* attached to the IUT at position "A".

In addition, this memo specifies the interface between the IUT and the *Simulator of Upper Levels* [Q.780] within the test environment.

The *Simulator of Upper Levels* **SHALL** be attached to the IUT at position "A" using an M3UA SCTP Association. The *Simulator of Upper Levels* **SHALL** inject and collect M3UA messages to and from the IUT during the performance of SS7 MTP Level 3 testing [Q.782]. The *Simulator of Upper Levels* **SHALL** inject and collect the M3UA messages as described in §8 of this memo.

6.1.3. SG-ASP Validation Test Configuration

6.1.3.1. Configuration A

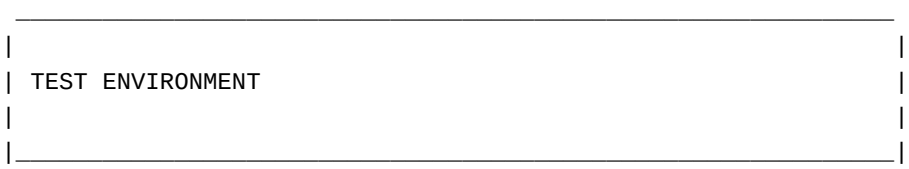


Figure 19. SG-ASP Validation Test Configuration A

6.1.3.2. Configuration B

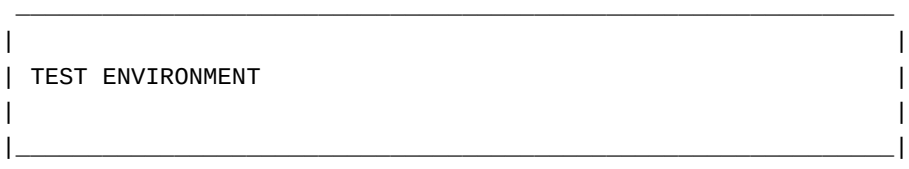


Figure 20. SG-ASP Validation Test Configuration B

6.1.3.3. Configuration C

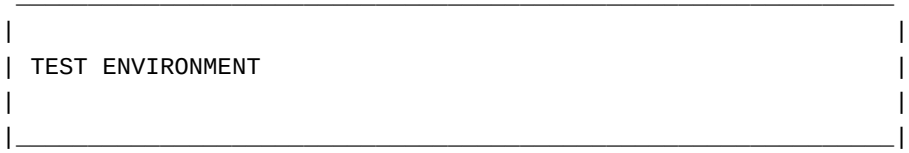


Figure 21. SG-ASP Validation Test Configuration C

6.1.3.4. Configuration D

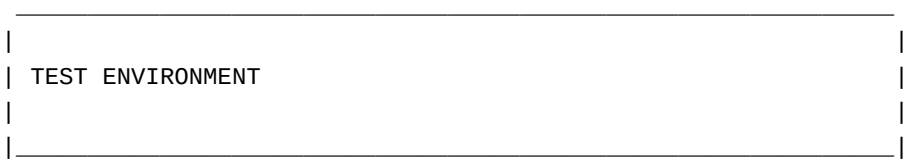


Figure 22. SG-ASP Validation Test Configuration D

Figure 22 illustrates a Validation Test configuration that includes one or more ASP in the validation tests. In this case, the *Simulator of Upper Levels* is connected at the ASP rather than directly to the SG. In this configuration, the combination of ASP and SG form the IUT.

For this configuration, the interface between the *Simulator of Upper Levels* and the M3UA ASP is the same as for normal SS7 MTP Level 3 Testing [Q.782, Q.780]. The test environment **SHOULD** include monitoring of the M3UA SCTP Association to ensure the mapping between SS7 MTP Level 3 [Q.704] primitives, SS7 MTP Level 3 Test Specification [Q.782] commands, and SS7 MTP3-User Adpatation Layer [M3UA] messages as described in §8 of this memo.

6.2. Compatability Test Configurations

Compatability testing consists of testing two IUT for compatability with each other. Several test configurations can be used with M3UA Signalling Gateways (SG) and Application Server Processes (ASP) as follows:

6.2.1. SS7 Compatability Test Configuration

6.2.1.1. Configuration A

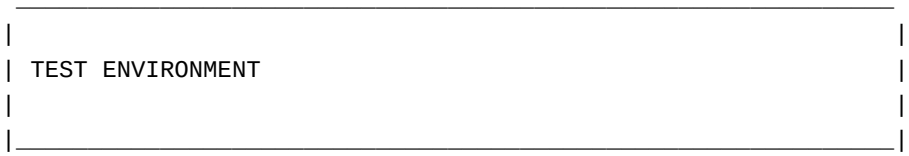


Figure 23. SS7 Compatability Test Configuration A

6.2.1.2. Configuration B

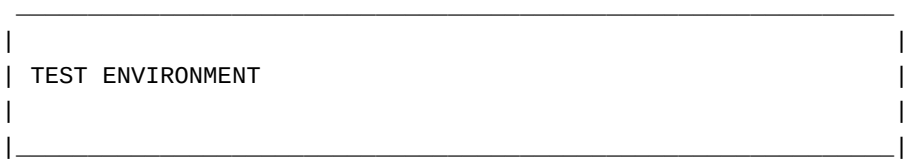


Figure 24. SS7 Compatability Test Configuration B

6.2.1.3. Configuration C

Figure 25. SS7 Compatability Test Configuration C

6.2.1.4. Configuration D

Figure 26. SS7 Compatability Test Configuration D

Figure 26 illustrates the Compatability Test configuration. As described in the SS7 Test Specification [Q.780], the SS7 MTP Level 3 compatability test environment consists of the following components:

(1) One *Implementation Under Test* (IUT) for compatability testing at postition “A”.

(2) Another *Implementation Under Test* (IUT) for compatability testing at postition “B”.

(3) One ore more *SS7 Signalling Links* [Q.703] between the IUT at position “A” and the IUT at position “B”.

(4) A *Simulator of Upper Levels* attached to the IUT at position ”A”.

(5) A *Simulator of Upper Levels* attached to the IUT at position ”B”.

For this configuration, the interface between each IUT and the *Simulator of Upper Levels* is that described in the SS7 Test Specifications [Q.780]. This is the normal configuration for SS7 MTP Level 3 testing [Q.782] and is not modified by this memo. Normal SS7 MTP Level 3 testing **SHOULD** be performed on the M3UA SG before performing compatability tests in the other configurations described in this memo.

6.2.2. SG Compatability Test Configuration

6.2.2.1. Configuration A

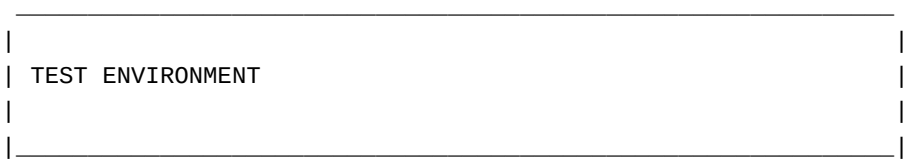


Figure 27. SG Compatability Test Configuration A

6.2.2.2. Configuration B

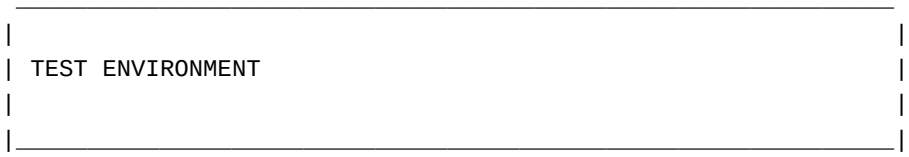


Figure 28. SG Compatability Test Configuration B

Applicable Test Cases:

- 5. Forced rerouting (Multiple SG only)
- 6. Controlled rerouting (Multiple SG only)

6.2.2.3. Configuration C

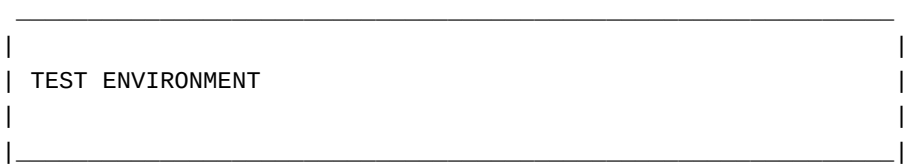


Figure 29. SG Compatability Test Configuration C

6.2.2.4. Configuration D

Figure 30. SG Compatability Test Configuration D

Applicable Test Cases:

- 9.2.1 Signalling route management — Broadcast of TFPs — One one linkset failure (STP)
- 9.2.2 Signalling route management — Broadcast of TFPs — One on multiple failures (STP)
- 9.5.1 Signalling route management — Broadcast of TFAs — On one linkset recovery (STP)
- 9.5.2 Signalling route management — Broadcast of TFAs — Various reasons (STP)

Figure 30 illustrates the Compatability Test configuration. AS described in the SS7 Test Specificaiton [Q.780], the SS7 MTP Level 3 compatability test environment consists of the following components:

(1) One *Implementation Under Test* (IUT) for compatability testing at postition “A”.

(2) Another *Implementation Under Test* (IUT) for compatability testing at postition “B”.

(3) One ore more *SS7 Signalling Links* [Q.703] between the IUT at position “A” and the IUT at position “B”.

(4) A *Simulator of Upper Levels* attached to the IUT at position ”A”.

(5) A *Simulator of Upper Levels* attached to the IUT at position ”B”.

In addition, this memo specifies the interface between the IUT and the *Simulator of Upper Levels* [Q.780] within the test environment.

The *Simulator of Upper Levels* **SHALL** be attached to the IUT at positions “A” and “B” using an M3UA SCTP Association. The *Simulator of Upper Levels* **SHALL** inject and collect M3UA messages to and from the IUT during the performance of SS7 MTP Level 3 tesitng [Q.782]. The *Simulator of Upper Levels* **SHALL** inject and collect M3UA messages as described in §8 of this memo.

6.2.3. SG-ASP Compatability Test Configuration

6.2.3.1. Configuration A

Figure 31. SG-ASP Compatability Test Configuration A

6.2.3.2. Configuration B

Figure 32. SG-ASP Compatability Test Configuration B

6.2.3.3. Configuration C

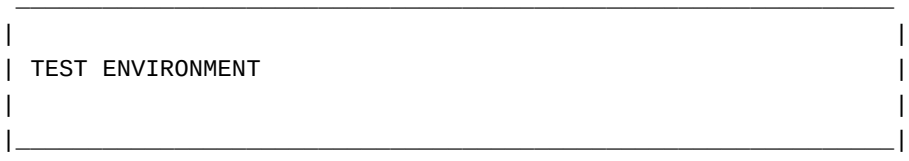


Figure 33. SG-ASP Compatability Test Configuration C

6.2.3.4. Configuration D

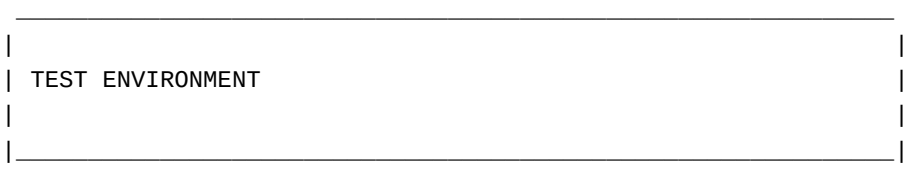


Figure 34. SG-ASP Compatability Test Configuration D

Figure 34 illustrates a Compatability Test Configuration that includes an ASP in the compatability tests. In this case the *Simulator of Upper Levels* is connected at the ASp rather than directly to the SG. In this configuration, the combinatio of each ASP and SG form the two IUT.

For this configuration, the interface between the *Simulator of Upper Levels* and the M3UA ASP is the same as for normal SS7 MTP Level 3 Testing [Q.782, Q.780]. The test environment **SHOULD** also include monitoring of the M3UA SCTP Association and ensure the mapping between SS7 MTP Level 3 [Q.704] signals, SS7 MTP Level 3 Test Specification [Q.782] commands, and SS7 MTP3-User Adaptation Layer [M3UA] messages as described in §8 of this memo.

Notes for §6

[1] Note that there are no SS7 MTP Level 3 Validation or Compatability tests for M3UA IPSP. This is because M3UA IPSP are restricted to point-to-point operation within the IP domain. As such, there is no SS7 component to the exchange between IPSPs and, thus, no SS7 MTP Level 3 test can be formulated.

7. SS7 MTP Level 3 Tests

8. SS7 MTP Level 3 Mapping

9. SS7 MTP Level 3 Test Examples

Security Considerations

There are no security considerations for this draft.

IANA Considerations

There are no IANA considerations for this draft.

0. Revision History

This section provides historical information on the changes made to this draft. This section will be removed from the document when the document is finalized.

0.0. Version 0.0

```
$Log: draft-bidulock-sigtran-m3ua-test-00.me,v $
Revision 0.8.2.2  2003/07/29 02:32:59  brian
A few more general updates.

Revision 0.8.2.1  2003/07/29 00:34:35  brian
Finalizing latest round of drafts.

Revision 0.8  2003/07/26 19:12:01  brian
Added new drafts.
```

R. References

R.1. Normative References

[**M3UA**] Sidebottom, G., Morneault, K. and Pastor-Balbas, J., (eds), *"Signaling System 7 (SS7) Message Transfer Part 3 (MTP3) - User Adaptation Layer (M3UA),"* **RFC 3332**, Internet Engineering Task Force - Signalling Transport Working Group (September, 2002).

[**RFC 2960**] Stewart, R., Xie, Q., Morneault, K., Sharp, C., Schwarzbauer, H. J., Taylor, T., Rytina, I., Kalla, H., Zhang, L. and Paxson, V., *"Stream Control Transmission Protocol (SCTP),"* **RFC 2960**, The Internet Society (February 2000).

[**Q.704**] ITU, *"Message Transfer Part − Signalling Network Functions and Messages,"* **ITU-T Recommendation Q.704**, ITU-T Telecommunication Standardization Sector of ITU, Geneva (March 1993). *(Previously "CCITT Recommendation")*

[**RFC 2119**] Bradner, S., *"Key words for use in RFCs to Indicate Requirement Levels,"* **RFC 2119 - BCP 14**, The Internet Society (March 1997).

[**Q.782**] ITU, *"Specifications of Signalling System No. 7 — Test Specification — MTP Level 3 Test Specification,"* **ITU-T Recommendation Q.782**, ITU-T Telecommunication Standardization Sector of ITU, Geneva (July 1996). *(Previously "CCITT Recommendation")*

[**Q.780**] ITU, *"Signalling System No. 7 Test Specification — General Description,"* **ITU-T Recommendation Q.780**, ITU-T Telecommunication Standardization Sector of ITU, Geneva (October 1995). *(Previously "CCITT Recommendation")*

[**Q.703**] ITU, *"Signalling System No. 7 − Signalling Link,"* **ITU-T Recommendation Q.703**, ITU-T Telecommunication Standardization Sector of ITU, Geneva (March 1993). *(Previously "CCITT Recommendation")*

R.2. Informative References

[**T1.111**] ANSI, *"Signalling System No. 7 − Message Transfer Part,"* **ANSI T1.111**, American National Standards Institue (1992).

[**JT-Q.704**] TTC, *"Message Transfer Part − Signalling Network Functions and Messages,"* **TTC Standard JT-Q.704**, Telecommunication Technology Committee (TTC) (April 28, 1992).

Author's Addresses

Brian Bidulock
OpenSS7 Corporation
1469 Jeffreys Crescent
Edmonton, AB T6L 6T1
Canada

Tel: +1-780-490-1141
Email: bidulock@openss7.org
URL: http//www.openss7.org/

This draft expires January 2004.

List of Illustrations

Table of Contents

Full Copyright Statement

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.